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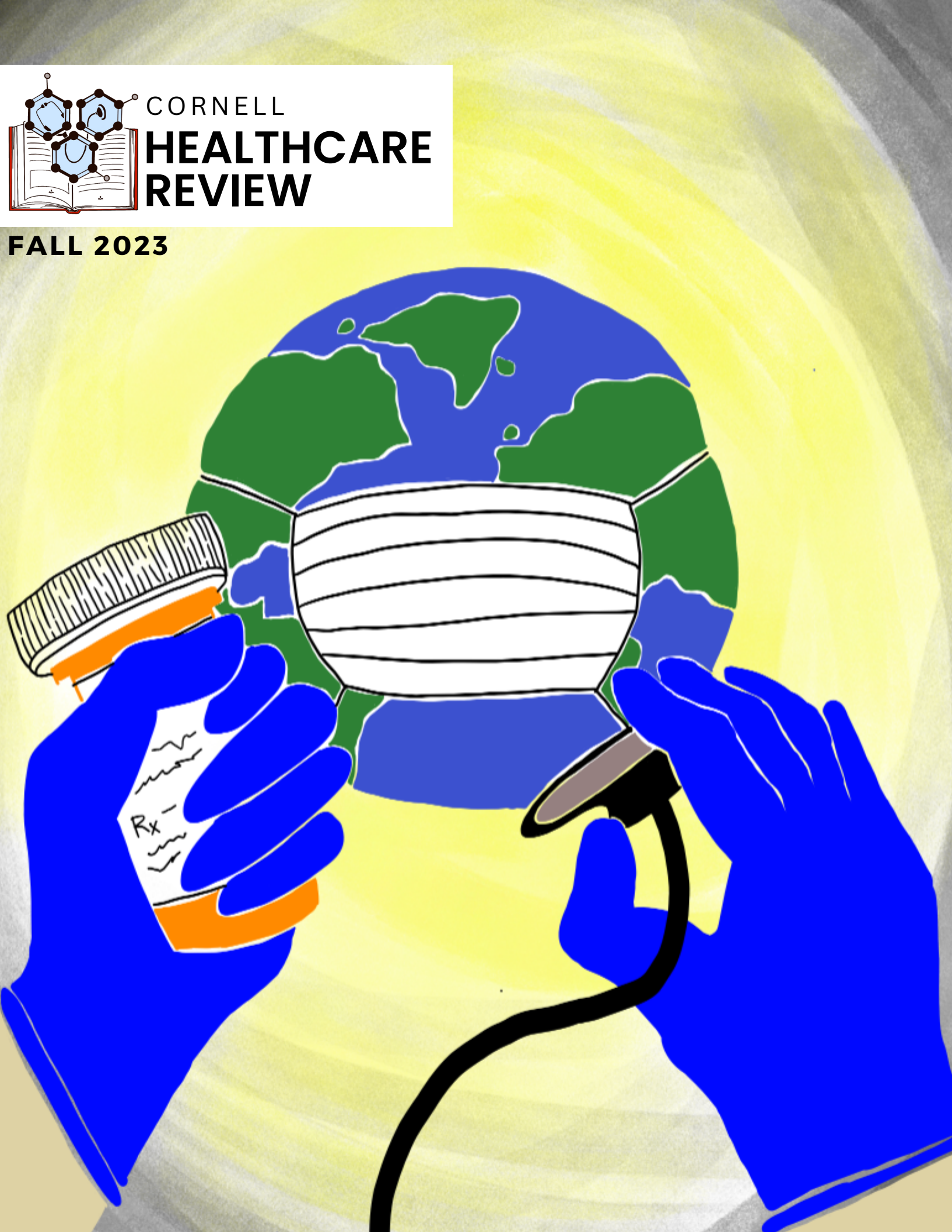
HEALTHCARE REVIEW

FALL 2023

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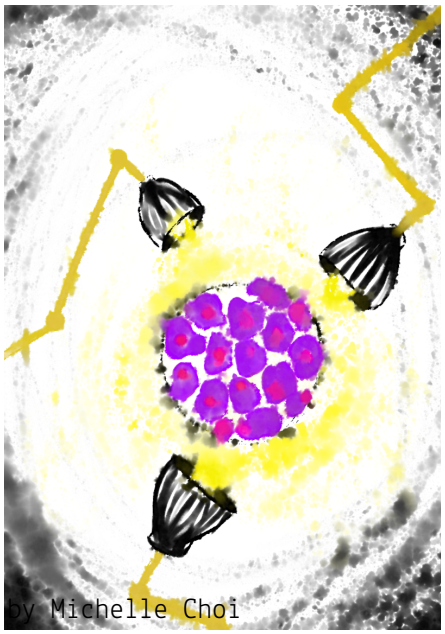
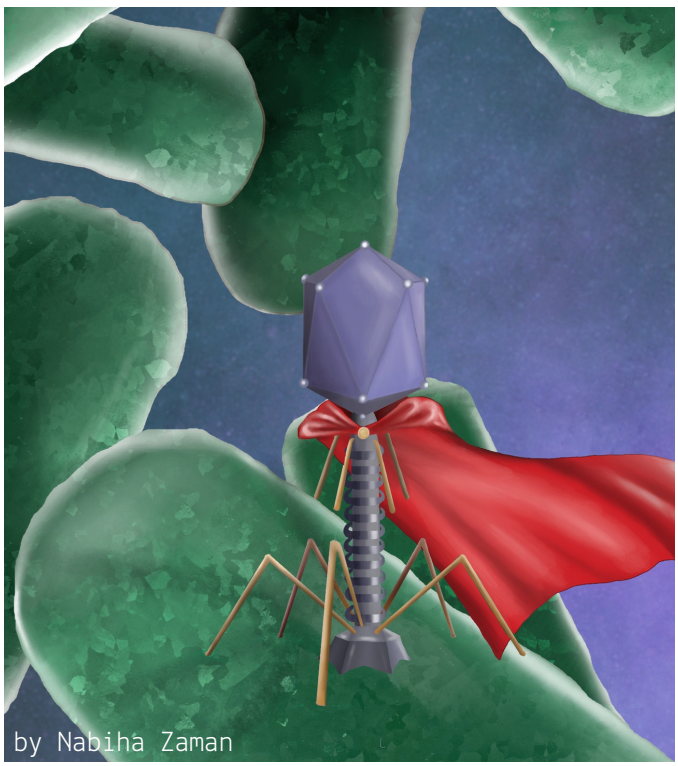

by Michelle Choi


THERAPIST
HELLO I'M DIAGNOSED
HELLO I'M DEPRESSED
HELLO I'M ANXIOUS
MENTAL HEALTH
by Audrey Trivedi


by Nabiha Zaman


by Jenny Li

Dear Readers,

I want to start off by acknowledging the passion and hard work of the Cornell Healthcare Review E-Board, and our teams of writers, editors, and artists. Since I joined the publication in the fall of 2021, I have been continually inspired by our dedicated members and their wide breadth of ideas and creativity.

During my three semesters as VP of Publishing, I have had the privilege to see firsthand our talented members communicating exciting, innovative, and challenging topics in healthcare through words and art. I am excited to see how the publication will grow and thrive in the future.

In addition to publishing our online and print publications this semester, we continued our Speaker Series and heard from speakers throughout the healthcare industry. CHR has also expanded into hosting social events and awards to foster collaboration and community amongst our team members.

We are pleased to share with you our Fall 2023 edition, a collection of articles highlighting challenges, opportunities, and outlooks in the healthcare system. We hope these articles will encourage you to stay informed about your own health and the health of our communities.

Happy reading!
Effat Rahman on behalf of the Cornell Healthcare Review E-Board

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TABLE OF CONTENTS

Getting A Head Start on Alzheimer's Management

by Noah Goodman, Human Development '27

Every year, Alzheimer's rates soar to new heights — with a projected 13 million patients by 2050 [1]. Thus, it is necessary that supportive programs be implemented for this growing population. The disease causes the destruction of brain tissue, making many previously learned cognitive tasks difficult to complete [2]. Therefore, the introduction of relearning programs for Alzheimer's patients could serve immense benefits. Meanwhile, an innovative and well-known program, Head Start, has shown tremendous results in improving the cognitive development of young children [3]. Given Head Start's effectiveness in promoting the development of immature brains, it is reasonable to infer that a similar educational program could produce similarly beneficial outcomes for Alzheimer's patients.

Such a program could promote the recovery of lost neural connections. Alzheimer's disease leads to the destruction of synapses — gaps between neurons in which information is chemically exchanged. Early childhood programs like Head Start have proven to be crucial in directing the neural connectivity process in immature brains, which have yet to develop an abundance of their synaptic connections [4, 5]. In addition, brain training games have been used to improve cognitive mechanisms in Alzheimer's patients, suggesting the possibility of neural pathway regeneration [6]. Therefore, a formal educational program similar to Head Start could provide an appropriate method of neural pathway stimulation in Alzheimer's patients, potentially sparking neuronal regenesis and connectivity.

Furthermore, a learning program could lead to the improvement of memory-based functions in Alzhiemer's patients. Damage to medial temporal lobes causes the characteristic semantic and working memory troubles seen in individuals with the disease [7, 8, 9] and also contributes to issues with spatial place learning [10]. Similar problems with memory and spatial place learning are seen in children under five years old [11. 12]. For such children, the Head Start program has yielded an increase in working memory function [13], long term memory consolidation, and spatial awareness [14, 15]. Therefore, the Head Start program provides tremendous contributions to temporal lobe development. In addition, the working memory functioning of Alzheimer's affected brains has shown a tendency to increase upon the introduction of chunking teaching techniques, implying that proper stimulation of the temporal lobe can lead to remarkable progress [16]. Due to this apparent plasticity of the Alzheimer's temporal lobe as well as its functional similarities to that of Head Start participants, it seems that an educational program similar to Head Start could help patients recover and maintain past memories.

Moreover, a structured teaching program could improve the executive functioning of patients. Alzheimer's disease often leads to frontal lobe damage, causing issues with attention, decision making, planning, motivation, and inhibitory control [17]. These same troubles are often encountered by children due to the fairly undeveloped nature of their frontal lobes.

For such children, Head Start participation is linked to increases in attention span, inhibitory control, mathematical competency, and thus overall frontal lobe development [18, 19]. In addition, studies have shown that proper frontal lobe stimulation can lead to cognitive improvements in Alzheimer's patients [20]. Therefore, implementing a program that offers patients with adequate frontal lobe neuronal incitement could lead to improved competencies similar to those seen in Head Start children.

Finally, a program similar to Head Start could offer socioemotional benefits to Alzheimer's patients. Due to damage caused to the frontal and temporal lobes, many Alzheimer's patients experience troubles in socioemotional functioning [21]. Similar difficulties are common among Head Start participants, who oftentimes lack support systems at home. For such children, participation in Head Start programs is associated with lower aggression levels [22], more positive approaches to learning [22], and overall increases in socioemotional functioning [14]. Furthermore, research has shown that cognitive stimulation can improve emotional symptoms and social interactions in Alzheimer's patients [23]. Therefore, an interactive, stimulative, and educational program could provide extensive socioemotional benefits to Alzheimer's patients.

This discussion raises the question: what exactly would the framework of a program similar to Head Start look like if it were geared towards an audience of Alzheimer's patients? The resounding answer is: structurally similar to the program given to the older range of children covered by Head Start, but with a

Artowrk by Jenny Li

stronger emphasis on mathematical competence, reading comprehension, memory consolidation, and attention retaining skills. In turn, lessons in Head Start that specifically prepare children for schooling would be dropped. In addition, it may be beneficial to incorporate physical activities into lesson plans for Alzheimer's patients. A multitude of research supports this claim, linking physical exercise to increases in overall cognitive function, neurocognitive performance, visual memory recognition, and physical fitness in Alzheimer's patients [24, 25, 26, 27]. Further research must be completed to determine the level of difficulty and strenuosity required for the program, although these factors would likely vary on a case-by-case basis anyways. Another important point to consider is that the relearning process is generally faster than the learning process, suggesting the potential for a faster-paced lesson plan than that of Head Start — although there is not adequate research to suggest that this principle applies as well for Alzheimer's patients.

Overall, the effectiveness of the Head Start program supports the need for the introduction of similar programming on a systemic level for Alzheimer's patients. Although structurally and fundamentally similar to that of Head Start, the curriculum for this program would have to undergo rounds of building, testing, analyzing, reviewing, and editing before further details can be extrapolated regarding the specifics of its optimal composition.

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Obesity and Depression: Can They Be Treated Concurrently?

by Alex Lambrianidis, Biological Sciences '24

When you have a headache, what is the first thing you typically do? For many, it would be to reach for the bottle of Tylenol. What about an upset stomach? You would probably go for the Tums. For many disorders of the body, medications are a viable solution to remedy the trouble. For others, however, prescription drugs may impart minor improvements, if any at all, while others seem to exacerbate the problem altogether [1]. Obesity and depression are two common physiological disorders of the body and mind that fall into this unfortunate category. Metabolic studies and other biochemical indicators have linked these two together, but successful treatment regiments have eluded clinicians for decades [2]. Rather than attacking the issues separately, newly integrated therapies have shown promise to meet both challenges at once [3].

Obesity and depression remain to be two of the most prominent health challenges facing the United States today. As of 2010, the Center for Disease Control (CDC) has determined that over one in three adults aged 20 and older are considered obese, and 7.2% are diagnosed with clinical depression [4]. These trends are predicted to continue increasing at an extraordinary rate. Studies have suggested that by 2030, the U.S. will observe a 33% increase in obesity prevalence from the 2010 data [5]. While these revelations are certainly alarming, research in the field has demonstrated significant promise. Specifically, scientists have identified key biochemical links in the occurrence of obesity and depression within the same individual [6].

