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Table of Contents

The Existence of Pink	Ben Livney	1
The Stuttering Brain	Mona Tong	3
Fracking	Eve Murphy	5
Suppression	Simar Goyal	7
Direct Cell Reprogramming	Vishal Mathew	8
The Future of Prosthetics	Maya Reddy	9
The Science Of Love	Celestine Castillo	10
Exploring Genetics & Neurology	Elad Raymond	11
Quantum Computing	Anton Repnikov	15
Neuroscience Behind Bad Habits	Mona Tong	16
Stem Cells	Kavya Atluri	17
The Key to Tone Deafness	Eve Murphy	18
Why are Some Things Perceived as “Creepy”	Lior Zweig	19
Meat Consumption & Colorectal Cancer	Harrison Garcia	20
Scientific Discoveries of 2015	Eylon Arbel	22
2015 Nobel Prizes in Scientific Fields	Michael Brill	23
Continuing Controversies	Editors-in-Chief	25

THE EXISTENCE OF

PINK

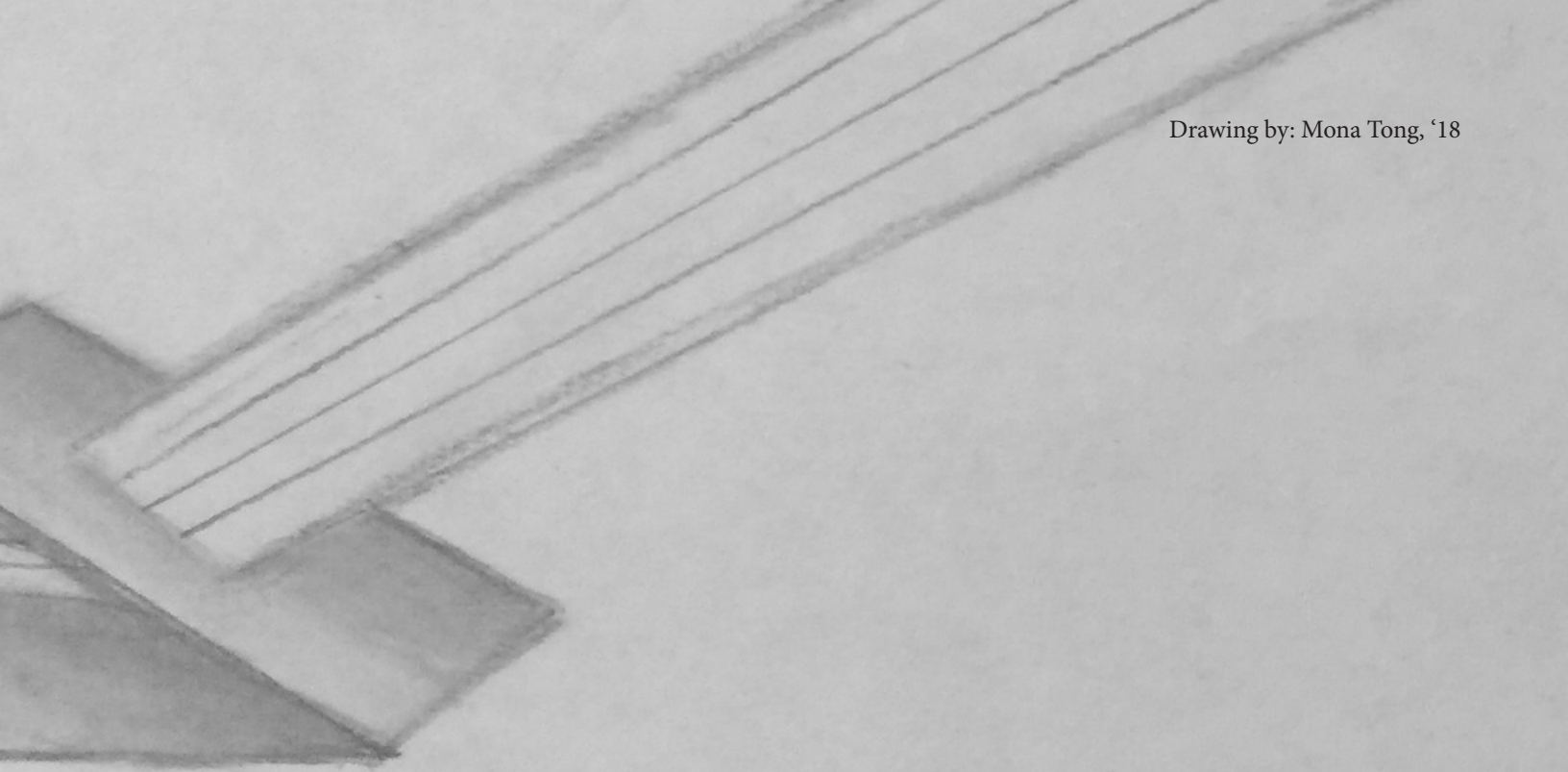
By: Ben Livney '17

We can see because our eyes receive light reflected off of various objects, and those objects have color because it may absorb most frequencies of light but reflect one, say red, and another object may reflect violet and absorb all the others. When Isaac Newton first discovered refracted light through a prism, he gave names to the colors: red, orange, yellow, green, blue, indigo, and violet. However, indigo is more of a transition color between blue and violet. In the 1600s Newton deemed blue what we would now call cyan or teal, and in what he named violet, we recognize a deep blue color. (hence “roses are red, violets are blue”). But then where is the purple? And for that matter, where is pink in any of this? There is no pink wavelength. Pink light does not exist on the visible spectrum, thus the color pink does not exist.

To start, pink light is what does not exist. There is no wavelength of pink light. Pink as a concept exists because anything to which we give a name, such as “lamp,” thereby exists as a lamp. Yet, like a more sophisticated concept such as dark matter, we have given pink a name but cannot prove its scientific existence. All colors of the visible spectrum are made apparent when white light is refracted through a prism, however pink is not one of them. The only way to get pink light is by mixing gradients of red and blue light, but

since those two colors are on opposite ends of the spectrum, they cannot blend. The only feasible way to blend them is to roll up the visible spectrum so that each end—red and violet—touch. But this cannot occur because there would be a gap between them where all kinds of non-visible light exist—UV rays, gamma rays, infrared, radio waves, etc. Thus, red and violet can’t even mix when the spectrum of light is bent to point at itself.

Under certain circumstances, we can see a purple color and sometimes even a shade of pink in a rainbow. Aside from the existence of the concept of pink, this is due to the nature of rainbows themselves. Rainbows are formed when white light from the sun is refracted in water droplets in the air, producing the visible spectrum. A double rainbow is caused when the water droplets allow extra rings of each color, or supernumerary rings, to be produced (the smaller the droplets, the stronger the supernumerary rings). When the size of the droplets is just right, the primary violet or blue rings might coincide with one of the supernumerary red rings, causing red and blue to mix and produce purple or pink. While this is a blend between red and blue to produce “pink”, it isn’t a blending of wavelengths. There is no place on the visible spectrum where a wavelength can get progressively longer or shorter from red to blue or from blue to



red. It's only the mixing of individual wavelengths to produce a color, similar to how all visible colors combine into white light, but there is still no pink wavelength.

What about all of the pink paint in famous paintings? We see pink in our everyday lives, but the pink that we perceive isn't the reflection of a pink wavelength. Rather, when we create pink artistically, we combine red dye or paint with white dye or paint to lighten it. But all the white is doing is restricting the eye's ability to perceive the red, because less of the red is being reflected back to the eye. The red is still red, but we see less of it and perceive it as pink.

One can still perceive pink with combinations of different wavelengths of light, namely, if one takes the green wavelengths out of white light, the result is pink. This can only be done on the quantum level. There are two ways to shine light: to emit light directly, like the sun or a fire, or to reflect light in a different direction. So far we have only dealt with the latter. To emit light, an atom must enter the excited state, when its electrons absorb energy causing a jump from their normal orbital to the next one up. It must then return to the ground state, when the electrons return to their normal orbitals. But the law of conservation of energy states that the amount of energy put into some-

thing must then be released. When electrons return to the ground state, they release energy in the form of electromagnetic radiation, or light. For example, when the electrons in hydrogen atoms return to the ground state, it emits a pink-ish glow. When one eliminates the green wavelengths, the combination of wavelengths usually perceived as white is now perceived as pink, as the human brain cannot distinguish between individual wavelengths. However, the absence of green forces the brain to perceive the combination differently. Now, excited hydrogen actually emits four different colors: violet, blue-violet, blue-green, and red. One can view these colors individually using a spectroscope, which breaks down the pink-ish glow into its component colors. Therefore, it is the combination of the emitted violet, blue-violet, blue-green, and red that we perceive together as pink.

We have a name for pink, however there is no pink light. We perceive combinations of light as pink, however there is no wavelength of light that is pink. Maybe non-visible light is pink but we can't see it because we have no way of accurately seeing nonvisible light without technology to transfer it into visible light. Rainbows and paint and excited hydrogen all can appear to be pink, but actually do not reflect pink light, so the next time you see pink a rainbow, think to yourself: "that color isn't real."

