



STEM 2 Schools Science Journal

Edition #2

June 2017

Executive Board:

Founder and President: **Russell Rapaport**

Vice President: **Max Price**

Events Coordinator: **Max Brody**

Editor-in-chief: **Danujan Thirumavalavan**

President of North Cobb Christian School, Kennesaw, GA Chapter: **Kelvin Pierre**

President of Westhampton Beach High School, Westhampton, NY Chapter: **Adam Sheren**

President of Lincoln-Sudbury High School, Sudbury, MA Chapter: **Sam Scribner**

President of St. Clement's School, Toronto, Canada Chapter: **Riva Menon**

President of Bishop Lynch High School, Dallas, TX Chapter: **Kennedy Martin**

President of Calabasas High School, Calabasas, CA Chapter: **Aidan Rigberg**

Board of Advisors:

Joshua Cohen & Justin Klee: Co-founders, Amylyx Pharmaceuticals

Mary Sabelli: Honors Biology/Forensic Science Teacher, Sharon High School

Table of Contents

The Internet of Things: For Better or For Worse?.....	4
Human-Pig Chimera.....	7
Trappist 1.....	9
The Ninth Planet of the Solar System.....	11
The Science Behind the Martian.....	13
SpaceX Landing of Falcon 9.....	15
Slingshotting Drugs onto an Infection.....	16
Should We All Be Vegetarians?.....	18
Risk of Opioid Addiction.....	20
Polluted Environments.....	22
New Advances in 3D Printing.....	24
New Icebergs Are Being Formed—In a Bad Way.....	26
IBM Watson and Artificial Intelligence.....	28
How Microsoft’s Technology Has Survived in the Business World.....	30
Genome Editing.....	33
Flu Vaccine or Frog Mucus?.....	35

Capturing the Event Horizon.....	36
Black Holes: One of the Strangest Space Phenomenon in Our Universe...	37
The Humane Genome Project.....	39
A Solution For Pollution.....	41
A New Member of the Hominid Family Tree.....	43
Works Cited.....	45

Note From Founder and President

Dear Readers:

It gives me great pleasure to introduce the second issue of the Stem2Schools Science Journal. I founded Stem2Schools.org, a STEM (Science, Technology, Engineering and Math) knowledge-sharing platform with a mission to spread awareness of STEM to high school students. Our aim remains to build an ecosystem whereby cutting edge STEM research can be made accessible for high school students nationwide. We make science accessible through dialog with leading scientific industry experts and academics, through this bi-annual journal that disseminates science through the perspective of students and I am happy to report, our first STEM conference that is taking place on June 16, 2017. Our organization has grown rapidly over the past year with chapters as far as Canada. Our hope is to spread the love of science, technology, engineering and math across every school in America.

I want to thank you for being part of this continued journey. I hope you enjoy and share the joy of what you read in this journal.

Best regards,
Russell Rapaport
President and Founder, STEM 2 Schools

Scott Blatte, Sharon High School Class of 2019

The Internet of Things: For Better or For Worse?

The year is 1991. A new technology called the Internet has just been released to the public with high expectations, but with plenty of doubters. We now know this would revolutionize the world we live in. Now, I'm sure many of you (myself included) believe that we would know the next "internet" when we see it. However, the next big invention may be sitting right under our noses. It even has the word "internet" right in its name. It's called the Internet of Things, or IoT for short. In a nutshell, the Internet of Things is where all the objects in our lives can share and analyze data in the cloud. Basically, every object becomes interconnected with each other. Many objects have already begun to switch over to the IoT. Think smart watches, smart homes, and anything else "smart" that was once "dumb". The IoT could revolutionize the world we live in, but it could also cause irreversible harm.

When you think of "smart" devices, you probably think about things like smartwatches and smart fridges. No doubt, these have had a significant impact on our society. However, this is only the beginning. The Internet of Things has the potential to spread to almost every aspect of your life. One crazy sounding example, but not actually so ridiculous, is the scenario where an alarm clock goes off, which automatically turns on the toaster, which will turn on your car 10 minutes later. To our current selves, this sounds absolutely preposterous. But it really isn't that crazy. If the Internet of Things spreads to common household objects, they will all share and receive data from the cloud. Every object will be interconnected to each other. At this point, it simply becomes a matter of interpreting the data, something these devices are trained to do. Now, this is what many people would call a "first world problem" or "first world scenario", and

yes, this example isn't really applicable to the developing world. However, the IoT itself is, and has the potential to save lives. The Internet of Things also encompasses things like smart meters, and smart farming equipment. In places with an extreme shortage of water, every drop counts. If the IoT becomes active in these countries, it will hopefully introduce innovations like smart meters, and smarter farming equipment. These will help control and distribute the right amount of water to the places that need it most, and in some scenarios, equalling the difference between life and death. The Internet of Things has immeasurable possibilities, but it also has some very real, and potentially dangerous issues.

Recently, leaked documents revealed that the CIA could spy on anyone through their TV's, phones and essentially anything connected to the internet. This is made possible by the internet of things, and is only one example of the dark side of this new technology. Now, I am not trying to sound like a "the internet is trying to kill us" conspiracy theorist. The Internet is not trying to harm us. People using the internet, however, are. For example, hackers were able to use the Internet of Things to take down a power grid in Ukraine. Imagine if that happened in America. We would be defenseless against our enemies. Furthermore, your data will never be private. A report by the Federal Trade Commission that over 150 million data points can be generated by less than 10,000 homes every day. Each one of those data points can be valuable to hackers, and needs to be protected in some way. Already, companies are having issues with protecting their consumer's data, and only 10% of companies recently surveyed believed they could secure their IoT devices against hackers. It is clear there is a long way to go before your data is truly secure.

The IoT is coming. There is no doubting that. One expert predicts that “Eventually, the IoT will encompass about 99 percent of all objects, which currently totals approximately 1.5 trillion things”. Every single object you interact with will start transitioning into the IoT during our lifetimes. The question is no longer will this invention come, but when. Furthermore, we must ask ourselves if this is a good thing. The Internet of Things could solve major world problems like famine, drought and poverty. However, it could destroy all traces of privacy, and make the world significantly less secure. Let’s not forget about the Internet. One newsweek article read “ The Internet? Bah!”. And look how wrong they were. We are stepping into an unknown future, one where technology reaches every corner of the Earth.

Human-Pig Chimera

The first human-pig chimera is the first human-animal hybrid. A chimera is a beast from Greek mythology that was a combination of many animals. This study was done at the Salk Institute for Biological Studies in La Jolla, California. The goal of this was to grow human organs inside these hybrids that can be used for transplants.