According to the CDC, 43% of adults with depression are also considered obese [4]. Researchers have linked the correlation between these two disorders to one prominent neurotransmitter: serotonin. The underlying issue for individuals with obesity is energy imbalance and metabolic dysregulation. Serotonin is believed to be integral in these biochemical systems to regulate energy intake and subsequent expenditure. Dysregulation of serotoninergic neuronal functioning within the central nervous system is also associated with changes in mood, leading to depressive states [6]. This common pathophysiology suggests that obesity and depression may represent neural manifestations of the same underlying dysfunction.

Serotonin-related studies have enabled the pharmaceutical industry to better understand the effects of neurotransmitters on the central nervous system. One widely prescribed antidepressant has been selective serotonin reuptake inhibitors (SSRIs) [7]. Between 1996 and 2005, antidepressant prescriptions doubled in the U.S. to potentially meet the challenges of obesity and depression simultaneously [1]. SSRIs work on serotonergic nerve terminals to prolong the effects of serotonin within the synaptic cleft by blocking reuptake of the neurotransmitter. The resulting increase in serotonin levels in the brain help facilitate weight loss by accelerating the onset of satiety and diminishing the impacts of mood disturbance. What clinicians observed, however, was that these effects were mostly transient, and could not sustain the desired long-lasting effects on behavior and mindset [7]. Consequently, despite the increased usage of antidepressants like these, obesity and depression continue to be a major public health concern [1].

In recent years, cognitive behavioral therapy (CBT) has been a widely accepted treatment for symptoms of major depressive disorder. Researchers have since wondered whether these practices can be applicable in the behavioral therapies aimed at diminishing rates of obesity in the population [3]. In one study, the short-term efficacy of combined behavioral weight management and CBT for depression were tested [3]. The 12 female participants received weekly group therapy for 16 weeks, led by a clinical psychologist. The first 90 minutes was dedicated to weight management strategies. Participants were educated on self-monitoring, stimulus control, setting calorie goals, and safe fitness techniques. In the second half, CBT was applied to treat depressive symptoms. Participants were taught to identify their negative conscious thoughts and core beliefs on body image and self-worth [3].

Over the course of the 16 weeks, there was a mean weight loss of 10.4 kg (equal to a reduction of 11.4% of initial weight), and depression scores were significantly decreased as well. While these findings do garner optimism for alternative, non-pharmaceutical treatment, researchers acknowledge the need for a larger, randomized control trial to establish the full efficacy of

Artwork by Sabrina Chen

the combinatorial treatment plan [3].

One critical limitation of the study was the demographic of participants used. These individuals represented those from higher socioeconomic status, with sufficient access to primary care facilities [3]. For many across the U.S., such availability is not always present, as health is often determined by environmental factors well beyond control of the patient. While such practices may not seem feasible at first, the rising prevalence of telehealth presents an opportunity for equitable access in both rural and urban centers. Behavioral therapy and CBT by way of telehealth thus presents an opportunity to deviate from the conventional treatment regiments focused purely on pharmaceutical treatment [8].

Obesity and depression represent two of the most pivotal challenges facing the U.S. today. These disorders are associated with reduced quality of life, cognitive dysfunction, and an increased risk for cardiovascular complications causing decreased life expectancies [2]. Facing these disruptions to health and well-being requires the utmost sensitivity and dedication to appropriate care techniques, not only for adults, but for many adolescents as well. As researchers continue their diligent work to uncover viable solutions, many retain a hopeful optimism that group therapy over invasive drug treatments is well within the scope of the near horizon.

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The Silent Epidemic: Physician Suicide

by Sophia Huynh, Human Biology, Health, and Society '25

Artwork by Amber Briscoe

Shrowded in the shadows of the COVID-19 pandemic, a silent crisis brews: physician suicide. A quiet murmur since the 19th century, physician suicide remained largely unknown and overlooked until the COVID-19 pandemic. While physician burnout is widely known to the general public, the extent of this burden was exacerbated by an increased sense of powerlessness over work hours and patient deaths, which results in climbing rates of depression, anxiety, burnout, and social isolation within physicians. Due to the great efforts of healthcare professionals, the number of COVID cases ebb and flow to a manageable level, but that begs the question: what about the front-line physicians that are left in their wake?

Physicians have increased access to lethal opportunities for suicide such as drugs, which signals to another looming issue: a physician's workplace creates an environment that is conducive to suicide. Throughout their academic and professional careers, physicians garner extensive knowledge of pharmacology and lethal doses of medications and gain access to these medications through their workplace. Additionally, medical students graduate into a work environment that is increasingly corporatized as physicians worldwide are expected to perform in unforgiving environments for extended periods of time. One study found that 23% of interns had suicidal thoughts, and 28% of residents experienced a depressive episode during their training [1], compared to 7-8% of similarly aged individuals in the general population [2]. When these statistics are further dissected, female physicians are found to have higher rates of suicide and alcohol abuse than their male counterparts [3]. While few studies explain this observation, it can be induced by the struggle of navigating a male-dominated profession riddled with gender biases. Nonetheless, the healthcare work environment is one that overworks and strips autonomy from the physician [4], while imposing impersonal measures of performance that views neither the physician nor the patient as individuals [5].

It is imperative that the healthcare work environment is improved on all fronts, for everyone involved. Despite undergoing extensive training in the various aspects of mental health and treatment plans, physicians who pass away from suicide are less likely to have received mental health treatment than non-physicians [6]. There are many explanations for this statistics, such as a mental health stigma and the fear of professional licensing repercussions that come with reaching out for support. This emphasizes a harrowing truth: physicians, despite their resources and education, continue to remain an increasingly vulnerable group for depression, anxiety, and suicide.

While the conversation regarding physician suicide steadily grows louder, it is far from loud enough. Proactive steps must be taken to create a supportive atmosphere in healthcare environments that supports patients and physicians alike. To lead the way, the Association of American Medical Colleges are implementing programs to support physicians. At the University of California, San Diego (UCSD), the Interactive Screening Program allows physicians and medical students to anonymously reach out for help, which can circumvent stigma, and has lead to at least 180 physicians at UCSD gaining a referral for mental health care, that they otherwise would not have received[7]. Following a medical student's death by suicide, Mount Sinai, a medical college, launched a four-year wellness curriculum called PEERS (Practice Enhancement, Engagement, Resilience, and Support) that promotes small group meetings with students and faculty to tackle stressors, which aims to provide medical students with skills to manage personal and academic challenges [8]. Although these programs and support systems are all small steps in the right direction, more questions remain unanswered. Further research is required to elucidate explanations for the female physician suicide rate being so high, and to better understand how to best support intersectional individuals such as LGBT+, BIPOC, first-generation, and international physicians.

Physicians are a cornerstone of our society and have been our advocates for hundreds of years. As the crisis of physician suicide quietly festers, it signals a need for the greater society to begin advocating for our physicians as we humanize healthcare.

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Aging and Health in Southeast Asian American Communities

By Emily Vo, Computer Science '25

Artwork by Angela Yuan

Southeast Asian American (SEA) communities have often been overlooked within conversations regarding public health and access to healthcare. And within these conversations, the topics of aging are significantly excluded. Understanding health disparities among aging populations is essential in delving deeper into the Southeast Asian American community's growing relationship with aging health services, public institutions, and primary care.

A central pillar and issue within these complexities includes equitable access to healthcare for older Southeast Asian American men and women. Limited English language proficiency and poverty are barriers in preventing access to necessary healthcare and disease prevention methods, such as vaccinations and access to free clinics [1]. Many aging Southeast Asian American communities also consist of immigrants, refugees, and displaced peoples, which current public health systems are not adequately equipped to navigate– from few translation services to affordable transportation and local resources. And, as a result, a lack of communication evolves between many patients and communities, impacting health cases that involve long-term, continual care such as disease prevention, cancer treatment, or mental health services. Among the aging population of SEA individuals, Hmong and Vietnamese women are at a higher risk of being diagnosed with cervical cancer and, in general, Southeast Asian Americans suffer disproportionately from Hepatitis-B, which may lead to liver cancer or failure [2]. According to the CDC, if left untreated, up to ¼ of people with Hepatitis-B may develop liver cancer or other detrimental liver problems [3]. Many cases of untreated patients also reveal a lack of public health resources. For instance, high rates of hepatitis B infection among the Hmong are attributed to vertical and horizontal transmission and are further exacerbated by low screening and vaccination rates [4]. Vertical transmission, from mother to child in utero, and horizontal transmission, from generation to generation, immensely contributes to the specific risk of community health with Homng families at the most vulnerable, being at the lowest survival rate for liver cancer– a rate that is nearly two times lower than other Asian ethnic groups [3].

These cases contribute to the growing need for public health equity among aging Southeast Asian Americans as many of Hmong patients diagnosed with Hepatitis-B were foreign-born and had lived in the U.S. for nearly 30 years, suggesting that infection most likely occurred prior to immigrating to the U.S. [3]. Understanding these disparities and historical challenges may lead to better treatment and expansion of public health communications and services, and more importantly, a revitalized response to healthcare for aging populations within the Southeast Asian American community.

In addition to physical health, the mental well-being of many aging groups within the Southeast Asian diaspora have also been under addressed. These disproportionate experiences with mental health include higher rates of post-traumatic stress disorder (PTSD), major depression, and anxiety disorders [1]. Traumatic experiences of war, violence, and genocide negatively affect many aging Southeast Asian American's physical health and mental well-being. In 2005, a study by RAND Health reported approximately two-thirds of Cambodian refugees suffered from post-traumatic stress disorder and anxiety [5].

Much of these underrepresented or "hidden" statistics can be attributed to the lack of resources allocated to focus on Southeast Asian American health centers or community, public initiatives. According to the Southeast Asia Resource Action Center (SEARAC), lack of evidence is also a consequence of "state and federal health systems [that] fail to tease out data on Southeast Asian Americans from "Asian Americans" overall, making it difficult to address and understand these disparities." And, again, many of these disparities can be attributed to the severe lack of language and translation resources. It is important to further emphasize this point because universally accessible healthcare, including access to therapy, psychotherapists, and medications, and public health centers for non-english speakers are needed in order to bridge the gap of cultural differences and

mutual understanding amongst physicians and aging Southeast Asian American communities. Moreover, clinical and public-facing research must be expanded upon to provide inclusive language on the diverse subgroups within the Asian American and Pacific Islander communities, an issue that has been important in explicitly defining the needs and differing health concerns of Southeast Asian American communities specifically.

In understanding and delving deeper into the physical and mental health as well as aging of Southeast Asian Americans, public health resources and healthcare professions can better understand the treatment and care of all aging, diverse groups. Gerontology and the health of all aging populations is essential to building toward a more inclusive conversation around health equity, creating diverse venues of patient care and enabling the development of culturally competent and targeted healthcare strategies.

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Bridge Clinics: A Scalable Solution for SUD

By Ishan Shah, Human Biology Health and Society '24

Substance use disorder (SUD) is a neurophysiological disease characterized by a chronic urge to use a drug that produces a reward, despite its negative consequences. Due to its variability, chronic effects, the potential for relapse, and widespread state, impacting 46.3 million people, it can be a challenging disease to address [1]. 107,081 deaths were reported in 2022 due to drug overdoses of which over two-thirds were due to synthetic opioids, primarily fentanyl [2]. There is no question that the overdose epidemic is a major public health concern in our nation. Yet, the infrastructure of the addiction medicine system is not built to support the many people suffering and dying from this disease. There are not even enough trained physicians, as there are around only 3,000 physicians trained in addiction medicine or addiction psychiatry [3].

Despite our system's shortcomings, there are fortunately evidence-based treatments offered for SUD like the administration of buprenorphine and methadone through agonist substitution treatment. This treatment method involves prescribing patients these opioids which will effectively out-compete other opiates like heroin and fentanyl. It has been shown to reduce cravings, prevent withdrawal, and regulate physiological functions [4]. Currently, the process of accessing buprenorphine and methadone for patients is rather challenging due to the stigma around replacing one substance with another. To combat the barriers to treatment for substance use disorder, bridge clinics, which offer medication-assisted treatment and other resources for addiction treatment, were designed [5].

But do bridge clinics really work to improve patient outcomes? A study by D'Onofrio et al. (2015) showed a significant increase in engagement in addiction treatment for patients whose care was initiated in emergency departments [6]. Furthermore, the emergency department model of bridge clinics displayed a higher likelihood of being linked to long-term care in the study performed by Serdarevic et al. (2023) [7]. Lastly, a study done by Sullivan et al. (2021) demonstrated that buprenorphine bridge clinics decreased future patient emergency department visits [8]. All in all, this is extremely promising evidence for some model of bridge clinic to succeed in a large-scale intervention for SUD.

CA Bridge is a program from California working to implement opioid use disorder care into emergency departments. Striving to reach all California hospitals with 24/7 opioid use disorder care by 2025 and aiming to extend into other states and develop a national standard of care for emergency departments. CA Bridge programs utilize a special system of patient navigation. Hiring patient navigators is an economical and practical solution to guide patients to the correct care and prevent patients from returning to the emergency department [9]. Lastly, CA Bridge has placed a huge emphasis on combating stigma and creating a low-threshold, accepting place for treatment.

What is really impressive is that expansion of these bridge clinics has happened very fast. Starting in June 2018 at just four hospitals,

Artwork by Flavia Scott

CA Bridge has grown into over 200 hospitals today [10]. The question is whether bridge clinics will be the solution to the over one million deaths that are estimated to take place from overdoses in the next 10 years. It is possible that we see this integration of addiction care in emergency departments nationally very soon. But, there are also models of bridge clinics that exist outside of the emergency department, which are likely more expensive and time consuming to start up, but also have their own advantages. The American Society of Addiction Medicine has tested the feasibility of a telemedicine bridge clinic, which proved to be promising to introduce patients into addiction treatment [11]. It will be interesting to observe what models expand and succeed to battle addiction and overdoses in our nation, despite the many barriers associated with implementing each of them.

