For years, The Synapse has provided a platform for creative scientific exploration, including articles on everything from the mechanics of equestrian riding to the importance of science writing. In the current climate of polarizations and misinformation, it’s critical to bridge the arts and sciences in pursuit of new understandings and greater truths. As the incoming Editor-in-Chief and the incoming Managing Editor, Rachael Branscomb (OC ’19) and Lauren Blaudeau (OC ’20) will be taking over as Treasurer, Web Manager, Tori Fisher (OC ’21) and Art Coordinator, respectively.

We’re incredibly grateful to our predecessors, Tara Santora (OC ’18) and Victoria Albacete (OC ’18) for their hard work and high standards. And we’re excited to welcome our new team, beginning with Yu Li (OC ’20) and Steven Mentzer (OC ’20) who are taking over as Chief Layout Editor and Art Coordinator, respectively. Emma Larson (OC ’20) will be our new Websperson. Tori Fisher (OC ’21) will be taking over as Treasurer and Jane Sedlak will be continuing on as our Outreach Coordinator.

As electric cars begin to line the streets and natural disasters ravage corners of the world, we at The Synapse are passionate about keeping up with the most recent scientific discoveries. In 2017, scientists created artificial worlds, growing lamb fetuses in a lab. For the first time, gravitational waves were detected from the merging of two neutron stars, a topic I covered 10 years ago. CRISPR was successfully used to edit a human embryo. If you’re hoping to learn more about advances in genetics, medicine, or environmental sciences, you can read Joanna Zienkiewicz’s article, ‘The Designer Plant Debate.’ If you’re fascinated by the idea of eventual human relocation, check out Kileigh Ford’s article ‘Exoplanets: A Home Away From Home.’

As we enter a period of skepticism within our solar system and beyond, our goal is to foster a shared love of science through scientific discovery, persuasion, and art. Our focus is to understand how the current political environment is affecting widespread change on both scientific discovery and policy. We hope that you continue to search for a booming sector of cancer research: the treatment of Breast Cancer.

Tara Santora graduated from Oberlin College in 2018 with a major in Biology. Tara began at The Synapse as a writer for the first semester of their freshman year, eventually becoming Editor-in-Chief and forming the partnership between Oberlin College and Denison University. At Oberlin, they worked as a Quantitative Skills Center tutor, played on the quidditch team, and did research in the Bio and Environmental Studies departments. Writing from the love of journalism they fostered at The Synapse, they’re currently attending New York University’s Science, Health & Environmental Reporting Program.

Victoria Albacete is a 2018 Oberlin College graduate from Pittsburgh with a double major in English and Spanish. In 2018, she began a Master’s degree in Hispanic Studies. In addition to serving as one of the previous Editors-in-Chief for The Synapse, Victoria spent her senior year as an Editor-in-Chief of the Plum Creek Review, Production Manager of the Oberlin Review, and President of Movimiento. She has always had a passion for reading and hopes to join a children’s and young adult literature-focused imprint of a major publishing company, or to work abroad as an assistant editor.
Esophageal cancer is the eighth most common cancer in the world with a five-year survival rate of less than 20%. This cancer is separated into two different classifications: squamous cell carcinomas (ESCCs) and adenocarcinomas (EACs). ESCCs develop from epithelial tissue that lines the esophagus, while EACs develop from glands that line the lower portion of the esophagus. Interestingly, ESCCs are more common in developing countries, while ESCCs are more common in developed countries.

Esophageal cancer geneticists have discovered several interesting genetic distinctions between ESCCs and EACs. These genetic differences have the potential to improve gene therapy as a cancer treatment option.

A few basic definitions are first required to understand the work of esophageal cancer geneticists. To begin with, a proto-oncogene is a gene that, when mutated, can become an oncogene. Oncogenes are pro-tumor genes that experience gain of function mutations, which result in hyperactive expression. Think of oncogenes like a car with a brick on the gas pedal. The oncogenes help to drive the progression of tumor development. In contrast to oncogenes, proto-oncogenes are tumor suppressor genes (TSGs). TSGs function to prevent tumor formation, but they fail to do their job when they experience a loss of function mutation. TSGs act like the brakes on a car to slow down and stop tumor development. A car stuck in acceleration mode combined with broken brakes will result in a vehicle that is driving out of control. Similarly, cancer progresses due to gain of function mutations in proto-oncogenes and loss of function mutations in TSGs.

One of the first critical findings in esophageal cancer genetics was understanding the differences between ESCCs and EACs. Researchers from the Cancer Research Genome Atlas (TCGA) questioned how there could be two different types of esophageal cancer. They sequenced DNA from samples of both ESCCs and EACs; the results shed light on the situation. Both types of esophageal cancer tumor tissues had acquired mutations in different proto-oncogenes, but both were mutated in the same TSG TP53. These results suggested that different proto-oncogenes contributed to the development of different tumor-types, but a universal loss of TSG function would also assist in ESCC and EAC development.

Another interesting discovery in esophageal cancer genetics is a connection between circadian rhythm proteins and cancer metastasis. Cancer metastasis occurs when cancer spreads to other parts of the body. Our circadian rhythm is your body’s natural 24-hour clock. It tells you when to wake up and when to rest. But what does it have to do with esophageal cancer metastasis? Researchers at the University of Cambridge were able to order the predominant preneoplastic mutations found in EAC patients. The results indicated that there were many mutated genes found in normal esophageal tissue. Two of the critical mutations, however, involved the TSG TP53 and the proto-oncogene SMAD4. Pre-cancerous changes were found in tissues that had TP53 mutated within the cells. Later in cancer development, early invasive tumors were found to also have mutated SMAD4 within the cells. The ordering of these two critical mutations provides an optimal screening window for doctors to intervene. Patients can potentially have DNA from their esophageal tissue sequenced to determine if they have these critical mutations prior to the development of an invasive tumor and can start treatment early.

In addition to an improved screening window, gene therapy is the future of personalized cancer treatment. Targeted gene therapy is designed specifically for the mutations found in each patient. One person may have an EAC due to mutations in TP53 and SMAD4, while another patient may have metastatic ESCC due to a mutation in TP53 and overexpression of the Per2 protein. Gene therapy is designed to introduce new copies of genes to make up for the genes that have been mutated. This is often done by injecting modified viruses carrying the desired DNA. If you are worried about effects the virus may have on the patient, do not fret because they have been modified so that no other infections can be introduced. This viral vector can be injected into the patient through an IV or by exposing a sample of the patient’s cells to the virus and later returning the cells to the patient. Gene therapy is still a relatively new treatment option and researchers continue to develop more efficient and safer ways to insert the new genes into patients.