The Stuttering Brain

By: Mona Tong '18

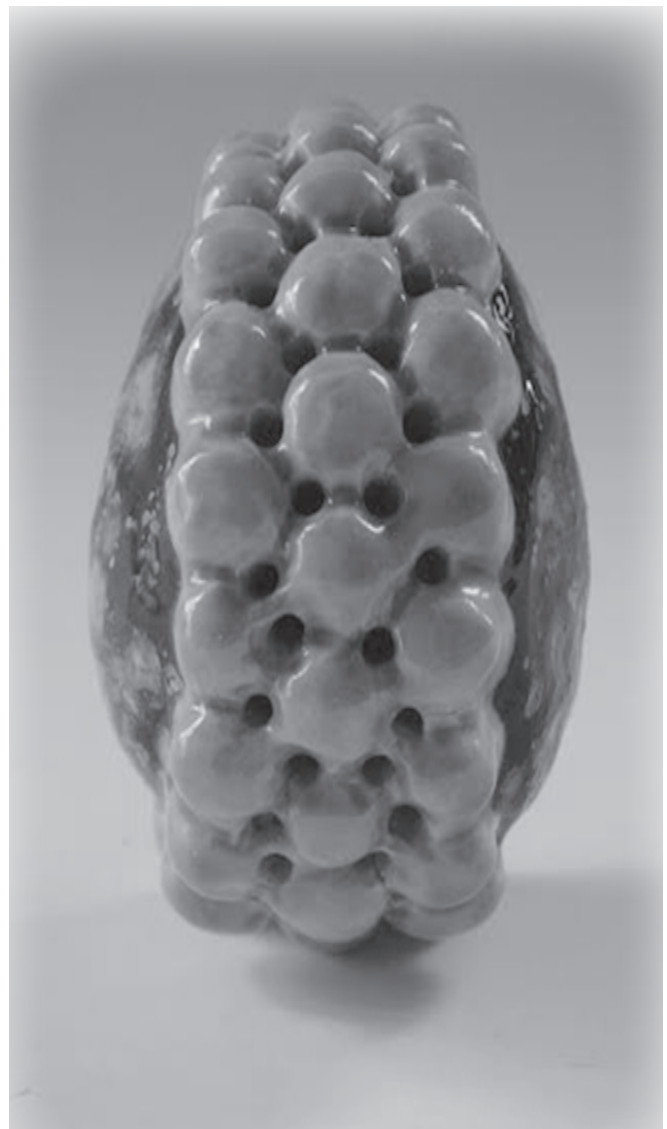
Stuttering is still considered to be a relatively understudied topic among scientists. Many questions about stuttering remain unanswered, and much of the research and data collected still remains undeciphered.

Stuttering is a neurobiological disorder, characterized by an involuntary repetition or drawing out of sounds or words. It occurs in about 5% of young children between ages two through seven, and the stutter usually goes away before puberty. However, in the 1% of developmental stutterers in the world, the stutter persists after puberty, or may even get worse, over time. Developmental stuttering stems from genetic roots, and is then further influenced by neurological changes and differences in the brain. Persistent developmental stuttering generally runs in families, and one identical twin has a 77% greater chance of stuttering if the other twin stutters, demonstrating that stuttering is genetically-related.

However, subsequent neurological factors also affect stuttering. A PET scan conducted in 1996 at the University of Texas at San Antonio presented significant differences between developmental stutterers and non-stutterers. The study showed that stutterers exhibited lower activity in the speech and auditory areas in the left side of the brain and higher activity in motor areas, the cerebrum, and the cerebellum in the right hemisphere. In contrast, non-stutterers displayed the opposite (higher activity in the left hemisphere, in speech and auditory areas, and lower activity in the right hemisphere, in motor areas). Thus, as opposed to non-stutterers who displayed left hemisphere dominance, stutterers exhibited right hemisphere dominance.

According to studies conducted in the University of Texas at San Antonio in 2004, stutterers also exhibited an abnormal neural process-

ing sequence, in comparison to non-stutterers. In non-stutterers, the processing sequence went from the Broca's area, which is associated with left hemispheric speech production and articulation, to the motor areas. On the other hand, the stutterer's brain reversed this sequence, going from the motor areas,



Cerebrum Sculpture by: Ashley Farnan, '16

to the Broca's area. Studies at University of California at Santa Barbara in 2015 indicated missing parts and reduced integrity in the arcuate fasciculus, a white matter pathway. The arcuate fasciculus is established in the scientific community, to play a critical role in producing normal speech. Damages or lesions and missing parts to it are thought to contribute towards stuttered speech, as well as many other acquired speech disorders.

Little is known about treatment and natural compensation/recovery from stuttering. In general, stuttering is thought to be treatable, but incurable. Interestingly, stutterers stutter less when singing or in chorus readings. Although an exact and

accepted answer has not been found, there are some hypotheses. When a stutterer speaks fluently, they may be using, or even just slightly activating, alternate speech pathways. Scientists have yet to find out what exactly these "alternate speech pathways" include. It is also hypothesized that over-activations in the right hemisphere of the brain may compensate for stuttering.

Brain scans conducted at the University of Texas at San Antonio in 2004 showed that when stutterers imagined stuttering, abnormalities appeared on the scan. These abnormalities included an abnormal activation in areas for speech planning, and an atypical deactivation in areas for auditory processing, speech monitoring, and articulatory movement planning. However, when the stutterers imagined speaking clearly and fluently, these regions in the brain scans normalized. This suggests that brain circuits may be already wired for stuttering before speech execution even takes place. I think that this finding should be delved into more, because I see it as an opening passage to create ways to rewire these circuits, through psychological therapy.

Moreover, there are essential differences between males and females in stuttering. For example, there are more male-stutterers than female stutterers (3:1 ratio), and females generally have a higher probability to recover than males. The reasons for these differences are unknown, but research has also gathered differences in brain structure between males and females, that may begin to open the doors to plausible answers. Research from the University of Texas at San Antonio in 2014 has found that female brains are more generally more bilateral, while male brains are more left-lateralized, and females also tend to have a larger Broca's area than males by 20-30%. Furthermore, female stutterers tended to have a lower cerebellum/motor activity than male stutterers. Interestingly, this characteristic is more similar to non-stutterers, as non-stutterers tend to exhibit a higher activity in in speech and auditory areas, and lower activity the cerebrum, cerebellum, and motor areas, than stutterers. Research has yet to expand upon the differences between male and female stutterers and why these differences occur.



Drawing by: Danielle Russo, '18

Fracking

By: Eve Murphy '18

What is a controversial element of American industry that encompasses issues of employment, environmentalism, health regulation, and resource independence? This is known to many as fracking.

Whether you've heard environmentalists declaring the negative impacts, or supporters, boasting the gains. Hydraulic fracturing, better known as fracking, is a method of releasing natural gas by fracturing shale rocks through high-power drilling and liquid injection into the ground. Many fracking supporters are more interested in the independence and efficiency of the United States than environmentalists who are concerned about the health of the environment and the risks for those living in it.

Many supporters consider hydraulic fracturing the best method, by far, and can list all of its benefits through statistics. These include the fact that oil and gas industries provide a significant amount of high-paying employment. In terms of the environment, the amount of CO₂ released into the atmosphere has decreased by more than two kilotons per day. Additionally the climate impact has apparently reduced by 50%, and therefore is said to be a cleaner method than burning coal. According to drilling info, an online source, the oil prices in the US are reportedly 20% less than they would be without the use of this process. This is a prominent reason that many identify fracking as an asset to our country.

Supporters declare efficiency and logic in our independent method of retrieving natural gasses. People argue that not having to rely on other countries particularly the Middle East for these resources, will lower costs and political risks. The fracking process is often criticized for its role in water contamination. However, research conducted in Carroll County, a major center of the industry in Ohio, has shown that the water was not contaminated. This study observed the purity of nearby water before and after the fracking process. Although they did uncover high levels of methane, it was reported that these resulted from natural biological origins. This is a major point for fracking advocates as they can utilize scientific conclusions which are more often used against them.



As they are fought with factual support of environmental science, supporters are able to counter with their own researched scientific data.

That brings us to the side of those opposing the use of hydraulic fracturing. Over 1,000 instances of water contamination near fracking sites, have been documented due to natural gases and toxic chemicals such as methane, uranium, mercury, and lead, that seep into drinking water. There are many reported symptoms, presumably caused by ingestion of contaminated water. These include damage to the respiratory, neurological, and nervous systems, and increased risks of cancer and birth abnormalities. Also after a fracking process is complete, the waste of the fracking fluids, which were injected into the ground, are left to seep into open air. This results in the release of harmful volatile organic compounds into the atmosphere.

To counteract the argument of this process being cleaner than burning coal, anti-fracking individuals explain that due to the massive amount of leaks at fracking sites, this claim won't be achieved for decades. Anti-fracking environmentalists argue that the climate is already alarmingly unstable and the methane produced by hydraulic fracturing is providing a further negative impact. The arguments against fracking are not only limited to the harmful substances released, but also extend to the atmospheric pollution as well as the extensive resources needed. On average, more than 400 tanker trucks are used to transport water and chemicals to a fracking site. Additionally, it takes up to 8 million gallons of water to carry out each of these tasks. About 300,000 barrels of natural gas are produced each day that the process is in motion. People are left to decide, based on their values, and what they believe to be true, whether the gains of fracking are worth the losses and vice versa. It is important to view the details from a scientific and logical standpoint, so that politics do not obstruct rational ways of thinking about what is really occurring. The current state of our environment has a major effect on these debates, seeing as with said climate change, people need to take into account what effect fracking will have as opposed to other methods. Therefore it can be difficult to weigh the importance of each tradeoff, and consider alternatives. All in all, hydraulic fracturing is a major component of America's industry, and therefore has extreme effects. The question of its applications being positive or negative, is ultimately left for you to decide.

