

NEXUS

Physics Equations:
 $I_1 V_1 = I_2 V_2$
 $\vec{F} = q\vec{v} \times \vec{B}$
 $F = qvB \sin \theta$
 $E = mc^2$
 $W = hf$
 $P_m = \frac{I_m V_m}{2}$
 $F = k \frac{Q_1 Q_2}{r^2}$
 $P_m = IV$
 $k = \frac{1}{4\pi\epsilon_0}$
 $\frac{q_b}{m} = \frac{2V}{B^2 R^2}$
 $E_n = \frac{-13.6 Z^2}{n}$
 $\nabla \times \nabla \times [p(x,y)] = \nabla \times \nabla \times [p(x,y)]$
 $y_{i+1} = y_i + x_n (b - a y_i)$
 $S = \frac{2\pi m v \cos \theta}{qB}$
 $V = IR$
 $\epsilon_0 = 8.8542 \times 10^{-12} \text{ C}^2/\text{Nm}^2$

Chemistry and Molecular Structures:
Molecules shown include: CCl_4 , CuCl_2 , SiCl_4 , $\text{Al}_2(\text{SO}_4)_3$, SiO_2 , HCN , MgCl_2 , GeO_2 , H_2O , NH_4Cl , ZnS , $\text{Mg}(\text{OH})_2$, CaO , NaNO_3 , MgSO_4 , PCl_5 , CO_2 , H_2S , BeCl_2 , ZnSO_4 , P_2O_5 , ZnS , H_2O , $\text{H}_2\text{N}-\text{C}_5\text{H}_4-\text{NH}_2$, H_2O , $\text{H}-\text{C}::\text{C}::\text{H}$, $\text{H}-\text{C}::\text{C}::\text{O}$, NCl_3 , PBr_3 , HCl , Na_2S , Cl_2O_7 , MnO_2 , KCl , ZnSO_4 , P_2O_5 , ZnS , TeFl , NCl_3 , PBr_3 , HCl .

Diagrams and Illustrations:
- Circuit diagrams with resistors, capacitors, and current flow.
- Bohr-style atomic models.
- Molecular ball-and-stick models.
- A scientist looking through a microscope.
- A hand pointing to a diagram.
- A car with a cloud of CO_2 coming out of its tailpipe.
- A flask with a reaction occurring inside.
- A skull and crossbones symbol.
- A radiation warning symbol.
- A hand holding a test tube.

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FOREWORD

Hisar School's mission is to enable its students to discover and develop their true potential. The Nexus journal aims to further this goal, allowing students to share their work and findings with their peers on an academic level. The word "Nexus" means the central or focal point of two or more things, which is why it functions as a platform in which arts and academia can co-exist through a shared interest to explore and question the workings of their surroundings. The papers published in Nexus not only become a part of the physical journal but starting this year are uploaded to the Nexus website to be immortalized. Much like the pieces published last year, this year's contents will continue to inspire individuals to pursue their interests in science, as well as inform students and teachers of the accomplishments of individuals.

The Nexus Team

Nexus Website



ELON MUSK'S NEURALINK PROJECT

SELIN EDIL '23

Introduction

Neuralink Corporation, a company in neurotechnology, develops implantable brain-machine interfaces (BMIs). The business, which shares space with OpenAI and has its main offices in San Francisco's Pioneer Building, was created by Elon Musk, Max Hodak, and Paul Merolla. Neuralink was introduced in 2016, and it was first made public in March 2017.

The neural lace, according to Musk, is a "digital layer above the brain" that may be implanted via an artery or vein rather than undergoing extensive surgery. He claims that the long-term goal is to create a "symbiosis with artificial intelligence," which, if not prevented, he claims, poses an existential threat to humanity. He thinks the technology would "address brain injuries or spinal injuries and make up for whatever lost capacity somebody has with a chip" and be "something akin to a video game, like a saved game situation, where you are able to restart and upload your last state."

Ethics of The Neuralink Project

Animal Cruelty

With the experiments on Gertrude, specialists came to the conclusion that since there are no wires protruding out through the skin of the animals, the chip's wireless nature may be advantageous for



animal testing. However, as soon as the experiment involved monkeys, complaints of animal mistreatment started to surface.

Only 7 of the 23 monkeys owned by Neuralink, according to the American animal rights organization Physicians Committee for Responsible Medicine (PCRM), have made it through the testing procedure. As of February 2022, PCRM officially complained about Neuralink to the US Department of Agriculture for mistreating animals and conducting intrusive testing. The business has denied the accusations and stated that it treats the animals it works with humanely. The animals were allegedly mutilated and abandoned to die, according to PCRM, which has since launched a second case.

Mind Control

Despite how preposterous it may sound, there is a danger that Neuralink chips may be hacked and used for mind control. The primary benefit of the technology—the capacity to control objects with your mind—is also its biggest drawback. The devices that connect the brain to computers might give hackers access to the brain. Through this route, hackers could be able to persuade wealthy people to transfer funds to their account or even influence elections in a candidate's favor. The chip would link to your phone through Bluetooth, which the business claims have lax security requirements.



Many experts are concerned since Musk also stated that the Neuralink app, which would link a smartphone to the brain, will be available on the App Store. They think that consumers would unintentionally download a knockoff program, which would again compromise the chip's security.

Altered Personalities

If the technology proves to be effective as the business promises at increasing brain activity, it may change people's personalities. This might have negative repercussions even if it can appear helpful for persons recuperating from mental health disorders without the need for counseling or medication. The chip's stimulation of the brain could not always have beneficial consequences; it might instead serve to amplify violent or aggressive tendencies.

Healthcare

According to a Deloitte research, 33% of the business volume for insurance companies in five years will come from unreleased goods. The insurance industry is about to undergo significant transformation. Neuralink brain implants are an example of an innovation that highlights the broad range of issues that technology poses:

- Taking on the issue of growing regulatory requirements Neuralink and similar technologies put further regulatory pressure on insurers and their associates. According to a recent survey, the biggest issue and barrier to innovation as identified by C-level management is the need to frame the adoption of new technology within each

country's regulatory framework. Is regulation capable of keeping up with innovation? How should insurers respond if an employer asks for access to the data Neuralink is monitoring? Are insurance firms required to give this information to security forces?

- Keeping up with tech giants and start-ups The success of Neuralink might speed the entry of start-ups and well-funded rivals into the insurance business, including Apple, Google, and Amazon. A big change is on the horizon because to our ability to develop and integrate with already accessible digital services. Established insurance firms can think about taking the lead by utilizing their understanding of the market and their clientele to develop new services, boost operational effectiveness, and foresee how the client experience could change. The use of new technologies like Neuralink would speed the entry of start-ups and well-funded rivals into the insurance business, including Apple, Google, and Amazon. The capacity to innovate and forge connections with currently available digital services portends a significant shift. Established insurance firms can think about taking the lead by utilizing their understanding of the market and their clientele to develop new services, boost operational effectiveness, and foresee how the client experience could change.
- Customers are increasingly looking for insurers and partners to provide them access to innovative healthcare products and services, according to a



Capgemini poll. An increasing percentage of clients base their decision on the service provider's technological "edge" and aptitude for embracing and incorporating innovation into their current insurance coverage.

Disabilities

Musk's statement that Neuralink will initially aim to "address key brain and spine problems" is likely to have caught the attention of disabled individuals. Throughout the presentation, Neuralink was in fact mentioned as having the power to treat a variety of chronic and fatal conditions, including blindness, spinal cord injuries, memory loss, brain damage, and even depression.

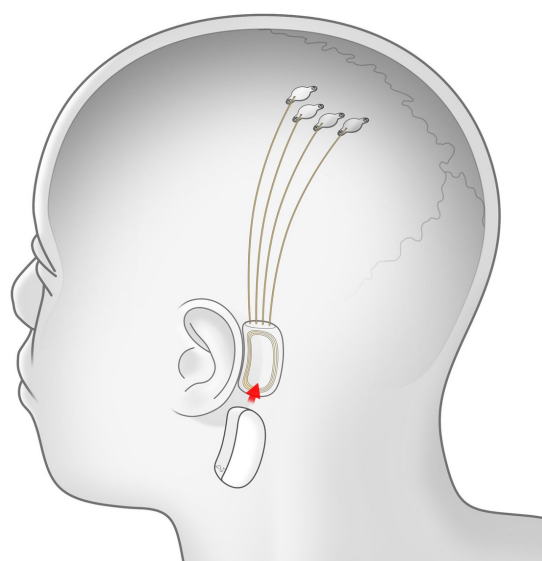
Patients with spinal cord injuries will be the main focus of the company's initial set of clinical trials. This may sound like an interesting story to those with disabilities who are listening, or at the very least, different from the professional publications' dreary medical terminology and quantitative facts.

Limits of The Neuralink Project

Even if we were to uphold the notion that freedom is about each person's right to make their own decisions, we would still need to take into account issues like how expensive neurotechnologies are and how widely accessible they are. In particular, this can favor socioeconomic groups who already have advantages in specific professions (such as medicine, science, philosophy, etc.) or even in important political professions like those in higher

administration. Democracies would face difficult questions as a result.

However, we cannot deny ourselves the potential advantages of "intelligent" brain implants and their applications for bridging medical diagnostic and therapeutic gaps in a variety of brain illnesses, as well as for enhancing social interactions and protecting the natural habitats of living things.



Because of this, the study of brain sciences and neurotechnologies is crucial for philosophical, social, and ethical debate. Although Neuralink is a private initiative, the "tomorrow" that this startup envisions calls for a kind of moral responsibility that need not only be understood as an individual choice: a human community is not a sum of individuals; otherwise (if one were to consider it that way) one runs the risk of condemning the concept of humanity and humanist values). This is the rationale behind Musk's moral inability to sidestep the existential question, "What is Human?"



Hacking the Neuralink

Due to the intrinsic physical separation between humans and technology, earlier periods were characterized by barriers preventing hackers from reaching their objectives. What transpires, though, when the line between technology and people is blurred? when they are basically the same thing?

A major security risk for BCI technology like Neuralink is this. The primary benefit of the technology, allowing direct brain-to-computer communication, may also prove to be its largest security weakness. There wouldn't be a distinction between people and machines that calls for authentication and judgment.

Hackers may gain complete control over a person if a computing device that is actually attached to the brain, like Neuralink, were to be compromised.

What may human hacking entail if Neuralink is able to precisely and thoroughly scan the human brain? Hackers will definitely target affluent people and maybe attempt to deceive them into transferring millions of dollars to an offshore bank account, according to recognized practices. Executive decisions made in boardrooms might potentially be hacked, with severe financial ramifications.

A more worrying possibility is that a hacker may quietly overturn governments and whole state infrastructures if they were able to convince a substantial portion of the populace to favor a certain candidate,

party, or issue. In the worst case scenario, hacking a Neuralink-like device may turn "hosts" into controllable drone armies that would obey any orders issued by their "master." Imagine the power a hacked army of sentient beings would have. Automobile autopilot software has previously resulted in fatalities.

Advantages and Disadvantages

Advantages:

- Improved interaction and cooperation between AI and people.
- Bettering the quality of life for those who are disabled.
- Improved capacity for knowledge learning and retention.
- Increased capacity for creativity and problem-solving.
- More gadgets and the internet are connected.
- Quicker reflexes and enhanced physical performance.
- The capacity to operate machinery and artificial limbs with your thoughts.
- A deeper comprehension of the brain.

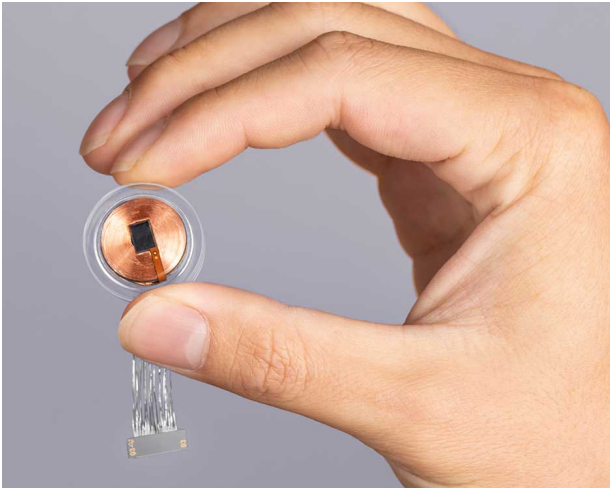
Disadvantages:

- Possibility of abuse and exploitation.
- Privacy invasion.
- BCIs may have unintended negative effects, including as addiction, anxiety, or sadness.
- Difficulty in removing or fixing a BCI if it breaks.
- Greater chance of infection or brain damage.
- The BCI technology is expensive.
- There has been little study of BCIs' long-term consequences.



Conclusion

Neurallink, in my opinion, harbors the potential to function as a sort of smartphone-like extension of ourselves. In certain fields, like health care, it will undoubtedly be beneficial. I think there are a lot more hyperparameters than we previously thought that can change how our brains work. The exact mechanisms by which the brain works are not well understood. There is still no general AI. How intelligence functions is still a mystery to us.

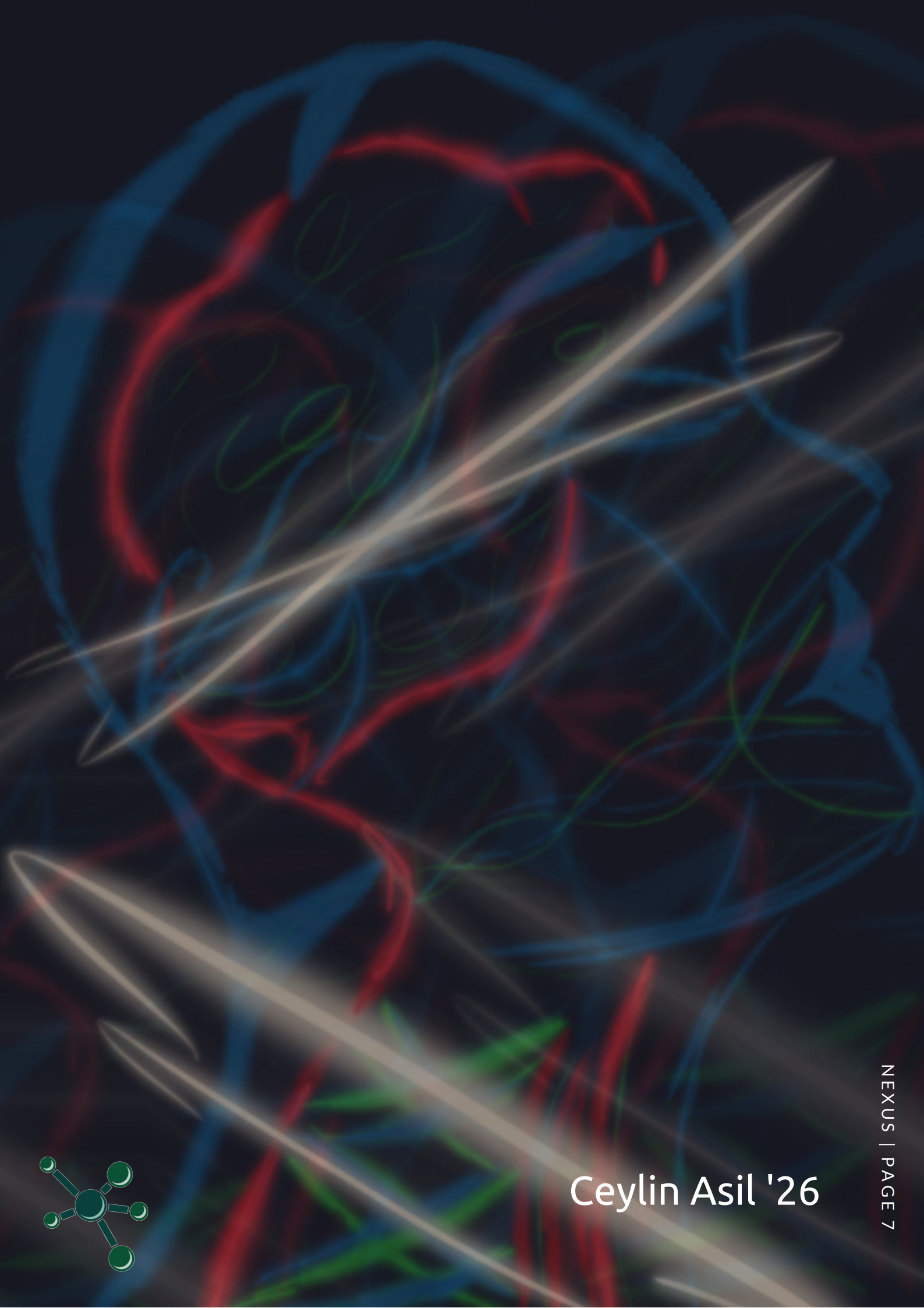


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Ceylin Asil '26



PEER PRESSURE'S EFFECT ON HIGH SCHOOLERS

KAAN TOMBALAK '23

Peer pressure has been the demise of many susceptible teens. Peer pressure is so versatile, it could even arise from just having the presence of another teen with them, and could have severely destructive consequences that come along with it. With this, I also conducted a fully anonymous survey in my own school and found out that more than half of the students had a tendency to fall victim to it. Mostly caused by the need to fit in, peer pressure can lead teens to serious injury or even death through the use of harmful substances by overdosing at the extreme and choosing riskier options when given with possibly lethal consequences.