To make the controversial human-pig chimera, scientists put human stem cells into pig embryos, and then placed these cells in a sow (a female pig). Timing was crucial, and they eventually realized that the human stem cells had to be at a certain stage of development to produce the best results.

They got the idea of making hybrids from previous research on mice and rats, which also involved using CRISPR to delete genes that coded for mouse organs. They then added rat stem cells to make the organs.

Despite how remarkable this is, there are also many complications and issues. The embryos grow very slowly because of the human tissue, and there is a chance that humans will reject the organs because they have too much pig tissue. Apparently, there is also the fear of accidentally letting strange human-pig hybrids into the wild, which caused the US National Institute of Health to stop funding this study; now it is funded privately. There have also been many ethical concerns, and scientists are debating whether these hybrids are more pig or human, and whether they have human thought. The cells have been engineered to not contribute to the chimera's brain, but it may still be a possibility.

Overall, it is unclear whether creating human-pig hybrids is advantageous (or moral), and there are still many concerns that need to be addressed.

Maytal Cooper, Sharon High School Class of 2020

Trappist 1

NASA'S Spitzer Space Telescope has revealed the first known system of seven exoplanets around a single star. This system of exoplanets is being called Trappist 1. Three out of these seven exoplanets are firmly located in the habitable zone of their parenting star, these are the areas that are most likely to house liquid water. Not only is this discovery exciting because it could be a big step into finding a habitable environment for life but also, this discovery set a new record for the most planets located in a habitable zone around their star outside of our solar system!

Using Spitzer's data, they were able to precisely measure the size of each of the seven exoplanet, and make the first estimations of the masses of six of the exoplanets, allowing their densities to be estimated. Unfortunately, these numbers weren't released in the article, but based on their densities, the exoplanets are likely to be rocky. Further observation will help determine whether these exoplanets have plentiful water and possibly reveal if there is liquid water of the surfaces. Sadly, the seventh and farthest exoplanet's mass has not been estimated but scientists believe it could be icy and "snowball-like" but they need to do more observation.

Their star is classified as an ultracool dwarf , which means that it is so cool that liquid water could survive on the exoplanets orbiting very close to it. Not only are Trappist 1's planets closer to each other than the planets in our solar system, but their planetary orbits are closer to their star than mercury is to our sun!

Not only are these the first Earth-sized planets found orbiting this type of star, but it is also their best bet yet for studying the atmosphere of potentially habitable, Earth-sized planets.

These planets may also be tidally locked to their star, which means that the same side of the planet is always facing the star, which means that each side is either eternal day or night. This can also result in them have weather pattern totally unlike Earth such as strong winds blowing from the day side to the night side as well as drastic temperature changes.

Spitzer, an infrared telescope, was well suited for studying Trappist 1 because their star glows brightest in infrared light. Spitzer's unique position in its orbit allowed it to observe enough passage of the planets in front of the host star to reveal the complex construction of the system.

Following up on this discover, NASA's Hubble Space Telescope has begun a screening of four of these exoplanets including the three habitable ones. These observations aim at checking for for the presence of puffy, hydrogen-dominated atmosphere, typical for places like Neptune. The two exoplanets closest to their host star didn't possess puffy, hydrogen-like atmospheres, which means it is more likely that they are rocky planets.

Being that Trappist 1 is 40 light years away (235 trillion miles) and also thinking about our current technology, it would not be possible for our generation to ever travel there or even be alive for a spacecraft's arrival to these exoplanets, but as far as we know, with the right technological advances through many, many years, these planets would be a very ethical place to live for the future generations.

Zack Light, Sharon High School Class of 2018

The Ninth Planet of the Solar System

In 2006 the International Astronomical Union created a specific definition of what a planet was which excluded the dwarf planet Pluto, and the number of planets in the Solar System became 8. Recent developments suggest that there is a ninth planet after all, In a mysterious region known as the Kuiper Belt. The Kuiper Belt is a collection of objects with orbits more distant than Neptune. It's believed that most of these objects are fairly small, but this is far from universal.

In 2014 it was discovered that the orbits 13 Kuiper Belt Objects coincided so that they were clustered together at the point when they were closest to the sun, known as the perihelion. Since the gravity of the gas giants tends to randomize orbits, this was fairly improbable, and researchers from the California Institute of Technology began searching for an explanation. They soon discovered that, not only did they cluster at their perihelions, but they also orbited on the same plane, which is astoundingly improbable without some outside gravitational influence. After mathematically testing a variety of arrangements of bodies in the Kuiper Belt, the most accurate one featured a large, rocky, planet-sized object with a perihelion exactly opposite the sun. Further testing confirmed that this is the most likely model by far, helping to explain other anomalies in the distant solar system, and in 2016 researchers all over the globe began trying to observe the new planet directly.

The new planet would likely be four times as wide as Earth, with 10 times the mass, and orbits 1000 times as far from the sun. Currently it should be in the southern sky. One notable attempt to find it involved a collaboration between the BBC and the Zooniverse citizen science

project, in which 60,000 volunteers sorted through data of the night sky taken by Siding Spring's SkyMapper telescope. The search identified 4 objects as potential candidates, which are now under further scrutiny. Many believe that the ninth planet of our solar system will be found by next year.

The Science Behind The Martian

The Martian, an award winning film, depicts the story of an astronaut left behind by his crew after being presumed dead after a fierce storm. Mark Watney, the astronaut, has to use his scientific knowledge to help him survive. Surprisingly, many of the technologies and things Mark does in this movie that takes place 20 years in the future are actually used by Nasa right now.

In the film, Mark is able to grow potatoes using sprouts from potatoes for botany. Nasa is making strides similar to that, growing lettuce that the current ISS crew ate. Water, along with food, needs to be created by astronauts on mars, so the astronauts in the Movie used a water reclaimer, which is used by Nasa now as well. This technology recovers and recycles water from everywhere: urine, hand washing, oral hygiene, and other sources. Later it will be filtered and ready for consumption. Moreover, Astronauts need to be able to breath, so they need to be able to produce oxygen. Watney is able to survive by bringing his own supply of oxygen wherever he goes. He makes the oxygen by using the 'oxygenator,' a system that generates oxygen using the carbon dioxide from the MAV (Mars Ascent Vehicle) fuel generator. Similarly, on the ISS astronauts have the Oxygen Generation System, which processes the atmosphere of the spacecraft to create breathable air. This technology works by using electrolysis, which splits water molecules into their component oxygen and hydrogen atoms.