Note to Reader: The cited website titled "Dangers of Fracking" is a very interactive informative website that you can visit for more information

Suppression

By: Simar Goyal '17

Have you ever tried to stop thinking about something, but then found it impossible? Suppression is a popular method of mind control in which someone consciously tries to remove thoughts of something from their mind. However, in the process of trying to govern their minds, people actually surrender control. Professor Daniel Wegner, a pioneer in suppression research, coined the term “rebound effect” to describe how those who attempt suppression are actually more susceptible to unwanted intrusive thoughts. The increased return of these supposedly suppressed thoughts can lead to obsession which eventually can contribute to mental disorders such as OCD, PTSD, anxiety, and depression. Even Sigmund Freud, the father of psychoanalysis observed that his subjects would blurt out things they were trying to suppress.

Suppression can be linked to behaviors such as smoking, self-harm, and depressing thoughts, which have all been linked to the rebound effect. Wegner created the Ironic Processes theory to explain the increased return of suppressed thoughts. It states that there is an unconscious and automatic monitoring process to check if suppression is working. If the thought is found, the conscious operating process is called upon. In essence, a person consciously attempts suppression, but unconscious monitoring continually triggers these thoughts, If someone told you to think of anything besides a white bear, what is the first thought that comes to mind? In one study conducted by Professor Wegner in 1987, participants were left alone in a room for

five minutes and asked to voice any thoughts they had on a tape recorder. Afterwards, the experimenter returned, telling one group of participants, “try not to think of a white bear” while telling the other group “try to think of a white bear”. Whenever a white bear appeared in a person’s thoughts, they rang a bell. The results concluded that those trying to suppress their thoughts rang the bell almost twice as many times as those in the control group.

The art of suppression can actually be improved upon through practice, abiding by the cliché of, ‘practice makes perfect’. Another study conducted by Wegner in 1995 discusses the suppression of past relationships. A “hot flame” is characterized as someone from the past who still intrudes your thoughts, while a “cold flame” represents someone from the past you have no interest in rekindling a relationship with. Studies demonstrate suppression of cold flames being more difficult than that of hot flames. Since hot flames infiltrated thoughts more generally, people had more practice suppressing them.

Thus, there are many effects that occur within our minds that we aren’t even aware of without close study. Once efforts

are made to recognize these effects and to combat inconvenient tendencies, one’s ability to suppress certain thoughts can improve. The inability to suppress is linked to many mental disorders where people cannot control the sub-conscious enough to fight certain triggers. As psychological tendencies continue to be studied in this manner, we can progress in understanding and improving the control center of our bodies.



Sculpture by: Ashley Joseph, '16



DIRECT CELL REPROGRAMMING

By: *Vishal Mathew '16*

It will “revolutionize what is already a revolutionary field”. This is George Daly’s, a stem cell researcher, description of the implications of Douglas Melton’s work in the scientific field of human cell conversion. In 2008, Douglas Melton and his team at Harvard University for the first time changed damaged pancreatic cells into the insulin-producing cells that are destroyed in diabetes. This opened the door* to what scientists call “Direct Reprogramming”: converting one cell type directly into another. The anticipated consequences of this discovery were monumental- a possible cure for diabetes and no longer did scientists have to worry about having to harvest scarce stem cells.

The field of direct reprogramming has been undergoing rapid growth in order to apply the concept to a variety of cells to try to cure a variety of diseases. The most recent of which was done by researchers at Washington University School of Medicine in St. Louis where they turned human skin cells into medium spiny neurons. Medium spiny neurons are important to the accuracy and control of muscle movement. These are also the main cells that are affected by Huntington’s patients. Huntington’s an inherited genetic disease in which the cognitive ability as well as muscle movements of a person progressively declines starting around the age of thirty. Often times these patients usually only live twenty years after the symptoms start to appear and usually by that time they do not have control over their body and are most likely cognitively impaired. There are no treatments that can change the course of Huntington’s but there are few medicines that can alleviate symptoms. Even then though most of the medications are used to help patients adapt to their

impairment. However, this study offers promise for possible treatments and preventions.

As in the Douglas Melton’s experiments, the team of researchers at Washington University School of Medicine in St. Louis also looked at transcription factors and how it can change cell expression. Unlike the Melton experiments though, they looked at microRNAs, a non-coding version of RNA that heavily affects gene expression, as well as environmental factors to reprogram the cells. In previous experiments, Andrew S. Yoo, the senior author of the paper, found that two specific microRNAs, miR-9 and miR-124 altered different cells to look like neurons. Therefore, Yoo and his team took skin cells from rats and placed them into an environment that mimicked a rat’s brain. When they transplanted the converted mouse cells into the Rat’s brain, the cells showed morphological and functional properties similar to that of actual neurons.

Later, they applied the same method to human skin cells. The researchers placed the cells into an environment that mimicked the human brain and with a combination of transcription factors as well as the two microRNAs they were able to turn the skin cells into medium spiny neurons. Yoo and his team are currently taking skin cells from Huntington’s patients and trying to convert those cells into medium spiny neurons. Although they are not injecting them into the patients as of yet, they are repeating the mouse experiments described above except they are injecting the cells into mice with a model of Huntington’s disease. Assuming the results of the trials go smoothly, the team could be on its way to developing a treatment or possibly even a cure for Huntington’s.

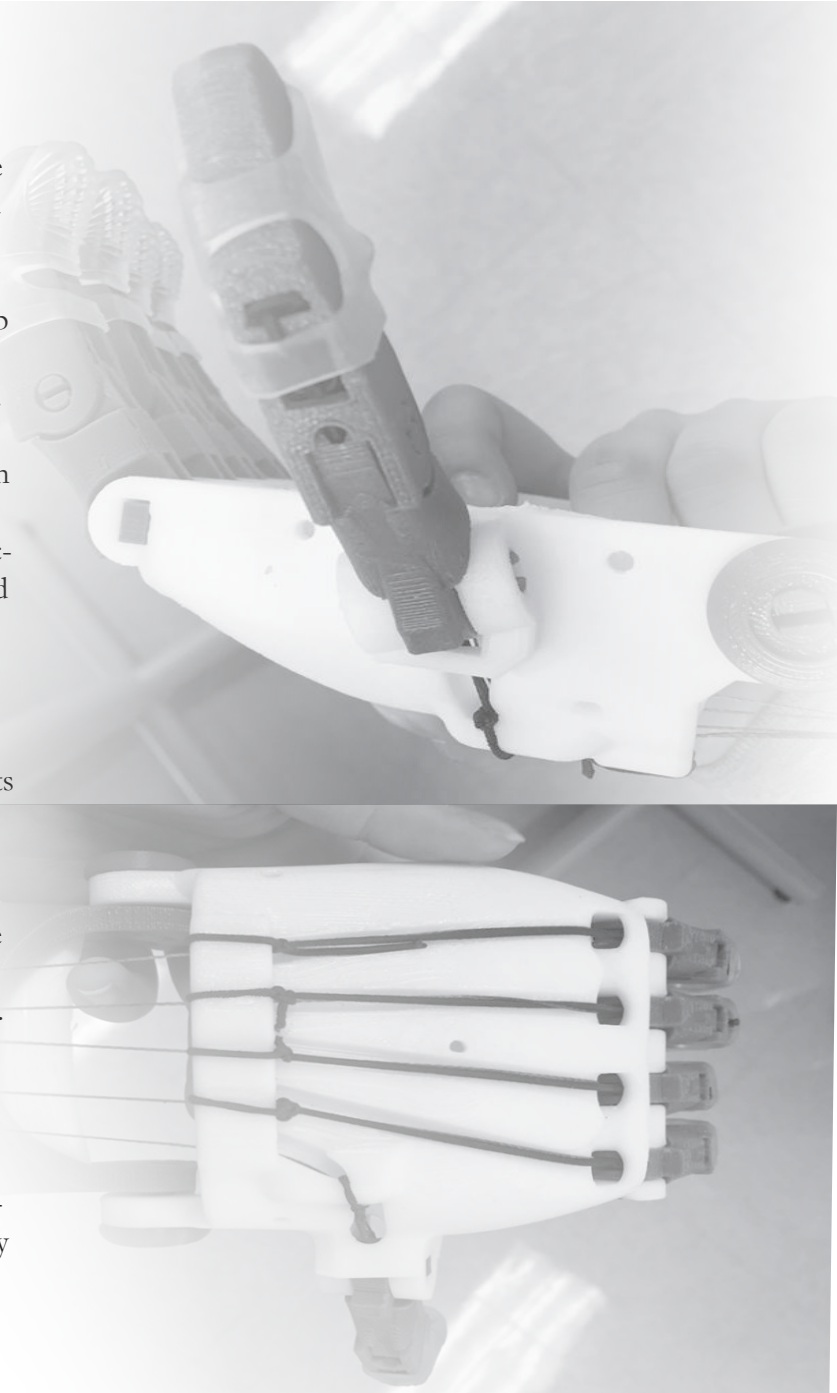
The Future of Prosthetics

By: *Maya Reddy '18*

Since the invention of the first prosthetic, biomedical engineers and scientists have been working to create devices that are able to satisfy the diverse conditions of various amputees. Van Phillips, who invented the first prosthetic leg in the 1980's, was an amputee himself. Phillips designed a prosthetic that utilized the weight being placed on the heel of the foot and converted it into energy, enabling the individual to move freely with the help of the prosthetic. The robotic arm is a new prosthetic that was recently introduced into the market. This device is programmable and can mirror the efforts of therapeutic methods that amputees often undergo.