A fully anonymous survey of my own conducted in my school with 47 respondents between the ages of 15-18 revealed that a slightly higher percentage of people do feel pressure of being left out of friend groups. Around 53.2 percent of respondents decided they would rather be in a friend group than not. However, an overpowering 89.4 percent of the votes indicated that most people would not change their opinion or ideas to be accepted. This means that despite a general trend about peer pressure, most students of my school did not follow this general idea in the sense of keeping their own opinions and not changing them.



The cause of peer pressure makes it look a lot more innocent than it actually is, at times opening up paths to the use of harmful substances that can end up being lethal. Peer pressure has caused the increased use of these lethal substances by those who want to fit in as those who use it open paths and encourage those who don't and have a negative effect on their lives. Especially when it comes to encouragement, it can be unavoidable, however the mere presence of peers is enough to tip the scales in usages favor, Nova Recovery Center says. Unfortunately, depending on how much they have taken, the consequences could be dangerous. Drugs and alcohol could end one's life if used unaccountably and overdosed, and yet, the presence of eyes watching without even any encouragement may push individuals to do what they have been told not to. This can further be extended to any harmful materials promotion in gangs, as illustrated in this piece "People get influenced easily when they join gangs. They start drinking, smoking, taking drugs and doing all kinds of negative activities. For them, it is fun doing such things because they are in a gang. They influence one another to do bad things.". These gangs, or previously mentioned popular friend groups, influence those who want to fit in to



be cool like them which includes the use of listed harmful materials, again destroying someone's life possibly forever or even ending it.

Students at my school were respectively more cautious against harmful substances, according to my survey, with 78.7 percent of votes going to drugs being a no-go. Another 14.9 percent of students agreed that they would be inclined to use such substances with encouragement from friends. The rest of the votes showed that some teenagers would see the presence of friends enough to use such substances.



To wrap it up, the so-called gangs that cause peer pressure are a pathway to any sort of harmful substance there is and anyone who feels the need to join them is likely to follow suit to those who use it.

Not only does peer pressure promote the use of harmful substances but it also gives the tendency to choose a riskier option when given among teenagers. It is linked to the choosing of higher risk solutions when

placed in a dilemma that can have destructive consequences. A study done by the National Institute on Drug Abuse has found that teenagers are more willing to take risks like running speed lights or drunk driving if they know their peers are watching.

Once again, peer pressure has caused the illegal actions of teenagers which are considered cool among them. The breaking of law is highly dangerous and punishable, yet teens every day do stuff like running a traffic light to be cool amongst their friends and having something to brag about, yet it definitely is not something to brag about. It is not only putting your life at risk but most likely putting others' lives at risk too. They take the chance to possibly kill someone or themselves, as stated here, "During the study, teens weren't encouraged by friends to perform risky behaviors but did so anyway in many cases. The way participants calculated risk versus reward was shown to be the underlying cause of these decisions". The only reason for this risk is because they seem to find it to be quite rewarding even though I fail to see why that would be. Sure maybe it might make you less cool to obey traffic laws and any other law for that matter but it should be considered if it is worth ending your own or someone else's life and ending up in jail.

Of my own findings, this matter showed less resistance than the use of harmful substances with 61.7 of the respondents rejecting any reckless behaviour. Out of the rest, 29.8 percent of students did say that they would need encouragement to do such



actions. However, there is no denying that encouragement or no encouragement, risky behaviors from teenagers are inevitable.

One of the worst parts is, again, no encouragement is needed in some cases to stray people from the right path and into risk-taking. Just the presence of their peers is enough for them to threaten lives carelessly.

In conclusion, one of the causes of peer pressure is the need to fit in which ends up with many possible life-threatening situations for both the one under pressure and any other people they might cross paths with. Those who are rather susceptible and get stuck in this loop cause consequences of the destructive kind and it should be prevented by any means necessary. After all, it is not agreeing to one another's ideas that make us important, but rather our own unique ones.

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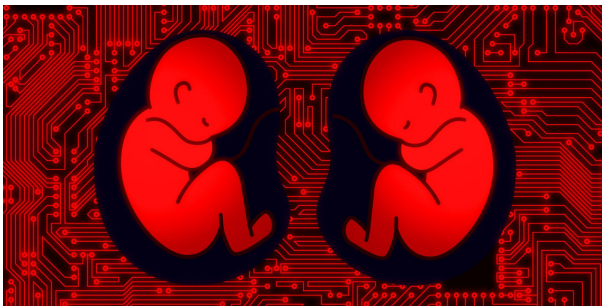
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CAN “DESIGNER BABIES” TECHNOLOGY CURE CANCER?

IRMAK ATILGAN '23

Imagine having control over all of your uncontrollable qualities; qualities that are "in your genes" such as your height, your body type, or even a disorder. Gene therapy is simply interfering with the genome by inserting, deleting, or swapping out selected genes or gene regions, also known as loci. Alterations to the genetic makeup, genotype, of an organism via gene therapy will be reflected in its observable characteristics, its phenotype, as the cells multiply and die, and as genes are expressed. The prospects of gene therapy can range from being the next “big thing” in the cosmetics industry to saving millions of lives all over the world. Directing the research, public attention, and funding to the medical use of gene therapy is critical since it is one of the most promising technologies in the modern age, commercial or cosmetic use of it can become an aesthetic luxury like designer babies which would maim society, and the medical use of gene therapy can treat fatal diseases such as cancer.

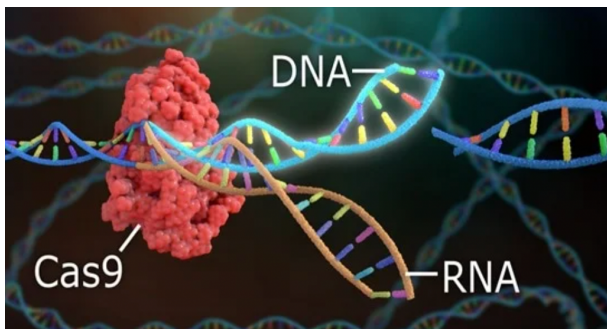


As gene therapy is an emerging and rapidly developing technology, it has immense prospects in the modern age. As gene therapy can be performed on somatic or germline cells, the changes made can end with them or be inherited by the following generations. Although gene editing on germline cells is currently a banned practice around the world due to ethical and legislative controversy, all three forms of gene therapy (in vivo, ex vivo or in situ) on somatic cells have gone as far as giving vision to the blind or curing a disorder of the blood cells known as beta-thalassemia (“Gene Therapy Successes”). An emerging method in gene therapy is the CRISPR Cas-9 technology, which imitates an immune mechanism from a certain type of bacteria. In an article called “The CRISPR Craze” by Science Magazine George Church Ph.D., a pioneer of this technology at Harvard University School of Medicine, claims it to be much more efficient and easy to use in comparison to similar emerging methods of gene therapy. Gene therapy is already an industry worth billions of dollars, and it will only continue to grow. As technology progresses and builds on itself, what people now know as “impossible” will become regular practices.

When most people hear about gene therapy, the first thing they think of is “designer babies”, babies genetically engineered in their embryonic state to have certain cosmetic traits such as a certain eye color, height, hair type, or even superhuman qualities. Although this method seems plausible in theory, it raises countless questions on human rights, ethics



and religion, or finance. “This is the first step in a well mapped-out process leading to GM [genetically modified] babies, and a future of consumer eugenics,” says David King, director of Human Genetics Alert (“British Researchers Get Green Light to Genetically Modify Human Embryos”). The genetics industry can very easily turn into a new branch of the tree which is the cosmetics industry. However, bioethicist Dr. Christopher Gynell from Murdoch Children’s Research Institute notes “[e]dited embryos won’t lead to designer babies or eugenics – unless we want it to” (“GM Human Embryos Won’t Create Designer Babies”). The testing alone would take years since engineered genes will likely turn out to be toxic to the cells and may even end up killing the organism. Moreover, in order for the testing to begin and for the technology to be implemented in the real world, countless ethical and political disputes need to be settled first. This may range from defining limits for the traits that can be engineered or even drafting a separate “Universal Declaration on the Human Genome and Human Rights.” The CRISPR Cas-9 technology, for example, bears great potential, and as stated, its capabilities are not limited to manipulating a few genes to make someone



or their baby look more aesthetically appealing. So although the idea of customizing future generations may sound interesting, it is hazardous and definitely not a practice to be seen in the near future.

The actual future of gene therapy lies in medicine and public health. The main intention behind the development of gene therapy has always been to cure hereditary diseases and improve the quality of life. In addition to being the more virtuous outcome of the advancing technology, this goal is also supported by legislation as gene therapy for medical treatment is performed on somatic cells anyways. A great focus of the gene therapy industry has been cancer diagnosis and treatment. For instance, “The present in situ gene therapy clinical trial for human prostate cancer demonstrated safety, clinical efficacy, and biological effects of antitumor activity” (Sato 2). Professionals are targeting certain types of cancers such as prostate and breast cancer, and developing gene therapy models apt for the loci of the selected regions. Similarly, a research paper titled “Precision cancer mouse models through genome editing with CRISPR-Cas9” notes: “In the future, the CRISPR-Cas9 system will be more finely tuned, accelerating in vitro and in vivo genome editing to establish novel cancer models and better understand cooperative effects among complex tumor suppressor gene and oncogene networks”(Mou 15). Progress and demand for the use of gene therapy in medicine are accelerating rapidly. The advancement of current technologies such as CRISPR, and the discovery of new methods over time will



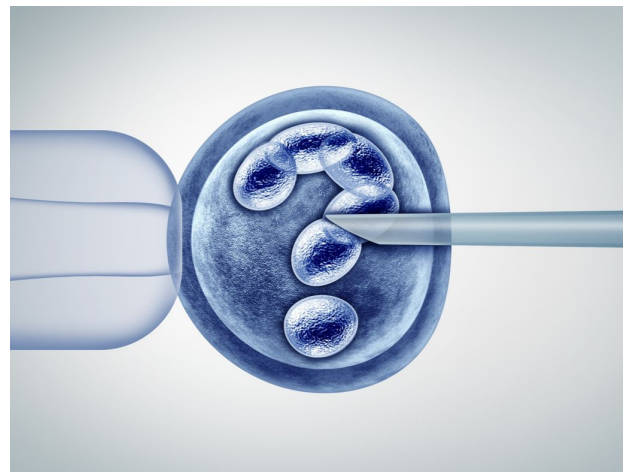
make way for revolutionary innovations in medicine such as more effective treatments for cancer.

It is important to remember that gene therapy is the same technology whether it is being used to make designer babies or cure cancer. However, if people manage to direct the funding and support to the correct and ethical implementation of gene therapy methods, it can be used to revolutionize medicine and public health. The technology to make designer babies exist yet scientists, bioethicists and professionals with expertise in the subject are purposefully avoiding this development due its deleterious consequences on society. On the other hand, the implementation of gene editing technologies in curing fatal diseases like cancer and beta-thalassemia, which used to be “impossible” to do, are producing great results will likely be seen as a common practice in the approaching decades.

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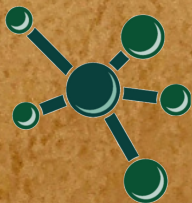
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Ceylin Asil '26



ANIMAL VS HUMAN BRAIN

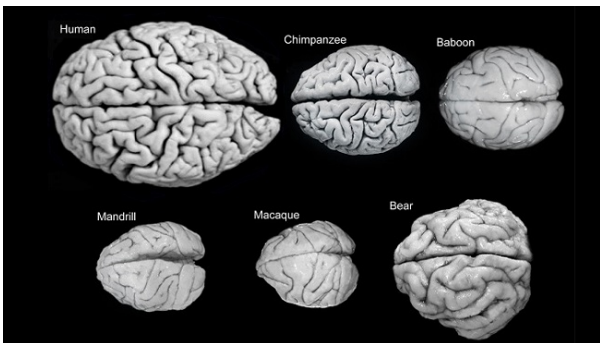
ZEYNEP ÖLMEZ '24

There are many people who think that humans have evolved from animals such as chimpanzees. Their reasoning for this is actually comparing their abilities to humans which seem similar. In reality although there are major differences, the cognitive side of the brain is quite similar. It could be said that there is no fundamental distinction between the mental capacities of a man and those of some animals. Some observations have shown that animals have demonstrated human-like skills. Some examples of it are teaching, their short-term memory, and planning. It is detected that some animals can actually teach. Mostly, they are parents who try to make their children learn how to survive, like cats teaching their kittens how to kill and find food, by demonstrating it to them. And similarly, humans teach their kids everything about life, like how to walk and talk. It should be added that not all animals teach but even if some do it, it shows a similarity between the human and animal brain. The short-term memory of chimpanzees is just somewhat inferior than that of humans. Only five to seven things are retained in memory for both species. This doesn't mean chimpanzees are as smart as humans because the 'five things' that we can remember differentiates between the two species. While humans can remember five full stories, the chimpanzees can only remember the name of the five stories. So

human brain works more complex and it can achieve more in a sense. This means that based on the additional cognitive services of the species, same constraints in different species may have radically different effects. Lastly, planning was considered to be unique to humans till now, but recent experiments made us doubt this belief. This experiment was made with scrub jays, and people observe that these birds portioned their food for the whole day depending on how much they had. In comparison to humans this is basic planning, humans also think ahead, but there are more complicated actions involved in the planning process. So while animals might have easier and more straightforward plans, it is still a closer step to the way the human brain works. Besides the cognitive side of the brain, other similarities were found between human and animal brain's as well. Peter Cook made a research based on 2 types of animals and their relation to humans. Cook's research centered on three areas: neurobehavioral evaluations of wild sea lions, opportunistic dead brain network imaging in dogs and other animals, and functional brain imaging in dogs. His study on sea lions provided information about the parallel between humans and sea lions in the hippocampus. A sophisticated brain structure, located deep within the temporal lobe is the hippocampus. It plays a significant part in memory and learning which creates the similarity between the sea lion and human. The research also showed that people and sea lions had similar reactions when affected by hippocampal epilepsy. Cook discovered that



dogs have a significant level of neurological skill for social processing similar to humans, as a result of his studies on dogs. Most of the dogs interactions with humans seem to make them happy and it is also proven that the difference between different humans and different canine faces can be told apart by them. Also they are interested in how people and dogs interact. As a result, it is possible to use dogs as an animal model to study social neuroscience. In addition, Cook discovered that dead brains could be gathered and trained canines could be trained to store enough information for functional brain imaging, adding another another way to compare how the brain has developed and evolved.