Bridge clinics serve to be a promising solution to a huge issue that is pressing our nation today and is only growing. Will people be able to receive medication-assisted therapy for SUD online through telemedicine bridge clinics or in-person in the emergency department? The answer is hopefully both. As bridge clinics continue to pop up around our nation and the addiction medicine network is built, we wonder how this will impact the delivery of treatment for SUDs and how exactly addiction medicine will look in the near future. With various exciting models, we hope bridge clinics in any or all forms will be the scalable solution to the SUD problem.

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South Asian Americans and Atherosclerotic Cardiovascular Disease

By Amina Khan, Biological Sciences, Neurobiology and Behavior '22

"As a primary care physician, I would see young South Asians coming in who'd had a heart attack," said Dr. Kandula, founder of the Mediators of Atherosclerosis in South Asians Living in America (MASALA) study [1]. Interestingly, Kandula and other researchers found that people of South Asian ancestry did not necessarily fit the typical risk factor profile. Individuals of South Asian background (from India, Pakistan, the Maldives, Nepal, Bangladesh, Bhutan, and Sri Lanka) who migrate to North America or Europe seem to have an elevated risk for atherosclerotic cardiovascular disease (ASCVD) compared to non-Hispanic White and other Asian-American groups [3]. At MASALA, the question of whether any biological variance related to ancestry predisposes the South Asian population has garnered significant interest and remains an active area of research.

Taking a deeper look at disease incidence, South Asian Americans experience a higher proportion of mortality and higher burden of premature mortality from ASCVD. Furthermore, South Asian adults have a higher prevalence of cardiovascular risk factors type II diabetes and hypertriglyceridemia, and greater levels of ectopic fat compared with non-Hispanic White adults [3]. South Asian adults with hypertension are also younger, more likely to be male, and have lower mean BMI than non-Hispanic White adults. Additionally, South Asians are more likely to deposit extra fat in organs like the liver, inside muscle tissue, and around the abdominal visceral organs rather than depositing it under the skin [1].

A combination of varying sociocultural, behavioral and lifestyle factors related to ethnicity and regional association come into play when understanding the difference in disease prevalence. Dietary and nutrition patterns, physical activity levels, healthcare access, language barriers, and socioeconomic position only begin to explain this phenomenon [6]. In regards to preventative health, the public statement of the risk factors of hypertension and dyslipidemia has led to an increase in education, empowerment, and change in the South Asian community. For instance, when hypertension was first determined to be a risk factor for ASCVD, increased awareness surrounding lifestyle modifications was raised and led to novel drug developments over the years [5]. Furthermore, South Asian ancestry was added in the cholesterol guidelines as a risk enhancer for ASCVD (American College of Cardiology). However, skeptics like Dr. Jaideep Patel, a cardiology fellow at the Virginia Commonwealth University Medical Center, claim that despite preventative health campaigns such as AHA's Life Simple 7, Go Red for Women/Go Red Sari, and national prevention guidelines, which reinforce healthier lifestyles, higher prevalence of ASCVD still remains in these populations [2]. Therefore, modifiable risk factors can only partly explain this disparity.

In studying the potential genetic predisposition to cardiovascular disease, data revealed a polymorphism in the patatin-like phospholipase domain-containing protein-3 (PNPLA3) gene which has been found to be associated with non-alcoholic fatty liver disease, a cardiovascular disease risk factor [7]. Variation in PNPLA3 genotype can also determine insulin sensitivity, which can contribute to the onset of diabetes from a prediabetic state and hence plays a role in development of ASCVD [5]. From a dyslipidemia causality perspective, genes such as LDR, APO C3, LPA, and others may be upregulated in the South Asian population, further contributing to ASCVD prevalence [5]. Other studies have focused on the modification or dysregulation of metabolites and their correlation to ASCVD risk [4]. A metabolomics study of 145 South Asian Indians revealed that the metabolite pattern of aromatic amino acids, branched-chain amino acids, and short-chain acylcarnitines, which display a nonvegetarian diet, was associated with adverse cardiometabolic profile [4].

Artwork by Flavia Scott

In conclusion, further research is likely to increase awareness but may also create uneasiness in the South Asian community. It is important to clarify that South Asian ancestry is not a modifiable risk factor. However, modifiable risk factors are more prevalent in this population and should be investigated and treated. Following leadership at American Heart Association, National Lipid Association, and American College of Cardiology, this knowledge can help individuals modify their lifestyle to reduce the risk of cardiovascular disease and recognize symptoms, ensuring prompt

medical attention. Proactive intervention, risk assessment, and positive reinforcement are critical clinical strategies that must be employed to effectively reduce the burden of ASCVD disease in the South Asian population [5]. From a medical perspective, this decision offers an opportunity to research biomarkers of risk earlier in SA patients and innovate new treatments.

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Designing for Walkability

by Simeon Swaby, Biology & Society '26

Artwork by Jenny Li

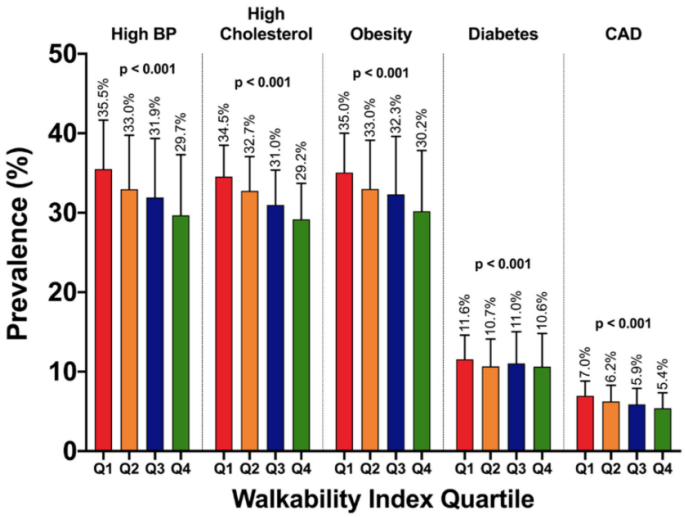

Fig. 1: Graph of the prevalence of different diseases among communities of various levels of walkability. Q1 communities have the lowest levels of walkability, while Q4 communities have the highest levels of walkability (Source: Science Direct).

"There are so many from Brooklyn. And I can see why—the charm of the houses, the walkability of the village, and the closeness of the city," says Loretta Chiavetta, a new resident to the small village of Pleasantville in Mount Pleasant, NY [1]. Like many from New York City, Chiavetta was looking for a new community for her family after rising prices pushed them out of their original community. What she found was Pleasantville, a village that had elements of a small town, mixed with a walkable and accessible neighborhood.

In a housing market as competitive as the one in America, some of the most sought after homes are located in walkable communities; and it's easy to see why. Walkable communities have been shown to improve the health and well-being of its citizens by providing an open atmosphere where physical activity is widespread and social interaction is encouraged [2]. Not only are these communities conducive to forming neighborhoods that are more connected socially, but the innate incentives of being in a walkable community can promote physical activity and consequently reduce the chances of health complications like coronary artery disease and diabetes.

Rather than using a car to get from place to place, residents are encouraged to use more active forms of transport like bikes in walkable communities. Being regularly active could have wonders on one's health. Moreover, easy access to local markets or doctors' offices can reduce the risk of health complications as a result of other factors. In a study from the journal *Current Problems in Cardiology,* researchers studied the relationship between cardiovascular disease and the walkability of a neighborhood. They found that the instances of someone diagnosed with high cholesterol were 29.2 percent in the most walkable communities, compared to 34.5 percent in the least walkable communities [3]. Similar measures have been found for obesity, and to a lesser extent, for coronary artery disease. The difference comes down to higher levels of physical activity in walkable neighborhoods, along with greater access to healthy foods, and healthcare, which all link to a reduced risk of cardiovascular disease.

The benefits of walkable communities go beyond their ability to make one physically active. A community's layout and accessibility can improve an individual's mental well being. Findings from the *International Journal of Environmental Research and Public Health* show that the urban design and development of certain communities could impact one's mentality [4]. Using an advanced neural network system, researchers were able to map out communities which exhibited elements of walkability and related this back to the mental health of the residents. They found that the people residing in communities containing elements of more walkable neighborhoods, mainly less single-lane roads and more sidewalks, were less depressed than communities without those elements. Quinn Nguyen, an associate professor at UMD's School of Public Health and a contributor to this study, suggested that "neighborhood walkability and urban development are connected with lower chronic diseases, better mental health and reduced smoking" [5].

Although there are a considerable amount of benefits to walkable neighborhoods, these benefits aren't always felt by everyone. Non-white and lower-class residents, while oftentimes living in highly walkable communities, are less likely to take advantage of them for several reasons. A study from the journal Obesity compared BMI levels between walkable and non-walkable communities across various racial and ethnic groups [6]. It was found that while the BMI

increased for whites as a community became more walkable, the inverse was true for predominantly Black, Hispanic, and Asian communities. One reason for this could be due to the historic inequalities that have existed for racialized groups within urban centers. Disinvestments into these communities from historic "redlining" policies created poorly built "physical activity" environments [7]. These environments are inflicted with a lack of walkability, street connectivity, and green space.

What's worse is that when these communities do get investments into improving walkability and infrastructure, it usually prices out local residents [8]. The white residents who had left many city centers during the age of "white flight" are now returning to take advantage of new amenities and benefits of living in a more open community. Sadly, these improvements are coming at the cost of long-time residents from marginalized backgrounds.

However, there is some hope. Data from the Housing + Transportation Affordability Index (H&T Index) shows that walkability has the potential to reduce housing properties. In fact, the 25 largest traditional cities (usually the most walkable cities) have 19 percent lower combined housing costs than 25 largest sprawling cities (usually less walkable cities) [9]. This means that an increase in walkability isn't inherently correlated to increased community costs.

Ensuring that walkable communities remain affordable to everyone will be an important task in future. Everyone should have the opportunity to live in a comfortable and welcoming community, no matter who they are.

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Origami in Medicine: An Artistic and Intellectual Alliance

by Olivia Qin, Biological Sciences '27

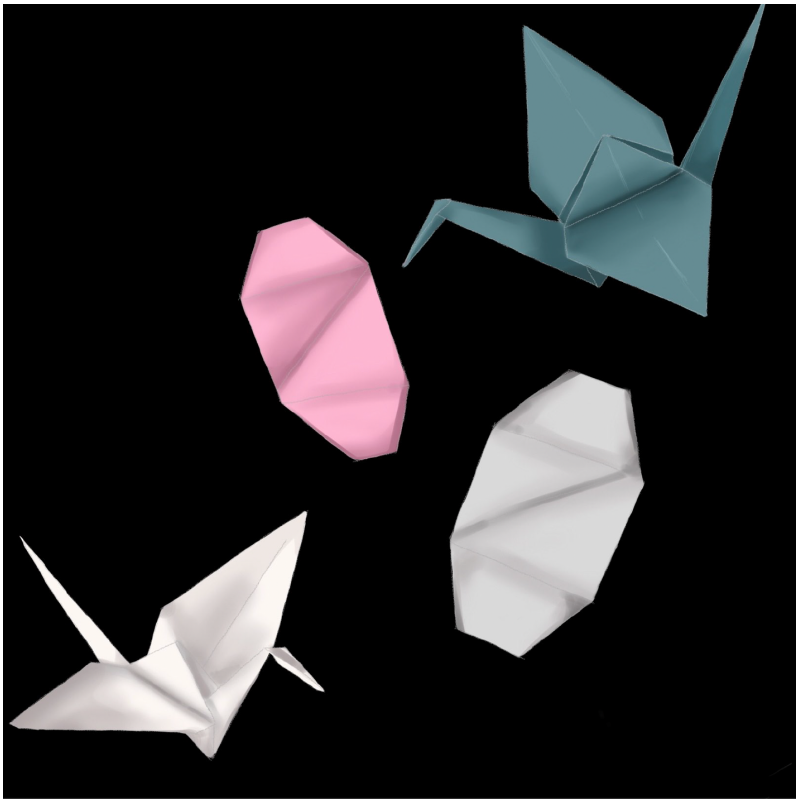
Paper-folding is a mesmerizing form of art capable of transforming plain sheets into mythical creatures and snowflake fractals. Yet, its value surpasses mere visual gratification. The fluidity and flexible nature of this ancient art is promising for medical practices where microscopic mobility is essential. Although origami is a new area of scientific study, researchers have confirmed its remarkable potential in advancing the capabilities and effectiveness of biomedical instruments, models, and techniques. In this interdisciplinary field where origami and medicine coalesce, modern science transforms a once purely aesthetic form of art into a promising direction for the future of medicine.

The most impactful attribute of origami in medicine thus far is its ability to transform freely at microscopic levels. In 2003, a British-Japanese team from Oxford University presented a stainless-steel stent prototype with an origami water-bomb base as the underlying groundwork. When fabricated using bioplastic, the stent was able to maneuver into an arterial blockage and expand its diameter from 12 mm to 23 mm [1]. The flexible but sturdy nature of this design allows for efficient function with minimal risk. Currently, surgeons perform angioplasties using grafts of metal mesh and polyester. Though this method temporarily relieves artery blockages, frequent mesh fractures and graft ruptures pose serious threats of restenosis, where tissue in-growth through mesh openings block the open lumen [1]. The origami stent prototype offers a pragmatic solution while also optimizing tensile strength with a shape memory alloy (SMA) foil that prevents collapse. This crucial step forward in biomedical research creates hope for more effective and long-lasting surgical treatments for chronic diseases, including coronary artery stenosis and aortic aneurysm.

In addition to coronary stents, scientists have also developed DNA origami nanostructures (DONs) for medical modeling and performance of specialized tasks in the bloodstream and tissues. Synthesizing these nanostructures involves graphing three-dimensional polyhedral meshwork to create single strand route scaffolds [2]. Prior to this, strands of oligonucleotides, also known as staple strands, are assigned to sequence designs and arranged on the DNA backbones. Once materialized, the structures self-assemble into three-dimensional nanoparticles based on the arrangement of staple strands [3]. This method of DNA modeling and nanoparticle construction is essential in biomedical research with its potential to synthesize encoded DNA nanostructures in living cells. Current in vivo therapies with Luxturna and Zolgensma injections are able to help treat inherited retinal disorder and spinal muscular atrophy, respectively, by stimulating the production of missing proteins [4]. By applying origami nanoparticle modeling and DNA construction, there is a high likelihood of improving treatments by surpassing present limitations, such as the possibility of protein misfolding. Furthermore, investigating the practical applications of DNA origami may lead to the discovery of effective in vivo genetic therapies for inherited disorders, such as classical hemophilia, as well as acquired diseases including atherosclerotic arterial disease.