Leslie Baugh, who lost both arms in an electrical accident, was a participant in a trial conducted by research scientists from Johns Hopkins University in 2014. This trial was conducted in order to expand the use of robotic artificial arms through human thought. After the robotic arms had been surgically attached to Baugh, he ran some basic tests with his new limbs. For example, he was asked to move an empty bottle from a counter to a higher shelf. After ten days of training, Baugh was able to control his two hands more freely than before. The prosthetic arms pick up signals from the brain, allowing the user to move the arm purely by thought.

This revolutionary invention marks a milestone in the evolution of prosthetics and robotics. With the development of this device, millions of amputees all over the world will be able to live a comfortable and independent lifestyle as well as exercise newfound control over their bodies. Not only does this successful experiment have the potential to change the lives of millions of amputees, but it can also provide a foundation for future advancements in the engineering of prosthetics.



Photos by: *Victoria Jeon, '17*

The Science of Love

By: Celestine Castillo '18

“What is love?” asked singer, Haddaway, in 1993. Well, it is unclear whether or not the question could ever be answered fully simply because the concept of love, although deeply explored by scientists, still remains somewhat of a mystery. What is known about love however, could begin to explain the feelings and “symptoms” one experiences.

First, there are many types of love one can feel. The types of love between parent and child and between partners, are the strongest. The two share similar “symptoms”, intensity levels, and actions in the brain. To answer Haddaway’s question, we will be discussing what happens in the brains of people in love.

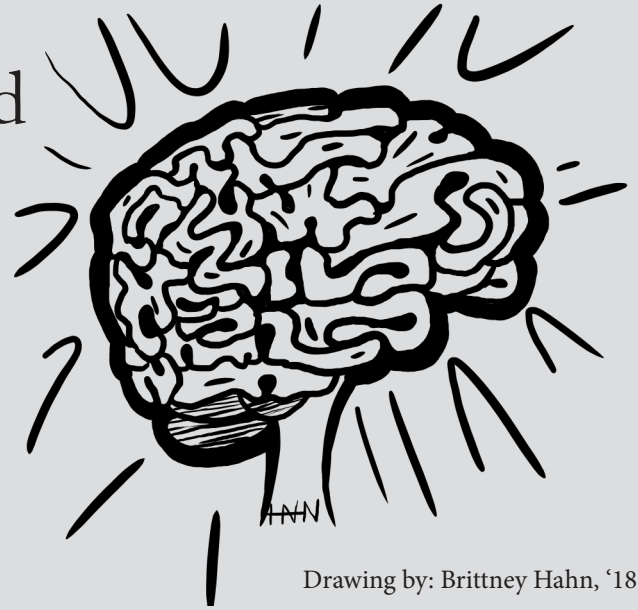
The overwhelming feelings of exhilaration and euphoria often associated with being in love are largely due to the balance of chemicals in the brain. The release of dopamine is a common process that takes place in the brain that causes one to feel pleasure when one experiences something pleasurable. Being in love lowers the threshold at which the dopamine is released making any experience seem more pleasurable, causing the one in love to romanticize the world around them. The hypothalamus releases more dopamine and norepinephrine, chemicals which are part of the brain’s reward system, inducing euphoric feelings and causing a yearning

and desire to be with the loved one. Along with that, serotonin levels start to decrease, causing obsession and infatuation with the desired one. In a study involving subjects who claim to have been in love at the time of the experiment, when shown even just a picture of the significant other the subject experienced intense feelings of romantic love. Other neuromodulators called oxytocin and vasopressin enforce trust, bonding and are linked to sexual attraction. In another study, these chemicals were injected into prairie voles, those who received the chemicals were able to find a mate immediately. Also, when looking at the face of a loved one, parts of the brain which contribute to the processing of social cues are suspended, causing the one in love to be less judgemental toward the significant other, explaining the “love is blind” phenomenon.

Overall, the processes that occur in the brain while one is in love are similar to the processes that occur in the brain of a cocaine addict, which explains the claimed likeness to being high. So what is love? Although many parts of the concept of love remain a mystery, like why we are attracted to the people we are attracted to, we do know that feelings of love are caused by a series of necessary brain processes resulting from thousands of years of evolution to aid in the survival and procreation of the human race.

Exploring Genetics and Neurology: An Interview

By: *Elad Raymond '18*



Drawing by: Brittney Hahn, '18

What is neurology?

The study of the brain, spinal cord, and the nervous system, as well as the diseases that affect them.

What is the nervous system? What are neurons? The nervous system is comprised of cells called neurons which communicate with each other to relay information between the brain and the rest of the body to help the body function properly and respond to stimuli.

Why is neurology a significant field of science?

It is important to understand the normal function and disease of the brain, so that in the future we can use that understanding to develop better treatments and cures for these diseases.

What are some neurology related employments? and briefly what is the role of each one?

Neurologists treat patients and act as investigators on research projects. Nurse practitioners also see patients and may administer special treatments, Neuropsychologists have a doctorate degree and administer cognitive testing to evaluate the cognition of patients. Physical therapists help patients with mobility issues to stay active and maintain strength through special exercises. Genetic counselors work with patients and families to help them understand the genetic causes of their

neurological diseases and whether other family members may develop symptoms. All of these professionals may also be involved in conducting research studies.

What kind of degree is necessary to be a genetic counselor? How many years of university/graduate school?

A Master's degree in human genetics. That means 6 years of university total: 4 years of undergraduate and two years of graduate studies.

What does a typical day of work for you consist of?

Seeing patients for genetic counseling and for research, talk to people to explain genetic causes of their disease, explain about our studies and why it is important to participate and what would be required of them. We work with information that is generated by the study by organize it, making sure it's entered to a database, ensuring accuracy so that it can be later used for analysis. Different researchers work on the same projects at different institutions with many interhospital connection. Many studies are international and we do writing related to applications for research and publication of study findings, teaching students about genetics and research.

What are some genetic disorders that you and your colleagues have researched?

Parkinson's, dystonia

Which disorder(s) is the most common and most studied?

Parkinson's is most common, and that also means more funding is available to study it.

What is Parkinson's disease and dystonia?

What are some symptoms? How much do we know about it?

Parkinson's disease is a neurological disease that originates in the brain and is caused when neurons that produce dopamine, an important neurotransmitter for movement and mood, die. It is unknown why the cells die. Symptoms include shaking, slowness, issues with balance, rigidity of muscles. In many cases it can cause shuffling walk, sleep issues, depression, constipation, and dementia late in the disease, which is cognitive decline.

Dystonia is a disorder that also originates in brain with causes involuntary sustained contractions of the muscles (long lasting contractions) which causes the affected parts of the body to become twisted into unusual postures. The cause is unknown, but some cases are genetic.

How does Parkinson's disease develop in a person?

We don't know exactly what happens to cause someone to get Parkinson's disease or dystonia, but in some cases we know which genetic mutations contribute to getting these diseases. In Parkinson's some of the genes are LRRK2, GBA, Parkin. In dystonia some of the genes are called TOR1A, THAP1, GNAL.

What kind of behavior/signs can be noticed prior to fully developing the disease?

For Parkinson's, a main focus of the research is to find out what the signs are that occur prior to the onset of symptoms. Sometimes depression precedes symptoms but much more research is needed to find others. We know that once symptoms start people have lost about 30% of their dopamine producing cells.

Dystonia has nothing that really precedes onset, it is a gradual progression, and can become more severe in time especially if it starts in childhood.

Are there any specific patterns that the disease runs in, such as being hereditary (parents)?

Parkinson's is usually either dominant or recessive, and rarely x-linked in terms of inheritance. If its recessive it usually affects siblings because both parents must be carrier which is rare. If dominant, it can be in multiple generations because only one copy of the gene is needed, if x-linked recessive it goes through females who are unaffected carriers to affect males like mother to son because gene is on x chromosome. People with gene for Parkinson's are more likely not to get it, known as reduced penetrance, because there need to be other factors in the genes or environment that dictate whether one will get it. Unfortunately, we don't know these outside factors at this time. Sometimes a person who has the mutation is the only one in the family the get the disease because of the reduced penetrance, making patterns hard to see.

Dystonia is almost always inherited in an autosomal dominant pattern (usually not on x chromosome). also has reduced penetrance.

How is Parkinson's disease treated?