Many of these technologies and methods that Mark Watney used in the movie The Martian seem impossible; however, they are being mimicked by Nasa today. This goes to show that while some things may seem unreachable or implausible, they can be done and achieved.

Futuristic movies are fake realities, but sometimes, like in *The Martian*'s case, they can and do reflect many possibilities for the future of science and technology.

John Robert Nelson, North Cobb Christian School Class of 2018

SpaceX Landing of Falcon 9

On May first at 7:15 a.m., SpaceX, a company founded by Elon Musk, successfully landed a rocket that went into space. Falcon 9, the name of the rocket, sent a government satellite into space and landed back on earth safely. The rocket was launched in Cape Canaveral, Florida, and landed back there on Landing Zone 1. The landing of Falcon 9 has revolutionized journeys into space. By being able to reuse rockets, SpaceX saves millions. Although developing rapid reusable rockets is still in progress, SpaceX still has many contracts on their radar. SpaceX currently has been flying many cargo resupply missions to the International Space Station. For SpaceX, the sky is the limit, with over seventy future missions on the horizon. The success of SpaceX is amazing, and behind every successful company is an innovative leader, and that is Elon Musk.

Elon Musk is the founder and CEO of SpaceX as well as the co-founder and CEO of Tesla. He oversees development and manufacturing of advanced rockets and spacecraft for SpaceX. The company was founded in 2002 with a goal to create a sustaining civilization on Mars for humans to live. Because of the historic monuments that SpaceX has made, such as building a reusable rocket, this goal can be attainable in our lifetime. SpaceX is revolutionizing the way we look at space travel as well as giving us hope that the journey to Mars is possible and near.

Slingshotting Drugs onto an Infection

In recent years, Biomedical technology has reached its peak, developing medical devices that have never been considered plausible before. Whether it's generating the world's first artificial pancreas or a surgical robot, Biomedical engineers have addressed virtually all facets of medicine. Nonetheless, the most significant, broadest applications may come from the creation of the world's first molecular slingshot that can shoot drugs at an area of infection when triggered by specific disease markers.

According to researchers from the University of Montreal and the University of Rome Tor Vergata, this molecular slingshot is merely 1/20,000th the size of a human hair, but could have drastic effects on drug delivery methods. A synthetic DNA strand, the 'rubber band' of the slingshot, is composed of two anchoring parts that are able to stick to a target antibody, which is a Y-shaped protein expressed by the body in response to different pathogens such as bacteria and viruses. As the two ends of the synthetic DNA recognize the target antibody, they bind to it, allowing the drug to be loaded and subsequently released. In order to develop such a complex device, researchers had to engage in a long series of experiments to find the optimal design. The specific makeup of the nanoscale slingshot holds the drug loaded in 'rubber band' in the absence of the antibody, without affecting too much its shooting efficiency once the antibody triggers the slingshot. If this was not the case, drugs would frantically be shot into the human body, causing the whole device to bust. But, because researches have been able to optimize the complex design of such a small appliance, they have seen great promise.

Despite the fact that one may believe the nanoscale molecular slingshot can be applicable to few diseases, the research has shown that the long term potential of this product lies in its versatility. Alexis Vallée-Bélisle, an Assistant Professor in the Department of Chemistry at the University of Montreal, explains, “until now we have demonstrated the working principle of the slingshot using three different trigger antibodies, including an HIV antibody, and employing nucleic acids as model drugs. But thanks to the high programmability of DNA chemistry, one can now design the DNA slingshot to 'shoot' a wide range of therapeutic molecules.” Thus, the molecular slingshot is a culmination of the fascinating advances in all of DNA technology; because DNA is now able to be programmed via chemistry, there truly is no limit to the range of diseases the slingshot can treat.

The next step for the molecular slingshot is clinical trials. However, prior to testing in mice, the researchers aim to test cells in vitro for targeting a specific disease. After that, the slingshot will be tested on mice, and eventually be released for medical use. Not only would the molecular slingshot drastically improve the efficiency of drugs, but it would also decrease their toxic secondary effects. Therefore, it is clear that the potential long term effects of the device are both extensive and momentous. Overall, the biomedical technologies that have been recently developed are outpacing our expectations and will have a significant effect on the way we treat disease in the near future.

Max Price, Sharon High School Class of 2018

Should We All Be Vegetarians?

In American culture, steak, burgers, and fried chicken are often idealized. They are called “comfort food” and “American classics”. As a result, many Western vegetarians are scorned and mocked for their choice not to eat meat. A more extreme dietary group called “vegans” eat nothing that comes from an animal, further restricting their menu by excluding eggs, dairy products, and fish. It has become trendy to be a vegetarian; roughly 7 million Americans follow a vegetarian diet, with upwards of a million identifying as vegan.

The most common arguments for vegetarianism and veganism are largely unquantifiable, citing the questionable morality of animal-based food production as reason enough to skip out on eating meat. Other radical “animal rights” activists use veganism as a protest to mistreatment of animals on farms and illegal hunting. However, another thread of discussion that has picked up steam as of late is the thesis that it is healthier to be a vegetarian.

While many so-called “carnivores” have scoffed at this logic, making reference to the lack of protein and other essential food requirements in vegetarian cuisine, new research by Timothy J. Key of the University of Oxford has provided insight as to the benefits of eating green. “Compared with non-vegetarians,” summarizes Key, “Western vegetarians have a lower BMI...they may also have a lower risk for some other diseases such as constipation, diverticular disease, gallstones and appendicitis”. This conclusion, while new and fiercely debated by dieticians and physicians alike, may serve to make a point about what Americans eat these days.

Americans eat meat at a higher rate per capita than any other nation; according to NPR, this is not a sustainable exercise. In their article “A Nation of Meat Eaters”, they exploit the

amount of natural and fossil energy used to raise, transport, and manufacture meat. However, to combat this, more meat is being used from less cows to make the system more efficient. The sustainability of the current state of animal-based food production has yet to be seen, but many environmental scientists are anxious about the future of food, and what it means for the Earth.

While vegetarianism is certainly “trendy”, and may have inherent health benefits, the efforts of a small vegetarian percentage of Americans may not be able to outweigh (literally) the impact of hundreds of millions of meat eaters. Like it or not, they are along for the ride. Unless something drastic happens, it is unlikely that the general trend will flip towards vegetarianism. These dietary choices are not for everyone, but there are lessons to be learned from the self control required to maintain them and the health benefits that come as a result. Perhaps if more Americans would turn to veggies instead of McDonald’s, we would not be looking down the barrel of the obesity crisis that we currently face.