Esophageal cancer genetic research continues to pave the way for improved classification and treatment options. EACs and ESCCs are good models for common tumor types, but the genetic mutation classification process can be applied to many other types of cancer. Gene therapy also has the potential to be a major player not only in esophageal cancer treatment, but in all types of cancer. Imagine genetic screens that are as easy, if not easier, as getting a blood work panel done. Everytime you go to the doctors office, they could sequence your entire genome in the time it takes to do a basic physical assessment. This information could give doctors improved predictive power and patient-specific gene therapy treatment options. Such a futuristic concept is the direction that cancer treatment is headed due to more efficient DNA sequencing technologies and gene therapy options.
When you think of dirty objects that you encounter every day, the first thing that comes to mind is probably along the lines of bathroom door knobs. The number of germs on unsuspecting items that you touch daily might come as a surprise to you. For example, kitchen sponges are often considered safe because we use them to clean things that we eat off of. However, these sponges carry 10 million bacteria per square inch on average. Some of this bacteria is pretty frightening, as it can contain salmonella, which causes diarrhea and vomiting in humans. Another surprisingly dirty household object is refrigerator handles, which are home to bacteria that often live in the intestines of warm-blooded mammals and have the potential to cause the symptoms of the common stomach flu when ingested. Your remote control is also teeming with germs, having been touched by anyone that has ever used your television, as well as your carpet and couch. An easy fix to clean both your cell phone and remote are running antibacterial wipes over them once in a while to avoid coming down with severe flu symptoms. Moving away from household electronics and into self-care items, toothbrush holders have been found to be extremely dirty. Although toothpaste kills most germs drip down the body of the brush as it dries and get caught in the holder. Toothbrushes can hold germs such as staphylococcus, which is a bacteria that causes pus formation in the skin and mucous membranes. Thus, weirdly enough, if you want clear skin, make sure you don't use the same toothbrush for more than three months.

Money is, not surprisingly, heavy with bacteria because it gets passed from hand to hand so often. Most dollar bills are covered in 3,000 different types of bacteria. Other countries have plastic coatings over their currency so that it can be washed without disintegrating. Although the United States has yet to make this change, it would be a smart move health-wise. Another dirty household object that is more surprising than money is your washer and dryer machines. Viruses such as rotavirus, a group of RNA viruses that can cause acute enteritis in humans, are found in the metal drums. Enteritis is the inflammation of the intestines, which is usually accompanied by diarrhea and an especially strong pain in the small intestine. Ways to cut down on the germs that get transferred to your clothes include washing on hot whenever possible, using bleach, and drying for extra time.

We already discussed the 10 million bacteria per square inch on the average kitchen sponge but may come as a hard blow to snackers, vending machines are absolutely covered in germs. Kimberly Clark and a research team at the University of Arizona swabbed 5,000 different parts of the kitchens and break rooms in office buildings and found a large number of bacteria on the buttons of vending machines. These buttons pick up the germs that the people who used the machine were carrying on their hands. Most people eat their snack immediately after removing it from the machine, meaning that those germs go directly into their mouths. The contagion found most often on these machines is rhinovirus, which can give you the common cold. So, to avoid sneezing after your snack, make sure to wash your hands before eating out of a vending machine.

An interesting way to identify whether or not certain objects are dirty is through analyzing their ATP levels. ATP, adenosine triphosphate, is a compound made of an adenosine molecule bound to three phosphate groups. ATP is present in all living tissue, and the breakage of a phosphate linkage forms adenosine diphosphate (ADP), which provides the energy needed to carry out the body’s physiological processes. When the ATP levels of objects are 300 or higher, it means that the transmission of an illness is likely.

Parking meters are another commonly utilized piece of public technology that have high ATP levels and 40% of them have been found to be contaminated on average with unhealthy bacteria. Who knew that parking your car could give you a cold! Going along the vein of public technology, crosswalk buttons have been found to be teeming with bacteria. It seems unfair that attempting to safely cross the road has the potential to make you sick, but 35% of crosswalk buttons were found to have ATP levels of 300 or higher. Common germs on crosswalk buttons include parainfluenza virus, which can cause the flu. Even if you aren’t travelling by foot, you still need to be careful in public places. For example, the next time that you are on an escalator, don’t grab the rails unless you absolutely need to! These rubbery safety nets have a 43% chance of having ATP levels of over 300. Germs on these rails that can negatively impact your health include multiple strains of the flu because these bacteria remain active on surfaces for several hours before dying.

When considering household germs, you should look directly at your cell phone to find where the most germs are housed. Cell phones have been found to be 10 times dirtier than toilet seats and could even have E. coli on their surfaces. An inter esting way to identify whether or not certain objects are dirty is through analyzing their ATP levels and 40% of them have been found to be contaminated on average with unhealthy bacteria. Who knew that parking your car could give you a cold! Going along the vein of public technology, crosswalk buttons have been found to be teeming with bacteria. It seems unfair that attempting to safely cross the road has the potential to make you sick, but 35% of crosswalk buttons were found to have ATP levels of 300 or higher. Common germs on crosswalk buttons include parainfluenza virus, which can cause the flu. Even if you aren’t travelling by foot, you still need to be careful in public places. For example, the next time that you are on an escalator, don’t grab the rails unless you absolutely need to! These rubbery safety nets have a 43% chance of having ATP levels of over 300. Germs on these rails that can negatively impact your health include multiple strains of the flu because these bacteria remain active on surfaces for several hours before dying.

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Parkinson’s disease (PD) is a neurodegenerative disorder that affects around one million people each year. The disorder is characterized by severe motor impairment symptoms including tremor, rigidity, and abnormalities in posture. A key cellular feature that leads to these symptoms is the preferential degeneration of dopamine-producing neurons. Though motor dysfunction can be modestly rectified by dopamine replacement drugs, unfortunately these therapies only superficially relieve symptoms and can, paradoxically, further impair motor skills.

The need for more effective therapies for Parkinson’s disease is a call for a stronger understanding of what causes it. Choi et al., a group of researchers centered at Kyung Hee University South Korea, suggest a seemingly unlikely culprit as a contributor to the development of motor impairment symptoms in Parkinson’s patients: the gut bacteria Proteus mirabilis. Though more experiments are needed to determine the exact mechanisms, Choi et al. observed a significantly higher amount of α-synuclein filaments in the distal gut of bacteria-infected mice. This suggests that α-synuclein travels through the vagal nerve to the brain.