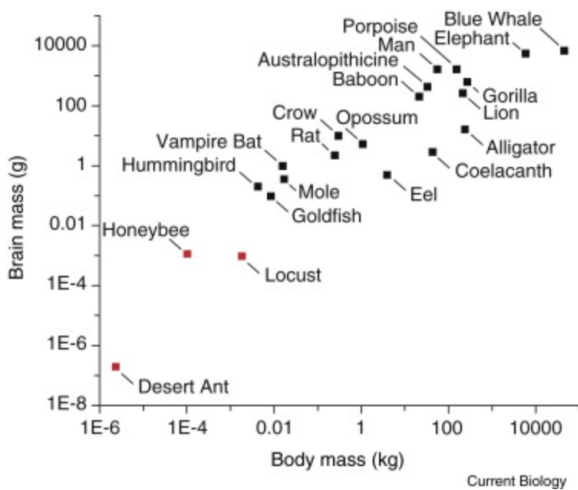


One of our bodies' most interesting parts, the brain is where all of our behaviors, feelings, and instincts originate. The brain serves as the coordination hub for sensation and action and aids in the seamless operation of all the body's systems and organs. It is made up of billions of neurons that collaborate to receive and transmit information. This body part is unique for all, including animals. Different species have different brain structures. For example, the brains of certain spiders make up a significant portion of their body, which is unusually

enormous for their size. Spider brains may also take on some extremely intriguing forms, pouring out into the spider's body chambers and legs in addition to its head. For spiders to carry out tasks like web-building or hunting, their enormous brains are crucial. Another example is squids. The squid's brain is formed like an oval with a hole at the center of it, which makes it incredibly efficient at connecting information between its two huge eyes. From this comparison we can conclude that the purpose of the animal, defines its brain structure. Independently of the impacts of body weight and evolutionary history, species variations in lifestyle, particularly nutritional preferences and patterns of juvenile growth, are linked to diversity in brain weight. These findings start to hint at the evolutionary forces favoring various brain sizes and brain components when combined with behavioral and neuroanatomical assessments. The similarities between the brains of various mammals may easily be seen when they are put side by side. The same components are present in all brains, despite the fact that their sizes and fold patterns vary greatly. Even if the components are the same, this does not imply that the same number of each type of cell is used to construct brains of the same size. Furthermore, it is not necessarily true that a larger brain contains more cells than a smaller brain. Most scientists believed that brains of the same size would have the same amount of neurons, until around ten years ago. They believed that there was a single 'way' used by nature to construct brains and that this was the same for all brains. Additionally, it



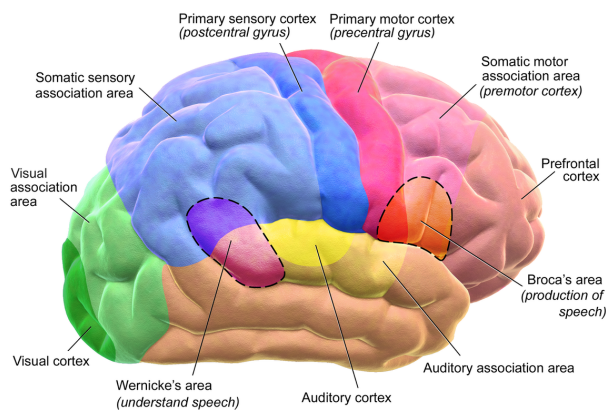
implied that the brain would have more neurons the larger it was. However, these hypotheses were both wrong. In 2005, a study was conducted to find a way to count the neurons present in the brain. Turning a recently dead brain into liquid form, was founded to be the most effective way, because not every part of the brain has equal amount of neurons, so it is not possible to count the neurons in a section of the brain, and estimate a number according to that. This technique was used for rodents and primates. Although rodent had the bigger brain size between the two, primate had more neurons than the rodent. As a conclusion scientists found out that every brain has different building rules. These rules show the relation between the size and the neurons and their proportionality. So scientists have figured out a pattern between these characteristics of the brain and the structure of the brain, and although they don't surely know the answer to why that is, they believe that the complexity of the brain affects the animals actions and emotions.



When the anatomy of a human brain is explained, there are many parts to it. First of all the brain is made of 3 necessary parts. The cerebrum taking up most of the space, consist of the left and the right hemispheres. It controls most of the human skills such as; understanding speech, thinking, emotions, learning, touch, vision, and hearing, as well as speaking, learning, and fine motor control. Then there is the cerebellum, right under the cerebrum, and it helps us synchronize your muscular movements, our posture, and balance. Lastly, the brainstem which connects the spinal cord to the cerebrum and cerebellum. Numerous automatic processes are carried out by it, including those related to breathing, heart rate, waking and sleep cycles, digestion, etc. and swallowing. When you get deeper into the brain, like it was said before, there is the left and the right side of the brain. A group of fibers known as the corpus callosum connects them and carries messages from one side to the other. The opposing side of the body is controlled by each hemisphere. The left hemisphere of the brain is generally in charge of speaking, understanding, mathematics, and writing. Creativity, spatial awareness, creative ability, and musical talent are all governed by the right hemisphere. The cerebrum also have lobes known as; frontal lobe, motor strip, broca's area, sensory strip, parietal lobe, Wernicke's area, temporal lobe and occipital lobe. The frontal lobe contorls the humans personality, which means their emotions and behavior. It also includes our problem solving skills and judgment as well. The Broca's area is inside



the frontal lobe and it affects our speech abilities. Similarly, the motor strip is responsible for our body movements and it is also included in the frontal lobe. The parietal lobe interprets language, signals from vision, hearing and our memory. Plus, it also consists the sensory strip which affects the way we feel pain and our sense of touch. The occipital lobe controls our vision and its characteristics such as color, light and movement. The temporal lobe is responsible for hearing and memory, and the Wernicke's area is a part of this lobe which understands language. This complex structure of the brain consists of everything that makes us a human and differentiates us from animals and their brains.



Animal brains occur in a wide range of sizes and forms, but intelligence is not strongly correlated with brain size. The number of neurons and their location appear to be more important than brain size. More than any other animal, humans have more neurons than any other species in their cerebral cortex, the part of the brain responsible for language, thinking, and information processing. This might explain why we have improved cognitive capacities. To find similar neuron-dense brain regions and their roles in brain

function, scientists are examining different species. Numerous insects provide as examples of how highly varied motor repertoires, vast social systems, and cognition may exist with extremely little brains, highlighting the necessity to comprehend neural circuits. The numerosity, attentiveness, and categorization-like functions observed in insects may only need relatively few neurons, according to neural network analysis. Because of fundamental biophysical limitations, bigger neurons are required in large animals, which results in larger brains, at least in part. Additionally, they have more neural circuit replication, which improves the intricacy and precision of perception, allows for more parallel processing, and increases store capacity. In other animals such as bees, their learning abilities have developed very impressively. They must be adapted to a lifestyle where they need search really long distances to find a suitable feeder, and then memorize the place of the feeder, and how rewarding the feeder is depending of the time of the day. Their memorizing and learning abilities are really strong which means that their frontal and temporal lobe has more neurons present than the other parts of their brain. Another example of this is insects with big eyes such as bigger flies. Their eyes are bigger than humans meaning they have greater vision abilities. This shows us that their occipital lobe has more neurons than humans which gives them this specific ability. Therefore, while certain increases in brain volume will have an impact on cognitive ability, numerous increases in specific brain regions, particularly those



related to sensory and motor processing, only result in quantitative gains: more accuracy, sensitivity, finer resolution, and more detail.

To give a specific example of differences between the human and animal brain, the sheep and human brain can be compared. As for the size of their brains, human brain is larger. The shape of the sheep brain is also different meaning that, the complex structure of the human brain isn't present in sheeps and their brains do not have as many turns (the shape where the brain looks like it has turns all around it) and it is much simpler, with less turns and a smoother surface, which results in the smaller brain size. In contrast to the spherical form of the human brain, the brain of a sheep is elongated. Given that the backbone of a person is vertical, as opposed to a sheep's horizontal backbone and its brain's outward orientation, the human brain stem is oriented downhill and towards the backbone. The size of the cerebellum is also different for the sheeps and human. Humans have more sophisticated tough behaviors, greater motor skills and learning capacities, which means their cerebellum is larger. The sheep is the quite opposite of humans but some of their their senses such as smell is more developed since they rely more on it. These characteristics shows that the olfactory bulb in the sheep's brain is noticeably larger. Also, the location of the human hind brain is likewise different from that of sheep due to the human's upright posture. The human brain enables invention, creativity, and imagination. This

is a key distinction between the human and animal brains, as evidenced by the size of the prefrontal cortex (In humans it is larger).



In conclusion, although there are some similarities between the human and some of the animal brain, humans are more complex creatures and most of their abilities have developed better in time, which means that they have more neurons on most the the lobes of the brain compared to animals. The said to be lobes are also explained and it could be said that even the main parts of the brain have its own parts and those parts also get divided into other parts. Also depending on the animal, they have different characteristics due to the amount of neurons on a part of their brain. The brain size doesn't show the intelligence of a creature. Intelligence cannot directly be measured, since different species have different areas that they are better at. As an example, bees and insects were given. Lastly a more concrete comparison was made between sheep and human brain regarding the size and the shapes of the brain. And it was found that both of them had different specialities and that the human brain was larger with more neurons due to the shape of the brain.



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Ceylin Asil '26



TYRANNY OF THE FISHERMEN

CEM KABAŞ '23

Oceans are like the secondary lungs of the Earth as 70% of the oxygen is generated in the oceans, and the ocean's fauna feeds 3 billion people (David Attenborough, A Perfect Planet). Much like forests, the oceans are also full of carbon-storing life and through life and death, this balance is kept. However, in the high tides and oceans, a significant threat to the marine ecosystem is present due to the increasing number of human fishing operations. Fishers partake in significant illegal actions such as out-of-season fishing or misuse of gear, both of which pose a serious threat to the number of aquatic life in the waters.

The foremost problem caused by fishers is overfishing and by-catching which usually occurs when they fish during off-seasons. The off-seasons are when fish reproduce to balance the number of their kind consumed by larger fish, therefore fishers are only allowed to catch with fishing rods and not by nets or traps. Furthermore, if they ever catch an endangered species or a breed that they are not allowed to catch, they're supposed to release them with minimal damage. Nevertheless, some fishers continue even though it's illegal. Overfishing causes fish to fail in reproduction which means their numbers are less than what needs to be present for the balance of the ecosystem. Consequently, the food-chain shatters as



the ratios of prey-predator-scavenger fish depend upon the continuous reproduction of smaller fish and the continuous hunting of smaller fish by larger fish to keep their numbers in check. "Overfishing has removed about 90% of all large predatory fish, which means there are less lifeforms to store carbon in the marine world"(David Attenborough, A Perfect Planet). Thousands of sharks, rays, seabirds, and sea turtles are now at risk of extinction because of overfishing (WWF Seafood Sustainability), and that is without taking into account the unintentionally caught marine life which were caught and never released for a chance of profit from selling endangered species. The reason for so many cases of illegal fishing is due to "Inadequate government capacity and cooperation to manage, regulate, and control fisheries and fisheries trade, especially in developing nations and on the high seas, are key factors contributing to the current problems in oceanic fisheries" (WWF Seafood Sustainability). Thus many fish are stolen from under the nose of



Another problem caused by fishers is ghost gears which also happen to occur as a product of overfishing. Ghost gears are lost and abandoned fishing gear such as nets, lines, pots, and traps that are deadly to marine life. Ghost gear can continue to catch target and non-target species unselectively for years, potentially decimating vital food resources as well as endangered species, such as marine mammals, sharks, and turtles which end up suffocating in the process or after washing up onshore. “Each year millions of sharks and over 300 thousand whales and dolphins are accidentally killed by fishing nets” (David Attenborough, A Perfect Planet). There are many reasons why fishing gear can be lost or abandoned, including severe weather, conflict with other gear, interaction with other vessels, and, rarely, intentional discard when no other options are available due to many ports lacking the facilities to collect, recycle or trade nets. Ghost gear is thought to make up 10% of all marine litter (The Guardian) and is found in large quantities in the Great Pacific Garbage Patch.



One viable solution to combat overfishing and by-catching is through GDST and marine protected areas. The Global Dialogue on Seafood Traceability or GDST is an international, business platform assembled by the World Wildlife Fund Inc.

(WWF) and Global Food Traceability Center (GFTC) to produce the first-ever industry-wide voluntary standards for seafood. The GDST currently brings together dozens of major seafood companies from around the globe, representing over \$35 billion in annual seafood sales. This work would help the seafood industry establish common goals and technical design standards for traceability to facilitate the flow of information through supply chains (GGGI). Moreover, through the establishment of more marine protected areas, it can be guaranteed that there will be zones where marine life can flourish without issue. One example is on the coast of Gabon, where there is currently a network of marine protected areas that has become a major hot spot for breeding whales, dolphins, and sharks. Marine life in Gabon now has a chance to thrive once again. (David Attenborough, A Perfect Planet). Community-managed areas, often based on traditional knowledge and customary practices, benefit people in places where fishing is such an important part of the livelihoods of coastal communities(WWF), therefore, precautions and actions taken from both a legal standpoint and a cultural standpoint would have major impacts for the betterhood of the aquatic life.

A secondary approach to dealing with the ghost gear side of the problem would be for each aspect of the community to take action in their respective way. Governments can adopt appropriate fishing gear or join the Global Ghost Gear Initiative(GGGI) or help in the establishment of a new treaty to



prevent marine plastic pollution. Fishing gear designers and producers can, design and manufacture fishing gear that is traceable and could be recyclable or re-useable, with proper end-of-life disposal in mind. Fishers can, avoid fishing gear loss by implementing gear control practices or reporting the fishing gear they lose and if it is possible, retrieving it. The general public can report ghost gear sightings which would allow professionals to remove the gear and help develop improved waste management and fisheries management programs. (GGGI) One such example of this system being plausible is Ben Lecomte, a Frenchman who is journeying from Hawaii to San Francisco via the Great Pacific Garbage Patch to better understand how plastic is affecting our oceans. As someone from the general public, he is raising awareness of the problem and through media outlets, more and more people are becoming aware of it and requisition new regulations and treaties(The Guardian).

One of the biggest obstacles in the way of marine eco-life is fishers whose reckless fishing practices are causing a rapid decline in the stability of the food chain. Overfishing and by-catching result in fewer fish reproducing and larger fish to deal with food shortages. Meanwhile, ghost gear causes mass deaths as it travels with water currents. To deal with harmful fishing practices as such, both law and culture-based methods can be utilized on top of gaining the aid of the general public to sway governments and fishing gear producers to pursue more environmentally

friendly methods of fishing. By tackling the issue from multiple sides, the impact can be quite large and there could be a moderate chance for a change for the better-hood of everybody.

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CONSEQUENCES OF MARINE POLLUTION

IRMAK ATILGAN '23

Water, the lifeblood of the planet, makes up 70% of its surface with rivers, seas and oceans. However, the blood is being poisoned with plastic(BBC). 46,000 pieces of micro and macro plastics are in every square mile of ocean, weighing up to 269,000 tonnes in total all around the world(Condor). The production of plastic waste, which is finding its way into the food chain, is increasing by the day but operations like collecting the emitted plastic from waters and developing biodegradable alternatives to plastic are in progress to remedy the environmental damage.