Using the same concept of DNA origami, synthetic nanoparticles can also function as microscopic transporters for drug encapsulation in cancer therapy. As the scientific community continues to evolve its understanding of cancer biology, the development of technologies that spare healthy tissues while delivering cytotoxic drugs to tumor cells have lagged behind [5]. With the ability to manipulate the structure and responses of self-assembling nanoparticles, origami has become a promising approach to equipping drug nanocarriers with ligands and environmentally responsive molecular switches that target tumor cells and leave healthy ones unaffected. For instance, a cylindrical nanoparticle carrying thrombin, an enzyme that promotes blood clotting, can bind to a molecular trigger that appears in a specific tumor, prompting the release of thrombin. The local formation of blood clots occludes blood vessels that supply the tumor, leading to tumor necrosis [5]. Since all solid-tumor-feeding vessels are similar in nature, the capacity of origami-based nanoparticles to seek out and react to tumor-specific triggers provides a hopeful gateway into effective therapy for currently untreatable cancers.

Furthermore, applying operative DNA particles to the construction of self-sustaining cells is promising in the context of more complex operations, especially organ transplants. Using the potential of DNA origami to culture functional cells, it is plausible for scientists to specialize these cells for different organs, such as the heart or



Artwork by Ashley Chopra

kidneys [4]. The intricacy and sheer number of required designs pose practical barriers. Regardless, this hypothesized method has taken a turn toward becoming a reality with the onset of four-dimensional bioprinting of tissue-engineered implants. Previously, emission tomography has confirmed effective absorption of radiolabeled DONs by kidneys to ameliorate acute kidney injury (AKI) in mice [4]. The DONs self-arranged for exclusive absorption in the kidneys. If scientists tailor DONs to different cell types, it would be possible to not only stimulate and accelerate tissue growth in a damaged organ, but also grow entire transplantable organs modified for individual patients. Moreover, the required materials and equipment for working with DONs are relatively inexpensive in comparison to those for treatments that are available today. With this technology, the promising contributions of this cost-effective method are no longer science fiction.

Though seemingly incompatible before, the traditional art of paperfolding has merged into medicine, paving new paths for the improvement of surgical instruments, biomedical modeling, in vivo therapies, and organ transplants. Further research on precise molecular interactions and growth processes are necessary to apply these newly developed methods and technologies to practical situations. However, it is undeniable that this artistic and intellectual crossover is revolutionizing the field of medicine.

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LGBTQ+ Youth: Social Media Legislation and Civil Rights

by Elsa Leichty

The effects of social media on young people's mental health have long been debated. Nearly 5 billion people globally use social media, and the number is growing exponentially [1]. As a result, social media usage and adolescent mental well-being captured the attention of lawmakers. Now, the topic is steadily evolving into a matter of paramount concern for policymakers. This article will discuss the multi-faceted dimensions of governmental restriction on social media platforms, focusing on the civil rights implications for LGBTQ+ teenagers associated with parental and technological controls on social media.

Teenagers are at high risk for mental health challenges which may be exacerbated by social media. However, it is important to consider both the positive and negative consequences of social media on adolescent health. Alexey Makarin, an assistant professor at MIT Sloan explains the challenge of determining whether social media contributes more positively or negatively to mental health stating: "There may be hundreds of papers that present correlations between social media and well-being...but we still know very little about which way the effect runs." Many arguments against social media stem from mental health data via the Centers for Disease Control such as the increased suicide rate among 10-24 year olds which stayed fairly constant from 2000 to 2008, but increased by a whopping 57% between 2007 and 2017. Social media use also skyrocketed during this time [2]. The potential increase in mental health disorders among young adults associated with social media is highly important, but the positive effects of social media for teenagers must also be weighed.

Artwork by Joyce Wang

where cervical cancer has been almost eliminated after implementing an HPV vaccination program among adolescent girls [4].

The struggle for HPV vaccination acceptance and lack of screening for cervical cancer have been further exacerbated by the COVID-19 pandemic [5]. One country that has been particularly affected is Zimbabwe, which has the fourth highest cervical cancer rate. In Zimbabwe, there are just two gynecological oncologists who serve the entire population [6]. At the beginning of the COVID-19 pandemic, all non-essential services were discontinued, including gynecological screenings designed to detect cervical cancer at early stages. While these services have come back as the pandemic has subsided, there has been a decreased number of patients seeking screening and treatment for fear of contracting COVID-19 [7].

Zimbabwe faces a challenging vaccine landscape with a high prevalence of vaccine hesitancy and inadequate financial resources. This low COVID-19 vaccine uptake has been paired with a sharp decline in HPV vaccinations throughout the country. The onset of the pandemic has resulted in HPV vaccines going to waste as many countries were solely focused on rolling out COVID-19 vaccinations, while suspending HPV vaccination programs [7]. Additionally, the closure of schools has shut down a very common venue for girls to receive HPV vaccinations. As a result, the COVID-19 pandemic has had a lasting negative impact on the health of young girls in Zimbabwe, leaving them more vulnerable to HPV and higher cancer risk due to early marriage and sexual exposure [7].

A major part of the issue of low uptake of vaccines is overall hesitancy and negative views of the HPV vaccine in many African countries. There has been a movement towards offering HPV vaccines in schools throughout sub-Saharan Africa, however these programs have not been very effective, as evidenced by an average vaccination rate of only around 60% [8]. Parents, when asked about why they rejected the vaccine, cited many different reasons. Among the most common ones is inadequate education about the program due to poor or complete lack of communication [7]. Additional motives for vaccine hesitancy include misconceptions about the risk of HPV, belief that the vaccine would cause sterility, and that it is ineffective [9].

Vaccine hesitancy is an ongoing battle in sub-Saharan Africa that will require a comprehensive approach in order to overcome it. There is a long and devastating history of medical experimentation in Africa. One example is Pfizer's trial of meningitis drugs in 1996 that led to the death of 11 Nigerian children [10]. Because of this troubled past, many people, including government officials, have a negative view of vaccines coming from the West. The former Tanzanian president John Magufuli stated: "Vaccines are not good. If they were, then the

white men would have brought vaccines for HIV/AIDS" [11]. Magufuli's statement reflects the feelings of much of the African population: minimal trust in Western medicine.

It will take much effort for the Western world and big pharma to earn the trust of African communities. In the meantime, it is important that there are new and greater community and policy interventions within the African countries. For example, public health organizations could hang posters and flyers throughout the country written in local languages. Additionally, governments need to focus on collaborative efforts with communities to make sure these campaigns and education are reaching all parts of the country. Lastly, it will be imperative for governments and pharmaceutical companies to partner and facilitate the production of vaccines in Africa, which could help reduce the fear of Western influence [11].

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When Culture Meets Science

by Yelenia Almonte, Biological Sciences '25

Perhaps one of society's most common misconceptions is the notion that science is an objective truth. For centuries, people have turned to science through observation and experimentation to understand their surroundings and their societies. As a result, scientists have made some incredible discoveries, some of which we can observe as recently as the development of CRISPR technology or the rollout of the COVID-19 vaccine. It would be deceptive to suggest that science does not produce some of the great, universal truths of the world. However, it would be just as deceptive to neglect the real and prevalent ways that science, namely biological science, has been constructed and maintained on the various cultural norms within which it is contextualized.

The so-called objectivity of science appeals to the human desire to claim a truth that cannot be disproven, but the reality is that science is not always unbiased. Instead, as Aimi Hamraie states in *Building Access: Universal Design and the Politics of Disability,* it grants the "power and authority of supposed truth and objectivity", even where objectivity may

Artwork by Audrey Trivedi

not be present [1]. Following the Scientific Revolution, modern societies have placed high value on certain notions of "reason" or "logic" as the qualifiers of truth and, ultimately, power. A symptom of this turn to logic and science is the repositioning of normative ideologies and the justification of societal hierarchies within the framework of objective science. Under a scientific guise, many "biological theories have provided the scientific justification for ideologies that support, explain, mystify, and obfuscate patriarchal relationships of power, domination, and control" [2]. For example, in the book *Black on Both Sides: A Racial History of Trans Identity*, the author highlights how J. Marion Sims – often regarded as the "father of gynecology" – not only performed experimental vaginal procedures on enslaved women, but described the lives of some of his patients as "ones of suffering and disgust" [3]. Not only is this ethically corrupt, but it demonstrates how revered biological and medical scientists have meaningfully contributed to the construction and reproduction of harmful social structures that have functionally excluded and marginalized already othered populations.

For the larger part of western medicine's existence, medical professionals have played a crucial role in legitimizing existing power structures. A striking example of this can be found in Kevin McQueeney's detailing of the slave-based economy and healthcare system that was built in New Orleans, Louisiana [4]. Not only was racism prevalent, but it was so culturally ingrained that scientists and doctors could not separate it from their practice and sought out scientific logic to justify it. Some physicians went as far as to say that "there was 'no doubt' the Africans were of a different species … an intermediate between the Caucasian Race and the Anthropoid apes" [4]. These doctors were not the first nor the last to weaponize Darwin's theory of evolution in favor of the White race, but they do serve as a pertinent, more overt example of how culturally accepted truths fix themselves within science. Whereas the medical narratives of "peoples of African descent as having innate immunity to tropical diseases" were once supported, one might now find cultural acceptance of Black patients having innately higher pain tolerance as justification to medical negligence. This provides just one example of how scientists have advocated strong claims about the "social and political" roles of various marginalized groups, "claiming all the while to speak the scientific truth" [5]. Furthermore, these schools of thought repeat themselves when the very people who are advocating for their use go on to educate future generations of doctors and scholars in the field.

This is why it is important to recognize that the voices and experiences of marginalized populations are not and have never been in a position of privilege or power to be equal participants in the production of knowledge capital [6]. This exclusion not only omits their input from the conversation, but also gives dominant voices more of a platform to speak on their behalf and make normative assumptions of what is required to help or treat them.

Current research still fails to address how our culturally accepted truths influence medicine and science, and will likely continue to do so in the future. Because there is always a human doing and interpreting scientific research, it is almost impossible to separate societal context and science. Narratives around obesity, for instance, are often developed and amplified within a larger trend of fatphobia and arbitrary measures of "healthy" BMI which develop into scientific discourses on "curability" through simple diet fixes that will cure the gut microbiome or detox the body. These notions completely overlook why there is even an urge to "cure" these "diseases" in the first place and how much of the widespread fear stems from cultural norms. Even the field of genetics carries the dark remnants from eugenics, a heavy past aimed at purifying the nation's body of racialized and disabled communities. Thus, I urge scientists and healthcare professionals to

reevaluate the way we approach so-called "neutral" questions, and investigate why it is we ask certain research questions. Who are they helping (or hurting)? How are we acquiring this knowledge? How might the things we know be shaped by a broader normative framework?

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The Small Change, Big Impact: Reframing Language in Healthcare

by Ankitha Kasavaraju

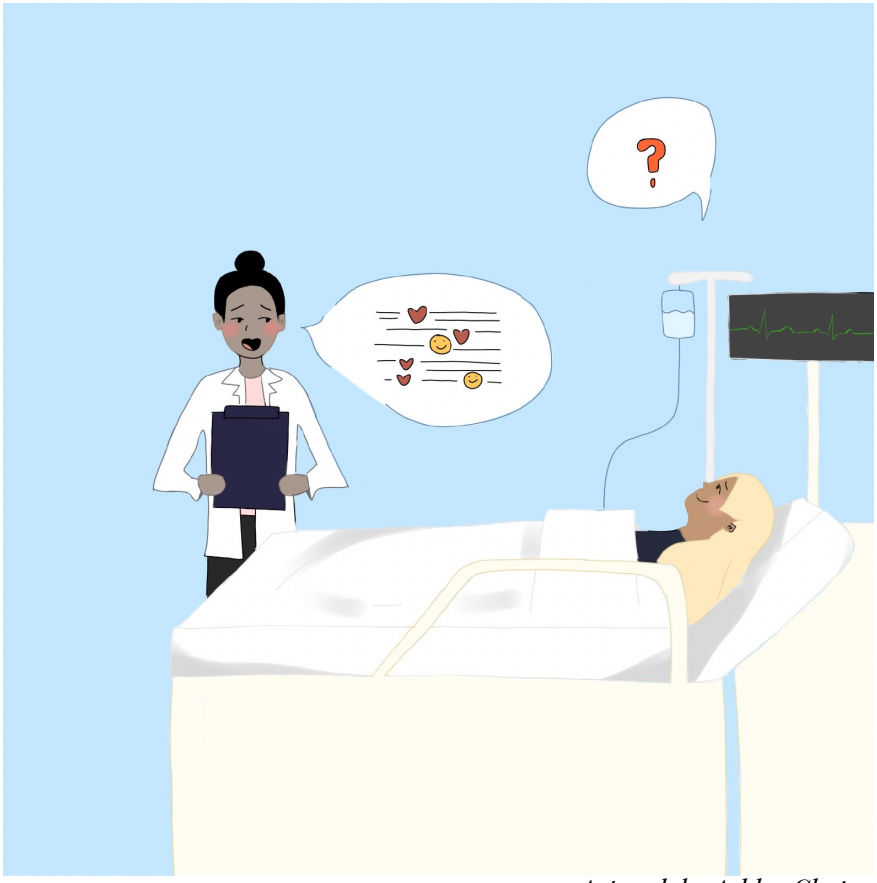
"I am eating healthy because I am on a diet."