α-synuclein is characterized by severe motor impairment symptoms and is direct evidence that Parkinson’s disease development, has been found in the intestine of mice before the onset of motor impairment symptoms. There is direct evidence that α-synuclein spreads from the gastrointestinal tract to the brain via the vagal nerve in rats with PD. These discoveries, taken together, suggest that pathological changes in the intestines may indicate Parkinson’s disease. Analysis of the fecal microbiota of patients with severe PD showed increased amounts of bacteria from the family Enterobacteriaceae, suggesting that gut microbial changes may be partially responsible for Parkinson’s disease progression. Since there is a dearth of more specific information behind this phenomenon, Choi et al. set out to determine which strain of gut bacteria can influence PD and a possible mechanism for doing so.

To determine which bacteria may be associated with Parkinson’s disease, Choi et al., measured the number of bacterial colonies at the family level in animals with PD, then identified the bacteria that were high within specific families. The researchers orally administered these bacteria to the mice, then observed motor behaviors and relevant brain tissues. Finally, the researchers tracked direct damage of dopamine-producing neurons by analyzing change in α-synuclein, a hallmark of Parkinson’s disease, levels in the brain. Choi et al. also measured amounts of α-synuclein in the colon to ensure that the protein was indeed coming from the gastrointestinal tract.

By chemically inducing Parkinson’s disease in mice three different ways, Choi et al. confirmed that the number of Enterobacteriaceae was increased in mice with Parkinson’s disease; they found that specifically P. mirabilis was increased. The researchers then treated mice in the premotor symptom stage (PS) of Parkinson’s disease with P. mirabilis to see if the bacteria exacerbate motor symptoms at this early stage of the disease. Treated mice showed severe motor impairment in addition to a significantly lower density of dopaminergic neurons in comparison to both mice in PS not treated with bacteria and control mice. This strongly suggests that P. mirabilis may contribute to the onset of motor symptoms in mice with PD. Interestingly, Choi et al. also found that the increased presence of P. mirabilis in healthy mice could also induce motor deficits, further supporting the role of this bacteria in the development of Parkinson’s disease.

The researchers connected P. mirabilis to Parkinson’s disease by showing that the bacteria selectively damages dopamine-producing neurons. Choi et al. suggest that a possible mechanism for this is that P. mirabilis can increase α-synuclein production in neurons. Though more experiments are needed to determine the exact mechanisms, Choi et al. observed a significantly higher amount of α-synuclein filaments in the distal gut of bacteria-infected mice. This suggests that α-synuclein travels through the vagal nerve to the brain. The researchers understand how to chemically induce PD in mice, but they are not clear on how the chemical inducers lead to downstream effects such as the increase of P. mirabilis in the gut. This raises the question: how do the researchers know that the treated mice actually have PD? Though the mouse models used by Choi et al. were useful for preliminary experiments, the research could benefit from using mice who have naturally developed PD so that the researchers could observe differences in results between mice with naturally occurring PD and chemically induced PD.

The research raises important questions. Is there a protein or other upstream factor that causes the changes seen in Parkinson’s disease? Is PD entirely gastrointestinal in nature? The latter seems unlikely as some neurological symptoms of PD, such as memory loss, were not explained by the increase in gut bacteria. Regardless, recent research seems to suggest that the devastating motor effects of Parkinson’s disease might simply be surface-level symptoms of pathogenesis that is not even occurring in the brain.

A possible way to determine how much gut bacteria controls PD and its symptoms would be to treat mice with the disease with antibiotics, which would significantly lower the amount of P. mirabilis in the gut. This would be accompanied by wiping out the PD gut bacteria and reconstituting the gut with gut bacteria typical of healthy mice. Not only would this experiment allow researchers to gauge the importance of P. mirabilis, but it would test the possibility of using antibiotics as a treatment for PD. Antibiotic treatment would likely only treat symptoms of the disease, as much is yet to discovered about the underlying causes of PD. However, antibiotics would not have as severe side effects as dopamine-replacing medications.

We must be cautious extrapolating what was found in chemically controlled mouse models to human patients. Though changes in gut microbiota have been observed in human PD patients, whether or not those changes reflect the extremely simple model shown in Choi et al. is yet to be seen. The chemical that the researchers used to induce Parkinson’s disease in mice may have directly increased the amount of P. mirabilis in mice. It is possible that this same shift in the gut environment would not be seen in human patients. This question calls for a clinical trial that samples the gut bacteria of human Parkinson’s disease patients and analyzes the microbiota to determine which species are being upregulated in the gut.

Parkinson’s disease is most commonly seen as a neurological disease. People associate it with aging and brain deterioration, which is not necessarily incorrect. However, Choi et al. and other researchers have shown that this view is an oversimplification. With this knowledge in mind, the researchers could be traced back to specific imbalances in the gut microbiota, researchers and physicians have a new basis for future experiments and therapies that could fight PD at the very core, reducing the need for superficial therapies with harmful side effects.
The Synapse

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The Basics of Imposter Syndrome and How to Handle It

Written by Kirsten Heuring
Illustrated by Athina Apazidis

According to psychiatrist Carole Lieberman, it is because grad students are in an “in-between” state of their professional lives; they are not quite out of school, but they are doing more than they did in undergrad.

Despite the problems that imposter syndrome causes, there are ways to combat it. First, one must recognize their imposter feelings. If you notice you are having imposter feelings, try writing them down or changing your thought process. For example, instead of thinking “I am not qualified at all for a lab position,” a person can refuse the first statement and correct it by thinking “I might not be completely qualified, but that is okay since no one can be completely prepared for everything.” This helps take the mental pressure off of a person’s thoughts. If someone with the syndrome focuses on noticing their imposter thoughts and modifying them, eventually their thoughts and modifying them, eventually their feelings about themselves will change. However, this needs to be done gradually over a period of time since many of these thoughts tend to ingrain into one’s thought processes. Another way someone can battle imposter syndrome is by acknowledging compliments. Instead of brushing off praise, a person can accept it and attempt to see where the complimenter is coming from. For other people, starting to recognize when problems are not their fault could help with imposter feelings. Talking note of when things go wrong and figuring out which things can be attributed to chance or other causes besides human error may be a good step for that.

One of the best ways to fight imposter syndrome is to talk to others about it. Many people with the imposter phenomenon do not talk to others about such thoughts. However, if people discuss their performance with others, they can figure out if other people feel the same way they do. Maybe other people are just as noticed for how they are, and people that can be reassuring. A person with imposter syndrome can talk to a group of friends or classmates or a single trusted person like an advisor, a professor, a best friend, or a psychologist. Any trusted person who knows your strengths and weaknesses can help to lessen the feelings. For those who are worried about talking to other people about their imposter feelings, there are relatively anonymous online communities where people can explain their imposter feelings and help each other sort through them.