The first problem is that plastic waste in the oceans is entering the food chain. Bodies of water are very rich habitats for numerous blessings of nature including seabirds, fishes, and seals. Consequently, when tonnes of plastic waste is dumped into bodies of water, they are accidentally or intentionally consumed by sea animals, which are later preyed on and digested by other sea animals higher in the food chain (BBC). For example, not only do newly hatched Shearwater seabirds mistake plastic for actual food, but the mother shearwaters also fall into this cycle and unknowingly feed their chicks with plastic by eating plastic themselves and spitting it into the chicks' mouths (BBC). As a result,

chicks' throats and stomach linings are damaged, and their hormone levels are disrupted. Every year 260 pieces of tiny plastic, on average, are pumped from the stomachs of newly hatched shearwater chicks that are found in bad condition (BBC). Contrary to popular belief, animals like sea birds on the lower trophic levels are not the only beings who are living with microplastics in their systems. Due to the fact that species on higher trophic levels consume those on lower ones, microplastics travel up the food chain. A research paper published by the International Journal of Medical Sciences emphasizes that many plastics such as BPA, BPF, or DEHP, which can cause cancers around the body, infertility, and hormone imbalances, are commonly found in people's bodies (IJMS). The study also identified that the source of this plastic content was food. Beyond recognizing this very important issue, is stopping pollution once and for all actually enough to prevent the spread of plastic in the bodies of almost every organism on Earth?



The second problem is that plastic consumption is only growing. A 2022 study from the United Nations Environmental program proves how about a million plastic bottles are purchased each minute all around the world; the study also finds that

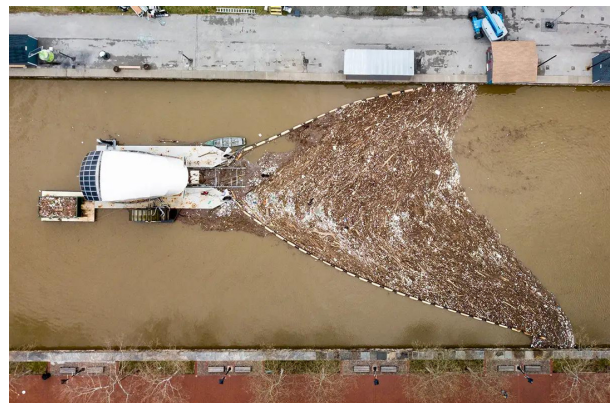


annually 5 trillion plastic bags are consumed globally (UNEP). Additionally, it is crucial to remember that an incredibly small proportion of these plastic bags and bottles are being reused or are able to degrade in nature. A study from National Geographic shows that 40 percent of the plastic produced annually is meant for single use. Considering that only 1% of all plastic is biodegradable, annually thousands of tons of plastic are guaranteed to be in landfills and oceans for centuries to come (European Environment Agency). The owner of a relatively small warehouse which contained approximately 30 tons of plastic bottles in the outskirts of Makassar City, Indonesia, Marwan Hassan claims that, "It never reduces. In fact, the amount of plastic is increasing year on year, the amount we are shipping to Jakarta is increasing"(BBC). Accordingly, the poison on this planet's plate is not only daunting but also ever-increasing.



Nevertheless, new practices are being organized all over the world to battle the entrance of microplastics into the food chain. One such practice is removing the existing plastic in the oceans. All around the world, systems like sea bins, trash wheels, or ocean cleanup barriers have been implemented to collect tons of plastic

from bodies of water daily (BBC). In fact, the trash wheel system starting in Baltimore, Maryland called "Mr Trash Wheel" is said to collect over 35 tons of plastic daily (BBC). Moreover, researchers are working on removing the plastic in marine animals in and in the ecosystem itself. For instance, a team of marine biologists led by Dr Jennifer Lavers has been traveling to Lorde Howe Island every year for about two decades to pump the stomachs of shearwater chicks in order to get them to vomit up all the plastic they swallowed (BBC). The team is usually able to pump 30-40 pieces of plastic out of each chick (BBC). So, what is supposed to happen when plastic is collected?



A 100% effective solution may be not using any plastic in the first place. This can be achieved by reusing and recycling the already emitted waste or shifting to biodegradable alternatives to plastic in daily practices. What is not commonly known is that there are numerous alternatives to plastic that serve the same function when manufactured correctly, and degrade in nature within a couple of years depending on the choice of material. A research article published in Research Journal of Engineering and Technology

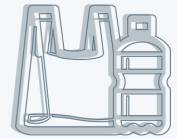
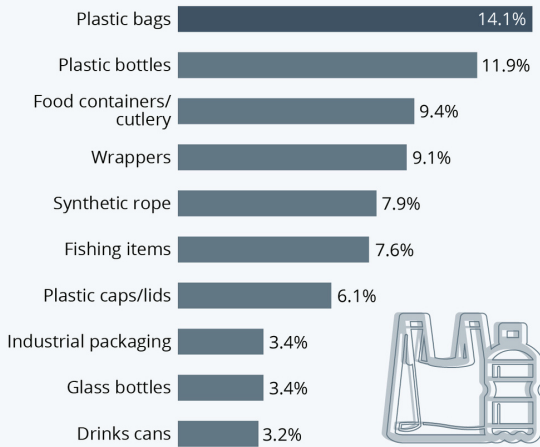


clarifies how of the five types of degradable plastic (biodegradable, compostable, hydro-biodegradable, photo-degradable, and bioerodable), biodegradable plastic has the longest decomposition time, which is 2-3 years (RJET). Many companies like Vegware, UrthPact, and Vevoware commonly use compostable plastic in their products which are designed to fully decompose within approximately 80 days (Vegware, Vevoware, UrthPact). Even though it is important to keep in mind that degradable plastic cannot decompose under conditions like above or below certain temperatures, or in the presence of light or water for some types of degradable plastics, the fact that these plastics are fully able to decompose and complete their decomposition in 2-3 years maximum may be a real and permanent solution to marine pollution (RJET).



Plastic Items Dominate Ocean Garbage

The 10 most widespread waste items polluting the world's oceans*



* Based on waste items found in seven aquatic ecosystems globally.
Source: Carmen Morales-Caselles et al. (2021)



statista

In conclusion, plastic waste has spread to every part of the Earth from bodies of water, to the food chain and the amount of plastic that is spreading is in a continuous climb. However, slowly but surely, the emitted plastic is being collected from bodies of water and companies are shifting to degradable plastic options. It is key to note that while plastic collection methods are helping reduce marine pollution, they, unfortunately, do not have mass impact and are not sustainable as they do not offer a sustainable out source for the collected plastic. All the plastic is being plucked from marine ecosystems only to be dumped into landfills to poison terrestrial ecosystems. The ultimate answer comes back to degradable plastics, which are currently in such small amounts all over the world. It is only the beginning of an era that will have everybody's life revolve around the safety of the planet and yet the question still remains: what will happen to the plastic already in the waters?



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Ceylin Asil '26



THE STORY OF CHARLES WHITMAN

LARA TÜRELI '24

Introduction

In this research paper, the story of Charles Whitman will be examined and explained under five points: who Charles Whitman was, his career and background, concerns about his health, the mass murder he caused, and his death - including the results of his autopsy.



Who Was Charles Whitman?

Charles Whitman was raised in Lake Worth, Florida. He was the eldest of three brothers. People who knew Charles Whitman thought he was the perfect American boy. It was said that he was a hard-working, caring person who continuously pushed himself to do better. However, apparently, his accomplishments never reached his father's standards.

Whitman's father believed in parenting methods that included abuse and harsh

punishments. He not only treated his kids this way but also beat his wife. Because of this Charles Whitman hated his father deeply. His mother, on the other hand, was a caring religious person whom Whitman loved dearly. Whitman's father was a fanatic gun lover. This passion of his led him to teach Charles how to shoot from a very young age. Whitman's shooting precision was one of the few things his father was proud of.

Even though he seemed to be a good person who cared for his mother, brothers, and wife Charles Whitman is widely known because of the mass murder he was the cause of at the University of Texas in 1966. Where he killed 18 people, injured 31, and eventually got killed by the police - while trying to stop him from hurting more people.

Career and Background

The way Whitman was treated by his father pushed him to leave the environment he grew up in. Even though his grades were good, his academic record was stained by his actions in school. Because of this, instead of going to school, he joined the Marines. Since Whitman had years of practice with a gun, and during his time at boot camp, he qualified as a sharpshooter. After his time at boot camp, he was sent on duty at Guantánamo Bay naval base in Cuba for 18 months. His success in Cuba resulted in his appointment to a training school in Maryland. His academic success earned him a military scholarship for mechanical engineering at the University of Texas. Here he met Kathleen Leissner, another



student at the university, who he would eventually marry.

After some time at the university, under his military scholarship, his grades started dropping causing him to lose his scholarship and be called back to active duty. After he finished his time in active duty, Whitman went back to the University of Texas to study architectural engineering. Soon later Whitman's mother left his father and moved to Austin, Texas. With this change, Whitman's anger and hatred for his father grew stronger, leading him to more violent tendencies. He started documenting his violent impulses and sought out psychological help. In one of his psychological help sessions, he confessed that he fantasized about shooting people from the tower at the University of Texas. On August 1 1966 he killed 16 people and injured 31. He was killed by police officers during this time. Before his death, he specifically asked for an autopsy to understand if his impulses may have been caused by a physical problem.



Health Concerns

Whitman had many issues deeply rooted in his relationship with his father. His violent impulses, the way he treated his wife, and his mother leaving his father led Whitman to seek psychological help. He went to one of the school psychiatrists at his university. Here, he told the psychiatrist, Dr. Maurice D. Heatly, about his violent impulses and his fantasies about killing people from the tower on the university campus. Dr. Maurice D. Heatly told Whitman to come back for more sessions; however, Whitman never returned for more help.

Whitman documented his feelings and thoughts regularly. The day before the shooting at the tower, Whitman wrote, "I do not really understand myself these days. I am supposed to be an average reasonable and intelligent young man." This shows that Whitman was also able to recognize that he wasn't acting like his usual self. He explains how the trauma caused by the household environment he grew up in may have affected how he felt but that he couldn't deal with it on his own.

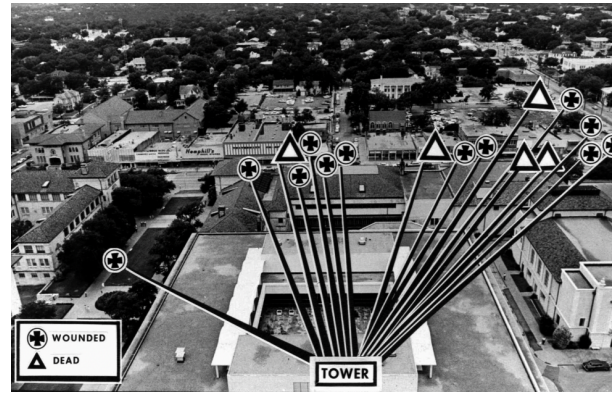
Mass Murder: Texas Sniper

On August 1, 1966, the Texas tower shooting took place. The person behind this mass murder was Charles Whitman. The night before Whitman wrote about his newly unusual impulses and thoughts in a possible suicide note. However, he did not write about what he would do the next day. The night before the mass shooting, Whitman went to his mother's house in Austin and killed her. After returning to his house he also killed his wife in her sleep.



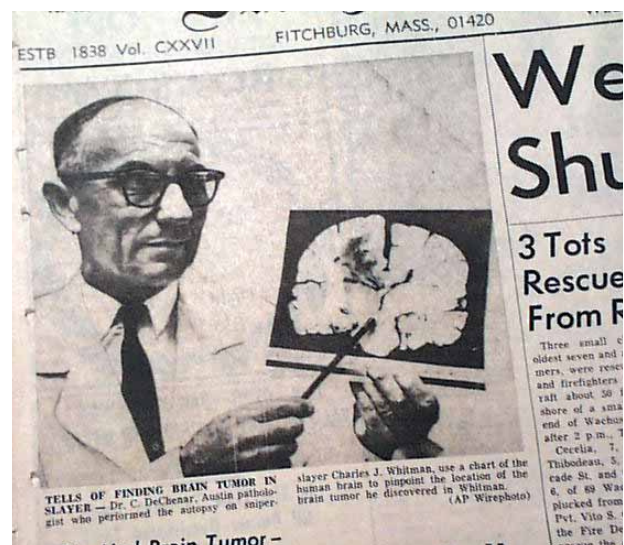
He left a note next to her wife saying “I don’t want her to have to face the embarrassment [sic] my actions would surely cause her.... I truly do not consider this world worth living in, and am prepared to die, and I do not want to leave her to suffer alone in it....Similar reasons provoked me to take my mother’s life.” This shows that Whitman thought that he was doing his wife and mother a favor by killing them. Another thing to note from this note is that even though he doesn’t specifically talk about the shooting he implies that he will be doing something outrageous.

The next day Whitman prepared for the shooting. He assembled his weapons which included guns, rifles, knives, and a machete; he also packed food and water. Later in the morning he headed to the university with these supplies. He disguised himself as a worker and made his way to the top of the clock tower. Once he reached the reception of the observatory of the tower he killed the receptionist. As he made his way up to the top of the tower he killed two and wounded two other people who were there as visitors. Once he got to the top of the tower he set up to start shooting. Whitman shot randomly in all directions. His previous experiences with guns gave him an advantage against the police and the innocent people on campus. After killing 14 people and wounding at least 30, three police officers and an armed citizen climbed up the stairs to stop Whitman. Once the four reached the observatory, Ramiro Martinez and Houston McCoy shot and killed Whitman.



Death and Autopsy Reports

As Whitman wishes, an autopsy was conducted to try and understand the motive behind these murders. As a result of the autopsy, a mass was found in his brain. It was argued that this mass would not be the reason for the shooting. However, after more research, it was understood that the tumor was a glioblastoma tumor. The aggressive nature of the tumor led researchers to believe that this may have caused these actions. This led some investigators to believe that the tumor may have pushed against the amygdala, causing irregular patterns in Whitman’s fight-or-flight responses. Moreover, these are just hypotheses and the reason for why he did this is not certain.





Conclusion

To conclude, many who knew Charles Whitman thought that he was the ideal American man. He served in the army, was invested greatly in his studies, and lived a “normal” life with his wife. However, his upbringing, his relationship with his father, his father's relationship with his mother, and his exposure to guns from a young age surfaced Whitman’s violent tendencies. He was the shooter of the Texas tower shooting causing 16 deaths and at least 30 injuries. Even though he had a traumatic past, had some psychological issues, and - apparently - a brain tumor, the reason why he did this will never truly be understood.



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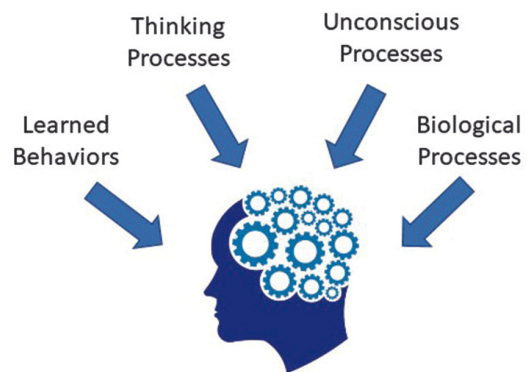
EDUCATION AND PSYCHOLOGY: INSEPARABLE

YANKI MIHÇI '23

Over 65% of teachers are unaware of student psychology and utilize it in the classroom (Hruza). Educators must understand this matter as it will help students integrate into the class, making it a more suitable environment for learning. The two most significant problems tutors face are dealing with challenging behavior and keeping attention. Comprehending psychology allows positive language and shorter tasks to be employed, achieving a healthier classroom.