"I am eating healthy because I am a healthy eater."

The change is small, but the effects can be dramatic. It is no question that the language, words, and phrasing of what we say plays a significant role in the changes we mean to bring. Learning how to reframe public health messaging effectively has been in the spotlight since the COVID-19 pandemic, where confusing and weak messaging contributed to the spread of the disease. Since then, more research has studied how language affects a population's and lifestyle habits—and how shifting messaging away from more traditional scientific facts—could prove to be effective.

Reframing messages in the public health sphere from scientific jargon to messages that appeal to values has been proven effective [1]. The National Institute of Health (NIH) published a study on message framing for mask-wearing during the COVID-19 pandemic; results of this research showed that loyalty-framed messages improved the frequency of mask wearing among participants compared to messages on scientific information. Differences among conservative and liberal participants were observed as well in similar studies, showing that mask-wearing behaviors improved in liberal participants when directed to messages on care and fairness in mask-wearing [2]. These studies not only demonstrate how reframing messages from purely scientific facts to value-based messaging can be used to improve public health outcomes, but they also demonstrate how adjusting messages can help public health organizations target specific populations.

Reframing can give ideas about individual health as well, especially when it comes to obesity and weight loss. A comprehensive study done on reframing weightloss across nationalities, gender, and race have all shown common themes from participants' journey in their weight loss, including changing their terminology in the subject and how they defined their relationship with food [3]. For example, participants noted that moving away from using the word "diet" to describe changes in their eating habits to "way of life" or "lifestyle" had changed the way they saw their new eating habits. By moving away from the word "diet," participants could avoid seeing their changes as temporary and restrictive. These alterations demonstrate how reframing can be effective in creating sustainable change in participants and creating shifts to their mindset on weight loss. Additionally, it was commonly found that participants would reframe their



Artwork by Ashley Chopra

relationship with food, changing their definition of food from a comfort item to "fuel." While different participants modified their definitions of food in different ways, the studies together demonstrate how changing the meaning of food for participants can alter their behaviors and gear them to their weight loss goals [4].

Participants in these studies also mentioned that reframing behavior goals and identity influenced their weight loss journey. Instead of focusing on shedding pounds and losing weight, participants shifted their goals to improving health and their lifestyle, appealing to their values of a sustainable lifestyle. Additionally, it was noted that some participants reframed their own identity—describing themselves as a "runner" instead of someone who simply runs. Reframing their identity helped participants build their lifestyle, as being a runner required eating healthy in order to run well [5].

In conclusion, the power of language and reframing is evident both in public health messaging and personal wellness. Lessons from the COVID-19 pandemic emphasize shifting from data-driven to value-based messaging, improving outcomes, and targeting diverse populations. On an individual level, reframing one's relationship with food, weight loss, and lifestyle fosters sustainable change. This comprehensive approach to language and mindset has the potential to enhance public well-being and promote lasting health and lifestyle improvements.

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Environments for Exercise in NY City and State

by Christopher John Arroyo, Health Care Policy '23

State variation in environmental policy, both in our built and natural environments, may prove insightful to state variation in lifestyle and exercise habits among residents. Both lifestyle and physical activity are essential requisites to an effective preventive health model, very likely improving health outcomes in the United States while reducing waste and costs. New York State provides a lovely microcosm for the question of "exercisability." Always making for an interesting case study, New York State has over eight of its nearly 20 million residents located in New York City and the remainder are dispersed through wide suburban and rural geographies. These urban and more rural natural environments and populations experience a range of weather conditions throughout a given year. Thus, if New York can successfully facilitate physical activity among its population, nearly any and every state can follow in its footsteps.

Nationally, New York State ranks only behind the state of Hawaii for its natural environment in U.S. News's "Best States" rankings, making New York the top-ranked state in the continental United States. Said rankings incorporate the pollution health risk index, the air quality index, water quality, and other measures [1]. Nevertheless, NY ranks 8th in terms of adult non-obesity rates, with an obesity rate of 29.9% in 2022 [2]. Further, compiling data from 2017 to 2020, NY sits at having a just-over-average rate of physical inactivity of 25.9% compared to a national mean of 25.3%. This makes New York one of the 21 most physically inactive states [3].

Perception of greenness, trees, shaded outdoor areas, and nature in a given neighborhood, for example, are well-associated with physical activity among occupants [4]. For older adults, physical activity can be especially important, where inactivity can contribute to frailty and thus more inactivity. Outdoor fitness equipment and outdoor gyms, more common in European countries compared to the United States, improve physical health, mental health, and socializing among older adults, based on self-reported data [5]. Another study found that older adult utilization of an outdoor gym for moderate to vigorous physical activity increased from 1.6% to 5.1% of users in the year after the gym's installation, helping to normalize exercise for this demographic [6]. As heart disease, cancer, stroke, Alzheimer's, and diabetes are among the top ten causes of death in the United States [7], aerobic exercise should likely be prioritized over resistance exercises, which admittedly promote a musculoskeletal strength uniquely valuable in older adulthood [8]. Returning to the built environment, physical activity is strongly associated with an area's "walkability," which is a metric based on walking option availability such as with sidewalks, mix of residential and commercial land, and access to destinations of interest or local transportation [9].

Though New York State excels on our natural environment, it is time to deeply consider our built environment policy as a way of in-part addressing trends in New Yorker inactivity, obesity, and

Artwork by Jenny Li

health. From Scenic Hudson v. FPC's protection of Storm King Mountain to our clean-up of hazardous school grounds in Love Canal, we have a rich judicial history in environmental law [10]. Looking at New York statutes, our Obesity Prevention Programs, for example, focus primarily on health care provider education and public health information campaigns, with only one component that more actively seeks to create healthy schools and communities [11]. Operationalizing a campaign focused on increasing the physical activity of New Yorkers does not require a reinvention of the wheel; both precedent and roadmaps exist for us. The New York Health Foundation, for example, is a private organization that has to a degree stepped in for New York State in funding activity-focused initiatives and investments on a local level [12]. Additionally, academically proven frameworks for physical activity environment policy are readily adaptable, conceptualizing both policy and infrastructure implementation as well as providing best practices for governments to adopt [13]. In advancing beyond only traditional health care system reforms, New York has an opportunity to earn back dividends on an investment in physical health as well as lead the nation in health policy innovation.

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Too Matcha: The Overconsumption of Caffeine

By Leyna Hoang, Biological Sciences '27

Every time anyone walks into a grocery store, arrives at class, or scrolls on TikTok, caffeinated drinks appear instantly. Whether it is an energy drink, coffee, or tea, there is no escaping caffeine's overwhelming presence around teens, adults, and even children. It has taken over the beverage market as well as control of the population through people's high dependency. Although there can be many health benefits of caffeine, the stresses of school and the influence of content creators and social media incentivize a quick "fix" for many people's energy levels, resulting in overconsumption of the tasty drug.

So, what is caffeine, and is it safe? Caffeine is categorized as a member of a drug class called stimulants. Stimulants increase the activity throughout the brain and body by altering its chemistry. Stimulants can improve someone's potential heightened alertness, confidence, and more. According to the FDA, "400 milligrams a day" is the maximum amount not associated with harm for most people. However, it still requires consideration of age, medications taken, health conditions, and more because this number is not the definite maximum for everyone [1]. Apart from the caffeine quantity, separate ingredients that typically accompany caffeine products can also be harmful. The rise of high-energy drinks, such as Prime or Celsius, come with loads of sugar (or artificial sweeteners) and health issues that incite panic around the world. These caffeinated drinks with high sugars provoke dental cavities and increase obesity on top of the already present caffeine-induced side effects such as increased heart rate, nausea, insomnia, and more [2]. When people ignore the FDA's recommendations, problems can arise.

Artwork by Flavia Scott

One focus group that repeatedly overconsumes caffeine is college students. On average, many college students consume 400-500 mg of caffeine a day, breaking the threshold of moderate amounts [3]. College students today are tasked with impossible schedules and rigorous course loads, requiring them to obtain energy throughout the day, and sometimes into the night, from sources other than sleep. As people continue to consume caffeine, a tolerance begins to build over time as they become accustomed to the routine. Their body adjusts and reacts to caffeine less. This causes people to drink more and more caffeine to achieve a certain level of energy.

Overconsumption of caffeine does not only affect college students, it can involve children too. In recent years, more and more children are consuming caffeine. Bright and colorful packaging, fruity flavors, and the marketing of energy drinks as fitness drinks create the illusion of having great effects on the body as well as drawing children into drinking them [4]. Social media and marketing play a significant role in influencing its users. Content creators like Logan Paul and KSI, creators of Prime, and Charli Damelio, who has a cold brew drink named after her at Dunkin, both directly and indirectly influence people to consume caffeine. They advertise their products to their young audiences without knowing its full effects. In addition, children unintentionally receive caffeine through less obvious ways, such as soda. Children and adolescents are continuously developing, and consistent intake of caffeine alters the natural progression of growth. Caffeine's complete effects are still unknown, but it can cause increased anxiety, increased heart rate and blood pressure, acid reflux, as well as sleep disturbance [5]. Most children do not need caffeine to get through the day, but rather drink it for its aesthetics, image, or alluring concept.

Government regulations are needed to ensure the safety of minors as well as to bring awareness to the potential harms of caffeine overconsumption. The occasional Starbucks drink here and there is satisfactory. However, caffeine intake often transcends into a socially acceptable, but still harmful addiction.

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Life [Expectancy] in the Southern United States

by Finley Allen, Human Biology, Health and Society '27

The southern United States is defined by more than its geographical location. These states share a unique mystique characterized by long syllables, cowboy boots, and country music, but there's another commonality unique to the south—southern residents have shorter lives than the rest of America [1].

In southern states like Mississippi, Louisiana, Alabama, South Carolina, Kentucky, Arkansas, and Tennessee, the life expectancy is approximately five to ten years lower than in other American regions [1]. Although the specific cause remains hotly contested and undefined, different studies and sources pose various theories regarding this discrepancy and endemic mortality rate.

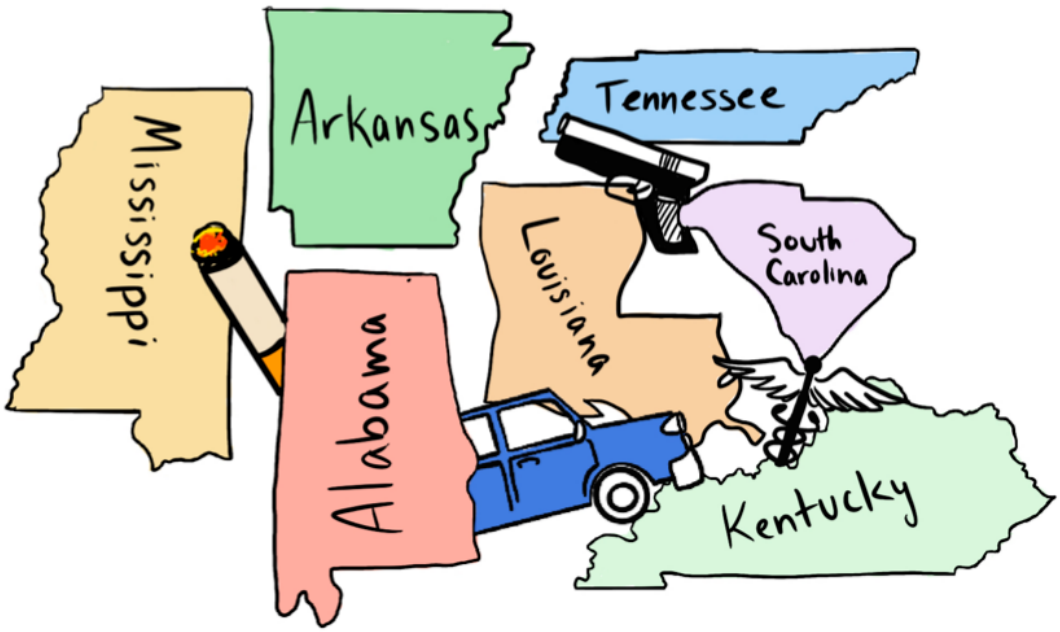
In a longitudinal study spanning 49 years, Nathan T. Dollar, et al. examined specific disadvantages Southerners face and the impact they have on life expectancy. Dollar found that young people, ages one to 24, who live in the south experience high mortality rates due to gun violence and motor vehicle crashes [2]. It is widely known that southern states have few firearm regulations. The prevalence of guns, paired with a lack of proper training, will invariably contribute to more deaths, but it's not likely that motor vehicle crashes contribute significantly to the disparity in life expectancy across all ages. According to the Insurance Institute for Highway Safety (IIHS), driving at higher speeds is directly proportional to more motor vehicle deaths [3]. However, speed limits are not significantly higher in Southern states [3]. Furthermore, the South does not appear to have a higher total traffic fatality rate when compared to other American regions [4]. This does not negate Dollar's conclusion; it does, however, mean that the life expectancy in the South is influenced by more variables.

An article published by Texas A&M University asserts that Southern state residents are subject to a slew of health-related challenges due to a lack of public smoking bans, limited walkability, and a shortage of primary care physicians [5]. It stands to reason that these factors will also cause higher mortality rates. After all, cigarettes are carcinogens, sedentary lifestyles cause obesity, and, according to an article published in 2019 by Stanford Medicine, the availability of primary care physicians is inversely proportional to mortality rates [6].

Fortunately, new legislative acts are starting to address these problems. For example, in August 2021, the Biden-Harris Administration passed the Emergency Rural Healthcare Grants to provide funds to rural healthcare facilities to expand and serve more people in these regions [7]. Unfortunately, legislation can be slow and is often subjected to arduous bureaucracy, so some non-governmental organizations are creatively addressing these problems.

The Association of American Medical Colleges noticed that physicians from rural areas are the most likely to practice in these communities. In 2016 and 2017, however, aspiring physicians from rural areas made up less than 4.3% of the national matriculating class. By incentivizing students with automatic admissions and recruiting directly from rural communities, medical schools are seeing an increase in this demographic, a trend that is expected to continue rising [8]. This is a good start, but more should be done to solve this systemic problem. However, there are very limited financial resources to incentivize physicians to practice rurally.