For those who have impostor syndrome, know you are not alone. In an interview with The New York Times, Maya Angelou admitted that despite her success, she still worries that people will discover she “has run a game on everybody.” Even Oberlin College’s own Professor Rebecca Whalen, chair of the Chemistry and Biochemistry Department, admitted to her own problems. In her college education, she wanted to graduate summa cum laude. She worked her hardest, but as soon as she achieved her goal, she thought anyone could have done what she did, and it was not a big deal. Even the most amazing and accomplished people can have problems with impostor syndrome. Just because you have it does not mean it is a sign of failure.

For my own bouts of impostor syndrome, I tend to make jokes. When I texted my mom that I was going to write this article on impostor syndrome, I joked that it was not going to be amazing, and she did not get the joke until I explained it. I have been trying to change my thoughts and be gentler on myself, correcting myself when I think I am not perfect. I also do not know enough about the world for research opportunities. Instead, I tell myself that I am still learning, and it is not bad for me to make mistakes. It will take some work for me to ever be comfortable with myself and my abilities, but hopefully I can take the right steps from here to work on myself.

Imposter Syndrome

Impostor syndrome, also referred to as the imposter phenomenon, is a mental condition that occurs when high-achieving people attribute their success to luck rather than their own hard work and talents.

The Brain

September 2018

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In their original research, Clance and Imes noticed the more likely impostor syndrome occurs in high-achieving women. However, research has found that impostor syndrome can occur in people of any gender, but people from minority communities are more likely to develop the condition. Generally, people who are the only minority in their field are more likely to have impostor syndrome than people who are in a field full of people like them. Research by psychologists Pauline Clance and Suzanne Imes first coined the term in 1978.

According to Clance and Imes, people with the condition tend to fear of being exposed as impostors. As of the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), impostor syndrome is not a recognized diagnosis, but often coincides with anxiety and depressive disorders.

There are multiple risks that are said to contribute to the development of impostor syndrome. Originally, it was thought that impostor syndrome only occurred in high-achieving women. However, research has shown that impostor syndrome, also referred to as the imposter phenomenon, is a mental condition that occurs when people from minority communities are more likely to develop the condition. Generally, people who are the only minority in their field are more likely to have impostor syndrome than people who are in a field full of people like them.

According to the American Psychological Association (APA), impostor syndrome is a mental condition that occurs when high-achieving people attribute their success to luck rather than their own hard work and talents. Psychologists Pauline Clance and Suzanne Imes first coined the term in 1978.

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Anyone with ADHD struggles with the task of organizing and performing in certain cognitive measures, but those with ADHD and creativity outperformed the rest in all other measures. The symptoms of ADHD coincide with many typical traits of creative people, and this study further indicates this correlation. The most striking aspect of this study was the finding that children with ADHD in many cases of creativity in people who rated low in measures of novelty-seeking, while it decreased creativity in those who measured high. Novelty-seeking describes how often individuals seek out new experiences and risk.

As suggested by the study from the University of Amsterdam, and many others, people with ADHD tend to perform better in high-pressure or high-risk situations. In many cases, this leads to success, enabling them to achieve creative goals. This suggests that “goal-directed motivation may drive the enhanced real-world creative achievements of people with ADHD.”

This study focused on real-world creativity, described as the component that relies on the novel and approachable design of existing knowledge through several lower-level cognitive processes. This can be understood as goal-oriented, productive creativity that is valued in settings. This indicates that people with ADHD who consider themselves creative can succeed especially in certain scenarios, namely those in which they are most driven. In high-pressure situations, people with ADHD tend to outperform those without. In other tests, those without ADHD demonstrated similar levels of creativity, but ultimately did not outperform those with ADHD and creativity. This suggests that perhaps ADHD can define the settings in which creativity is expressed, and how it is expressed—such as an idea that could help doctors navigate the pitfalls of treatment.

Furthermore, they found that the children with ADHD who outperformed in certain cognitive measures, but those with ADHD and creativity outperformed the rest in all other measures. The symptoms of ADHD coincide with many typical traits of creative people, and this study further indicates this correlation. The most striking aspect of this study was the finding that children with ADHD in many cases of creativity in people who rated low in measures of novelty-seeking, while it decreased creativity in those who measured high. Novelty-seeking describes how often individuals seek out new experiences and risk.

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As suggested by the study from the University of Amsterdam, and many others, people with ADHD tend to perform better in high-pressure or high-risk situations. In many cases, this leads to success, enabling them to achieve creative goals. This suggests that “goal-directed motivation may drive the enhanced real-world creative achievements of people with ADHD.”