One of the most shared problems faced in classrooms is getting students to behave. Using positive language is a more manageable and beneficial way to warn students. This is because using negative language reinforces destructive behavior rather than blocking it. Utilizing positive language means straying away from sentences with negative words, such as "don't" and "can't" etc. For instance, if there is a group of students constantly chatting, instead of responding with "You can't talk during class times." teachers can say "Let's get our attention back to the class." This will make students less likely to continue talking because, especially the younger brain, is more likely to continue doing what it is told not to do. Another way positive language can cooperate in the classroom is by smiling more and frowning less often. Positive Action states, "Model

the behavior you want to see in your students. Studies have shown that students learn from the language and behavior that educators display." (Positive Action). Consequently, using positive language by straying away from negative sentences and modeling behavior will achieve a better class environment.



Young learners have short attention spans. According to CNLD, primary students have an average attention span of 10 minutes. Therefore, keeping the attention of younger learners proves difficult. A way to approach this situation is the prepare a range of activities. This allows the teacher to switch through activities, getting the attention of students on a new subject quite efficiently. Joanna Wiseman states, "In the classroom, it is rare to have the whole class fully engaged in something for a long period of time, since the children will have different interests and levels, so it is essential to plan a number of activities for each lesson." (Wiseman). Utilizing this will also help to keep the class dynamic and adapt the class to the needs of the learners. To summarize, having a wider range of activities will allow students to have a higher retention rate,



while also helping the teacher to adapt the class toward the needs required of students.

Psychology and education exist in an inseparable state. Utilizing psychology can support teachers battle difficult situations in the classroom. Some samples include positive language, which can help stop students from acting on bad behavior. Another is having a range of activities, helping students' attention and allowing a more dynamic classroom. 65% of teachers aren't able to use these techniques, which is why it should be far more widespread.



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CAN YOU CHANGE YOUR DNA?

LAL ANAHMIAS '23

Technology has improved so much that actual babies can be genetically modified now. CRISPR gene editing (Clustered Regularly Interspaced Short Palindromic Repeats), is a newly developed genome editing technique used to modify certain DNA segments along with the Cas9 protein. These work together to form an antiviral defense system called CRISPR-Cas9, remarkably advancing the technology used in genetic engineering. This makes it possible to assign desired qualities to new-borns by altering specific parts of their DNA. More importantly, this innovation creates numerous solutions for certain difficulties in the health industry. Whilst there have been significant improvements in the technology available to enhance research for the prevention of genetic disorders, there are also concerns about the health risks accompanied by this technology, and its impact on society.

Genome editing systems have helped make valuable progress in research for polygenic diseases, such as cancer, HIV and diabetes, that have been thought to be untreatable before. Gene editing tools are currently being examined in clinical trials for a variety of diseases, tested on animal and cell models to guarantee their safety. However, there have also been cases that required treatment via CRISPR-Cas9: "Somatic gene therapies, which involve

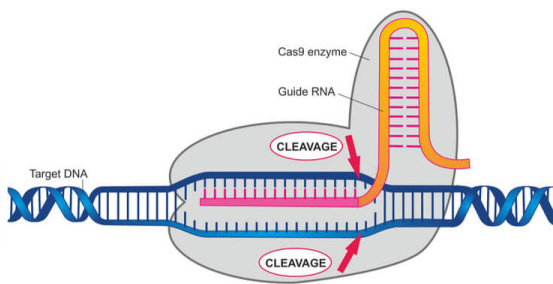
a patient's DNA to treat or cure a disease, have been successfully used to address HIV, sickle-cell disease and transthyretin amyloidosis" (WHO: World Health Association). This technology has already made major contributions to the health field even though there are aspects of it yet to be explored. Moreover, Labiotech states, "CRISPR technology is a game-changer for cancer research and treatment as it can be used for many things, including screening for cancer drivers, identifying genes and proteins that can be targeted by cancer drugs, cancer diagnostics, and as a treatment" (Fernandez). Therefore, it can be concluded that gene modification is the leading alternative for clinical applications in the foreseeable future.



Like most treatments, however, genome editing comes with its limitations. Since there has not been enough time to observe its long-term effects on individuals, modifying the human genome may ultimately cause new health problems. Rubeis and Stager explain that altered genes may turn pathogenic (causing disease) over time: "This aggravates safety concerns, since not only one individual, but many individuals or whole populations might be affected by possible pathogenic effects of the modified genes", they touch upon the unpredictable consequences of modified genes for future generations ("What are genome editing and CRISPR-Cas9?"). Regardless of its hypothetical



impacts in the future, gene editing, specifically CRISPR, may still have undesirable effects on individuals during the procedure. Due to the manipulation of the genes' structures, professionals have to take extreme caution and consider the possible side effects before preferring this method of treatment. The Yale School of Management, weighing the advantages and disadvantages of gene modification, explain that, "[a] series of studies have suggested that CRISPR may cause cells to lose their cancer-fighting ability, and that it may do more damage to genes than previously understood" (Mattison). Thus, the procedure must be done with extreme caution and both the healthcare professional and the patient must be aware of the side effects, thoroughly researching all options before any kind of operation. This may leave the patient in a dilemma, considering whether the benefits outweigh the risks, which isn't the case for most conditions.



Along with the possible unfavorable impacts of genetic modification on the health of individuals, it also affects the society, both economically and ethically. Although the potential decline in mortality rates, caused by the adaptation to diseases this technology provides, may seem favorable to most, it also has its drawbacks. The National Library of Medicine suggests that, "One of these

concerns is the effect of GGE on the population level" (The National Academies 2017). If birth rates do not decrease along with death rates, the rising population will derive an increased demand in, and the reallocation of resources. It will simply not be possible to adjust all systems to meet the needs of an abruptly changing population, and resorting to imports as a temporary solution will negatively affect the economy as a whole. On another note, the unethical aspects of changing one's DNA sequence cannot be disregarded. Genetically engineering babies, elongating lifespans, even treating diseases by manipulating the genomic sequence, may not fit people's perceptions of righteous practices. While discussing the morality (for different groups of people) of gene editing, "Relatively few white evangelical Protestants and black Protestants say it is morally acceptable; just 16% and 15%, respectively" (Funk et al.,) states the Pew Research Center. It can be conveyed that a significant part of the population dispute the moral aspects not reached by this technique. Thus, this major development in the health field impacts societal issues in various contexts.

New technologies, making genomic modification possible, have majorly contributed to research and practice done for certain disease treatments, yet these techniques have also raised doubts about their safety and impact on society. Gene editing techniques are improving day by day, and are already used as solutions in some cases. However, like all developments, this new technology comes



with its limitations, such as the risks an operation involving these techniques includes, and in a different way, its negative effects on economic growth and sustainability. When the advantages and disadvantages are compared, the benefits outweigh the risks, although many beg to differ. The enhancement of gene editing, more specifically CRISPR-Cas9, has controversial aspects to it, yet is truly a unique and practical approach to clinical practices, certainly promising a future.

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Ceylin Asil '26





FRC

NoktaParantez was established in 2016 to be a representative of Hisar School and Turkey in national and international events and competitions. It was built upon the mutual interest and passion of the students, working out of Idealab and Fablab. Being a part of the HisarCS community, they thrive to guide and support all students in Hisar in their quest to develop projects in different fields of STEM (Science, Technology, Engineering, Arts, and Maths), as well as helping students develop skills such as engineering, coding, and marketing. Much like every other team, NoktaParantez can only be as efficient as it is through strong bonds and communication between its members of various skill sets.

Their motto "Ad Astra per Aspera" means "To the stars through difficulties" in Latin, going alongside the mission of Hisar School, "Discover and Develop Their True Potential". Latin being the ancestor of many modern languages spoken in various parts of the world, makes the motto only more powerful as it innately forms bonds with all countries and teams through a mutual goal.

NoktaParantez has been a part of the FIRST Robotics Community for over 6 years, learning new skills, establishing new relationships and being introduced to new cultures along the way.

They stand as a beacon of development and social awareness, aiming to create open-sourced educational content to aid in the respect and appreciation for all STEM fields.

In their first year, they were awarded the Rookie Inspiration Award and, the Winner Alliance and Grant Award in the Turkish Off-Season. In 2017, they attended the New York City Regional event where they were awarded the Rookie All-Star Award and got a chance to attend the World Championship in Houston, Texas. In 2019, they attended the Bosphorus Regional and Festival de Robotique, a Quebec City Regional event where they won the Team Spirit Award and Entrepreneurship Award.



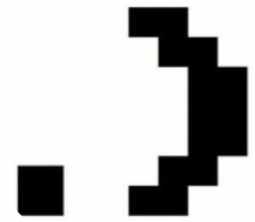
INSTRUCTOR

HisarCS .)

Hisar School Computer Science Team

Total students Reviews

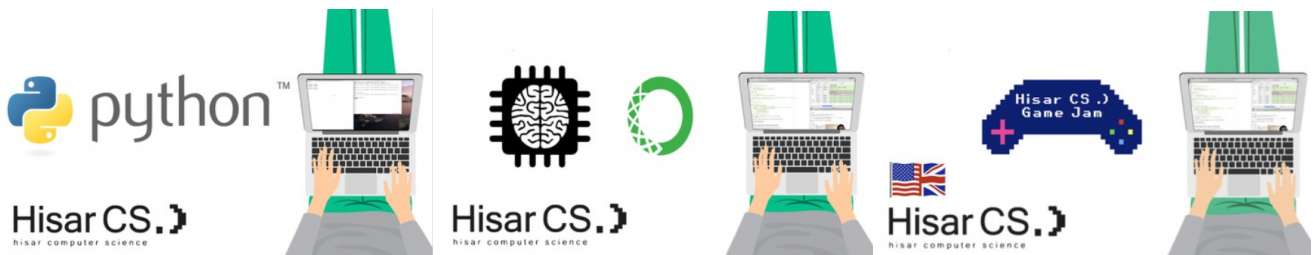
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UDEMY

Udemy, Inc. is a global destination for teaching and learning online. It was founded in May 2010 by Eren Bali, Gagan Biyani, and Oktay Caglar. Students take courses primarily to improve job-related skills. Some courses generate credit toward technical certification.

Hisar School's very own HisarCS community is also an educator on Udemy, providing free and open-sourced educational videos for everyone to aid everyone interested in STEM. They have over 27.5k student followers, 39K enrolled in all of their courses, and an average of 4.3/5 ratings for their videos. The videos are categorized as beginner, intermediate and advanced levels to let individuals progress their learning at their own pace. Among their videos, are; "Introduction to Programming with Python", where students learn the basics of coding, as well as doing projects to put their learnings to work, "Fusion360 and Rapid Prototyping" which comes in 2 parts and teaches the basic concepts of the program, followed by how to draw 2D prototypes for 3D designs, and many more courses going into detail on game design, artificial intelligence, and machine learning, and raspberry pi based robot construction.





SCIENCE TALKS

Hisar welcomed Prof. Dr. Bilge Demirköz for an afterschool event titled “Science Talks.” Prof Demirköz is a professor of High Energy Physics at ODTÜ University and a researcher at the CERN supercollider. Around 50 students gathered at the Nautilus to attend her presentation on particle collisions and high-energy physics. A question & answer session was held after the presentations where students gained a deeper scope of the subject.

Prof Demirköz graduated from Robert College in 1997 and to take part in research during her undergraduate degree, moved to Massachusetts Institute of Technology. She earned a Bachelor of Science in Physics and Music from Massachusetts Institute of Technology in 2001 along with winning the Joel Matthew Award for outstanding service to the physics department. Building on her thesis “ Studies of Transition Radiation Detectors for AMS-02”, she was a member of the Alpha Magnetic Spectrometer (AMS-02) collaboration from 2001 to 2004. She was a Science and Technology Facilities Council(STFC) Dorothy Hodgkin Scholar at the University of Oxford from 2004 to 2007, where she completed her postgraduate studies, and was a member of Balliol College.

During her talk, Prof Demirköz introduced the concept of particle collisions and touched on some of Einstein’s equations to support her lecture on high-energy physics. She explained the experimental procedure and tools at CERN utilized to collide particles and the measurement of results, such as the trigger system and the ATLAS detector. Furthermore, Prof Demirköz elaborated on how the CERN functions as an institution and interacts with research facilities all



around the world in the transaction of the derived particles. She discussed CERN's values and aims in operation, as well as its connection to international governments. Throughout the middle of her lecture, Prof Demirköz dove deeper into her studies in the AMS(Alpha Magnetic Spectrophotometry.) She introduced cosmic rays, and the Higgs boson, and walked through the process of calculations with Muons. She related these calculations to the proof of Einstein's theory of relativity.

Prof Demirköz went on to give insight into her work at ODTÜ University in collaboration with CERN. She began this part of the lecture by discussing the functioning mechanisms behind modern-day satellites. She talked about the multi-platform algorithm of EGL (Explorer of Grid Load) in the context of current technologies surrounding satellite images and GPS. Prof Demirköz concluded her lecture with a brief discussion of dark matter/anti-matter alongside the journey of black holes and supernovas.





OUTAR SPACE

Augmented reality (AR) is defined as a real-time direct or indirect view of a physical real-world environment that has been augmented by adding virtual computer-generated information to it. As AR combines real and virtual objects registered in a 3-dimensional platform, it is a potent and interactive tool with interdisciplinary applications in education, healthcare, science, engineering, and mathematics.

OutAR Space was a mobile app made by HisarCS that was aimed to guide children to learn directions through a space-themed Augmented Reality (AR) guide, the application challenged children to help the lost alien Bobo return home by completing the direction-asking tasks given by the application and assemble Bobo's rocket.

The reasoning behind the app being developed lay in what second-grade primary school teachers reported in a conducted interview. Educators noted that in the post-quarantine teaching process, the most apparent shortcomings of the students was in the ability to distinguish between left and right. Unlike standardized homework or extra-work assignments, the app aimed at aiding students through a "learning by doing" experience, as well as in a narrative form to immerse students in the subject.



Starting off with simple directions such as “left”, “right” and “straight”, supported by continuous visual and auditory feedback such as changing colors, players were able to easily understand whether their attempts were successful or not, actively enabling classical conditioning progress that facilitates learning. Aiming to capture the interest of children of all types of learners, auditory learning, where learners gain information by listening, was implemented in all directions throughout the game. The voiceover feature of the application, allowed both auditory learners and children who had not yet learned to read can take advantage of the feature.

Repeated playing of games which are implement strategy and combination is known to be effective in learning, furthermore adding on a timer to measure the time it took for completion creates a sense of competition, pushing students to learn faster and achieve the shortest time possible.

Breaking through the division of games and educational materials required a broad understanding of what made games so attractive and how that could be used to eliminate the possible loss of interests students feel when learning. OutAR Space was made up of 10 distinct levels, each level having a different path that took the player to the desired rocket part which was marked with a color. The moves players take make were given in the form of shapes as that was discovered to be as simple as possible to understand.

Going forwards, the team aims to make it so that the app encourages children to be more active through sports and dance tutorials. The system would be able to simultaneously observe the user, evaluate their performance, and give feedback on the user’s activity. Another goal is to use AI algorithms to optimize the learning experience of the children by analyzing their data and performance patterns while using the app. Furthermore, the algorithm would suggest which type of learning application is best for the child.





FABLAB

The Fablab program began as a collaboration between the Grassroots Invention Group and the Center for Bits and Atoms at the Media Lab at MIT. Fabrication laboratories, or Fablabs, are workshops that offer the technological and the material infrastructure required to enable the aim of making “almost anything”. There are currently over 2000 Fablabs in about 150 different countries, one of which being Hisar’s own Fablab, The Idealab. With the aim of democratizing access to the tools for technical invention, Fablab provides a massive network for its members through websites, events and more.