By trying to replace missing dopamine with drugs, like l-dopa which is a precursor to dopamine, and to help people produce more of their own dopamine. It can be difficult to produce successful medication for any brain disease because

of blood-brain barrier which prevents larger molecules from crossing into the brain from the bloodstream. Other drugs are used to prevent dopamine from being broken down or enhance effect of dopamine. Also, there is deep brain stimulation surgery, which involves implanting electrodes in the brain to normalize the messages that come from that section of brain.

Dystonia, also use deep brain stimulation as well as a variety of oral medication that target acetyl choline, another neurotransmitter. Botox, which is a neurotoxin to block synapses of neurons temporarily weakens muscles that are directly adjacent to injection of botox, so that muscles are postured less.

Which types of people are most impacted by Parkinson's disease?

Parkinson's: Usually people over 60 although they can be younger, more males are affected than females. Ethnic groups where genes are known are European Jews and a group of North Africans known as Berbers.

Dystonia: Most common type of dystonia, is neck dystonia that begins in adulthood, more common in women, rarer forms exist that start in childhood including one type DYT1, which mainly affects European Jews, and DYT6 which was first identified in Amish Mennonites.

How should someone who knows a Parkinson's patient receive that person, given the struggles he or she may face?

Try not to treat that person differently, but be sensitive to their disabilities. One may need more patience because certain tasks, especially physical tasks, become more difficult. Patients tire more easily and may need help with certain tasks.

On average, approximately how many years is there between diagnosis and death for

Parkinson's patients?

Parkinson: about 20 years.

Dystonia is not a fatal disease.

One well known Parkinson's patient is Michael J. Fox, what is known about why his case emerged so early?

He has early onset Parkinson's got it at around 29, rare case, usually gotten in 60s, reasons for how early it arose unknown and gene unknown.

What have neurologists learned about the case of Robin Williams?

He suffered from a disease known as Lewy Body Dementia, which is similar to Parkinson's in that it is characterized by the presence of Lewy Bodies which are inclusions in the brain that can only be found postmortem. The genes for Lewy Body Dementia are still unknown.

What kind of technology is used in genetic studies and experiments?

MRI, other neuroimaging like PET-scan and DAT-scan and lab techniques which includes, genome sequencing, exome sequencing and others.

How is a gene found?

The first step is to identify a person or people with a disease that is suspected to be genetic because for example, there are family members with the same disease or because it is a condition that often starts in childhood. Then we can use methods like exome or genome sequencing to look for mutations in that person's genome compared to that of their parents and to controls within the same population. Then the person's DNA is entered into a computer and then spits out hundreds of thousands of possibilities of what the mutation could be that's causing the disease. Then a statistician has to analyze the

possibilities and narrow down which is the actual mutation, and then more work has to be done to confirm that the findings.

What is your most current study about?

We are currently doing studies to try and determine the genetic and environmental factors that cause Parkinson's disease to manifest in carriers of particular mutations.

What about genetics attracted you to a profession in the field?

I find it fascinating and because we are in an era where technology allows us to understand the genetics behind many diseases and because genetics is the key to try and find the cure to some and also because many of the diseases are usually chronic and affect individuals and families is a very significant way.

Would you encourage students to go into the genetic field?

Genetics is a new and exciting field that's opening up due to the new found knowledge and new technology and many new jobs are expected to be available in the field so it is a good career path to pursue.

Quantum Computing

By: Anton Repnikov '16

Computers get faster every year. At least, they have been, at a very fast and consistent rate. The creation of faster computers is attributed largely to the compression of more power into a smaller space, creating more efficient microprocessors. The biggest factor in increasing the speed of a processor is adding more transistors per chip. According to Moore's law, the speed of processors should double every eighteen months, as it has in the past, and as this doubles, so does the amount of transistors per chip. To fit more, the processors would need to be smaller, but at this rate of doubling, their size would eventually reach atomic level, and when this happens, things become much more complex. Are we doomed to this fate?

No. There is another solution, that if successful will create an entirely new standard for computing. The solution lies in quantum computers. These machines use the quarks of quantum world, the mechanics that occur at the smallest scales, to their advantage.

A transistor reads data as ones and zeros, and performs steps one at a time. Quantum computing, on the other hand, encodes information in quantum bits, also known as qubits. These bits come in different forms in how they store their information, but all have one thing in common: Rather than storing information as one or zero with the contemporary processor, qubits allow the information to exist in a state in between. Not knowing what the exact value is, the actual value floats around in uncertainty. This is called superposition, and allows for problems to be solved all in one step as opposed to the step by step approach of modern processors. This ability would exponentially increase the capability of computers. Instead of having to go through a system of commands, a quantum computer would perform all of these in one go, the ambiguous state of the qubit allowing it

to respond instantly. It basically bypasses the steps by already being in all of the states.

With recent breakthroughs in physics and technology, many of the difficulties in creating a practical quantum computer are being overcome. One of the largest difficulties with the quantum world is actually viewing the result of these qubits. That is because when observing them, they can't be every value at once; they sort of "pick" one. Observation changes the result. This is called entanglement. It's important for qubits to be in a superposition between one and zero, but upon observing them, they can no longer exist in all states in between. With new methods of observing and interpreting qubits without disturbing them being constantly discovered, the entanglement issue is being overcome. For example, if neutral matter is placed next to a qubit, it will mimic it. This piece can then be observed without disturbing the original, and from multiple of these trials, the approximate answer found. A way to compress qubits has also been recently discovered by a Canadian team of scientists. Compression of qubits is necessary so that the huge amount of information they can store doesn't overwhelm networks when their data is transferred. Small quantum computers capable of doing multiple simple tasks at once have already been crafted. Most predict that within the next few decades, quantum computers will be not only practical, but common, as their success will accelerate their own production.

The prospect of quantum computers in a quickly advancing world is exciting. Currently, the largest amount of functional qubits in a quantum computer is fourteen. It is interesting to imagine that one with 30 functional qubits would be over 1000 times faster than the world's fastest supercomputer.

NEUROSCIENCE BEHIND BAD HABITS

BY: MONA TONG '18

Bad habits. They are easily formed, difficult to get rid of, and easy to resume. From biting nails to smoking, picking up a bad habit is surprisingly easy. Based on a study performed by neuroscientist Giacomo Rizzolatti at the University of Parma, mirror neurons, on the most basic level, fire when a person sees another person perform a bad habit, when they react to the stimulus and perform the habit themselves. Mirror neurons are a special type of brain cells that fire both when a person watches an action taking place and when the person carries out that same action on its own. It reflects, like a mirror, the true sophistication of humans' social abilities. Simply watching a person perform a task strengthens neural connections associated with the task and greatly increases your chances of imitating them. Once these connections are formed, strengthened, and consistently revisited, the bad habits become extremely hard to break.

Additionally, dopamine contributes greatly in forming and keeping bad habits. It solidifies rewarding behaviors into the brain making bad habits harder and harder to break. As the action is repeated, the neural connections to the behavior become stronger and stronger. The dopamine rush travels faster and faster, and the inhibitory controls, located in the frontal lobes of the brain, become disabled. In other words, the neural pathways connected to the bad habit is able to use the excessive dopamine rush to prevent the brain's inhibitory controls from preventing the behavior.

According to a study conducted by MIT's McGovern Institute, neural patterns are crucial to the formation of habits and are changed upon the forming and breaking of habits. However, it is hard to maintain the absence of bad habits, as they instantly reappear when a nerve impulse triggers the memory of that bad habit again.

For example: you have a bad habit of chewing your fingernails when you're bored or stressed. The process would most likely work out like so: Your mirror neurons fire rapidly as you watch another person chew their fingernails. Then, you are able to repeat the action of chewing your fingernails, with the same neurons firing again. You continue to bite your fingernails because of the dopamine rush that occurs and the consistent revisiting of the neural pathways. Since in an environment of boredom or stress, chewing your fingernails gives you something to do and/or helps to relieve stress, it is characterized as a rewarding behavior. Therefore, you continuously bite your fingernails. In doing so, your dopamine rush travels faster and faster to strengthen the neural pathways associated with the bad habit of biting fingernails. In some instances, the process will skip the mirror neurons step as a whole, and sometimes, mirror neurons will be a major reason why the bad habit forms.

According to studies done at the University of California, the key in breaking bad habits is your perspective and outlook. Additionally, by focusing more on the creation of new neural pathways rather than trying to get rid of your bad habits or overemphasizing the habit, one may be able to alter their bad habits. This simply means that one should form a new good habit, and although both the good and bad habit stay in the brain, one should strengthen the new good one over the original bad one. As journalist Charles Duhigg states, "[Bad] habit loops" [are composed of] a cue, a behavior and a reward. Understanding and interrupting that loop is key to breaking a habit." In other words, one should become aware of the habit its structure in order to effectively tackle them. Habits are always malleable, but there is no single, effective way to eliminate bad habits for everyone.



Stem Cells

By: Kavya Atluri '18

Drawing by: Mona Tong, '18

Stem cells are leading the way to discovering incredible advancements in medical history. These cells of multicellular organisms have the capacity to differentiate into many different types of cells. Since a stem cell is undifferentiated, meaning they are not one restricted to one specific cell type, they can become a muscle cell, or skin cell, or even a cardiomyocyte (heart cell). This is why scientists have a newlyfound expedited interest in researching stem cells. Conditions such as Parkinson's disease, Alzheimer's disease, myocardial infarctions (heart attacks), diabetes and many others, can be treated if we find out how stem cells are properly utilized. Many of these conditions are degenerative diseases, meaning the tissue has irreversibly deteriorated, causing the organ to lose function. Since stem cells have the ability to differentiate into multiple types of cells, they can replace the dead tissue.