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Even if we think the benefits outweigh the costs, there’s also the issue of the difficulty of this procedure, let’s look at human IVF. Even if IVF is a relatively common procedure, it still has a less than 50 percent success rate even under perfect conditions where the surrogate is in perfect health and fairly young, is taking fertility drugs, and the embryos are in as good a condition as they could be. That means that when the IVF process has gone perfectly, the odds of this working correctly are no better than flipping a coin. Human IVF also costs roughly 20,000 dollars per attempt, which is not exactly cheap, but there is reason to believe (when you factor in the additional transportation costs and specialists that would be required for rhino IVF) that the figure could be multiplied by a factor of five or ten. National Geographic quotes a researcher saying the price tag could be as high as 9 million for the successful birth of a calf. Even if we think the benefits outweigh the costs, there’s also the hiccup that, in order for any population to be genetically stable, there needs to be a few dozen genetically unique members of the species. As a point of clarification, the above inquiry is distinct from the question of whether or not Northern White Rhinos ought to have become endangered/extinct in the first place. The answer to this is obviously no. However, this leads to another question. Whether it is ethical to bring a species back from extinction. If you’ve seen the film Jurassic Park you’re familiar with the concern here. However, there seems to be a morally relevant difference between bringing back a species whose extinction was caused by natural selection, and bringing back a species that was hunted to extinction by humans. Therefore, one may well think that preservation of the species rights some transgression humans have imposed on the rhino. This notion has a sort of intuitive appeal: since we caused them to go extinct, we ought to cause them to become un-extinct. However, there are several reasonable objections to this line of thinking, which arise from the aforementioned financial concerns, that suggest the revival of the Northern White Rhino would be good neither for ecosystem nor, counter intuitively, for the rhinos themselves. For one thing, insofar as poaching is still an extremely extensive problem for wildlife conservationists, any animals that were brought back to life would be targets for poachers. This seems a particular worry if the goal of conservation is to reintroduce a herd of rhinos into the wild. One might propose the counterpoint that stricter anti-poaching regulations, along with a potentially dwindling demand for rhino horn, might help keep new rhinos safe. However, even if this were the case and future rhinos truly would be able to live their lives free from human intervention, there’s a subtler ecological concern that makes reintroducing the species seem less than ideal. Namely, in that the White Rhino hasn’t existed in the wild in any significant numbers for decades, there is some concern that either the habitat would no longer suit them, or they would no longer suit the habitat. If a sufficient amount of time is allowed to pass (say the amount of time required for scientists to produce a viable herd of rhino) it is likely that the species’ former habitat will have adapted to life without them. Therefore, the White Rhino could effectively become an invasive species in its own territory, causing a more ecological damage than the initial extinction. Possibly more likely is the converse, that the habitat would no longer be able to provide for a large number of rhinos. In either case, it seems irresponsible to, in the current climate, bring back a creature only to see it suffer (whether that suffering comes from poaching or lack of resources). And, since breeding a species extant to exist solely in captivity seems cruel in its own sense, there seems to be a moral reason to believe the species should, at least for the time being, remain extinct. Hopefully, in the near future, something will happen that will allow the White Rhino to return without fear of persecution. Until that time however, I suggest that we keep these creatures in only our thoughts, so that their non-existence may protect them from further pain.
The ability to manipulate the expression of genes can reach as superficially as changing hair color or as impactful as treating and preventing deadly diseases. The ability to knock down the expression of a gene has intrigued cancer researchers. Breast cancer is a disease characterized by mutations leading to the overexpression of oncogenes and a subsequent loss of function of tumor suppressor genes. In addition, cancer cells’ constant aberrational resistance to drugs occurs due to the chemical treatment. Natural selection will isolate those cancer cells that can survive the treatment and prevent cancer cells from proliferating and metastasizing. However, most of the cancer cells will die; however, one of the key traits of these cells is their tendency to mutate at a rapid rate. Eventually, a cancer cell will likely adapt in such a way to survive the chemical treatment. Natural selection will isolate those adaptive cancer cells, and as a result, the cancer cells become resistant to the drug. Cancer cells adapted to survival often have increased production of BCRP. Overexpression of the transport protein reduces intracellular drug concentration and decreases cytotoxicity.

For more information about gene manipulation, check out the 2004 article “Unlocking the potential of the human genome with RNA interference” featured in volume 431 of Nature.
Selective Serotonin Reuptake Inhibitors (SSRIs) are often the first line of defense against anxiety disorders, after therapy. However, there are some misconceptions about how these drugs work.

SSRIs increase the concentration of serotonin in synapses. Generally, after a pre-synaptic neuron releases a neurotransmitter, there needs to be a mechanism in place to "clean up" the synapse. Otherwise, synaptic plasticity would be clogged up with neurotransmitters. One of the ways that neurons clear the synaptic cleft is by reabsorbing serotonin into the pre-synaptic neuron through a process called reuptake. SSRIs increase concentrations of serotonin in synapses by preventing the pre-synaptic neuron from reabsorbing the serotonin in the synapse. They block the serotonin reuptake transporter, so there will be more serotonin in synapses.

While SSRIs were originally intended to help with depression, they are now used to help with a host of conditions including anxiety disorders. Oftentimes, the general public takes this to mean that anxiety stems from a decreased concentration of serotonin in the brain. This is a misperception.

SSRIs target proteins in the BNST. That way, we could directly target the part of the brain that the serotonin acts on to increase anxiety in the short term. One theory is that increases in serotonin lead to an increase in neurogenesis, or the making of new neurons. While adult humans have a very limited capacity for neurogenesis, it still does happen. There is some evidence that suggests that SSRIs and increases in serotonin lead to an increase in neurogenesis in the hippocampus. The hippocampus is involved in short term memory regulation and emotion processing, so it is possible that the increase in neurons in the brain can allow for improved emotional processing, decreasing anxiety symptoms.

While SSRIs are effective in treating many anxiety disorders, we don’t really have a clear understanding of how they work. One possible option is to find a drug that targets proteins in the BNST. That way, we could directly target the part of the brain that the serotonin acts on to increase anxiety in the short term. By taking this drug with the SSRIs for the first few weeks, we could combat the initial side effects. This is especially important since one of the big problems with SSRIs is noncompliance. One study determined that almost 50% who have been prescribed SSRIs stopped taking them within 60 days. By decreasing side effects, we can help decrease noncompliance rates and help the large number of people with mental illness feel better.

The short answer is that we really don’t know. One theory is that increases in serotonin lead to an increase in neurogenesis, or the making of new neurons. Until relatively recently, it’s been thought that after childhood, this is impossible for human brains to make new neurons. However, more recently, scientists have found that this is not true. While adult humans have a very limited capacity for neurogenesis, it still does happen. There is some evidence that suggests that SSRIs and increases in serotonin lead to an increase in neurogenesis in the hippocampus. The hippocampus is involved in short term memory regulation and emotion processing, so it is possible that the increase in neurons in the brain can allow for improved emotional processing, decreasing anxiety symptoms.

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Exoplanets: A Home Away from Earth

Three Potential Destinations for The Human Race Once Life on Earth Is No Longer An Option

Written by Kileigh Ford
Illustrated by Jack Bens

Through a modeling study, astronomers discovered that Kepler-62f could be an entirely water-covered land mass.

I
f we were to pick up and move Earth’s population today, where would we go? With the eventual death of our Sun in 4 billion years, there are a few options in our solar system for relocation—but the most viable choices are just outside. Exoplanets are planets beyond our solar system that resemble the Earth in size and lie in the habitable zone of the star they orbit. Exoplanets increase in number every year, each varying in size, resources, and even proximity. With 3,708 confirmed exoplanets and another 4,496 candidates, astronomers are still on the hunt to find Earth’s perfect twin.

To be habitable, an exoplanet must be close enough to its star that liquid water can exist on the surface, which also depends on the temperature of the planet. Exoplanets may have a greenhouse effect, like we do on Earth, where greenhouse gases present in the atmosphere trap heat from the planet’s surface heating it up. This can create a different temperature from what scientists calculate the expected temperature of a planet to be just based on the distance from the exoplanet to its star. Meanwhile, clouds reflect light, or cloud coverage contributes to cooling the planet from a high average temperature or trapping the heat radiating from planet within the atmosphere, heating it up.