Gracie Johnson, North Cobb Christian School Class of 2018

Risk of Opioid Addiction

Hospitals across the nation treat numerous patients every day as they visit the emergency room with everything from a broken wrist to a major spinal injury. These patients, when eventually sent home, often walk out the door with a prescription for a potentially highly addictive opioid. Studies show that about “7 percent” of patients treated are sent home with the painkiller. These opioids can often jump start a painkiller addiction as the initial prescriptions continue to be refilled, running the risk of a tolerance and addiction to form with continued use. It is clear that many of those who begin treating their pain with opioids often have a difficult time ceasing use of the drug, even after the pain has passed.

Researchers are reacting to this issue by strongly encouraging that opioids are only prescribed when absolutely necessary. The less people exposed initially to the painkiller will greatly decrease the accidental addiction to this drug. They insist that if an opioid proves necessary, doctors must begin by prescribing the least amount possible in order to regulate the pain experienced by the patient while still making a serious effort to prevent the patient from being led down a path of addiction. However, it proves difficult to gauge the pain of each patient, and to decipher the difference between a severe case that requires strong painkillers and one that does not. It is not simple to recognize when a patient requests more painkillers due to genuine pain and discomfort or when one is simply feeding an addiction.

Researchers have specifically looked into the relationship between the prescription of opioids and the patient admittance due to a minor injury such as a sprained ankle. There is evidence that a number of cases of a simple twisted ankle were treated with these addictive

painkillers. A Harvard professor described this finding as evidence of “how much arbitrariness there is in how physicians prescribe opioids.” Such injuries like a sprained ankle should not require a strong painkiller such as opioids. With this issue growing, a patient has the potential to enter a hospital with a minor injury and potentially leave later that day with the beginning of a detrimental painkiller addiction. The root of this issue is found simply in the mistreatment of minor injury cases in hospitals. There must be alternate prescriptions to treat such injuries so that there is no longer a potential for addiction every time a sprained ankle, or any other injury, is treated by a doctor. The prescription of opioids must be conducted more responsibly in order to insure that doctors are helping patients and not hindering them.

Andrew Hay, Sharon High School Class of 2018

Polluted Environments

Almost every mother and father in the world can speak to how important their kids are to them. However, millions of kids die each year from something we can prevent. More than a quarter of deaths in children under age 5 worldwide are tied to polluted environments, such as contaminated water and smoggy air.

A report from the World Health Organization (WHO) found that each year, 1.7 million children under age 5 die due to polluted environments, equivalent to about 26 percent of all childhood deaths in that age group in 2012.

An environment that is polluted is certainly a deadly one for all, but especially for young children. Dr. Margaret Chan, the director-general of WHO, said in a statement, "Their developing organs and immune systems, and smaller bodies and airways, make them especially vulnerable to dirty air and water." In proportion to their body size, children eat more food, drink more water and breathe a greater volume of air than adults. In addition, children are more likely to play outdoors and put their hands and other objects in their mouths, which increases their exposure to environmental hazards.

"Investing in the removal of environmental risks to health, like improving water quality or using cleaner fuels, will result in massive health benefits," said Dr. Maria Neira, the director of WHO's Department of Public Health. For instance, WHO estimated that a 75 percent reduction in smoke from household cookstoves could reduce cases of child pneumonia by up to 46 percent in certain settings. Interventions to increase access to safe drinking water and improve sanitation and hygiene could reduce diarrheal morbidity in children by up to 45 percent, the

organization said. Government agencies could also work together to improve hygiene at health facilities where women give birth, increase the availability of public transportation to reduce emissions from vehicles and better manage hazardous waste to reduce exposure to harmful chemicals, WHO reported.

As you can see, performing simple tasks can decrease the number of illnesses and fatalities from pollution substantially, as WHO's report makes this very obvious. The lives of all, but particularly younger children are something we should all cherish. Working together as a global community by making more environmentally-friendly decisions is what must be done in order to save one life at a time and create a safer environment for all.

New Advances in 3D Printing

3D printing continues to advance and it's implications are beyond incredible. Engineers have designed a robot using a 3D printer that is able to walk on a vast number of surfaces such as rocky surfaces, which give most robots a very difficult time maneuvering through. This is why 3D printing could be the means of the next huge breakthrough in science. These engineers were able to micro engineer legs that would support the robot and allow it to walk through uneven and abnormal surfaces. The engineers designed the legs, and through 3D printer, were able to simply print their ideas. This could have major benefits in the medical field. Imagine a machine that could analyze measurables on a person, then could print a prosthetic that would perfectly fit! 3D printing has the opportunity to lead to several amazing breakthroughs in science and medicine.

This new type of printing could also allow the mass production of normally specialized products. These are products such as highly technical robots, specialized medical machinery, or devices for specific disabilities. This could also drive the costs down for most of these products, making them more affordable for disenfranchised individuals.

3D printing is great in so many ways, but one major issue for it right now is its price. Scientists are working around the clock to develop ways to make 3D printers more affordable so that it could become a household product. Once these printers become a household and common product, then possibilities will expand even further. Homeowners could simply purchase the "layout" of a desired product and then could get the product delivered to the printer. This would revolutionize online shopping and how the delivery industry worked. Food can also be created through 3D printing using a type of "sugary ink". A new machine called the "Foodini" is a 3D

printer that can create all kinds of food such as burgers and pizza. The current price is around \$1,000.00. If these prices were to decrease, and this became a household product, there would be a huge market for this industry. For example, imagine a world where you ordered a Pizza Hut pizza, and it would just send it to your printer where it would print and be ready to eat. This would be a highly popular product that I believe everyone will be using in the next twenty years.

Scott Blatte, Sharon High School Class of 2019

New Icebergs are Being Formed—In a Bad Way

The presence of icebergs in Antarctica has been well documented. People often point to these large icebergs as a sign of climate change. But is it really climate change, or is the ice splitting for other reasons?

The Larsen Ice Shelf is one of the three largest masses of ice in the Antarctic area. It is (or was) divided into three areas: ice shelf A, ice shelf B, and ice shelf C. The reason I say “was” is that the Larsen A Ice Shelf disintegrated in January of 1995, and Larsen B ice shelf disintegrated in February of 2002. Recently, Larsen C began to crack. By February of this year, the crack had grown to 180 km or about 112 miles. And while the crack has paused its growth, recently, a second crack has branched off from the main one. This new crack has been measured at 15 km (9 miles). At the time it was measured, scientists observed that the new crack had not even existed only six days earlier.