Each year, Fablab organizes several events around the world to gather and showcase the latest projects of its members. This year, the Lemon team from Idealab traveled to Bali, Indonesia for the 7th Fabfest & Fabcity. Idealab actively maintains communication with the Fablab network throughout the year. It also strives to become a more sustainable environment and strengthen Hisar School’s commitment to the United Nations Sustainability Development Goals (UN SDG’s) by following Fablab’s own manual on “aligning your Fab Lab/Makerspace with the U.N. Sustainable Development Goals (SDGs).”





LEMON

For the past year, students at the IdeaLab have been developing a project called “Lemon.” Lemon is a learning kit aimed at building a solid foundation of mechanics, electronics, programming, and computer-aided design(CAD). The kit is a product in development that is targeting first-timers in these fields without age restrictions.

Lemon contains 3 biometric and bioinspired robots: a fish, a turtle, and a dog. These robots are meant to be levels of difficulty for the user. Learners assemble the robots from their pieces according to a manual, solve a challenge by targeting a certain skill and control the robots as a result. When successfully assembled and the CAD-design challenge is completed, the fish begins flapping around. The turtle robot contains electronic mechanisms such as sensors and motors that lead it to wave its legs, when successfully assembled. Finally, the dog robot uses code and servo motors to be put together by the learner to walk.

This October, the Lemon team traveled to Bali for the 17th Fabfest and the Fabcity Summit 2022 events. At the week-long event, the lemon team gave daily workshops for 3 days: each day focusing on one robot and the skill it teaches. As the only workshop given by high school students at the event, Lemon had the most consistent participation with about 40 participants each day from ages 10 to 50 all around the world. Among the participants was Neil Gershenfeld, an American professor at MIT and the director of MIT's Center for Bits and Atoms, a sister lab to the MIT Media Lab. Prof Gershenfeld gave his feedback on Lemon kits during the workshops. Fabfest and Fabcity Summit 2022 became a major marketing opportunity for Idealab, as it led to many offers from international FabLabs to purchase and integrate Lemon in their own trainings.



Looking forward, Lemon is working on commercializing the kits. They are renovating the pieces of the robots to be interchangeable and sustainable. Currently, each robot can be assembled once, as they require glue to hold the pieces together. The Lemon team aims for learners to be able to reassemble the pieces to form all three animals. They are also developing their research report to submit to international conferences and be patented.

It is possible to see some member of the Lemon team working on the next phase of their project in the IdeaLab at all times. As active members of NoktaParantez.), they visit the idealab to check on and develop Lemon kits in their breaks, free hours afterschool and even during some lessons. Lemon can be a great inspiration and example for students who wish to jumpstart their own projects and explore their interests in CS or business.





ECO-MARATHON

Each year, Schell Company hosts an international competition to select a car with “the highest energy efficiency” in response to the climate crisis and the large impact of the automotive industry on global carbon emissions. In simple terms, the competition is meant to see which car will go a farther distance with minimum energy consumption. Thus centering around the seventh UN Sustainable Development Goal: Affordable and clean energy. Continental competitions are held initially, after which the winners gain the opportunity to move on to the World Championship Series. Hisar Scool has been preparing for the regional competition for Europe and Africa, which will be held on May 20-25, 2023 in Nogaro, France.

Although this competition is dominated by companies and university teams as participants, Hisar Mechatronics is one of the numbered high school teams in Eco-Marathon. As a result, Hisar Mechatronics students need to put extra effort into getting the necessary know-how of how an electric car works and each small detail behind what meets the eye. In past years, Hisar mechatronics collaborated with professionals in Yıldız Teknik University and Istanbul Teknik University by receiving mentorship, observing senior engineering teams in the universities, and emulating that environment at Hisar.



Although Hisar Mechatronics' Eco-marathon team welcomes any and all students who share a passion for engineering, automotive, coding or even high level mathematics, most of its newer generations are students who worked effectively and wanted to pursue their passion from Hisar's own Vex teams. Due to the high level mathematics and physics building a car requires, newcomers are put through a year-long training process where they enroll in a google classroom and learn concepts in automotive mechanics, advanced calculations and in physics. Through this process, added to the exposure to the actual process and working environment of building a car, students often explore niche positions and responsibilities within the team to pick an area of interest and focus on that exclusively in their following years.

The competition has an incredibly strict set of technical requirements for the competing projects, one of which is that teams cannot use pieces or code from external resources. This means that the Hisar Mechatronics team has to learn about and build every part of the car: from the motor, to the design, or the code. For instance, this year the team began using the Matlab programming language to develop its code for the car. As this is a new concept for everyone on the team, a collaborative learning process is being developed.

The Eco-marathon team of Hisar Mechatronics works in the container next to the bubble. Students gather and work in their club times and afterschool. Hisar Mechatronics aims to build and test their car in its every aspect, so that they can attend the 2023 regional competition for the first time since the initiation of Eco-marathhon in Hisar.





VEX

The Vex Robotics Competition has had student teams from Hisar joining and representing the competition nationwide since 2016. As one of the most successful projects of Hisar Mechatronics, Vex teams work systematically and collaboratively throughout the year. This year, two teams are participating in the tournaments. Hisar's Vex teams in the 2022-2023 school year are majorly made up of 9th and 10th graders. The Vex Competition is made up of several regional competitions and an annual event where winners of the regional competitions gather. In each competition, teams are assigned alliances that aid the development of each other's robots during the challenges.

"The robot we take to a competition never ends up being the robot we come back with."

-Dila Yağmurdereli, Coordinator of Vex @Hisar

The Vex competition aims to teach students how to think and operate like an engineer. Each year, small games related to the year's pre-determined theme are organized where robots of competing teams fulfill the round's technical requirements, collect points, and move ahead in



the tournament. This year's theme is "SpinUp!", thus we expect to see competing robots throwing discs, carrying a certain amount of weight, etc. Each game has about half an hour in between, these breaks are usually at different times for different teams. It is within these intervals that teams note and modify the features of their robot to be fixed, improved or added.

Vex also has a strong programming side to it. Writing, debugging and executing the code of a robot is always up to several members of a team. During quarantine, students received online training in C++, a common coding language, from this year's Hisar Mechatronics coordinator: Selin Orbay. This year, students who pursued their passion for coding in this activity used their training to become mentors and tutor the next generations of Vex team members.

The teams are now competing in regional matches, one of which takes place at Hisar School, in hopes of going through and possibly winning the National Championship in 26th of February.





TECHNOVATION

Hisar School has participated in and represented the Technovation Girls Challenge for the past few years. Every year, a team of student ambassadors and organizers is gathered to keep in contact with the Technovation Girls Foundation and prepare student teams of Turkey for the annual competition. The Technovation Girls challenge is aimed to encourage more girls to get involved in STEM and entrepreneurship positions and pursue these areas later in life.

Students form teams and sign up for the competition from the beginning of each school year, follow Technovation’s curriculum, and pitch their projects virtually at the end of Spring. Semi-finalists from this competition get the opportunity to pitch their projects further at the Global Summit in California in August. For the challenge, teams identify a problem in their target community and propose a solution to it through an app or an AI model.

The Idealab hosts office hours for the highschool teams every Monday and Thursday. During these sessions, teams get to work interactively with the student ambassadors as mentors in addition to attending workshops for idea development, coding, and design. The technovation curriculum is very straightforward and easy to follow. Ambassadors and student teams leverage these resources to follow through with their pitch preparation. Over the course of the year, team members explore different areas of startup development and executing their solution such as programming, design, or business. Although each team member gains experience of the simple tasks from each field, they distribute their responsibilities according to the areas they want to focus on. Teams create logos, UI layouts, business plans, and pitch video for their projects.



Technovation Turkey is holding a launch event on 11th of February 2023 where they will welcome teams from around the country and host speeches and lectures on UN Sustainable Development Goals, Mobile Applications of AI and Design Thinking. The launch event will also be an opportunity for teams and mentors to interact with and learn from each other. Towards the end of the event, there will be a project hour where mentors will have a Q&A session amongst each other on AI Integration in Educational Technologies.

Students especially benefit from Technovation's strong alumnae network. With a LinkedIn group of 1,658 members, Technovation alumnae support each other, share opportunities such as similar competitions, and updates on their achievements that can be useful for fellow alumnae. Since its establishment in 2006, Technovation has created a massive community of girls exploring their talents and interest in male dominated fields such as computer science or entrepreneurship.





IDEALAB

The Idealab is home to many teams and projects of Hisar, primarily NoktaParantez. On the second floor of Block C, four main components make up The Idealab: Electronics and programming room, mechanical workshop, fabrication room and Multimedia Lab. Each room aiding a different skill set including entrepreneurship, coding, mechanical engineering, and 3D design.

The idealab welcomes first timers through club sessions, elective classes, or through personal contact. First timers get to participate in branches of projects of the Idea Lab that they're interested in and they gain exposure to other areas of computer science, while they're spending time working in the idealab by staying in after school hours or during the lunch breaks, they gain exposure to these areas and they explore their passion and talent throughout the fields of computer science. Newcomers are asked about their interests rather than the position they want, and assigned to "teams in the FRC" accordingly.

Having groups or individual students work on many subfields of computer science work in the same environments has many upsides. After a while, students take a break from their own work, get up and look/tour around in the lab to clear their minds. As they do this, they get to see their peers working on their own projects and often ask about what it is they are working



on. When students share their work with each other, short conversations spark and these engagements are what inspires students to stick around and discover more. Most of the time, anyone is welcome to watch or even help out with minor parts of projects they aren't officially involved in, just for the sake of learning certain skills or concepts from their peers. It is not uncommon that students switch between projects by discovering their passion for a new field of computer science after gaining exposure. This gives everybody the opportunity to work on what they're truly passionate about.

At this point, the NoktaParantez team has become like a family. There is a very large number of students at hisar who have some sort of an association with the Idealab or another. And although people may not be able to arrange the same age time frames, a good amount of students come to the Idealab whenever they have time, whether it is during lunch breaks or between lessons, or extra time afterschool. Projects in computer science often tend to get too frustrating, going through and resolving these situations bring the IdeaLab closer together





PAKETTE BILIM

As one of the school's most active community service projects, Pakette Bilim bridges students' passion for science and helps others by establishing a system where students all around Turkey get to perform experiments with Hisar's student mentors. In its third year, Pakette Bilim expanded their reach to one more grade of students.

Palette Bilim works in structured groups including the mentors, the technical team and the business team. Each student mentor is assigned four students, which may be of grades 5, 6 or 7. Over video call, the student mentors unpack the science packages with their students, go over the experimental booklet and complete the experiment. Each science package contains the materials and instructions for five different experiments performed weekly. At the end of the 5-week process, both the mentor and the students receive a certificate. Throughout the academic year, three of these processes are conducted and each process has a different set of mentors & students. It is between these processes that the technical team picks the experiments to be performed, prepares the experimental design, procedure and materials. The team then gathers these materials in the exact amounts to be used for the experiment and puts together each science package one by one. This team is also responsible for writing the booklet that comes in each science package and finally, tracking the shipment of the packages to



students.

As Pakette Bilim is a club and a project, the technical team do most of their work during club hours and the rest in google meet sessions, while the mentoring team works almost entirely remotely and therefore only operates on google meet. At the beginning of each year, students fill in the application google form to volunteer to be a student mentor. Pakette Bilim attracted many student mentors this year since mentorship covers 5 hours of community service requirement each week of the mentorship process.

Working in parallel with each team, Pakette Bilim has a business team that is responsible for keeping Pakette Bilim's social media active and up to date by posting weekly. The business team also arranges the project's sponsorships from companies including Mplus and Tempo Call Centers.

With 56 mentors and a technical team of 15 people, Pakette Bilim has reached over 250 students in the past year and is currently in the third week of this year's first mentorship process. Student mentors are continuing to emphasize and work beyond the MEB curriculum by performing experiments like building solar system models or periscopes with their students.





WOMEN IN SCIENCE

The Women In Science club is currently in its fourth year, preparing for yet another conference to host successful female researchers or professionals in their respective fields. Founded in the spirit of emphasizing the role of women in scientific advancements, this club has maintained its activity online through the COVID-19 pandemic by publishing articles on stories of successful women and their projects. With an active group of 13 people, this club is gathering in their breaks and in online meetings to put together this year's conference which will take place in spring.





A COMPARATIVE PERSPECTIVE ON THE SOCIOECONOMIC IMPACT OF MELTING GLACIERS: CASE STUDIES OF TURKEY AND INDIA

KERIM WILLEMS '23

Summary

This study analyzes the implications of climate change on mountain glaciers and emphasizes the dangers that the natural system faces as a result of the glacier meetings. The Cilo Mountain Glaciers (Located in Hakkari, a Province in Turkey) and the Uttarakhand Mountain Glaciers (Located in India) were taken as case studies. Various academic studies on the two regions imply that a majority of the glacial covers of the respective mountain glaciers melted away due to climate change. With respect to their geomorphologic, socioeconomic and ecological circumstances it was observed that the two regions show rural characteristics. Thus severely limiting the potential economic activities that can be done in the region, the two of the most common economic activities done in the two case study regions are Agriculture and Animal husbandry. If the estimated scenarios were to become true, it can be inferred that the agricultural and animal husbandry activities in these regions will stop because the glacial lakes that are fed by the glacial seasonal meltings will dry out due to the fact that their feeding source will melt away. This prompts a major threat of rural-urban migration, an issue that is already prevalent in both countries which are densely populated. Another major

threat that mountain glaciers melting poses is the direct threat to human life and well being. With the two case study regions having residential areas such as Villages formed near a glacial lake or a glacial melting zone. This puts the population living in those areas at risk because natural disasters as a result of glacial melting such as erosion, avalanches and floods will increase due to the rapid melting. What makes this situation even worse is that the people living at those locations will be in zones that will directly feel the impact of these disasters, making the people very vulnerable. To avoid a major catastrophe there are a few steps that can potentially be taken by the governments (In light of the results obtained from this research). Although there is no direct solution proposal for the melting of the glaciers, this melting can be slowed down by covering the mountain glaciers with various special fabrics in summer, as Italy and China do. In order to prevent the local people from being affected by disasters as a result of these meltdowns, disaster risk reports should be prepared.

Negative impacts on residential areas can be prevented by constructing dams and channels for possible floods and landslides. Due to the disaster risk in the region, all



kinds of industrial, winter sports and economic investments such as tourism and hydroelectric power plant construction should be stopped. In order to reduce human contact in these areas, first of all, a protected area should be declared and entrances and exits should be limited.

Keywords: Mountain glacier, climate change, Cilo, Uttarkhand

Introduction

Climate, alongside being the most important factor that determines the habitat and characteristics of all living beings, is the source that meets all living requirements for survival (Davarcioğlu and Lelik, 2018). It is the source that meets all living needs for humanity (Davarcioğlu and Lelik, 2018). When we look at it today, cultures, settlements, all kinds of economic activities, especially agriculture, have developed depending on the climate. Climate is defined as "the combination of the average properties of all weather conditions experienced or observed anywhere on the earth for many years, as well as the temporal distributions of their occurrence frequencies, the observed extreme values, severe events and all types of variability" (Türkeş, . 2001). The most important feature that distinguishes climate from weather is that it shows continuity for many years. Despite this continuity, the climate has not remained unchanged since the first day the world was formed. The change in climate characteristics in a region or in the whole world is called climate change. In the process from the beginning of human

history to the present day; the natural environment during these glacial and interglacial periods was greatly affected (Davarcioğlu and Lelik, 2018). Over the course of history, as the seasons followed each other, periodic climatic changes were experienced within the geological times. Periodic changes in the Earth's orbit and axis of rotation occur over tens of thousands of years, producing rhythmic climate changes known as The Milankovitch cycles (Meyers and Malinverno 2018). In line with The Milankovitch cycles, extreme climate changes such as desertification and glaciation have been experienced all over the world. Although many living species disappeared during these changes, living things have adapted to these slow but impactful changes. As a result, a variety of new species However, the climate change we experience today takes place independently of Milankovitch cycles and is considered a crisis unlike other climate changes. The fact that the current climate change is evaluated as a crisis is due to the fact that this change occurs due to human activities. According to the IPCC report (2021), the current climate change is the result of the increase in greenhouse gas concentrations since about 1750.