Stem cells are different from regular body cells because of two properties; self renewal and potency. Self-renewal enables stem cells to go through numerous cell division cycles, yet still maintain the undifferentiated state. For example, a stem cell can divide into other stem cells, that are also undifferentiated, or one differentiated cell and one non-differentiated. Potency describes the capability of a stem cell to differentiate into specialized cells. If a stem cell is totipotent or pluripotent, it is able to differentiate into almost all the different body cell types. Multipotent and unipotent stem cells are only able to become a few types of specialized cells.

Additionally, there are two main categories of

stem cells; embryonic stem cells and somatic stem cells. Embryonic stem cells come from in-vitro fertilization. During in-vitro fertilization, many eggs are fertilized but only one is used, so the extra fertilized eggs are used for research, when permitted. Embryonic stem cells originate in the inner cell mass of a blastocyst. A blastocyst is one of the earlier stages of a human fetus during pregnancy. These are the preferred stem cells because they are pluripotent. Somatic stem cells are found along with specialized cells in the body. The main purpose of these cells is to maintain and repair the tissue they are located in. Generally, they are found in bone marrow, and unlike embryonic stem cells, are rarely pluripotent. In 2006, scientists made a major breakthrough, finding a way to take already specialized adult cells, and return them into stem cells; called induced pluripotent stem cells. For example, we are now able to take a cell from the skin and revert it back to a stem cell.

In order to utilize these stem cells for treatments, scientists must determine the perfect conditions to place the cell under so that it differentiates into the desired cell. This environment is extremely precise, as even the smallest mistake could cause the cell to become something completely different than desired. Today, many scientists are researching stem cells and designing experiments in order to find out more about stem cells and how they can be utilized. As advancements are made in proper treatment conditions through the use of stem cells, the amount of lives saved can be immeasurable.

The Key to Tone Deafness

By: Eve Murphy '18

The idea of tone-deafness might instantly remind you of that specific friend who is always off-key, or maybe you are grimly reminded of yourself, but science reveals that most individuals who claim to be “tone deaf”, really just need practice. Yet there are some people that cannot find a pitch, despite training, and these fall under a category of individuals with congenital amusia. This affects about 1 in every 25 people and is characterized by an inability to differentiate notes or remember or recognize tunes previously heard.

When analyzing this disorder, scientists came to the conclusion that individuals with amusia, had fairly normal hearing, so it had to be something in their brains that prevented them from differentiating pitch. Agnosias are a wider category of conditions under which, amusia is contained, which all entail a lack of knowledge of a certain category of object. Prosopagnosia is often associated, being an inability to recognize or differentiate people’s faces, even with perfectly normal vision. In 2011 it was established that both conditions can be caused by injury or damage to the cerebral cortex, but in many more recent experiments, the auditory cortex of tone deaf subjects indicates sounds being registered the same way as a normally musically capable person. People with amusia are simply unable to distinguish

the notes even when fMRIs measuring blood flow in the brain, indicate these areas of the brain responding in the same way to people who can carry a tune.

It was concluded that other parts of the brain must play a role in interpreting music, but which structures exactly, remain a mystery. However the September 2007 issue of the Harvard Health Letter references researchers using brain imaging to measure the density of the white matter between the right frontal lobe and the right temporal lobes, where sound processing takes place. The brains of amusics were found to have thinner sections of matter, depicting a weaker connection.

People affected by congenital amusia are often first-degree relatives of members also affected by the condition, and although no particular genes have been identified, it is likely that these mutations affect connective wiring throughout the brain. Thus genetic variations do play a role in the linking of sensory information with previous knowledge. Adam Greenberg says, “Understanding what’s behind tone-deafness might one day help amusic people appreciate tunes after all.” as he discusses the type of “detective work” that scientists will have to continue to do to figure out where the melody is being discarded.

Photo by: Zack Kraushaar, '17

Why are Some Things PERCEIVED as "Creepy"?

By: Lior Zweig '18

A laughing doll, a sad clown, humanoid robot, or a stranger in a smiling mask. The mere idea of these objects somehow manages to give most people the chills. Why are people "creeped" out by objects that don't seem to pose much of a direct threat to anyone? The answer is complicated, but it makes sense; it lays in what is known as the "uncanny valley," something that has some recognizable characteristics of a person, yet does not meet all the "normal" standards. This often gives people feelings of ambiguity and unsureness. Humans like to be sure of what they see, in case it poses a threat. However, if an object has a eerie or twisted quality while still resembling a person, it increases the effect of its creepiness. A mask may look like a human face without changing facial expressions according to emotion. Certain recognitions are triggered to signal the mask resembling a human, but certain qualities such as the lack of demonstration of emotion, set it apart from a true human face. This confusion between human and object causes a sensation of creepiness. Mathur MB & Reichling DB conducted a series of studies investigated whether Uncanny Valley effects exist for static images of robot faces. The study utilized two parallel sets of stimuli spanning the range

from very mechanical to very human-like. First, a sample of 80 randomly chosen robot face images from Internet searches, and second, a morphometrically and graphically controlled 6-face series set of faces. Subjects were asked to clearly rate the trustability of each face. The analysis of one proposed mechanism for the Uncanny Valley, confusion at a category boundary, found that category confusion occurs in the Uncanny Valley but does not conciliate the effect on social and emotional responses. The concept of being creeped out stems from an evolutionary trait in which humans observe figures to determine whether or not it is a human in order to assess trustworthiness. Evolutionarily speaking, when individuals recognized a threat, to their survival and avoided it, they were more likely to survive than those who did not. As a result of natural selection, most people today are "creeped" out by the uncanny valley, which entails the brain's perception of being in the middle of safety and harm. Thus humans feel a sense of eeriness when they are fearful of the unknown.



Meat Consumption and Colorectal Cancer Rates

By: Harrison Garcia '18

Cancer has been a prominent aspect of our medical culture for thousands of years, first recorded in an ancient Egyptian medical text from 1600 BC. Even though this disease has been recorded and studied for such an immense time span, more than 7,000,000 people die from it each year. It is extremely important to research a cure for this degenerative disease, especially in the modern world we live in today due to its ever increasing causes, ranging from obesity to smoking, forcing rates to skyrocket over those of preceding decades.

What is cancer's effect on society? Aside from the millions of mortalities that occur from this disease, there is also a myriad of socio-economic aspects branching out due to this sickness. For example, the US alone pays an estimated eighty-eight billion dollars for direct medical costs each year. Aside from the monetary value, large emotional burdens are bestowed upon families and friends for each person that is diagnosed with the disease, making it almost impossible to hide from its harsh reality. World politics also diverts hundreds of hours debating how to deal with the economic and social strain that the subject of cancer bestows upon our governments. Because we waste countless hours debating the costs of cancer, one of the main issues is unveiled, one that isn't being attacked as vigorously as it should be; finding a cure.

Is there research being done? Yes, there are countless scientists researching a cure for cancer, and I am personally researching how the consumption of red meats may correlate with CRCs, or colorectal cancer. This is a topic of importance, especially in America where our culture glorifies the consumption of

those foods. There has, in fact, been a correlation of cancer rates with the intake of processed red meats, specifically a 36% increase through mathematical analysis according to Harvard professor, Mingyang Song, Adam Bernstein, and countless other researchers. This correlation was found in a study consisting of around 87000 people; and 2731 people developed distal colon cancer when they consumed about 50 grams of processed meats. 50 grams of meat, about 3 slices of cold cuts is enough to give people colon cancer. The recommended amount of meat to eat per day is 9 ounces, or 255 grams, and the average American eats more than the recommended value.

Why does this happen? When meat is cooked, HCAs, or heterocyclic amines are produced. This type of chemical is a known carcinogen, and may explain the correlation of CRCs with processed red meat consumption. Also, processed meats contain nitrates, and when these nitrates sit in the colon, it may cause damage to the DNA in the surrounding cells, therefore having the potential to form cancer.

How can people avoid this? A good tip on how to avoid CRCs is to either eat less processed meats, or just to go organic in the food group of meats. By going organic, there are no nitrates added to the meat, eliminating the factor that the nitrates may cause cancers. Also, by consuming unprocessed red meats, CRC rates dropped, further conveying the thought that nitrates may be the culprit for such a large correlation. All in all, the consumption of processed red meats correlated with higher colon cancer rates, while unprocessed meats correlated inversely.



Current Events

Photo by: CJ Marquez, '17

Looking Back on the Scientific Discoveries of 2015

By: Eylon Arbel '18



The field of science has had some revolutionary discoveries and moments in 2015, it would only be appropriate to summarize all the amazing new advances in science during the past year. Every year, brilliant minds are put to work trying to find new ways to better our world and change everyday life. Some of the advancements made in the past year may seem like “old news,” but when comparing them to what was available to us in 2014, they are game-changing. From inserting mammoth genes into an Asian Elephant, to a brain implant that can potentially treat victims of neurological diseases, 2015 has truly been an extraordinary year.