So why does this matter? Well, if either one of these cracks reaches the edge of the ice shelf, it has the potential to do two things. First, it could calve off a 5,000 km (3,106 miles) from the ice shelf, creating the largest iceberg ever. Second, it could destabilize the entire ice shelf. A similar occurrence happened in the early 2000’s around ice shelf B. And by 2002, Larsen B was no longer in existence. Now, the ice floats above the ocean, so the break wouldn’t have a large effect on the sea level. However, it would provide a solid example for scientists to analyze the remaining ice in and around Antarctica.

Now, the big question. Is this because of climate change? As with everything related to the environment, there are multiple opinions. Some believe that this, while not helped by the

warming climate, is a natural phenomenon. They argue that this has been coming for some time now. One of these people is Adrian Luckman of Project MIDAS, a British Antarctic research project that's keeping watch on the ever-growing crack. He argues that "There is no direct evidence to link this event to climate change. Although the general ice shelf decay along the Antarctic Peninsula has been linked to a warming world, this rift appears to have been developing for many decades, and the result is likely natural". However, Will Steger, an explorer who crossed Antarctica turned climate change advocate. He believes that the collapse of the ice shelf "represents the latest climate change wake-up call".

This is clearly a complicated issue with a complicated solution. As far as my opinion, I simply don't know. Look, climate change is real. And humans have a large responsibility for the change. Did warming cause the crack in Larsen C. I believe that while it may not have caused it, the warming ocean has certainly not helped it. And overall, other areas of ice are melting directly because of climate change. The world is changing. The crack in Larsen C is just another reminder of that.

IBM Watson and Artificial Intelligence

It's everyone's biggest fear: artificial intelligence. Whether they're afraid that AI will realize that they are superior beings and manage to take over the world, or that robots will take the jobs of Doctors, Engineers, and Statisticians, people have been dreading the day that artificial intelligence will finally become prominent in society. The question is, when will that day come? Arguably the most progressive company in the world of artificial intelligence is IBM with their world-renowned robot: Watson. With their stunning advancements, IBM's work with Watson should promote positive feelings about artificial intelligence, and the fascinating potential that it holds.

You probably know Watson for his appearance on Jeopardy in 2011, but Watson is capable of far more sophisticated uses than just dominating a game show, and has made drastic progress since then. First, Watson has been extremely useful to the world of medicine, particularly to diagnosing cancer treatments. With the ability to keep up to date with the large volume of medical journals, research, and clinical trials, Watson is able to apply his expansive knowledge to specific cancer patients. As Dr. James Miser explains, "It will be like having a capable and knowledgeable 'colleague' who can review the current information that relates to my patient... It is fast, thorough, and has the uncanny ability to understand how the available evidence applies to the unique individual I am treating." Specifically, Watson was able to correctly diagnose a 60-year-old woman's rare form of leukemia within 10 minutes--Japanese doctors were stumped on her case for months. Another example of Watson's genius is when researchers at Baylor College of Medicine used Watson to search through 70,000 articles about

p53, a protein that can sometimes indicate cancer. By sifting through the literature and suggesting proteins that control p53 activity, Watson allowed researchers to identify seven proteins within a *few weeks* that could lead to possible treatment. After graduating from medical residency in 2013, IBM claims that Watson has improved its performance by 240% from 2011-2013, and it has clearly shown through the results with cancer patients.

Besides its use in Oncology, IBM Watson is a powerful tool for analytics. For \$30 a month, Watson can discover patterns from your business's data and make suggestions for improvements based off of those trends. However, AI technologies can not only sort data but, in a sense, think about what the data means and also act upon it to achieve best outcomes. For this reason, it is easy to think that the far more efficient Watson will be able to make typical workers obsolete.

One practical example of artificial intelligence at work is the driverless car. Despite still being in the early stages, it won't be that long before people literally put their cars on autopilot. Tesla's \$75,000 electric car today can drive itself to some extent, as it can even make lane changes. According to the Associated Press, Toyota expects to be selling AI-enabled driverless cars by 2020. Nevertheless, despite great advancements in artificial intelligence, led by IBM Watson, there is still a long way to go before jobs will be taken away, and the working-class citizen is outdated. Although it is clear that AI is up and coming, it is not likely that robots will be taking over our livelihoods in the foreseeable future.

Sam Scribner, Lincoln-Sudbury High School Class of 2018

How Microsoft's Technology Has Survived in the Business World

In today's day and age, it seems like everyone is equipped with an iPhone or Apple device of sorts. With the booming growth of Apple nowadays, other technology companies seem to be reaching extinction, as they are struggling to find success with convincing consumers that their product is superior. In spite of this, the Microsoft dynasty still finds a way to succeed, as many of their aspects appeal more to businesses rather than everyday consumers.

Firstly, training costs for the Windows system are significantly less than that of Apple, due to the fact that Windows has been the mainstream operating system for a longer period of time. For enterprises, hiring technicians and tutorial systems can prove quite costly, but because more people have experience with using Windows over their lifetime there is a greater number of people capable of setting up and repairing the system. This means that Windows-based businesses can have a cheaper and more reliable way of using and fixing their technology.

Not only are the training costs of Windows cheaper, but the product as a whole costs significantly less money as well. For example, the average selling price of an Apple PC hovers around \$1400 and is still on the rise, while Windows PCs have been in the range of \$500 for multiple years. While people might argue that successful companies should simply buy the "higher quality" computers, the IT (information technology) budget of companies are tight and focus more on getting the best value rather than the best quality.

In addition, why change what works? Many people, especially those in the business workforce, are hesitant to make changes that would impact their everyday life. If a new system such as Apple is introduced to a Windows-based company, employees would have to learn a

whole new system, which would be both time-consuming and expensive. Furthermore, a transition in an operating system would create a huge room for error, as important online documents and information could be lost in the transformation. Thus, in a fast-paced industry such as business, Windows proves to be preferred simply because it is already used and trusted by the majority.

While Windows does not have the most modern and accessible technology, it has Microsoft Office and Excel, two programs which are essential for businesses. These programs are incredible for creating spreadsheets and organizing data, as they provide a wide array of tools and functions that are more accessible than programs such as Google Docs. Even though Microsoft Office and Excel can be accessed and downloaded via Apple browsers, there is a significant decrease in capability and functionality on Apple platforms, which proves to be inefficient and excessively simplified. Additionally, Apple-based enterprises are able to purchase a Windows license for virtualization software in order to run important Microsoft programs, but this process proves very costly and ineffective.