The increase in temperature in the earth and the lower parts of the atmosphere is called global warming, especially as a result of the strengthening of the natural greenhouse effect with the contribution of urbanization, due to the rapid increase in the accumulation of greenhouse gasses released into the atmosphere by various



human activities such as the burning of fossil fuels, deforestation and industrial processes (Aksay, Ketenoğlu and Kurt. , 2005). As a result of various human activities such as burning fossil fuels, industrial processes, land use changes and deforestation, the accumulation of greenhouse gasses in the atmosphere has been increasing rapidly since the industrial revolution and the natural greenhouse effect has been strengthened (Türkeş, 2008). The main greenhouse gasses are carbon dioxide, chlorofluorocarbon, methane, nitrogen oxide, ozone and water vapor (Atik, 2017). Although carbon dioxide is prominent in anthropogenic (human-induced) greenhouse gas accumulations (Türkeş 2001), according to the IPCC report (2021), the emissions of methane gas, which has had a high greenhouse gas effect in recent years, are of particular concern in this context.

Climate change has great effects not only on climate elements and natural life, but also on human and economic systems. As the biggest result of climate change, serious and rapid increases are experienced in global temperature averages. In this direction, scientists developed several schematic scenarios. It is predicted that the planet will warm by at least 1.5°C in all realized scenarios. Even in the scenario where the most ambitious steps are taken within the scope of emission reduction, the planet is expected to warm by 1.5°C by 2030s (IPCC, 2021). It is foreseen that the increase in global temperatures will change other climatic events and weather events will be

experienced at more extreme points. In this context, it is expected that climate-related natural disasters such as forest fires, drought, floods, desertification and erosion will increase the rates of ecological degradation (UNCCS, 2019). Another impact of climate change is on the hydrological cycle. As a result of the increase in global temperatures, serious problems are experienced in water resources and it is expected to cause a decrease in agricultural and forest products, energy shortages, and population movement from the coastal areas to the inner cities. (Davarcioğlu and Lelik 2018). The most well-known consequence of climate change is the melting of glaciers and the associated rise in sea levels. The melting of glaciers in the Arctic and Antarctic regions occurs very quickly (Image 1).

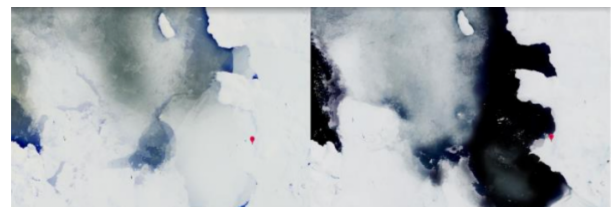


Image 1. Satellite images of the Pine Island glacier located in The Arctic (Google Earth, 2022).

However, the glacial cover of the world is not only located at the poles. Most of the glaciers on land (96%) are located in Antarctica and Greenland (14 Million Km²), and a small part (540.000 km²) consists of mountain-valley glaciers and ice caps (Gürgen, Çalışkan, Yılmaz, Yeşilyurt, 2010). Although the rate of mountain glaciers is less than the cover glaciers at the poles, it has a decisive role on all kinds of human and economic structures, especially the settlement and agricultural production at the foot of the mountains



where these glaciers are located. For this reason, the melting of these glaciers will have a direct effect on human life. This study analyzes the potential socioeconomic and ecological implications of mountain glaciers melting in Turkey and India. Taking the Cilo Mountain and the Uttarakhand Mountain glaciers as case studies.

Research Methodology

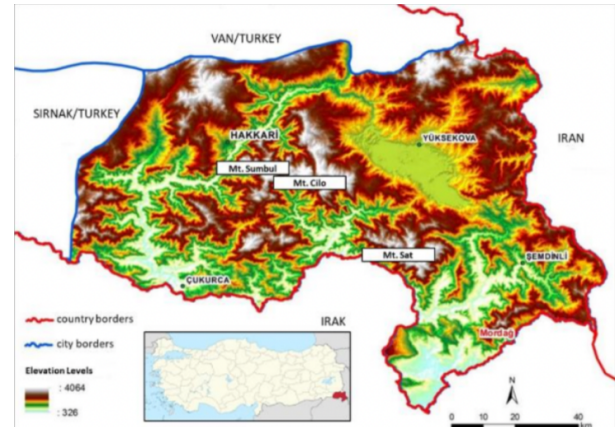
This study is a qualitative research sample prepared with a case study pattern. The analyzed geographical structures of the study are the continental mountain glaciers in the world. As a sample, the Cilo Mountain glaciers in Turkey and the Himalayan glaciers in India in the state of Uttarakhand were taken. In this study, which was prepared to examine the effect of the melting of mountain glaciers on the local socio-economic structure due to climate change, data were collected by document analysis method. In particular, studies of geographers on sample regions in Turkey and India were scanned. Using the Google Earth Engine, the historical change in the boundaries of the glaciers was revealed. Obtained findings were interpreted by comparative analysis methods.

Results and Analysis

a. Cilo Mountain Glaciers and the Impact of Climate Change on the Region

Hakkari is a mountainous and rugged city located in the southeasternmost tip of Turkey, adjacent to Van in the north, Iran in the east, Şırnak in the west and Iraq in the south. Hakkari is one of the most sparsely populated provinces of Turkey in

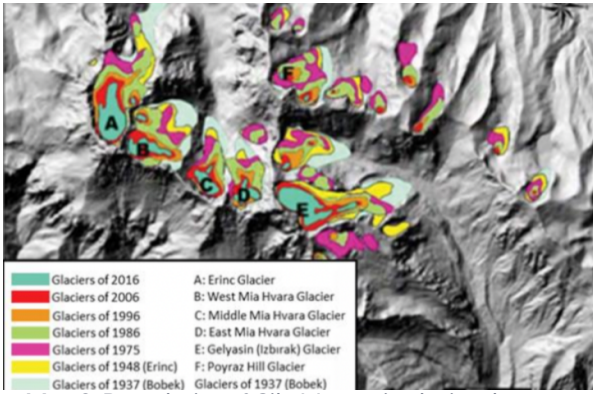
terms of population distribution. The population density of the province, which has a low total population, is also below the country average (Varol 2017).



Map 1. The physical map of Hakkari

Hakkari also appears as a geography where mountain glaciers from the Late Quaternary period of Turkey are seen. There are 6 large glaciers and many small cirque glaciers in the region, namely Erinç Glacier, West Mia Hvara Glacier, East Mia Hvara Glacier, Middle Mia Hvara Glacier, Gelyashin Glacier and Poyraz Tepe Glacier. Bobek (1940), who carried out the first academic studies in the region, did not take small cirque glaciers into account and mapped large main glaciers in his study and calculated the total glacier area as 11,195 km² (Varol 2017). Today, the boundaries of glaciers are obtained through remote sensing technology and satellite images (Map 2). Active glacial areas detected from satellite images are calculated as 10.56 km² in 1975, 9.96 km² in 1986, 4.12 km² in 1998, 3.26 km² in 2006 and 2.02 km² in 2016 (Varol 2017).

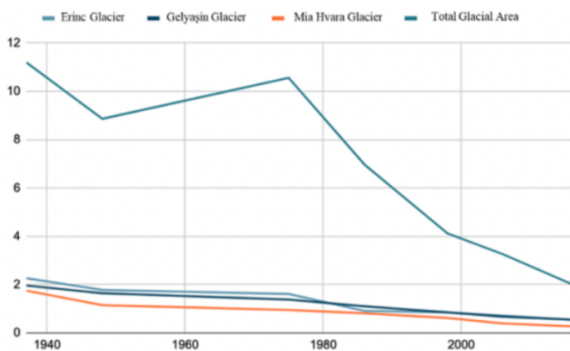




Map 2. Boundaries of Cilo Mountain glaciers by years (Varol, 2017)

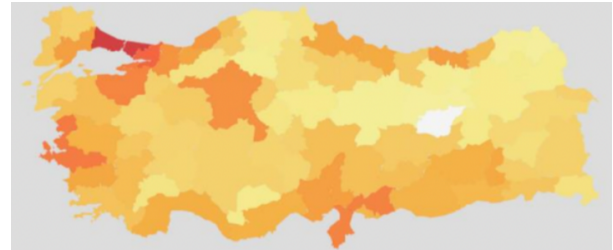
As a result of the literature review, it is seen that the glaciers in the region have been melting rapidly and their areas have narrowed due to climate change over a period of 30 years. During this period, he determined that half of the Erinç Glacier melted, 3/4 of the Western Mia Hvara glacier in Mia Hvara Glacier, half of the Central and Eastern Mia Hvara glaciers disappeared, and more than half of the Gelyaşin Glacier disappeared (Yavaşlı 2009).

As a result of the studies carried out by Bobek (1940), Erinç (1952) and Varol (2017) in the region, the boundary change of the glaciers in Cilo Mountain by years is shown in Graph 1.



Graph 1. The historical change in the borders of the glaciers on Cilo Mountain

Due to the mountainous nature of the study area, living conditions are difficult and it is a deprivation zone in every respect. The number of settlements in the area is quite low. The settlements are also scattered (Varol 2017).



Map 3. Turkey population density map (AtlasBig, 2022)

When the economic structure of the city of Hakkari is examined, it can be observed that it is showing rural characteristics due to the fact that agriculture and livestock activities in the city are still one of the most important economic functions. (Sadıkoğlu, 2021). This means that agricultural activities are carried out in a limited area. Agriculture is done on the valley floors, where streams form wide valleys. In addition, agriculture in this narrow area has irrigation problems. The biggest income source of the region is based on animal husbandry, especially pasture livestock. Traditional nomadic pastoralism is common. Existence of large pastures and pastures has created a suitable environment for animal husbandry (Varol 2017). The glaciers in the region constitute an important water source for these agricultural lands, especially with seasonal melting in spring. At the same time all rural settlements around Cilo Mountain were established around streams formed due to glacier and snow melt. There are a few villages established at the foot of the Cilo Mountains. The most important of these are the villages of Orişa



Serpel and Kırıkdağ (Varol 2017).

Another economic activity for the people of the region is tourism. Hakkari, with its high mountains, glacial topography, high flow streams in narrow and deep valleys, steep slopes, is one of Turkey's most important attraction centers for visitors, especially adventure tourism enthusiasts (Şahin, Kahraman 2017). In this respect, the region has a very high potential for winter tourism.

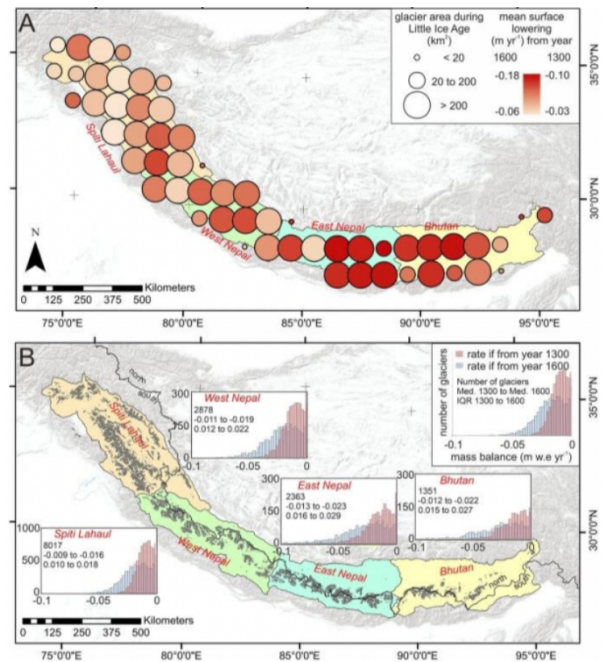
b. Uttarakhand Glaciers and the Impact of Climate Change on the Region

Uttarakhand is a state in northern India bordering Nepal to the east and Tibet to the north under Chinese control (Map 4). The region is located on the Himalayan Mountain system. There are many skullcaps, cirques and valley glaciers in the region. Uttarakhand was known for the collapse of a dam and subsequent flooding in 2021 due to the rupture of a large glacier as a result of the melting of the glaciers (BBC, 2021).



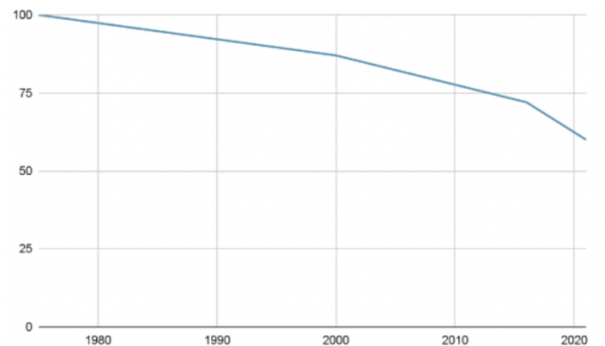
Map 4. The physical map of the Uttarakhand State Uttarakhand comprises 968 glaciers, covering an area of ~2885 km² or ~5.3% of the state (Singhvi, Bhattacharya and Guha 2008). The Gangotri Glacier is the longest glacier (~30 km) in the state, which originates in the Chaukhamba massif

(~6853–7138 m a.s.l.) and flows northwest towards Gaumukh (Mehta, Dohbal and Gupta 2015). According to the studies carried out in the region, it is seen that approximately 15,000 Himalayan glaciers from the small ice age that took place 400-700 years ago have melted to a large extent.



Map 5. The boundaries and melting rates of Uttarakhand and other Himalayan glaciers (Lee, Carrivick, Quincy et al., 2021).

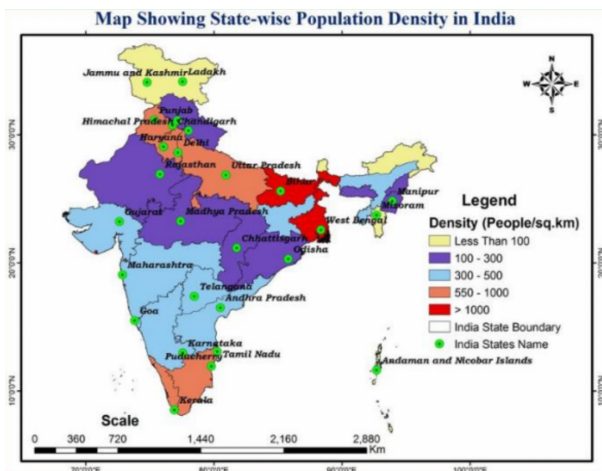
Although there is no clear information on the change in the area of the region's glaciers on a km² basis, according to the report of Lee, Carrivick and Quincey (2021), 40% of the glaciers in the region have melted (Graph 2).



Graph 2. Change of Uttarakhand glaciers compared to 1980



The Uttarakhand glaciers feed the Ganges River, one of India's most important water resources, with seasonal melting in spring. The Ganges River has been the most densely populated area in India since the establishment of the first center of civilization.