A habitability scale created by the authors of the paper “Comparative Habitability” may indicate that a perfect 1 is out there— we just have to look. For now, Earth faces it, and using trigonometry to determine how far away the planet is. Measured in light years, the closest exoplanet viable for humans to travel to is Proxima Centauri b, which is 4.24 light years away from Earth. This planet is the closest exoplanet to Earth and the planet, named Proxima Centauri b, is a viable option for a new human domain. However, with a radius 1.3 times greater than Earth’s, Proxima Centauri b is much closer to its star than we are to the Sun, which creates a set of circumstances very different from Earth. Proxima Centauri b receives x-rays that are 400 times stronger from Proxima Centauri than the x-rays we receive from the Sun. Proxima Centauri also often shoots out nuclear blasts.

Proxima Centauri b has a period of 11.2 days, which means it takes 11.2 days to orbit around its star. If the planet is tidally locked to its star, the orbital periods of the planet and star will be the same. If not tidally locked, they could have different periods (similar to Mercury and our Sun) in which Proxima Centauri b would orbit its star twice every three days. The differing periods would be ideal, as it would create a more even climate on the planet for humanity to dwell.

One major issue with Proxima Centauri b is that we don’t know what it is composed of. Because we do not know the diameter of the planet, we cannot calculate its density and therefore, though it is likely that the planet has a rocky composition, it could also be a gas ball like Uranus. Evidently, Proxima Centauri b has several mysteries about its habitability that scientists have yet to figure out. While this could cause our extraordinarily well for humankind’s sake, it could also turn out to be the opposite of what humans would need, this uncertainty is a problem we encounter with many exoplanets.

Moving on to the second area of space in the search for a new home, we find ourselves 1,200 light years away from Earth on the potentially Earth-like planet of Kepler-62f. Just 1.4 times bigger than Earth, the planet orbits a star that is smaller and dimmer than our Sun. Through a modeling study, astronomers discovered that Kepler-62f could be an entirely water-covered land mass.

The conditions of a planet like this means that life may already exist there. According to the author of the model, Lisa Kollmeier, “There may be life there, but could it be technology-based like ours?” Life on these worlds would be under water with no easy access to metals, to electricity, or for metallurgy” this option would mean relearning how to live as a society and adapting to life in or on water, potentially with new species to coexist.

Perhaps Kepler-62f is not the best option, but its neighbor, Kepler-442b, is 5 light years closer to Earth, and Wired’s K.G. Orphnides has dubbed it “more habitable than Earth.” As previously mentioned, in a habitability ranking Earth earns a habitability rating of 0.829—but Kepler-442b receives a 0.836. Kepler-442b is 1.55 times the size of the Earth, has a period of 112.3 days, and lies well within the assumed habitable zone of the star it orbits, so it is more like Earth in these characteristics than other exoplanets. Would an expedited and expensive attempt to advance our space travel technology be worth it to live on a planet more habitable than Earth? That is the question we need to examine in finding our way to Kepler-442b.

If we were to pick up and move Earth’s population today, where would we go? Three choices—each a new, unique world for humans to explore.

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The Anthropocene: How Modern Geologists are Creating a Paradigm Shift in Our Concept of Time

Written by Monica Dix
Illustrated by Steven Mentzer

The Anthropocene

75% of the species on Earth vanished, giving way to the Paleogene. In this time, adaptive radiation caused many new species to become present on Earth. These mass extinctions are one major geologic tracer in the fossil record, but the boundary is also shown globally by a thin layer of clay that was a perfect match for the levels of potassium and argon in Earth but common in asteroids. Called the K-Pg boundary, its highest levels found are across the Atlantic at Sven Konin, a white chalk cliff off the coast of Denmark, but also in National Parks in the U.S. and Mexico. When, for example, we think of the Anthropocene and what kind of transition in geologic time into bite-sized pieces. These pieces all represent different atmospheric, oceanic, biological and geological conditions on our planet that help us as scientists trace the development of our planet to the world we know today. Three spikes indicate a worldwide transition, and they have been present at many locations globally, at times, show a trend within the rock history in every region of the world.

One example of a Golden Spike occurred during the Cretaceous–Paleogene extinction event, known as the K-Pg boundary. The Cretaceous–Paleogene extinction event, known as the K-Pg boundary, is a geological event that marks the end of the Cretaceous period and the beginning of the Cenozoic era. The Cretaceous period is considered to be the last period of the Mesozoic era and is characterized by the dominance of dinosaurs and flowering plants. The Paleogene period is the next period, and it is characterized by the rise of mammals and the evolution of many new species of plants and animals. The boundary between these two periods is marked by a sudden and dramatic extinction event, in which up to 80% of marine species and 75% of terrestrial species were wiped out, including the dinosaurs.

This transition is a golden spike, a marker that transcends through geological time. The Fossil Spike is known as a "Golden Spike". This is a geological marker that transcends through millions and millions of years, a decisive transition that breaks units of geologic time into bite-sized pieces. These pieces all represent different atmospheric, oceanic, biological and geological conditions on our planet that help us as scientists trace the development of our planet to the world we know today. Three spikes indicate a worldwide transition, and they have been present at many locations globally, at times, show a trend within the rock history in every region of the world.

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The evolution of technology is inevitable and is a part of human nature, so it will never slow down, or work in the opposite direction. It only adapts according to the tools they make for themselves. As a result, when we communicate via technology, our communication styles change. Our cognition adjusts because we create tools that make it easier for us to communicate. We do not become less able or intelligent, but our abilities take on a different form, and adjust to the tools that are at our disposal. In principle, this is not necessarily a bad thing. It is worth warning people about, though, in my opinion, because it is a natural occurrence. The question then becomes whether we can recognize how significant it is to acknowledge which ways we want to use technology, and to be able to differentiate our necessities and our desires.
The Designer Plant Debate

Why CRISPR Crops May Be in Your Crisper Drawers Sooner Than You Think

Written by Joanna Zienkiewicz
Illustrated by Claire Segura

For decades now, both the public and the government have debated the production and sale of genetically modified organisms, or GMOs. Traditionally created by inserting genes into an organism from another, they are developed for a number of different reasons such as improving nutrition and flavor. The first GMO to hit grocery stores was the Flavr Savr tomato in 1994, which was developed by adding a gene that interferes with a specific enzyme in order to increase shelf life. Although there is a lack of evidence supporting the claim that GMOs are dangerous or unsafe for consumption, some people are still considering GMOs to pose environmental threats, such as decreasing biodiversity. A new biotechnology, however, is potentially turning the GMO debate on its head.