Lastly, Windows systems in general provide much better support for companies and businesses. The first way that Windows provides support is in the form of management software, which allows for IT staff to easily control and access the many computers within a company. This means that Windows IT staff can easily secure data and organize roaming profiles, which is substantially more difficult on an Apple system due to its “mobile device-like” support. The second support credential is the long-term support policy of Windows, which guarantees a ten year lifecycle for all of its devices. This warranty gives Windows-based businesses a consistent

security network that includes bug fixes and security patches. Consequently, Mac OS X systems change rapidly, which makes it difficult for IT personnel to guarantee security and reliability.

Ultimately, the business world relies on Windows technology despite Apple's consumer market dominance. This gap in Apple's success has caused them to focus more on mobile devices, which allows for Windows to prevail in enterprises. Thus, while Apple may have the superior technology, Windows exercises dominance in its accessible and consistent set-up that businesses have used, and most likely will use, for years.

Genome Editing

In the past, gene editing was possible, but it was risky because the consequences had not yet been assessed. Testing and innovation have progressed and now we have a powerful gene-editing tool called Crispr-Cas9 which can cut, delete, and insert genetic material with more precision than we ever could before. This technology enables us to edit the genetics of a person, taking away harmful genes and adding helpful ones in their places. Also, we are able to edit human embryos which can prevent newborns from having diseases and give them good traits such as beauty, intelligence, and strength.

With great power comes great responsibility. Back when this technology was in its early stages, the ethics of this did not need to be addressed as much because the technology wasn't even safe enough to use yet, but now that we have the advanced Crispr-Cas9, we are faced with the moral and ethical conflict accompanied with something of this magnitude and power. People believe this technology could be used to make "superhumans" which would create a divide between people who can afford for this to be done to them and the poor. They also believe babies' genes could be edited to make them capable of being a soldier or any specific job based on how their genes were edited.

As of right now, we cannot edit human genes due to safety issues. While Crispr-Cas9 is precise, it can cut DNA in places where it is not meant to be cut. Because the technology is foreseen to be applicable to humans in the near future, obviously after further testing, we need to deal with the moral and ethical issues in preparation. Gene editing could be the key to increasing

life span and decreasing health issues. If we can get past the complications, this could be revolutionary for the United States and the world as a whole.

Kennedy Martin, Bishop Lynch High School Class of 2018

Flu Vaccine or Frog Mucus?

Frog mucus might be the next upcoming flu drug! Scientists have spent years searching for various ways to fight off the virus by mining proteins that animals create to fight off infectious germs. Proteins recently found in amphibian mucus has had great success against HIV and herpes, and now, influenza! David Holthausen, a graduate student from Emory University in Atlanta, Georgia, collaborated with his colleagues and sampled mucus from the skin of a frog.

Known as *Hydrophylax bahuvistara*, this frog species was discovered in southern India. The mucus found in this amphibian contains a host of proteins. This frog is a type of fungoid frog that lives in the forests of south west India and has a striking orange stripe on its upper body. Holthausen and his colleagues tested thirty-two of them against the flu virus and four showed promise. Scientists have adopted the name Urumin, after a type of sword used in the region of India where the frog was found. Urumin did not harm mammals, but it did seem to give several flu viruses a hard time.

Influenza viruses multiply frequently, forming new types, known as strains. The family of each strain is known by a series of letters and numbers. Mice, which were treated with the frog-slime protein, had a better chance of survival when it had been exposed to the killer strain of the flu virus. The mucus protein even cut out the reproduction of viruses in seven different strains that had all become resistant to the effects of antiviral drugs.

It will take a lot more research, as well as time to turn urumin into an actual drug. But throughout time, it could serve as the basis for a new family of flu vaccines.

Maytal Cooper, Sharon High School Class of 2020

Capturing the Event Horizon

Our galaxy, the Milky Way Galaxy, houses billions and billions of stars and planets. It also houses the mysteries that are black holes. Each black hole includes an event horizon, the part of the black hole where the gravitational pull is so strong that nothing can escape. But is it possible to catch a glimpse of the event horizon? This is what scientists are trying to find out. Scientists are attempting to zoom in on a never-before-seen image, a black hole's event horizon using what is known as the Event Horizon Telescope!

The Event Horizon Telescope is not one telescope but rather eight radio observatories linked together into a massive network that stretches around the entire Earth. This will be the first observation to include the ultrasensitive Atacama Large Millimeter/submillimeter Array in Chile's Atacama Desert. This increases the possibility that the image will reveal new details. Astronomers will take data for five nights within a 10-day period. The telescope began collecting data on April 5, 2017.

Sadly, this picture is polaroid so it could be months before we are able to receive these images.

Where the telescope's views intersect, there are two supermassive black holes. One is located at the center of the Milky Way and the other located in a nearby galaxy known as M87. Scientists want to capture an image of the light as it swirls passed the event horizon, never to be seen again.

Black Holes: One of the Strangest Space Phenomenon in Our Universe

Black holes are a region in space, specifically in space-time, where the gravitational pull is so intense that the escape velocity required by an object to escape the black hole is faster than the speed of light; thus, no forms of electromagnetic radiation can escape, making the events that happen inside a black hole a very controversial topic among many astrophysicists today. Black holes were first discovered by Albert Einstein, who proved their existence through his famous general theory of relativity, which was published in 1916. Ironically, Albert Einstein himself did not himself believe in the existence of black; however, his theory showed that they do in fact exist. Today, scientists have observed that black holes are one of the most important features of our universe, as they play a vital role in the formation of galaxies.