Map 6. Population density map of India (Karuppannan et al., 2020)

Today, most of the people of the region still live their lives depending on the Ganges river. Wheat and rice, which are the basic nutrients, are cultivated intensively in the region. At the same time, the region is an area where cattle breeding is intense. The region attracts a dense population due to being an old cultural center. In addition, the Ganges River, which is considered sacred in Hinduism, attracts many people from the country to the region. This situation increases the touristic potential of Uttarakhand Region.

Conclusions and Recommendations

In the light of the findings obtained as a result of this research, the following conclusions were reached:

- As a result of global climate change, not only the polar cap glaciers but also mountain glaciers are rapidly melting. This melting rate occurs faster than polar ice caps because mountain glaciers have a smaller surface area and volume.
- As a result of this unavoidable melting, the frequency and severity of disasters such as seasonal floods, falling of rocks under the glacier and landslides increase. It is seen that the regional albedo effect will decrease and accordingly the regional temperature averages will increase if all the glaciers melt.
- Seasonal melting of mountain glaciers feeds the small streams in the region and directly affects the climate, water cycle and biome characteristics of the region. As a result of the melting of the mountain glaciers in the region, it is predicted that the rivers in the region will lose their feeding source and completely dry up. This will cause the mountain biomes, which are rich in highly endemic species, to lose their biodiversity. As an example, it means that the reverse tulips (*Fritillaria imperialis*) species that grow only in Hakkari in the world will be extinct.
- In both Uttarakhand and Hakkari, it has been determined that agriculture and animal husbandry are intensely practiced in rural settlements established around the glacial regions examined as samples. This common livelihood will be adversely affected by the melting of glaciers. As a result of the melting of the glaciers, which feed



the rivers, which are important for agricultural activities in the region, irrigation of agricultural areas will not be possible and agricultural activities in the region will cease. Again, the natural meadows fed by these rivers will be dehydrated, causing livestock to cease in the region. As a result of the cessation of agriculture and animal husbandry in the region, many people who lost their livelihoods will cause internal migration.

- Settlements in both Hakkari and Uttarakhand are endangered because they were established in melting zones. It has been determined that rockfall, avalanches, glacier movements, floods, and overflow will directly affect the settlements in the region, such as the glacier fall disaster in Uttarakhand in 2021.
- The melting of mountain glaciers, which is a result of climate change, will continue to accelerate if climate change is not stopped. Although there is no direct solution proposal for the melting of the glaciers, this melting can be slowed down by covering the mountain glaciers with various special fabrics in summer, as Italy and China do.
- As a result of the research, it has been seen that neither the government of India nor the government of Turkey has taken any precautions or made an action plan for the melting of the mountain glaciers and the disasters that this melting will cause. In order to prevent the local people from being affected by disasters as a result of these meltdowns, disaster risk reports

should be prepared.

- Negative impacts on residential areas can be prevented by constructing dams and channels for possible floods and landslides.
- Due to the disaster risk in the region, all kinds of industrial, winter sports and economic investments such as tourism and hydroelectric power plant construction should be stopped. In order to reduce human contact in these areas, first of all, a protected area should be declared and entrances and exits should be limited.

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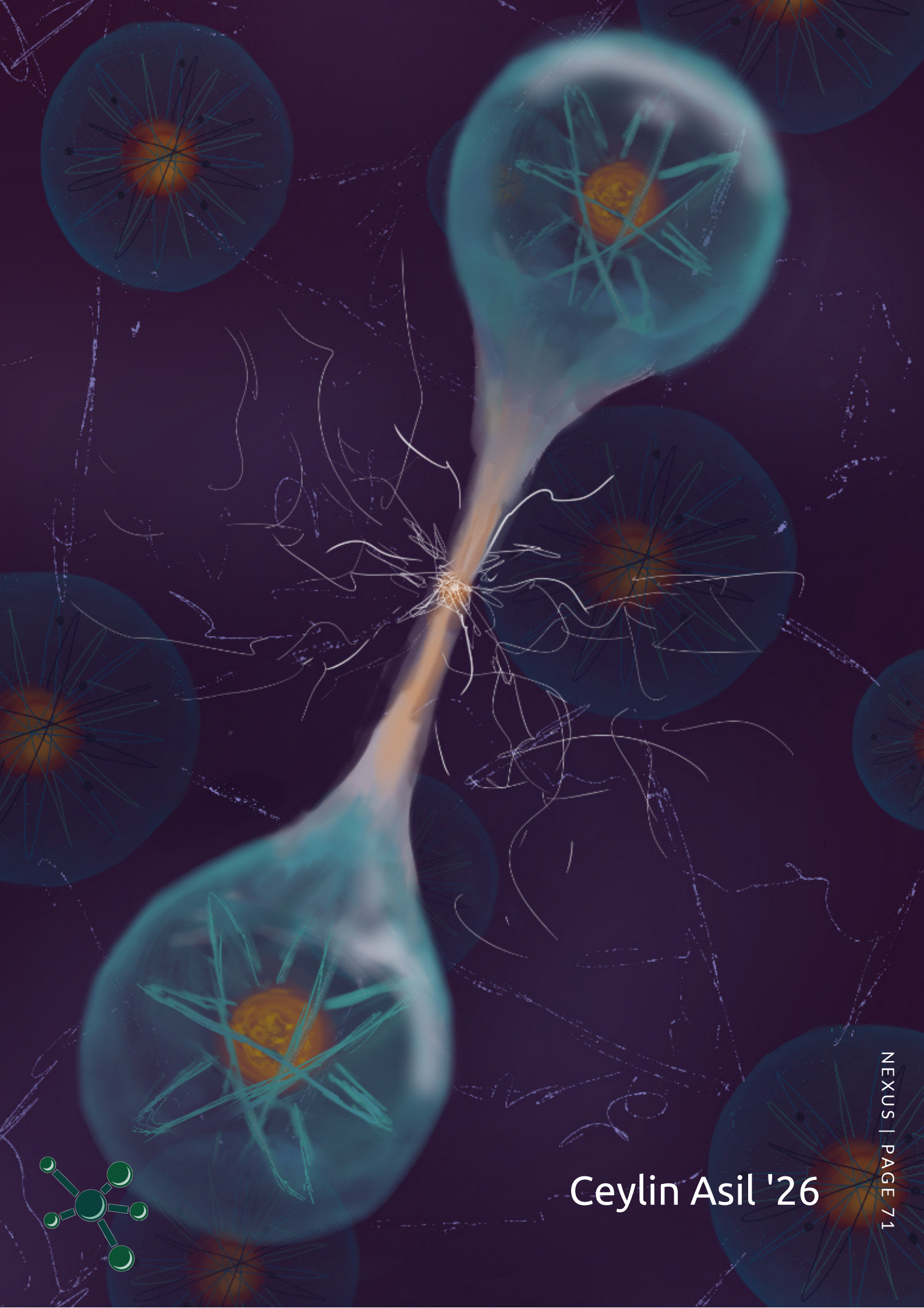


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Ceylin Asil '26

QUANTUM ENTANGLEMENT

GIRAY ALKIN ERDİNÇ '25 & BATU ÇALIYURT '25

In 2022, The Nobel prize in physics is awarded to Alain Aspect, John F. Clauser and Anton Zeilinger for experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science. Their work was a result of a long-lasting discussion and their experiments on quantum entanglement have actually shown the extraordinary nature of quantum once again.

In quantum physics, it has always been a matter of discussion whether the universe is guided by a pair of dice. At the core of quantum mechanics lies the uncertainty principle of Heisenberg and the wave-particle duality. According to the uncertainty principle, specific traits of a particle at an instant cannot be known simultaneously. For example, both the position and momentum of a particle cannot be determined at the same time. As Heisenberg remarks, "At the instant of time when the position is determined, that is, at the instant when the photon is scattered by the electron, the electron undergoes a discontinuous change in momentum. This change is the greater the smaller the wavelength of the light employed, i.e., the more exact the determination of the position." This means that the more accurate the determination of a quantity, the less accurate the determination of the other. Additionally, as shown in the double slit experiment, when electrons are not observed, they behave like

waves. However, when a detector is placed in various complicated setups, electrons somehow behave like particles. These ambiguous situations, which shatter the deterministic classical physics, lead scientists to many interpretations, the most common ones being: The Copenhagen Interpretation, the Hidden Variables Hypothesis, and the Many Worlds Hypothesis.

The Copenhagen Interpretation mainly states that the wave function, which projects the situations of the quantum world in probabilities, is the right way to describe quantum mechanics, and there is nothing beyond possibilities. If two properties are connected by an uncertainty principle, then what we can know is limited to the principle, and what we know depends on the measurement we do. A photon is either a particle or a wave, depending on the observer's wish. Niels Bohr was one of the pioneers of this interpretation during the 1920s, which caused a conflict between him and Einstein, who opposed the probabilistic structure of quantum mechanics. Consequently, Einstein, Podolsky, and Rosen claimed that quantum mechanics was actually an incomplete theory. They formulated a thought experiment, known as the EPR paradox, to demonstrate that our knowledge may go beyond possibilities.



Think about two particles that interact and then are separated towards opposite directions. When you determine the position of one, you can determine the position of the other. Thus, by determining the position of particle A, you can determine the position of particle B. Then, if you measure the momentum of particle B, you can find the momentum of particle A. This way, you may have information about both position and momentum, which means that quantum mechanics is an incomplete theory and is only a piece of a higher reality. Additionally, according to the Copenhagen Interpretation, two entangled particles would be a piece of non-local reality, which means that they could communicate faster than the speed of light (instantaneously) regardless of the distance and any local variables between them. However, this idea contradicts the theory of special relativity, which states that nothing can travel faster than the speed of light. Therefore, Einstein famously described this instant signal between the particles as "spooky action at a distance."

The thought experiment was later reformed by David Bohm, who built up the hidden variable theory, supposing from a deterministic perspective that there are some hidden variables at work which define the states of the particles, instead of a non-local reality. Bohm replaced momentum and position in EPR with the spin of the particles, changing the conditions. As a response to the hidden variable theories, which were getting popular, in 1966, John Stewart Bell

published a paper called "On The Problem of Hidden Variables in Quantum Mechanics." The problem with EPR is their supposition of pre-determined states and ignorance of the causal effect of the intervention of an observer. As has been demonstrated in the double-slit experiment, the observer does not stand outside the experiment; they are a part of the experiment. Additionally, as mathematically demonstrated by Bell, theories, including some predetermined values, do not match with the quantum measurements when three dimensions are taken into account. Most importantly, Bell proposed the idea of switching the axis to measure the spin (not only up and down, but also in the x-axis). If particles had some predetermined spin values, then the change of axis would have no impact on the result, but if spin values were affected by the axis shift, then this would mean that there were no pre-determined values.

Quantum Entanglement and The Nobel Prize

Quantum entanglement happens when two particles are in the same quantum state. Bell's example can be used to express the situation better. In his story, Professor Bertlmann always wears socks in unmatched colors (i.e. if one of them is blue, the other one is pink). Therefore, under normal circumstances when Alice saw one of the socks, Bob could know the color of the other without any observation. This real life situation carries deterministic, real and local (independent of the measurement) features. However, when Bertlmann wears quantum socks, the matter quite changes. The socks now do not



have specific colors till an observation is made. Thus, the color of the other sock depends on the observation, so this quantum situation is indeterministic, unreal (no predetermined color) and nonlocal. However, still, it was very difficult to be completely sure that the socks did not have pre-determined states.

This was the point when experiments were made. Firstly, in 1972, Clauser conducted an experiment, using polarized photons. Despite his claim before the experiment that his results would prove Einstein right, the results sided with Bell's predictions. After Clauser, Alain Aspect designed an experiment for which he used an extremely complicated setup with lenses which would randomly change during the billionths of a second. His data were indicating the validity of Bell's idea again. Finally, in 2017, Zeilinger led a team who used the "colors of photons emitted from distant stars hundreds of years ago" as their experiment settings to avoid any kind of loophole and claim of determinism. The results were proving Einstein wrong again. And in 2022, these three scientists - Clauser, Aspect and Zeilinger - were awarded the Nobel Prize for Physics. There are still some claims about the loopholes in the experiments, the most famous objection being superdeterminism. There are different versions of superdeterminism, but the general idea is a hidden factor that shapes the results (i.e. A secret force which leads the strings of the particles). Or with another formulation of the problem, if everything is already determined at the instance of Big-Bang, it

becomes impossible to talk about any kind of randomness or uncertainty, everything would develop according to superdeterminism.

Quantum entanglement, seemingly, promises a significant change in quantum computing. Despite the little information we have about its capacity, entanglement may enhance quantum cryptography, providing the possibility for completely secure communication. Furthermore, through quantum teleportation, quantum information such as electrons and photons can be transferred between systems with significantly less energy.

Quantum mechanics has sharply shaken the foundations of classical physics, and many scientists from Einstein to Bell played an important role in its development process. As quantum entanglement demonstrates, and based on our current knowledge, in spite of how difficult it is to accept the idea, it seems like there are some dice on the table.

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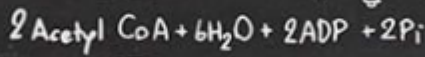


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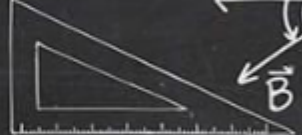




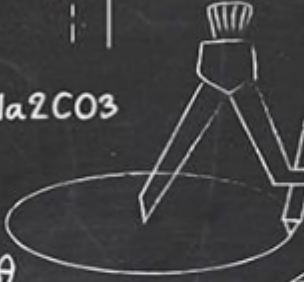
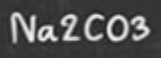
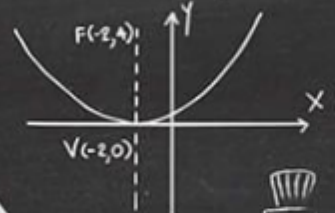
$$\cos \frac{A}{2} = \pm \sqrt{\frac{1 + \cos A}{2}}$$



$$\log_n m = \frac{\log m}{\log n}$$



$$V_{ab} = I \Sigma (R+r) - \Sigma E$$

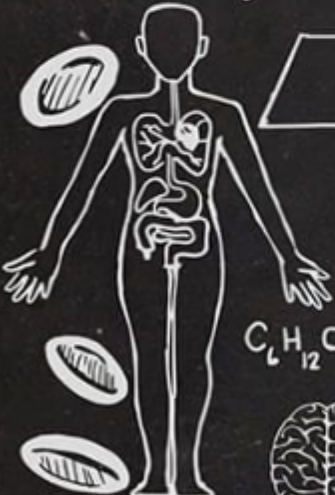
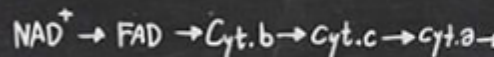
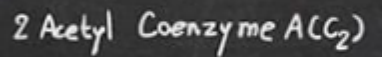
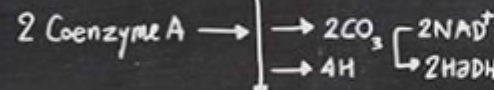
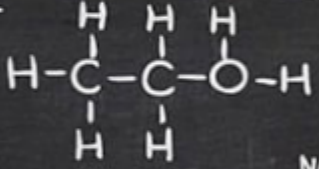
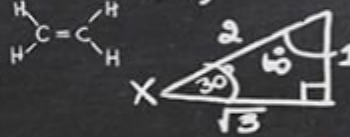
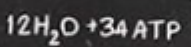


$$\frac{P(x)}{Q(x)} = \frac{G(x)}{Q(x)} + \frac{R(x)}{Q(x)}$$



$$E = -\frac{\Delta \phi}{\Delta t}$$

$$\sin \frac{A}{2} = \sqrt{\frac{1 - \cos A}{2}}$$



Parallelogram = bh