Clustered regularly interspaced short palindromic repeats and associated protein 9, or CRISPR-Cas9, is currently the fastest, cheapest, most accurate, and most efficient genome editing method. This complex of enzymes and genetic guides was adapted from an ancient and naturally occurring genome editing system that evolved in bacteria to fight against viruses. In the late 2000s, scientists found a way to harness the power of this system to target and alter specific DNA sequences, by designing molecular guides that can snip out a particular block of genetic code in any living cell. These guides are then injected into the desired cell along with Cas9, a DNA-cutting protein. Once in the cell’s nucleus, the CRISPR-Cas9 complex works its way down the genome until it comes across a match to the guide sequence. When it does, Cas9 is activated and snips the DNA. By doing this, the complex can knock a gene out of commission, or even insert a replacement sequence if so desired. This technology has a wide variety of exciting applications, from curing complex human diseases, to creating alternative energy biofuel, to even reviving extinct animals.

The agricultural application of CRISPR technology is rewriting the GMO debate. Since 2016, the US Department of Agriculture has discreetly allowed at least a dozen crops to be genetically altered using CRISPR, ruling that gene-edited cultivar fall outside regulatory purview. Just this past September, for example, a version of the indestructible crop Carthala sativa that had been engineered using CRISPR was approved by the USDA without having to go through the usual regulatory hurdles. The crop was developed by the company Vidal 10 Biosciences to produce more omega-3 oil content. The following month, the agency also ruled to exempt a drought-tolerant soybean variety developed using CRISPR from USDA regulation. In March, the agency issued a press release where they officially took the stance that gene-edited plants can be designed, cultivated, and sold without any regulation by the USDA as long as they don’t include any genetic material from different species. This technology has rewritten the GMO debate on its head.

CRISPR-edited plants, they have stated that CRISPR-edited products are practically indistinguishable from those developed through traditional breeding methods. So, the first time you pick up a pack of CRISPR-edited strawberries, you may not even realize it.

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geoengineering, the manipulation of the environment, in an effort to curb global warming.

Geoengineering strategies generally fall into one of two categories: carbon dioxide removal (CDR) or solar radiation management (SRM). CDR techniques remove carbon dioxide from the air, directly opposing the greenhouse gas effect. SRM technology focuses on removing carbon dioxide from small enclosed spaces, such as the International Space Station or submarines. Though effective on a small scale, applying carbon dioxide removal techniques to a degree that would make an impact on a global scale is highly unrealistic. Thus, most scientists have turned toward developing methods to reduce the heat trapped within our atmosphere through SRM. The heat radiation released from the sun that enters the earth’s atmosphere is absorbed by greenhouse gases and prevented from returning to space. SRM works to reflect some of this heat energy back into space, lowering the amount of heat trapped in the atmosphere.

One major SRM method involves albedo enhancement which increases the reflectiveness of clouds. For example, if more of the sun’s heat radiation is reflected back into space, it will be less likely to contribute to global warming. The sun’s rays, after being reflected, are eventually absorbed at the surface of the earth, where they contribute to the warming of the atmosphere. The more of the sun’s radiation that is returned to space, the less heat energy is absorbed by the atmosphere.

Another well-known method for blocking the entrance of heat into the atmosphere involves stratospheric aerosols. Sulfur dioxide projected into the air during volcanic eruptions causes temporary cooling effects. David Keith, a professor of applied physics at the Harvard John A. Paulson School of Engineering and Applied Sciences, devised a strategy in which jets fly through the atmosphere and spray sulfaric acid. The sulfuric acid would combine with the water droplets in the air to form sulfuric aerosols, which are then dispersed around the globe by wind. The difficulty part of implementing this technique again comes down to the scale at which sulfur atoms would have to be released. Thus, though more practical than trying to implant carbon scribbling technology around the entire globe, this method of geoengineering is still far from practical.

Other SRM methods that have been considered include employing space reflectors, such as satellites, to reflect some of the sun’s rays before they even reach earth. Other albedo enhancement techniques involve whitening clouds to reduce the amount of energy reflected. Regardless of the selected technique, possible side effects of global heat reduction techniques must be considered. The sulfur injection technique might successfully cool the globe, but volcanic eruptions often lead to alterations in rain patterns, namely reductions in rainfall, so sulfur injection might cause similar negative consequences. Other unspecified effects of sulfur injection may include the depletion of the ozone layer due to the presence of particles high in the atmosphere, as well as the possibility of altered ocean currents, which could damage marine life.

Ultimately, geoengineering is a dynamic and risky field in which scientists have severe reservations when it comes to implementing the above proposed mechanisms. There are many unknowns involved with geoengineering, and it is hard to say if the scientific community will ever have enough of a understanding of the intricate balance of our global climate to predict how it will respond to human climate intervention. That being said, as the world grows progressively warmer, many scientists are pushing for action before the effects of global warming grow too extensive to combat.

Oh What A Tangled Web We Weave
Finding Prehistory

Written by Zoe Swann
Illustrated by Maria Altier

As the world grows progressively warmer, many scientists are pushing for action before the effects of global warming grow too extensive to combat. The first suggestion of woolly sheep comes from a seventh-millennium BC Iranian figurine of a sheep with wooly clumps. The first proper evidence comes from 4000-3500 BC with the introduction of Mesopotamian and Egyptian descriptions of wool sheep being taller than their wild counterparts, and said. Therefore, in general, wool production does not seem to date before 4000 BC.

Wool thread only works when you spin “unnaturally” long wool strands together so that the fibers don’t pull apart. Tools for spinning in this day and age consisted of a hand-held spinning needle, likely made of bone, and are just about the only part of the spinning process that survives in the archaeological record. It is important to note that before wool was used, linen (PIE *linom) made from flax thread was the dominant thread in the Neolithic era (e.g., 7000-5500 BC), and tools for spinning flax and wool are difficult to differentiate. However, in the periphery of the PIE world, like India or Ireland, wool was predominant over flax, suggesting that when wool was introduced, it became very much a PIE staple.

Linguistically speaking (no pun intended), PIE language had several words and cognates indicative of close work with domesticated sheep, such as “ewe,” “lamb,” and “ram.” When this word evolved into daughter languages (as Latin evolved into Old-French, for instance), the result was often a word meaning “wool,” *Hw(Inf)*. This further evolved in a wide variety of European language families such as Slavic, Greek, and Germanic into words meaning “felt,” “roll,” “bead,” and “piece.” *Hw(Inf)* is likely the Proto-Indo-European root meaning among them, given that it goes into felt making. PIE also had a word for shoe, and blanket, and spin, weave, and even dye. This suggests that Proto-Indo-Europeans were wearing more than just animal skins!