Although black holes can't be seen directly, they can be detected through the gravitational pull of other objects. Black holes don't have to be just formed from the aftermath of a star's fate if the star's core has a mass of more than 2.8 times the mass of our sun. In fact, anything can become a black, as long as you can compress the object smaller than its Schwarzschild radius. The equation is $R = \frac{2GM}{c^2}$, where G is the universal gravitation constant ($6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2\cdot\text{kg}^{-2}$), M is the mass of the object, and c is the speed of light ($3.00 \times 10^8 \text{ m/s}$), derived by Karl Schwarzschild, German physicist during 1915 and was best known for finding the exact solution to Einstein's field equations for general relativity. To put this in perspective, Mount Everest can be turned into a black hole if it is compressed to the size of a nanometer. The Earth and Sun can be turned into a black hole if it is compressed to the size of a peanut and the size of Central Park. Obviously, those three scenarios are not possible. But in stars with a core of a mass

of 2.8 times the mass of the sun, once iron is fused in the core, the star will collapse on itself due to the gravity overcoming the force pushing outwards, generated from the fusion of elements within the core. In addition, as Albert Einstein said, a black hole warps the fabric of spacetime so much that not only is it that light can't escape from a black hole, but that any event that happens inside a black hole can't be known, since those events don't occur in time. If you were to fall in a black hole, you would see all of time pass behind you as you disappear from the known universe!

Black holes are one of the strangest phenomenon in our universe today. As comedian Steven Wright once remarked: "Black holes are where God divided by zero." Due to the black holes' unique properties, black holes have become a very controversial topic in astronomy today. Although we still don't know everything on how black holes work, we do know one thing for sure: Black holes are a vital part of the formation of galaxies. They have been found in the center of almost every galaxy in the known universe, and play a fundamental role in the formation and evolution of the universe that we inhabit today. Although they may seem like a scary phenomenon, we would not be here today without them.

The Human Genome Project

The Human Genome Project was an international program that aimed to sequence the entire genome of human beings and understand each gene. A quick biology lesson: a genome is an organism's entire set of genes, which are made of DNA. DNA has four bases (adenine, thymine, cytosine, and guanine) joined by hydrogen bonds. Adenine joins with thymine, and cytosine joins with guanine. This molecule has a double helix shape, and it codes for all the proteins produced by the body.

The Human Genome Project began in 1990 and found about 20,500 genes and their locations and 3 billion base pairs. The Human Genome Project was publicly funded, and it cost taxpayers \$2.7 billion. The first draft of the sequence was published in February 2001, and the final draft was published in April 2003. To help spread this knowledge, the information gathered was made available to the public on the Internet each day.

Anonymous volunteers gave blood, but only a few samples were used, so they do not know whether their DNA was used for this project. The sequencing was done in six countries: the United States, the United Kingdom, France, Germany, Japan, and China.

To map the genome, the Human Genome Project used BAC, which stands for "bacterial artificial chromosome". Small pieces of DNA (150,000 to 200,000 base pairs) were replicated in bacteria, and from these, the scientists determined where the genes came from in the genome. The clones were separated into smaller pieces (about 2,000 bases), and a sequencing reaction occurred. The results were put through a sequencer, which made 500 to 800 base pairs from each reaction, and then a computer put into one long sequence.

This project has allowed researchers to truly understand how humans work on a molecular level, and it also shows how we fail to work properly. This will help with future advances in medicine and biotechnology, and it also helps scientists understand how to prevent and deal with diseases.

Max Price, Sharon High School Class of 2018

A Solution For Pollution

Miles from the coast of California, a behemoth grows ever stronger with only one instinct: to kill. While this is not your traditional sea monster, the garbage patch littering the Pacific Ocean is an alarming problem, posing serious threats to underwater and coastal ecosystems.

Plastic pollution has been a fluctuant result of the lavish mass consumption and depletion of the resource in industrial developed countries, most notably China and the United States, both of which reside upon the Pacific. The lack of attention and action has allowed massive sheets of non-biodegradable trash to coalesce, trapped by the ocean's currents. Our aforementioned "behemoth" is the largest, clocking in at about 1.4 million square miles, about five times the size of Texas. The only natural dispersion of this maritime mountain of waste results in plastic washing up on shores of many Pacific islands, including Hawaii. This can culminate in the deaths of many natural species, tipping natural ecosystems on their heads.

Until recently, no pragmatic solutions had been posed for this serious environmental problem. Enter Boyan Slat, a 22-year-old Dutch entrepreneur who has made it his mission to clean the oceans in a manner that is not itself poor for the environment.

His plan is to deploy a massive floating barrier, even rivaling the trash islands themselves in size, in order to filter the ocean of plastic byproducts. His plan is eco-friendly; instead of using electricity or other means of anti-ecological power, he has proposed a design that would have the ocean's own currents do the heavy lifting, transporting the debris into the open arms of the collection mechanism.

He claims that his project, already receiving considerable international investment, could theoretically remove half of the Great Pacific Garbage Patch in 10 years, by no means a simple feat. “There is a lot of talk,” said Slat in an interview with NBC News, “and not a lot of action in the world of plastic pollution.” His goal is to change that.

While the extensive plastic pollution that plagues the world’s oceans can appear overwhelming, this young man is undaunted and welcomes the challenge. The project website asks a single question: “Why move through the ocean, if the ocean can move through you?” The ocean not only moves through this invention, it moves through all of us, and people like Boyan Slat come around once in a generation to ensure that it will be clean, clear, and most of all, natural, for generations to come.

Zack Light, Sharon High School Class of 2018

A New Member of the Hominid Family Tree

In 2015 A cave system in South Africa yielded 1,500 fossils of a new hominid species from 15 individuals, making the Rising Star caves one of the richest paleontological sites ever. The team was lead by Lee Berger, a paleoanthropologist at the University of Witwatersrand. The specimens belonged to a species of human relatives known as *Homo Naledi*, which had a mix of some remarkably human features and older ones, like an ape like torso and a brain approximately the size of a gorilla. It was theorized that *H. Naledi* Was bipedal, and was capable of both long distance walking and climbing. Some suggest based on the location of the fossils that they went to great efforts to bury their dead. One thing which wasn't known was their age, and without that it was impossible to determine their relation to modern day humans.

In early 2017, using 6 different dating methods in labs all over the world, the age of the fossils was estimated to be between 236,000 years ago and 335,000 years ago, startlingly recent in evolutionary terms. Previous estimates based on their anatomy suggested an age between 2 and 3 million years ago. Some theorized that *H. Naledi* might replace *Homo Erectus* as the main recent ancestor of modern humans The official age puts them in a time and place which might have overlapped with the range of modern humans. Before this it was believed that all Hominids with more ancestral features, like *H. Naledi*, had died out in Africa. This development also calls into question the idea that eastern Africa was the main sight of human evolution.

The samples were difficult to date because of the conditions in the caves. Standard dating techniques often rely on dating rock that formed around them, or the ages of known species found along side them, but the caves were devoid of most sediment formation, and few other

species were found in the cave. Instead, more detrimental techniques were used to constrain the age to oldest and youngest possibilities. To get the youngest age, layers of calcite which had been deposited on the specimens by running water were determined to have formed 236,000 years ago, meaning that the fossils had to be older. A number of other tests, including measuring the radioactive decay of uranium in fragments of the samples, set the oldest possible date at 335,000 years old.