First on the list of advancements in 2015, Chinese scientists have attempted to modify the genes of a human embryo and eliminate a harmful gene. They used a gene-editing method known as CRISPR/Cas9, however, there are a few “kinks” in this method which make it inconsistent. Out of the 86 embryos that were modified, only 26 were successfully eradicated of this specific gene. Hopefully, scientists will perfect gene modification in the upcoming years. Next, the creation of a bionic lens can potentially allow people to see three times better than 20/20 vision, through a quick and easy procedure, in as early as 2017! Each lens would be custom-made and would involve an 8-minute surgery that would grant that person perfect vision, no matter how poor the patient’s eyesight. Lastly, the Chinese company, Xi’an Particle Cloud Advanced Materials Technology Co., has expanded the use and practicality of 3D printers, above its common usage for printing sculptures, models, or other miscellaneous objects. Recently, this company has successfully

printed bones and used those 3D-printed bones in a surgery done on a rabbit. After the surgery, new cells almost immediately started to form on the surface of the bone, thus proving the surgery to be successful. This technology can soon be used to treat humans and counter many bone diseases involving bone loss and damage. Scientists have already started to experiment with this kind of technology and have printed human tissue and organs. Who knows where this new technology will lead to next?

Significant amounts of progress has been made in the field of science during 2015; some of which are only stepping stones that will eventually lead to better technologies and discoveries being made in the future. Others are useful and can be applied to our world here and now; they will advance the world in ways unimaginable. The gene splicing mentioned in this article will be one of the stepping stones that will slowly but surely, make eliminating genes an everyday medical procedure. The bionic lens and 3D printing of human bone and tissue are both nearly perfected and will be available to the public shortly. Hopefully 2016 will bring new discoveries and technologies that will supplement, or even improve, the current advancements made in 2015. The possibilities are endless in the field of science and there is no telling what the next year will bring.

The 2015 Nobel Prizes in Scientific Fields

By: Michael Brill '18



In his will, Alfred Nobel left money that he assigned to be rewarded to the highest achieving person in each given field. The first three fields he mentioned were, in order: physics, chemistry, and physiology, or medicine. Every year since their first award cycle in 1901, countless scientists who have made large discoveries in their fields have been considered for the prize of \$1,000,000.

When the Nobel Prize system was established in 1901, the prize for the highest achievement in the field of physics was generally regarded as the most prestigious, and still is today. This year, the prize went to Takaaki Kajita, out of the University of Tokyo, and Arthur B. McDonald, from Queens University in Ontario. They proved that Neutrinos, which are similar to the more well known electron but without a charge, do have mass. There are three types, or flavors, of Neutrinos: the Electron Neutrino, the Muon Neutrino, and the Tau Neutrino. Each are named for the charged particle that it reacts with. The experiments performed proving that neutrinos have mass was influential in the study of our universe because Neutrinos make up a lot of the known types of matter in the universe. This newly discovered mass helps to explain why, why the moments after the big bang were what they

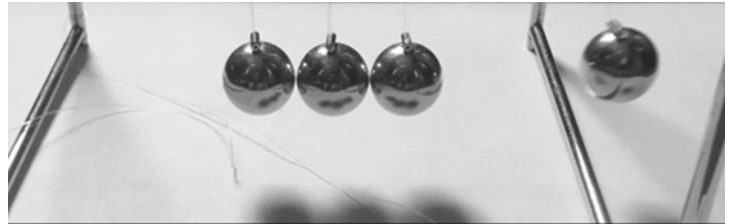
were. In the first fractions of fractions nanoseconds of the universe, two types of matter existed in abundance: antimatter and matter. But when matter and antimatter come into contact, they are both annihilated. The discovery of the neutrinos mass help explain why mass still exists in abundance as the mass of neutrinos contributes. The discovery of the Neutrinos mass sheds new light on what scientists know today and opens new opportunities for further research.

Next, the award for chemistry went to Thomas Lindahl from the Francis Crick Institute, Paul Modrich from Duke University, and Aziz Sacnar from the University of North Carolina at Chapel Hill. They won the award for their study on DNA repair. Lindahl found out just how many errors are made by cells in the copying of DNA, because there are many totaling in the thousands even without the mutagens people are exposed to constantly. However, every mistake made does not turn a human into an extremely mutated organism; your bodies have protection against that. The first layer is Base Excision Repairs in case there is a random switch from an adenine to a thymine, the BER system discovered by Lindahl will simply remove and replace the base with the correct base. The other method for DNA correction discovered

is Nucleotide Excision, this system is used if there is a large change, such as an addition, deletion, or a frame shift, generally caused by UV radiation or other carcinogens. Some biochemists, such as the nobel prize winners, believe that the systems mentioned to stop and fix gene mutations could be targeted by certain medicines in order to increase their production and effectiveness. As of now, when corrections aren't made, the mistakes can lead to mutations, and even cancer.

Lastly, the award in medicine was split between the team of William C. Campbell and Satoshi Ōmura, with Youyou Tu receiving the other half . The first group discovered and created a drug called Avermectin, which is shown to dramatically lower parasitic-caused diseases, such as River Blindness and Lymphatic Filariasis. Tu discovered the drug Artemisinin, which has proven to lower the number of cases of malaria. Both groups of winners have made contributions to hopefully stopping major health issues affecting the developing world and around 100 million people every year. The advances in medicine from 2015 are only a drop in the bucket of discoveries still to be made in the fight against parasitic infections, but their work should not be discounted or forgotten, because because of its capability and potential to save millions of lives.

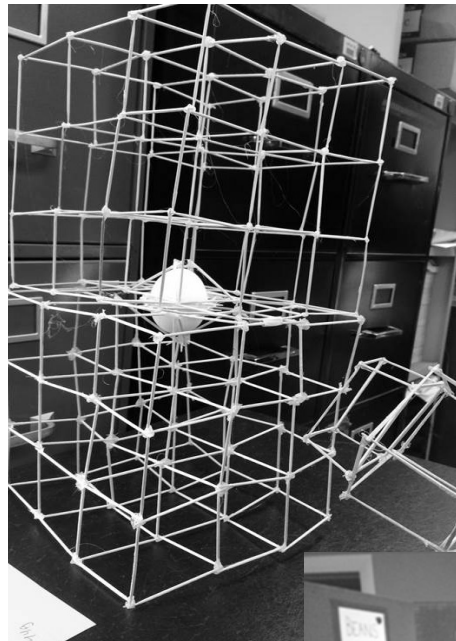
FUN SCIENCE FACT:



Newton's cradle shows the conservation of energy and momentum. When one ball hits, the energy from within it is moved through the balls to the last ball. The balls can not go any higher than the drop height of the first ball.

Photo and caption by: Eden Nebel, '17

AT NORTH HIGH SCHOOL:



North's Annual Physics Egg Drop

Photo by:
Sophia Greenberg, '17

Freshmen Honors Biology Independent Research Projects

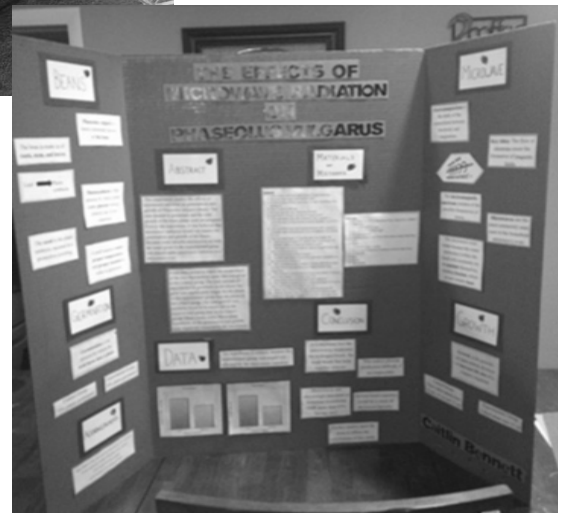


Photo by: Caitlin Bennett, '19

A black and white photograph of a woman with blonde hair, seen from the side, pointing her right index finger towards a world map. The map is the background of the entire page. The woman is wearing a dark long-sleeved top. The map shows continents and oceans, with labels like 'NORTH PACIFIC OCEAN' and 'SOUTH PACIFIC OCEAN' visible.

Continuing Controversies: Climate Change and Seaworld

An Interview with Mrs Bernasconi by the Editors

Climate Change

The 2015 United Nations Climate Change Conference, was held in Paris, France, from November 30 to December 12 2015. This was of major significance in environmental science as over 190 countries met to discuss cooperation in combating climate change. There were extensive efforts to attack emission reduction, but it's questionable whether new restrictions will actually be abided by everywhere, and even with this cooperation, whether it will be enough to save our climate. Biology and Marine Biology teacher, Mrs. Bernasconi says, "Their talk is good, but it's not realistic. Even if they followed through with everything they plan on, it's still going to have an increase of 2.7 degrees Celsius. If we do nothing, by 2100, it can go up to 4.5. So based off of what they discussed at Paris, they want to keep it at under 2 degrees, but with what's being proposed, it will still go up to a 2.7 degree Celsius increase."

If this increase continues at its current rate without a fight, scientists predict a foreboding

future including history's sixth mass extinction and the melting of the polar ice caps, causing the rise of seas high enough to flood coastal cities.