Passing multifaceted legislation to combat these fundamental causes is also imperative for raising southern mortality rates. Simple policy action can eliminate public smoking, legislatures can fund public parks to build trails for walking, and additional government



Artwork by Nava Lippman

initiatives like the Emergency Rural Healthcare Grants, can help bring primary care physicians to these regions.

Additionally, as in any "boots on the ground" work, equity must always be at the forefront–do these programs reach all rural communities equally? Or is there still a disparity between socioeconomic statuses, genders, and ethnicities? If so, rectifying this will take federal legislation and intentional work by the program directors and intentional action by these medical schools.

Do lower life expectancies in the south stem from gun violence? Sedentary habits? Healthcare accessibility? The simple and sad fact is that the answer is complex and multifaceted. Legislation must be improved to provide better education and stricter regulations on firearms, public infrastructure needs to improve to make cities more walkable, and physicians need to move to the south to help treat those in need. Though it is certainly an intimidating task, it is not insurmountable; average people, when coalescing, have great power to make change! Write a congressperson demanding action, listen to Southerners about their experiences, sign petitions, donate to southern organizations, and, above all, proceed with compassion. As human beings, it is our responsibility to ensure that all people have equitable access to health resources. Fixing this daunting task begins here and now.

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The U.S. Government Pandemic-Proofs Nursing Homes

by Carla Hu, Human Biology Health and Society '26

Think for a minute. Where might you be living at the age of 65 or older? For many Americans, that answer will be senior assisted living communities, also known as nursing homes. In 2017, a CDC survey revealed the U.S. has 1.3 million nursing home residents. More than a third of these individuals suffer from dementia and require 24/7 care from skilled registered nurses (RNs) [1, 2]. Nursing homes are a key part of long-term healthcare in the U.S., but debates on quality of care and cost have become increasingly prevalent among families and medical professionals. 67% of nursing home residents, many of whom are racial and ethnic minorities, live in Medicaid-funded homes, which often suffer from lower ratings and staffing shortages compared to privately-funded nursing homes [3, 4]. A study on Connecticut nursing homes during the pandemic found private nursing homes with higher RN staffing could better control the spread of disease by 22% fewer cases and 26% fewer deaths compared to homes funded by Medicaid or had larger ethnic minority residents [4]. As a result of these pandemic-related studies, the U.S. government has recently taken action to improve elderly care facilities as these long term deficiencies in the health care system have come to the forefront.

During the State of the Union Address, the Biden administration introduced new nursing home policies as post-pandemic measures meant to protect elderly individuals and increase nursing home regulations through The Centers for Medicare & Medicaid Services (CMS). The CMS is a federal agency that oversees nursing homes through state surveyors who inspect for deficiencies and give citations when regulations are not met. In 2015, seven percent of facilities had no deficiencies, whereas per facility, there is an average of 8.60 deficiencies [5]. The most common deficiencies included quality of care, infection control, and food sanitation, all of which reveal a concerning need for improvements, especially post-pandemic [5]. One of the proposals offers that the CMS will set a federal floor for staffing levels, known as the 24/7 RN rule [6]. This policy side-stepped the staffing debate in nursing homes by allowing facilities to continue enforcing the "sufficient" staffing policy of 2.45 hours of nursing care per resident daily [6, 7]. According to a 2001 CMS funded study, 4.1 hours was found to be adequate staffing, which is far above the current requirements [7]. Much of the proposal is "pandemic-proofing," which include increasing the accountability of nursing homes and penalties for low rated nursing homes, requiring infection control specialists in facilities, and furthering policies to regulate nursing home management [6]. These policies may prevent current abuses in management and poor conditions in low rated nursing homes, but for facilities with just "adequate" conditions, elderly care still suffers from deficiencies in quality of care and individualized attention.

Artwork by Angela Yuan

According to several studies, the key issues the US government should be "pandemic proofing" against should be done by developing variations of specialized care and health conditions among nursing home residents [6]. About half of nursing home residents do not stay long-term, but the individuals who do should consider staying at centers with programs dedicated to their specific medical condition, rather than placing the specialized work on nurse aides who often struggle to find time to provide adequate care [2, 7]. Residents with dementia or memory conditions may find memory centers specifically designed to meet the needs of such patients as a better fit for long-term health [8]. The U.S. government overlooks the potential in these specialized programs as opportunities to help ease the rising number of nursing home residents, failing to see the value of individualized healthcare. A study found that long-term residents who have complex medical conditions such as multiple comorbidities should consider smaller facilities with fewer beds and higher quality care [8]. Green Houses, or small nursing homes, are long-term care facilities.

that provide small homes with outdoor space and numerous rooms, rather than traditional nursing home complexes [8]. A study on small nursing homes compared to CMS data found that Green Houses had infection rates of 2.92 cases per 100 residents, while traditional nursing homes with less than 50 beds and more than 50 beds were, respectively, 5.48 and 27.0 [9]. These facilities may also reduce hospital admissions, lower use of medications, and offer a higher quality of life to the residents [9]. Currently, this model is unrealistic for nursing homes to undertake without any external funding, but it reveals a viable nontraditional living option [8].

Simply put, we should value the new post-pandemic measures set by the U.S. government, but we should also be aware that decreasing the understaffed and crowded nursing home facilities to smaller or more specialized programs could potentially lead to permanently safer conditions, in addition to more individualized care [10]. These ideas would create a mutually beneficial environment where patients receive more attention for their specific health conditions and staff are able to connect and care for patients on a more personalized level. The U.S. government has begun to introduce changes to nursing homes, but we must continue down this path to address further lackings in elderly healthcare in order to guarantee adequate and safe living conditions for our future.

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Critical Lifelines: Air Ambulances in Rural America

by Gina Lombardo, Health Care Policy '24

One-fourth of Americans are unable to access emergency medical care within an hour's drive from their home. Across the nation, small rural towns are facing a silent, yet deadly, crisis as rural hospitals continue to close and access to care becomes increasingly limited. Since 2010, more than 80 rural hospitals have closed, and an estimated 700 more are forecasted to shut down by 2028, according to the National Rural Health Association. The impact of hospital closures extends far beyond rural communities, however, as many of these communities comprise the backbone of our agricultural and industrial sectors. With an impending threat that can limit access for 85 million Americans to local healthcare services, the utilization of air ambulances is more vital than ever [1].

Air ambulances serve over half a million patients each year and have become increasingly important in the delivery of emergency medical care within the last decade. In rural and remote areas, patients have a significantly higher risk of injury-related deaths compared to those in urban areas due to the high physical demand of their livelihoods . Additionally, rural geography and demography pose fundamental challenges for EMS ground transport, as time, terrain, and delayed notifications prolong the time between the emergency incident and the patient's arrival at a hospital. Furthermore, most EMS services in the United States are locally-based organizations that rely on volunteer efforts and have limited financial means. Without adequate resources in such communities, providing sufficient care to vast regions is incredibly challenging. Even when patients do receive care at a facility in a remote location, they often require transport to a larger hospital for advanced or critical care. Commonly referred to as the "Golden Hour" after an emergency event, most patients only have approximately 60 minutes to receive life-saving care before their chances of survival dramatically decrease [2]. This is ultimately why the utilization of the air ambulance is an essential link in the chain of care;it exists as a necessary medium to increase patients' likelihood to get to the other side of their "Golden Hour."

Air ambulance crews typically have one pilot, one paramedic, and a flight nurse. The North American model does not employ the use of a physician on the helicopter, but this can vary depending on demand for care in different regions of the country. Pilots, nurses, and paramedics on board the aircraft all require extensive training in both medical and flight procedures, and essentially compose a 3-person flying intensive care unit (ICU). Renee Delau, a flight nurse for Lifenet in Saginaw, Michigan, speaks to the importance of air ambulance services, explaining that they serve the "sickest of the sick and most critically injured patients" on a daily basis [3]. Delau and her team respond to accidents and hospital-to-hospital transfers, predominantly in rural areas, in which time is of the essence. "We don't know what we're responding to until we get in the air, which adds to the thrill of it all," says Delau. Through her 13 years of being a flight nurse, Delau has become highly calculated and efficient in every one of her decisions, as the size and limited personnel on the aircraft forces her to apply her skills to real-life situations. Delau notes, "It's not like being in a hospital where you have unlimited resources to tap into, it's just you and your partner" [3].While there is a variation of different helicopter models suited for medical transport, most of them are a fraction of the size of a hospital room, but have the exact same capabilities. The cabin is equipped with infusion pumps, ventilators, heart monitors, and intubation equipment, allowing paramedics and nurses to practice just as they would bedside. Virtually any injury or illness can be treated, or at least stabilized, in these "flying ICU's," which speaks to their importance in protecting and preserving healthcare access across the country - especially in rural communities [4].

Artwork by Flavia Scott

There is a major drawback in utilizing air ambulances as the primary EMS response in rural areas: the costly price. The median price for an air ambulance trip is $36,000, and the cost of operating just one flight can range from $6,000-$13,000, on average [5]. This cost poses a major problem for Americans in rural communities, as they are historically more uninsured than not. The reimbursement rates provided by medicare and medicaid are also inadequate in comparison to the hefty price tag, and even private insurers fail to cover a significant portion of these services. However, a bipartisan group of lawmakers in both the House and Senate have proposed

an act which would require Medicare and Medicaid to develop a fair payment system and fix reimbursement rates - making such care accessible to people who need it most [6].

While the cost certainly imposes a challenge, there is a clear and impactful benefit through saving thousands of lives by using air ambulances. Ensuring good access to quality healthcare for these rural communities that compose the backbone of our society is not an option, but a life-saving necessity.

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Celsius Takeover

by Lauren Peysakhova

College is very fast-paced. Students are always on the go, trying to find time to keep up with their assignments, ace tests, socialize, exercise, and keep in touch with family. With all of this pressure to excel in many areas of life, students often put sleep aside. This lack of sleep results in a lack of energy throughout the day. Many students find that they need quick fixes to overcome their lack of sleep and continue to conquer the day. One quick fix has been Celsius

Celsius is an energy drink that was first released in Sweden in 2009 and has only gained traction in the United States in the past few years [1]. This drink has been a big success in the energy drink department and claims to be completely healthy [1]. This product is marketed as carb-free, vegan, and containing only natural flavors and different vitamins [1]. Celsius provides around 200 mg of caffeine and results in a quicker energy boost than coffee [1]. However, there have been many controversies over this energy drink. An American lawsuit showed that an ingredient within Celsius is not FDA-approved and that Celsius has misleading labels [2].

Celsius has a lot of good ingredients. The Metaplus proprietary blend that the company promotes contains green tea, caffeine, guarana seed extract, taurine, and ginger root extract [2]. Green tea has plenty of antioxidants and caffeine. Guarana is a weight loss stimulant and also another source of caffeine. Taurine improves metabolism and memory, and lastly, ginger root extract has more antioxidants and anti-inflammatory attributes [2]. With these ingredients, what could be so bad about this energy beverage?

The issue is guarana: it is not an FDA-approved ingredient. Therefore, it limits Celsius from being FDA-approved [3]. Guarana is a plant found in the Amazon and is used for losing weight, enhancing athletic performance, acting as a stimulant, and reducing mental and physical fatigue [4]. Guarana contains caffeine and thus boosts the central nervous system, heart, and muscles. There is insufficient evidence, but certain studies show that guarana can help with anxiety, mental performance, and weight loss [4]. Guarana can also be considered a superfood because of the quick and intense impact that it has on the human body compared to caffeine alone [5]. In addition, it also has amino acids and provides a boost in focus and concentration.

So why is this an important ingredient to address when looking at the energy drink Celsius? It is because guarana is considered to be medicinal, and there have not been enough studies done to conclude whether this plant is safe to consume in small amounts [6]. When looking at the ingredients in Celsius, guarana is not the only source of caffeine [3]. Although Celsius does state that there are 200 mg of caffeine, it is unclear whether or not that is the true value. Combining multiple caffeine-containing ingredients,

Artwork by Amber Briscoe

without full knowledge of the effects of guarana, poses a risk and can have unintended consequences. This is especially since there is limited information about the effects of too much caffeine on our bodies [3].

With the current lack of information surrounding guarana and the amount of caffeine actually present in Celsius, it is recommended that consumption of the energy drink is limited. As with all caffeine-containing products, some symptoms include increased blood pressure, heart palpitations, and anxiety [7]. Nutritionists do not recommend drinking Celsius, or other energy drinks for that matter. However, they do not feel the need to limit it entirely [2]. Celsius may be a better alternative to other energy drinks, due to its lack of sugars, but moderation is still key [2].