The discovery of *Homo Naledi* forces the scientific community to rethink the path of human evolution, both in location and the species involved. Just recently the team announced a second chamber containing fossils, so more discoveries about this new hominid are surely on the way.

Works Cited

Contributor, Nola Taylor Redd Space.com. "Black Holes: Facts." *Space.com*. N.p., n.d. Web. 06 June 2017.

King, Barbara J. "Dizzying New Evidence In Human Evolution Provokes Debates." *NPR*. NPR, 09 May 2017.

"*Homo Naledi* is only 250,000 years old – here's why that matters." *New Scientist*. N.p., n.d.

Conover, Emily. "Event Horizon Telescope to Try to Capture Images of Elusive Black Hole Edge." *Science News*. N.p., 05 Apr. 2017.

Harmon, Amy. "Human Gene Editing Receives Science Panel's Support." *The New York Times*. The New York Times, 14 Feb. 2017.

Bott, Ed. "After 30 Years, Why Did the Mac Never Break into Big Business?" *ZDNet*, ZDNet, 4 Dec. 2015, www.zdnet.com/article/after-30-years-why-did-the-mac-never-break-into-big-business/.

"Antarctica's Larsen C Ice Shelf: The Latest Climate Change Wake-up Call." *Star Tribune*, www.startribune.com/antarctica-s-larsen-c-ice-shelf-the-latest-climate-change-wake-up-call/414285743/.

Sumner, Thomas. "Crack in Antarctica's Larsen C Ice Shelf Forks." *Science News*, 2 May 2017, www.sciencenews.org/blog/science-ticker/crack-antarcticas-larsen-c-ice-shelf-splits-two?tgt=nr.

"Larsen Ice Shelf." *ScienceDaily*, ScienceDaily, www.sciencedaily.com/terms/larsen_ice_shelf.htm.

Rice, Doyle. "Watching with Bated Breath!: Massive Iceberg Set to Break off Antarctic Ice Shelf." *USA Today*, Gannett Satellite Information Network, 2 Feb. 2017, www.usatoday.com/story/weather/2017/02/02/antarctica-larsen-c-ice-shelf-crack/97402418/.

Pultarova, Tereza. "Soft 3D-Printed Robot Is Agile Even on Sand and Rocks." *LiveScience*, Purch, 24 May 2017, www.livescience.com/59237-agile-soft-3d-printed-robot.html.

Prisco, Jacopo. "'Foodini' Machine Lets You Print Edible Burgers, Pizza." *CNN*, Cable News Network, 31 Dec. 2014, www.cnn.com/2014/11/06/tech/innovation/foodini-machine-print-food/.

Choi, Charles Q. "Air Pollution Kills More than 3 Million People Globally Every Year." *LiveScience*, Purch, 16 Sept. 2015, www.livescience.com/52189-air-pollution-kills-millions-people-yearly.html.

Beil, Laura. “Even Short-Term Opioid Use Can Set People up for Addiction Risks.” *Science News*, 23 May 2017,
www.sciencenews.org/article/minor-injury-opioid-painkiller-addiction-risks.

Barclay, Eliza. “A Nation Of Meat Eaters: See How It All Adds Up.” *NPR*, NPR, 27 June 2012,
www.npr.org/sections/thesalt/2012/06/27/155527365/visualizing-a-nation-of-meat-eaters.

“Caltech Researchers Find Evidence of a Real Ninth Planet | News - NASA Solar System Exploration.” *NASA*, NASA,
solarsystem.nasa.gov/news/2016/01/21/caltech-researchers-find-evidence-of-a-real-ninth-planet.

“Hypothetical 'Planet X' - Overview | Planets - NASA Solar System Exploration.” *NASA*, NASA,
solarsystem.nasa.gov/planets/planetx.

“Four Candidates For Planet 9 Located.” *Universe Today*, 4 Apr. 2017,
www.universetoday.com/134824/four-candidates-planet-9-located/.

“Planet 9 Found? Astronomers Have Officially Found A Candidate.” *Futurism*, 9 Apr. 2017,
futurism.com/planet-9-found-astronomers-have-officially-found-a-candidate/. Accessed 8 June 2017.

Writer, Mike Wall Space.com Senior. “'Planet Nine' Can't Hide Much Longer, Scientists Say.” *Space.com*, www.space.com/34455-planet-nine-discovery-coming-soon.html.

“An Overview of the Human Genome Project.” *National Human Genome Research Institute (NHGRI)*, www.genome.gov/12011238/an-overview-of-the-human-genome-project/.

“What Was the Human Genome Project and Why Has It Been Important? - Genetics Home Reference.” *U.S. National Library of Medicine, National Institutes of Health*, ghr.nlm.nih.gov/primer/hgp/description.

“Human Genome Project Completion: Frequently Asked Questions.” *National Human Genome Research Institute (NHGRI)*, www.genome.gov/11006943/human-genome-project-completion-frequently-asked-questions/.

“A Brief History of the Internet of Things.” *A Brief History of the Internet of Things*, www.baselinemag.com/networking/slideshows/a-brief-history-of-the-internet-of-things.html.

Zee. “Newsweek in 1995: Why the Internet Will Fail.” *The Next Web*, 27 Feb. 2010, thenextweb.com/shareables/2010/02/27/newsweek-1995-buy-books-newspapers-straight-i.

Dailymail.com, Ellie Zolfagharifard For. “The Science of The Martian: Nasa Reveals the Real Technologies That Allow Matt Damon to Survive on the Red Planet in Blockbuster Movie.” *Daily Mail Online, Associated Newspapers*, 19 Aug. 2015, www.dailymail.co.uk/sciencetech/article-3203915/The-science-Martian-Nasa-reveals-technologies-allow-Matt-Damon-survive-red-planet-blockbuster-movie.html. Accessed 8 June 2017.

Northon, Karen. "NASA Telescope Reveals Record-Breaking Exoplanet Discovery." *NASA*,
NASA, 22 Feb. 2017,
[www.nasa.gov/press-release/nasa-telescope-reveals-largest-batch-of-earth-size-habitable-zone-pl
anets-around](http://www.nasa.gov/press-release/nasa-telescope-reveals-largest-batch-of-earth-size-habitable-zone-planets-around).