The first western city-like civilizations appeared in Mesopotamia and Iran, where we see wool textiles woven and dyed with seeds, minerals, and berries. Wool absorbed a wide variety of colorful dyes better than linen, and fabrics, so woolen textiles became a way to produce art. Apparently these tapestries and cloths were produced by dying individual strands.
I

they were always my friends. Part of central New York and being the only Asian person in my class, I

of interACT. What prompted you to write this novel and how did you begin working on it?

Q: There are many ways to advocate, support, and inspire change. As an intersex advocate and author of “None of the Above,” what do you hope that people get out of reading your novel?

Q: How did your intersex patient personally inspire you to write your novel? What other particular experiences influenced you to write “None of the Above”?

The main reason that my patient inspired [me] was because my medical education left me utterly unprepared to take care of her. I had to educate myself on how to care for intersex people. And they are often the educating doctors on what the unique aspects of their care are. The more I looked into the intersex support group pages, the more I became more aware of how great a disservice medicine has done to the intersex community.

After talking to my patient, I realized that she was unaware that she was going to have hormones for the rest of her life after we removed her tests, and potentially also had to do vaginal dilations. Clearly, there had been a major lack of communication between her and my attending doctor, and it was frightening to me [to realize] how people can be coerced into undergoing life-changing surgeries without understanding what they’ll be going through.

Q: What do you hope that people get out of reading your novel and learning about your efforts for change as an intersex advocate?

I hope that people start realizing that intersex exists and they can do their part to stop intersex shame and stigma. By doing that, they can help set the groundwork for the medical professionals to stop doing unnecessary surgeries. More often than not, the really problematic intersex surgeries happen because of parental anxiety — parents are afraid of how their kids will grow up, and if they will be bullied or treated differently. Surgeries happen because of parental anxiety — parents are afraid of how their kids will grow up, and if they will be bullied or treated differently. More often than not, the really problematic intersex surgeries happen because of parental anxiety — parents are afraid of how their kids will grow up, and if they will be bullied or treated differently. Surgeries happen because of parental anxiety — parents are afraid of how their kids will grow up, and if they will be bullied or treated differently. Surgeries happen because of parental anxiety — parents are afraid of how their kids will grow up, and if they will be bullied or treated differently.

We’ve just returned from the Triton One colony with the news that they have discovered on new source of fuel, but does there seem to be a significant chance they will do this. This was, in fact, the last nail in the coffin for the prospect of Extra-solar missions. Humans simply too quickly and too easily to leave the confines of our celestial cradle. Add to that the fact that a ship hoping to store enough fuel for such a mission would likely have to be the size of a small moon, and the prospects seem doubly grim.

The purpose of our mission was to survey the thirteen furthest colonies to see if any possessed anything close to a viable interstellar fuel source. It was thought with a compound denser than, in large enough quantity there might be some chance of a generational embarking, or perhaps same energetic moose that would put the stars in our grasp, but until some such source is discovered, the volume of fuel required for such a mission is simply too vast. There is no way to traverse the light years from our sun to another.

For my part I don’t really care. It’s not terrible news. Not great but not apocalyptic either. In either case it doesn’t affect me. I wouldn’t have made it out there anyway. It’s bad news for humanity as a whole: that we’ve just returned from the Triton One colony with the news that they have discovered on new source of fuel, but does there seem to be a significant chance they will do this. This was, in fact, the last nail in the coffin for the prospect of Extra-solar missions. Humans simply too quickly and too easily to leave the confines of our celestial cradle. Add to that the fact that a ship hoping to store enough fuel for such a mission would likely have to be the size of a small moon, and the prospects seem doubly grim.

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None of the Above?

By Ilene Wong

Illustrated by Emily Herrold

Dr. Ilene Wong, under the pen name I. W. Gregorio, wrote “None of the Above,” a young adult novel that became an international bestseller in 2015. Dr. Wong is an intersex patient during her residency at Stanford. Dr. Wong is an intersex advocate, a member of interACT: Advocates for Interests, Youth, and a founding member of We Need Diverse Books™.

It’s funny because many people ask me how a urologist became a writer. Growing up in the conservative part of central New York and being the only Asian person in my class, I grew up as an outsider. Books, as a result, have always my sanctuary — they were always my friends.

I could both write and be a doctor, and in many respects, being a doctor would give me the life experience and stories that I could shape what I wanted to tell. When I met my first intersex patient, however, I realized that there was a huge gap in our literature, particularly in young adult literature. When I think back on the books that I’ve read, it was really the children’s and YA books that really changed me. Teenagers, right now, are the ones who change the world and I couldn’t be prouder to be a YA writer.

Q: What is intersex and how have intersex people been affected by doctors and the rest of the medical community?

Intersex is an umbrella term that describes anyone who was born with sex characteristics that fall outside of the normal standard of male or female. This includes chromosomal anomalies or issues with external or internal genitalia. Unfortunately, the term intersex is problematic itself. Many people conflate intersex with gender, even though intersex has to do with biological conditions. Words are important. Being both a physiology and a sociological domain, language affects not only how we interact with people, but how we deliver care. 80% of intersex patients have changed care just because of the words that their provider uses.

I believe that the main thing that concerns me with how medicine has treated intersex is that medical professionals often pathologize this biological condition, deeming it as a disorder that needs to be fixed. Rather, it is a static identity that can be treated with psychotherapy and better training, and better care at all levels. Everyone needs to know that there is no normal—that the girl next door can be intersex and your own child can be who they are.

There is no real urgency to change anything. There are many ways to advocate, support and inspire change. As a surgeon, you have treated an intersex patient and are also a member of interACT. What prompted you to write this novel and how did it address the issues between the medical community and intersex people?

It’s funny because many people ask me how a urologist became a writer, when I think the better question is how a writer became a urologist. I actually started out as a writer. Growing up in the conservative part of central New York and being the only Asian person in my class, I grew up as an outsider. Books, as a result, have always my sanctuary — they were always my friends.

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The Synapse is an undergraduate science magazine that serves as a relay point for science-related information with a threefold objective. First, we aim to stimulate interest in the sciences by exposing students to its global relevance and contributions. Second, we work to bridge the gap between the scientific and artistic disciplines by offering students a medium through which to share their passions, creativity, and ideas. Third, we strive to facilitate collaboration between undergraduate institutions across the country, especially within the natural science departments.