So what will happen to the other 8 million species? The basis of the Paris agreements are geared towards humans with little mention of biodiversity and the mass expanse of it in the ocean. Loss of ocean biodiversity affects us through climate-change related issues such as coral bleaching and acidification. But what is coral bleaching?

"We don't know why it does this, but when the water around coral, who is an animal, increases in temperature, it will throw up its algae, and this kills its colors. Coral becomes bleached and that white color because it loses its algae. The algae is the producer of the ecosystem, and if you don't have coral, you don't have a coral reef. The Caribbean used to be very bio-diverse in around the 80's before huge bleaching. We have to bring that coral back."

What about acidification?

"Carbon dioxide is a greenhouse gas when it's in the air, so as a gas in the air, it traps heat in the Earth. Same with methane, same with CFC's; those are greenhouse gases. When carbon dioxide dissolves in water, it becomes carbonic acid, so it's not trapping heat; now, it's an acid. It's the same thing in a soda can. As there's more CO₂ in the air, some of that is going to dissolve into the water in the oceans, making the water acidic. So, carbon dioxide is bad on 2 levels: in the air, it traps heat, and in the water, it acidifies."

Why should people care about ocean acidification?

"Ocean acidification is really bad. Diatoms are producers of many ecosystems- they have glass shells and suffer from acidification. Diatoms are linked to 40-80% of the oxygen we breathe."

A major presence in climate change is the Great Conveyor Belt which is a big current that can bring explanation to the wacky weather changes and storms. So does the Great Conveyor Belt do?

Mrs Bernasconi explains,

“The job of the Great Conveyor Belt is to take heat that is absorbed at the Equator, and distribute it along our coasts, up into the poles. For example, all the heat that is absorbed into the Atlantic will go up the coast and hang a right, if you will, to Europe. All of Europe’s heat comes from heat absorbed from the Caribbean around the Equator. This current is driven on the poles being cold and the Equator being hot, and we want that difference in temperature and salinity. As the poles they get warmer, that see-saw starts to become balanced and there is a less of a difference. Without it, the current is going to slow.”

So where does our climate come into play?

“Winds drive the currents, but also carry our weather. So as the wind systems change, not only the currents are going to change, but our weather patterns are going to change. And now we’re living in a polar vortex, where it’s colder in New City than it was in Anchorage, Alaska, in most of January and February last year, because of the change of the currents.. If the Gulf Stream and Labrador current hit each other, because the Gulf is warm and the Labrador is cold, they don’t mix. Because they’re getting closer in temperature, a little mixing goes on. That puts a brake pad to the current; slows it down. With the storm last year, Boston got feet and feet of snow, because the current lingered. We had a Beluga Whale on the Long Island Sound last year- that’s evidence of the whole current coming down our coast. Beluga whales cannot handle the temperatures of the Long Island Sound, because it’s a warm water body.”

How to we get people to understand the immediacy of this issue?

“I believe that if you understand the great conveyor belt and it’s job, you will understand why the climate is changing differently in different locations on the globe. To understand what is slowing the conveyor belt we have to look at natural causes vs. human causes. My personal opinion is that we should stop wasting time arguing what is the bigger cause and start acting on solutions on our end. In addition while I personally feel that the disruptions that climate change will bring to our weather and our food supply are very important and long-term, we also need to address the issue of over harvesting fish and plastics in the ocean which are having a more immediate impact on our food supply.”

What’s that about our food supply?

“A lot of recent literature says that around 2048, 100% of the ocean population is going to be collapsed. A collapse is defined as 90% decline in population. This is due to many factors. Overfishing is a big piece of that, because we’re collecting fish faster than they can replenish themselves. So we are at a point where, we ask “what’s going to happen to our food supply? Everything has to change. We’re starting to understand, what it does to the ecosystem when we remove when we remove an apex predator, since they control the whole food web.”

Food Web? I know I’ve heard that term before...

“With the ocean, it’s different than a farm. If I’m a farmer, I have 100 acres, so my profit will only be the corn that I can grow on those 100 acres. I’m responsible for growing, feeding, nourishing, harvesting, selling the corn, and shipping the corn... when you “farm” the ocean, the ocean does all that work for you, so all you do is the harvest. It’s almost a free resource so people make a very quick buck off of it, but they’re not focusing on longevity. Some fisheries are more sustainable than others. Crab fisheries release pregnant crabs - they know that’s the next generation. Quotas are hard to manage so, I have no idea where we’re going to go with our food supply.”

Sea World

After the release of the film *Blackfish* in 2013, Seaworld has been under major attack by many groups because of the new information brought to light. The documentary exemplified issues with Orca whales being held in captivity and the controversy with trainers being blamed for deaths by the killer whales.

Are these Orca whales really out to kill us?

Mrs. Bernasconi says,

“There’s not a single piece of evidence of a killer whale ever killing a human in its natural setting. The issue is we have seen things in captivity that we don’t see in the wild. They’ll eat things that are equivalent to our size so what is it about us that they’re not eating and attacking in the wild and why is it happening in captivity? A lot of it shows the stress. They have a bigger frontal lobe than us, which is the emotional part of your brain and something that we have to understand about whales in general, especially killer whales, is they travel in pods, which is their whole extended family for life. And the babies don’t leave their mothers. And in captivity when they’re bred, they’re removed from their mother relatively young, and you have to remember in the wild they’re never removed from their mother. They become stronger as the pod gets bigger, they do a lot of things as a team, they feed as a team, they hunt as a team, the mother teaches the baby how to get food, it’s all something that’s taught.”

So why is the experience so stressful for them?

“It’s a big to-do to ship an animal somewhere, because they have to be wet all the time, they have to be temperature-regulated and it stresses them and I think that the stress that’s on their body becomes apparent in their actions. They rake each other with their teeth, they’re clawing on the cages to get out. I mean they’re essentially in a large bathtub, just doing circles for life. When they used to migrate hundreds of miles, now they’re swimming in a circle for life. You’d go mad if all you were allowed to do was walk around in circles on the track for the rest of your life, and you got rewarded if you did it well by eating fish.”

Seaworld, not being a solely negative establishment does state that they haven’t captured a whale from the wild in 35 years. They also argue that they help whales in the wild as they provide scientists research that would be difficult to acquire otherwise.

Mrs Bernasconi clarifies,

“There are two sides to sea world. There’s the show piece which is where they make revenue and then theres the conservation piece which is what they do with their revenue. One year after *Blackfish* came out in 2013, the stock of Sea World dropped 50%. People stopped going, people started boycotting and were more aware of what’s going on. Seaworlds across the country have closed so those animals have to go somewhere and there have been a lot of lawsuits. Here’s the good side of Sea World: Sea World does a lot of rehabilitation, conservation, and education on the outside. They can’t do that if stock goes down 50%.”

She goes on to discuss how going to Seaworld may have determined her career path and how this may impact other people:

“People don’t care about things unless it has a direct effect on their life. We’re not gonna indirectly care about the ocean. People don’t care about climate change because they don’t believe it affects their daily life. They don't see it, it doesn’t affect their day to day and until it affects their day to day people don’t care about it, and that's unfortunate.”

However many trainers have been killed by whales in captivity which Blackfish displays as an issue that exemplifies the stress on whales in captivity.

“Dawn Brashau dies in Florida 2010 and Seaworld puts the blame on her so there's the dark side of Seaworld where their shows are where they bring in the revenue. If they stop the Shamu show and the killer whale shows ,who’s gonna come to Seaworld? What are you going to see?”

So what is Seaworld going to do?

“The big push is to get the trainers out of the water with the whales. Right now in California there’s a couple things going on. SeaWorld in San Diego mentioned a couple years ago plans to double the size of their enclosures for the whales. That’s something that they wanted to do as a response to Blackfish. Blackfish is yellow journalism and it is very easy to portray something in a way when you’re looking at one side of it. Seaworld is claiming that those videos and those trainers weren’t even real.”

Is that a valid argument?

“That’s hard to prove..They have film of people at Seaworld saying that whales normally live 38 years in the wild when they don’t... they live up to 100 years in the wild. You really can’t take that in any other context, but the way Blackfish was showing it. Sea World in San Diego mentions plans to double the size of enclosures in what they call Blue World Project. However lawsuits arise as the California Coastal Commission has put a ban on breeding killer whales in captivity. As Sea World tries to sue California the Commission says they will not renew their expansion permits if they do not abide to the ban. Seaworld argues that the coastal commission has overstepped their jurisdiction.”

As of March 17, 2016, SeaWorld Entertainment has officially agreed to stop breeding Orcas and phase out the theatrical performances, marking a significant shift almost three years after the pressure from Blackfish.

Therefore these controversies are continuing to be unraveled and by evaluating the issues on a scientific basis we can begin to understand what is surrounding us and form our own opinions on it. As Mrs Bernasconi discussed, people don’t like to concern themselves with things that affect their day-to-day life, but with closer evaluation you may come to realize the effect that climate change has on your future and acquire more interest in your ocean and its variety of creatures.

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To Submit to Chaos 2016-17:

Look out for club updates and morning announcements or contact Mrs. Gertzler to submit articles or art and photography through Google Classroom!



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