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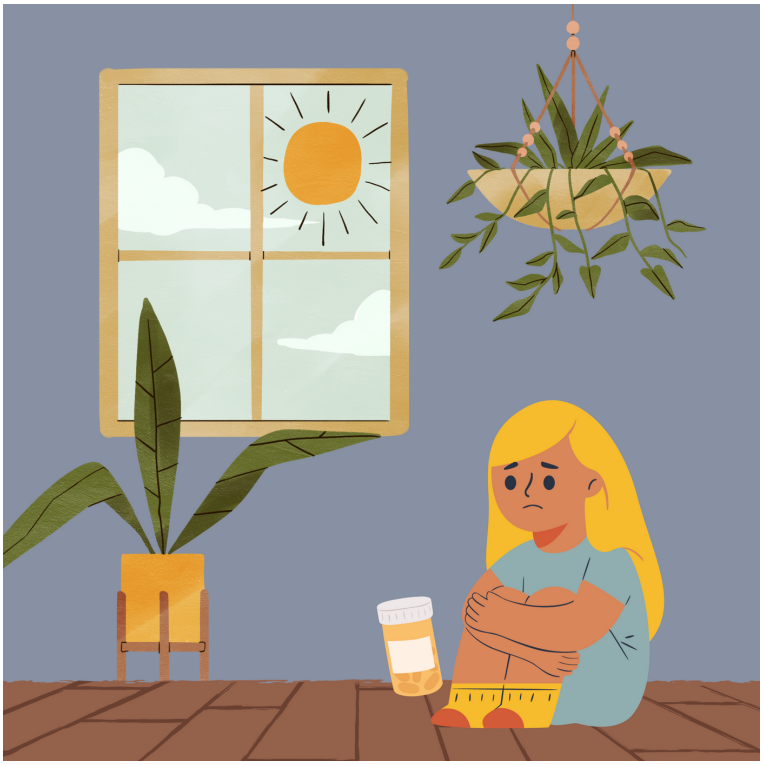
Could Ecstasy Offer Hope for Trauma Survivors?

by Emma Davila, Human Biology, Health, and Society '26

The drug ecstasy, or "molly", often has a negative stigma given its association with drug abuse. However, previously illegal and controlled substances are increasingly being approved by the Food and Drug Administration for various medical purposes. Ecstasy, or MDMA, is one of them. In a study conducted by MAPS Public Benefit Corporation this September, researchers found MDMA successful as a form of therapy for PTSD patients [1]. After the study, 72% of the treatment group did not display the symptoms to be diagnosed with PTSD [2]. MDMA-AT used with talk therapy was found to decrease PTSD symptoms and improve the quality of life for participants with moderate and severe PTSD [1]. These exciting new results offer hope of a brighter future for survivors of trauma with this condition.

PTSD itself faces stigma as a mental health disease, often being overlooked in the field of medicine and lacking needed research attention. In fact, the current therapies for PTSD are only proven to help 50% of victims, yet it affects roughly five percent of American adults [1]. Furthermore, one study found that various socioeconomic factors may lead to higher rates of PTSD in Black and Latino adults, suggesting there may be a specific need for a new type of therapy in certain marginalized communities and attention focused on how these groups are disproportionately affected [3]. In these communities and beyond in the United States, there is stigma around mental illness and a notion that mental health illnesses do not have a cure, leaving individuals with a sense of hopelessness. One doctor, Dr. Stephen Xenakis, a board-certified psychiatrist with published research on PTSD, even said that he feared many people struggling with PTSD feel so forgotten that the only option for them is suicide [1]. Recent studies have given hope to people with PTSD and if approved this therapy will be the first new development of its kind in over 20 years.

The study conducted by MAPS showed that more than half of the participants identify as ethnically diverse making it the first research study about psychedelic therapies with a diverse study population. 26.9% of participants identified as Hispanic/Latino and 33.7% identified as non-white [3]. Research studies, regardless of their focus, are historically known to have only white-male participants. According to the National Institute of Health, African Americans and Hispanics make up 30% of the United States population, but only make up 10% of genetic studies [4]. Many health conditions being studied have the greatest prevalence in marginalized communities [4]. This presents the question of whether the results of studies can even be generalized to greater populations, especially those needing the most help. Many non-biological factors influence the development of a disease, the likelihood of contracting it, and the response to a treatment [4]. Thus, research studies that lack a diverse group of participants create gaps in our medical knowledge. This issue highlights a notable element of the MAPS study, as the organization is placing an emphasis on creating options for low-income individuals to receive the new therapy including discounts and even free treatment [1]. It is efforts like these that will begin to close the gap of inaccessible mental and medical care for trauma survivors, yet these novel designs present their own hurdles to overcome.



Artwork by Flavia Scott

The legalization and approval of highly controlled drugs as medical therapies is captivating and offers inventive solutions, but because of drug abuse, there are barriers to overcome. MDMA has been a controlled, Schedule 1 drug since 1985, meaning that the FDA considers the drug to be at an extremely high risk of misuse [1]. Because there is a stigma associated with controlled drug therapies, gaining acceptance from the general public and dismantling implicit fear and bias will be difficult and will require powerful marketing campaigns and persuasive endorsement from respected physicians and healthcare providers.

Although it is still early in the approval process and it could be months until there are prescriptions available to the general public, the results of the MAPS study offer a glimmer of hope for people suffering from PTSD. MDMA therapy could be a trailblazing solution as other options like talk therapy and different prescription drugs are not adequately effective for trauma survivors today.

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Leqembi and The Costs of Cognition

by Kate Constan, Cognitive Science '26

The families of Alzheimer's Disease patients share a simple wish: more time and more clarity for their loved ones. Until recently, this seemed impossible. The cruel disease proceeds at its own pace, robbing people of their health, cognition, and autonomy. This year, that changed: a new drug for Alzheimer's emerged, one that could allow for previously unheard-of improved outcomes.

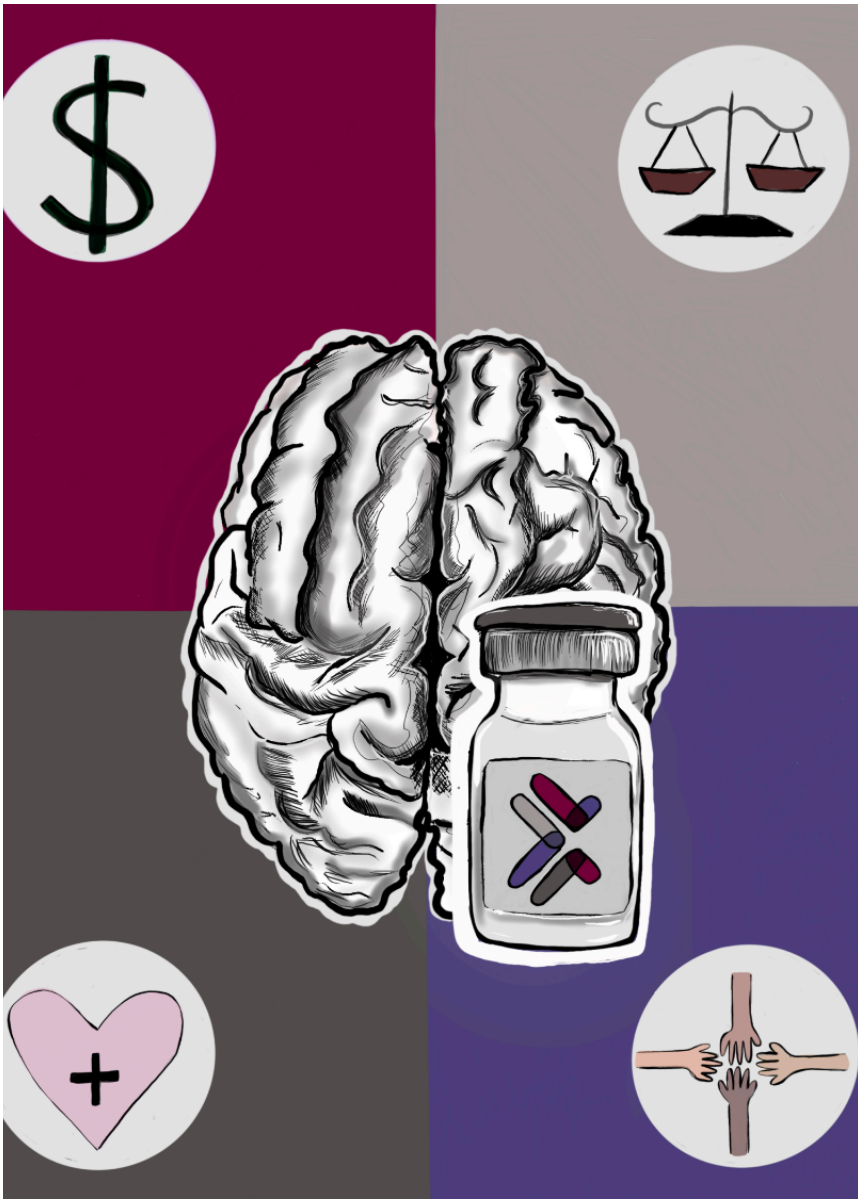
Lecanemab–marketed as Leqembi–is a breakthrough in the world of neurological drug development. It is the first, and currently only, treatment clinically proven to slow the progression of Alzheimer's, helping to preserve memory and function [1]. On biological and societal levels, Leqembi is significant.

Leqembi's efficacy was proven through an 18-month study using 1,795 early-stage Alzheimer's patients [2]. "Lecanemab in Early Alzheimer's Disease" by van Dyck et al. was published in its final form in the first days of 2023. Results showed a marked slowing of disease progression in patients treated with Lecanemab, but researchers noted "adverse effects" in the brain and cardiovascular system, mentioned little impact on late-stage patients, and urged for a longer longitudinal study [2]. Nonetheless, (and under pressure from advocacy groups), the FDA granted accelerated approval for Leqembi on January 6, 2023, and granted the drug traditional approval seven months later [3].

Leqembi is an intravenously administered drug that works as an antibody targeting amyloid plaques, which are believed to be responsible for Alzheimer's [2]. Specifically, Leqembi targets and breaks down harmful clumps of proteins called Aβ protofibrils in the brain, leading to slower plaque buildup, and thus, a slower progression of the disease [2]. This allows for an extended period of normal cognitive function for patients. While this by no means is a cure, it buys time for many patients hoping to stave off worsening symptoms.

Developed through a collaboration between Eisai Co. (Tokyo, Japan) and Biogen (Cambridge, Massachusetts), Leqembi was a product of international collaboration, which reflects Alzheimer's status as a global health crisis. The drug has been granted initial approval for use in both countries [4].

Alzheimer's Disease treatment is a powerhouse industry. The 6.5 million Americans suffering from Alzheimer's are estimated to have the highest impact on the economy of any disease: $321 billion [5]. This figure is expected to top $1 trillion by 2050 [5]. With this staggering expense, lucrative possibilities for addressing it emerge.



Artwork by Amber Briscoe

With a scientific breakthrough and a staggering number of people affected by the disease, it is easy to assume that Alzheimer's care will vastly transform. However, Leqembi's value is overshadowed by high costs and serious medical risks.

Unfortunately, some advances in healthcare are accessible only to those who can afford it. Currently, a Leqembi prescription and associated testing cost over $26,500 per year, leaving it inaccessible for uninsured Americans [6]. Medicare leaves gaps, not covering all aspects of Leqembi treatment, which includes testing and follow-up appointments. There are powerful and effective drugs that go unused due to cost barriers. Further, these barriers intersect with racial disparities. The elevated prevalence of dementia and reduced income levels among elderly Black and Hispanic individuals in the United States, compared to their white counterparts, could exacerbate inequities [7].

Eisai argues that the cost of Leqembi reflects its "social value" [8]. While

Alzheimer's detrimental impacts on society are undeniable, this argument is weak in the face of the families struggling to provide their loved ones with adequate treatments.

But even if expenses did not limit access to Leqembi, other problems remain. Leqembi is not recommended for individuals who are already in advanced stages of illness; only 15-20% of diagnosed Alzheimer's patients show mild enough symptoms to qualify [2]. Even for those who do qualify, there are continued considerations: the possible side effects may be staggering in severity and scale.

Slowing the symptoms of Alzheimer's is valuable, but how valuable? Atwood et al. titled a 2023 paper about Leqembi "Playing Russian Roulette with Alzheimer's Disease Patients," citing serious vascular consequences including stroke [9]. Other side effects include ARIA, or "Amyloid Related Imaging Abnormalities," which usually present as asymptomatic but can lead to swelling and brain bleeds, introducing issues like confusion and seizures [9]. Perhaps the most alarming warning comes from David Rind, the Institute for Clinical and Economic Review's Chief Medical Officer. Rind: "People are as dug in on this as almost anything I've ever seen in medicine" and that he doesn't "think it's healthy" [10]. While breakthroughs in medicine often draw speedy approval and wide press acclaim, our priority must always be health and safety.

The hopes of a patient and their family for more time and clarity might trump their fear of risks. As with any medication, Leqembi forces patients to consider the price they might pay for the possibility of better health that they seek. Each patient must consider if the ends justify the means.

Leqembi is still in its nascence and as it is used more widely, more data will become available about its accessibility and possible detrimental influences [2]. Reductions in cost and adverse effects should be addressed quickly and thoroughly. Despite criticism, though, Leqembi is still worth celebrating. While the cost and side effects are alarming, the development of this drug indicates a path forward for the treatment of neurodegenerative diseases.

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Vaccine Diplomacy and Biotechnological Advancement: An International Understanding

by Kylie Huber

Since the upheaval of the COVID-19 pandemic, the demand for vaccinations has created a geopolitical landscape in which the control of global vaccine distribution routes have translated to control over diplomatic ties. An example of a country that has learned to adapt to the growing influence of this "vaccine diplomacy" is mainland China. As a consistent major world player, China can best be viewed in what it offers both in the goods it offers to the public and in its emerging technologies. [1] At the intersection of these factors, the vaccine diplomacy strategies achieved by China have shaped more recent biotechnology business developments. An investigation into how China's vaccine diplomacy has impacted the biotechnology market and healthcare innovation is important in order to best broaden our perspective on pharmaceutical development across the globe.

To first understand China's influence on modern vaccine diplomacy, we can look to dissect its strategy with its long-term allies. China's distribution channels have been stronger than those of other non-Western nations, and China has therefore primarily committed itself to bolstering existing ties rather than expending resources on developing new relationships. These partnerships included Cambodia, Hungary, Zimbabwe, and Serbia [2]. This widespread distribution to both lower-income and high-income countries is not necessarily a means to challenge the strategies of Western countries – which have traditionally been viewed as economic powerhouses capable of rapid donation – but rather signifies the rise of China as a vaccine donor within its unique economic framework.

As a parallel to China's dedication to expanding vaccines to the public, China has also been intentional in its efforts to advance its technological output. The Chinese government implemented a state industrial strategy known as "Made in China 2025," which maintained biotech as one of its top sectors to focus on domestic technologic growth [3]. The pharmaceutical companies based out of China regulated their operations with the intention of competing with Western companies. This initiative appears to have potential for working toward their domestic goals. For example, there is a growing pharmaceutical market in China due to its increasingly aging population [4]. At a policy level, China's Basic Medical Insurance fund saw a 3.92 increase in spending from 2010 to 2020 [5], which will reveal a need for increased pharmaceutical research and development to aid these newly covered populations.

However, in more recent news, many investors outside of China have pulled finances out of several Chinese biotech startups, citing a lack of innovation and "risk-taking." More specifically,

Artwork by Joyce Wang

finances have fallen from $1 billion in 2021 down to about $102 million in 2022. [6] One potential reason for the pullback in investments can be revealed in the makeup of China's pharmaceutical firms: 70 percent of pharmaceutical developers in mainland China consist of only 300 employees or less and operate at a revenue of less than $3 million USD [4]. Additionally, while Chinese firms' close relationships with their prestigious universities is important to research efforts and is a shared characteristic they have with many developers in the United States, prioritization of patenting projects by individuals with personal accolades rather than the true nature of the work can have a net negative effect on the rate of drug development and commercialization. Both the sprawling nature of small pharmaceutical companies across the country and the prioritization of prestigiously-titled projects can make the decisions of investors increasingly more elastic, as both factors are connected by an undercurrent of structural problems in the industry.

This challenge to development can be overcome when collaboration is promoted among countries with differing economic frameworks. On the side of distributing public goods, while China's strategy in vaccine development primarily relied on bilateral partnerships, countries like the United States retained much of their development internally until they donated vaccines much later than non-Western countries like China [2]. Greater interconnection between the two potentially would have reduced the lag in the release of efficient vaccines, rather than making the process excessively competitive at the expense of the public good.

Furthermore, when looking at advancement in technology, export controls by China have made American business partners and investors more apprehensive toward biotech sector trade. A policy of over-securitization has had harmful effects to both parties [7]. In the United States, C-suite pharma executives often explicitly raise drug prices to astronomically high levels – for example, Isuprel, a heart medication, experienced an increase from $440 to $2,700 per dose after its developer acquired it from another – to suit the needs of their shareholders [8]. This pattern has been mirrored in China, with many high drug prices instead resulting from lack of payer negotiation power [9]. High drug prices in both countries are largely a result of a desire to please investors, leaving true technological growth in a slowdown as well as making millions of individuals pay steep prices in their day-to-day medication purchases.

Developers in the pharmaceutical industry, at the end of the day, look for complementary skills and offerings, without much discernment on the country a partner comes from [7]. Once this silo gets diminished, the two countries can stay abreast of the latest technologies and best serve both their own and their partner's populations.

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The Role Investors Play in Healthcare Innovation

by Cameron Meyer, Biology & Society and Economics

The healthcare market is attractive to many investors due to its volatility, potential for immense upside, and its tangible impact on society. Both private equity and hedge funds have had significant influence on the development of different industries through their allocation of capital. As these investors have historically been heavily engaged with the healthcare industry, I will explore their impact on the healthcare space from the standpoint of driving innovation through managing healthcare corporations.

Investors in the healthcare space include private equity firms, hedge funds, and venture capital firms. Private equity firms such as Warburg Pincus, Blackstone, and Bain Capital, and hedge funds such as Deerfield Management, Perceptive Advisors, and Pershing Square Management are prominent examples. While venture capital firms are also highly involved in healthcare investment, their capital commitments are to generally smaller companies and a more volatile sub-vertical of healthcare than the investments made by private equity and hedge funds. With an intensified investor appetite for healthcare companies, 2022 marked the second highest year on record for deal value for healthcare private equity [1]. On the other hand, healthcare hedge funds declined an average of 22.1%, a sharp contrast to the success in healthcare private equity investment [2]. To understand how each has impacted the healthcare space, we will consider cases that align with the general deal experience that each investor type is involved in.

Private equity has generally had a strong and positive impact on private businesses. It has a long track record of creating value for corporations and investors by improving operations, optimizing production, promoting innovation, and providing access to capital to support infrastructure improvements [3]. Studies have demonstrated that when PE firms acquire hospitals, their financial performance improves, their focus shifts from outpatient to inpatient care, and they increasingly adopt technological intensive service lines such as cardiac catheterization, advanced imaging, and robotic surgery [3]. Private equity's efforts in private healthcare are similar. In 2007, private equity fund Warburg Pincus invested in Bausch & Lomb, a developer, manufacturer, and marketer of ophthalmic products. After taking the company private, Warburg Pincus rearranged the management team and board of directors, guided management in developing expansion opportunities such as the acquisition of Eyeonics and the formation of the Technolas Perfect Vision joint venture. Warburg Pincus sold the company in 2013 [4]. Warburg Pincus' carried this success into the acquisition of JHP Pharmaceuticals in 2012 in which they assisted the company in commercializing 9 new drugs and opening new research facilities to focus on future product expansion [4]. Warburg Pincus' success in the healthcare private equity market is just one of the many examples of PE transformation of portfolio companies. This industrial development serves as a hallmark of how PE firms provide capital for development and expertise for growth.

Artwork by Michelle Choi

On the public side, activist hedge funds operate by purchasing large volumes of stock in a corporation and driving change through their voting rights on the Board [5]. Despite short term challenges in the equity markets, healthcare hedge funds have performed well over the long-term. Rising global awareness on pandemic preparedness, aging demographics across developed countries and the healthcare sector's independence from global macro conditions have enabled hedge funds to capitalize on the status quo [2]. Deerfield Management, a healthcare-focused New York City hedge fund, runs $14B and has made significant contributions to healthcare research. Deerfield is just one of many healthcare focused hedge funds that operates beyond solely buying equities and is actively engaged in building new drugs, healthcare services, and devices with their portfolio companies and partners [6]. With an experienced team of over 58 MDs, PhDs, and JDs, Deerfield has played a pivotal role in further developing its 150 portfolio companies. Deerfield Discovery and Development (3DC) is their in-house suite of biopharma experts with skill sets across the drug development spectrum that works with portfolio companies to expand into new territory. In addition, Deerfield's CURE is an innovation ecosystem for start-ups and entrepreneurs providing opportunities for networking,

expertise development, and access to talent and innovation. Deerfield also partners with universities and institutions to build out healthcare solutions. In June of 2023, Deerfield partnered with NYU Langone Health to launch a research and development collaboration designed to accelerate the commercialization of biomedical discoveries. Deerfield has agreed to commit up to $130mm for this effort.

Historically, both private equity and hedge funds have made immense contributions to healthcare advancement in the avenues of new drugs, innovative devices, and optimized services. Through managerial guidance, product development, and optimizing operations, these investors have transformed the healthcare industry and will continue to influence healthcare trends and focus in the future.

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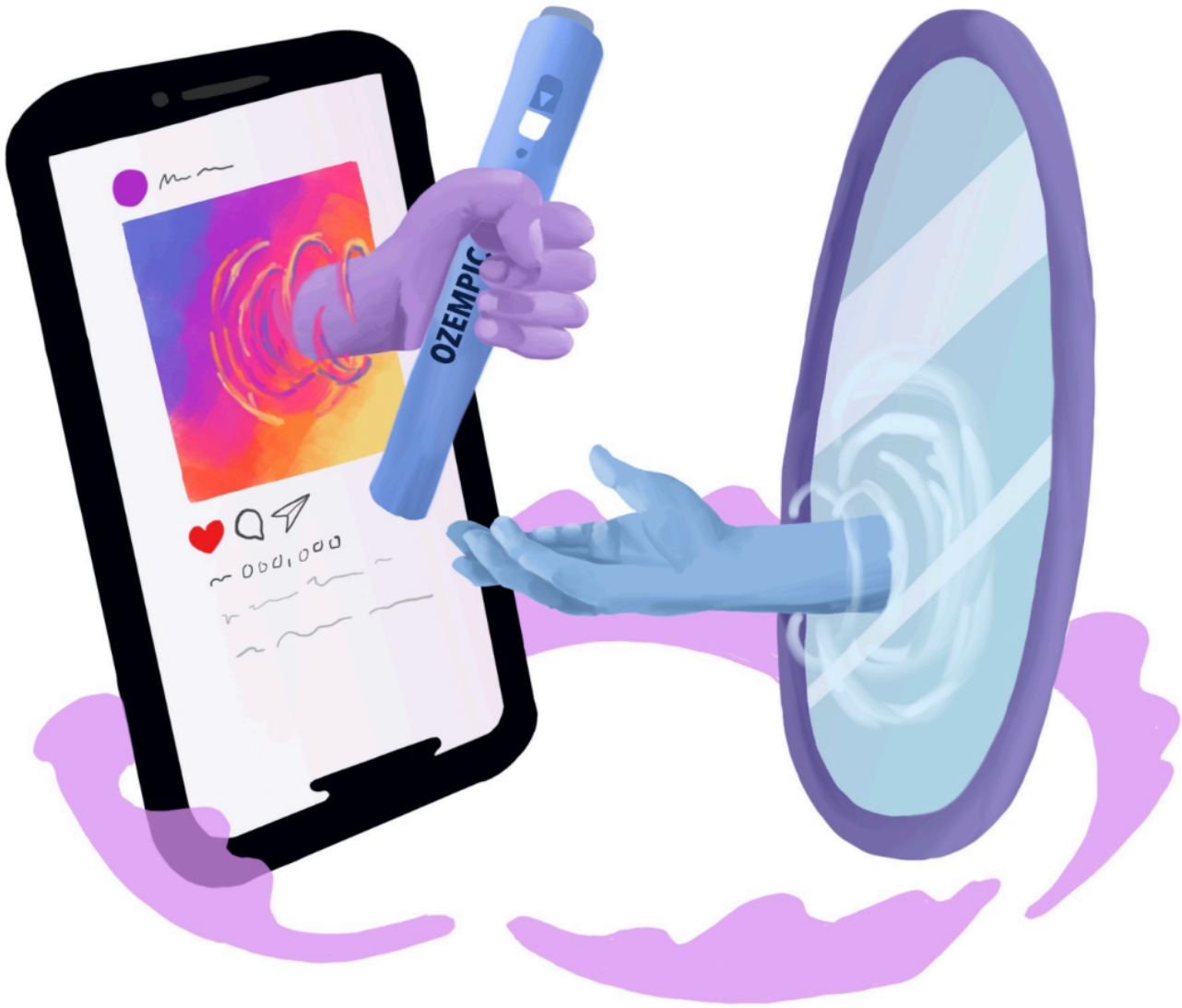
#Ozempic

by Mahesa Miah, Human Biology, Health and Society '26

We all want to look our best, but to what lengths will we go to achieve our ideal figure?

Ozempic (Semaglutide) is a medication approved by the U.S. Food and Drug Administration (FDA) for the treatment of type 2 diabetes. The drug is part of the broader class of medications called glucagon-like peptide 1 (GLP-1), where its receptors help lower elevated blood sugar levels [1]. Although its intended use is to treat type 2 diabetes, there has been a growing interest in this medication for its side effects, particularly weight loss. The off-label use of Ozempic for cosmetic weight loss has been glorified, adversely impacting the patients who need this medication to manage their type 2 diabetes. Influencers have advertised its "weight loss" effect on social media platforms, such as Tiktok. One post after another, and suddenly, the drug's availability is scarce. Now, pharmaceutical companies face a shortage of this medication, and patients who require it for its intended purpose–to manage their diabetes–are suddenly without access.

In a clinical study, subjects were taking 1mg/week of Ozempic, and results included individuals losing approximately 10 pounds over 30 weeks, nearly five percent of their body weight, and a waist shrinkage of 1.6 inches [1]. With these result supporting the glorified "weight loss" effect of Ozempic, it is clear why individuals would want to participate in the #ozempic trend on Tiktok with over 1.3 billion views. Although its side effect of weight-loss has received much exposure, it seems that the other side-effects have been neglected by the media. Aside from weight-loss, individuals taking Ozempic can also experience abdominal pain, diarrhea, and vomiting, among many other effects. Some of the major



Artwork by Fiona Reilly

side effects that can arise from taking this medication include Hypoglycemia (when used with insulin or sulfonylurea), Acute Kidney Injury, and Acute Gallbladder Disease [2]. Despite these potential side-effects, individuals who are prescribed this medication to manage their type 2 diabetes can expect positive results when they are monitored by a medical professional. However, there are instances where patients aren't diabetic and are still given Ozempic medication by medical professionals.

European countries, such as France, estimated that 2,185 patients were given Ozempic medication even if they were not diabetic. According to those values, around one percent of Ozempic prescriptions covered by state health insurance were "misused" [3]. Subsequently, France's national drug safety agency issued instructions in September 2023 where they urged doctors to only prescribe this medication for patients with type 2 diabetes and a history of stroke or heart disease [3]. Other countries, such as the UK and Australia have had authorities issue warnings to influencers that are promoting Ozempic online [3]. In the United States, certain insurance companies are only covering the medication for individuals who are diagnosed with type 2 diabetes. Though, some insurance companies do not cover the cost at all, even for individuals with diabetes. Without coverage, the cost of Ozempic medication begins at $3,800 [4]. Additionally, there have also been other recommended alternative drugs that can be taken by type 2 diabetics. The other recommended medications fall under the GLP-1 class, such as Trulicity, Victoza, Bydrueon, Rybelsus, Adlyxin, and Byetta. None of these medications can replace Ozempic, despite Trulicity and Byrueon having a similar weekly injections regime to the famed drug [5].

Ultimately, the shortage of Ozempic medication has resulted in a need for awareness in terms of healthcare availability and accessibility. In terms of availability, many individuals with type 2 diabetes who need Ozempic medication have been forced to find other alternatives due to its shortage from its increased popularity. In terms of health accessibility, patients with type 2 diabetes who are unable to afford the expensive cost of Ozempic are forced to find other alternatives that may not be as effective, whereas the influencers that receive profit off of their advertisement of Ozempic medication can continue to purchase it. This makes you wonder whether #Ozempic is worth the popularity, especially if it means creating a gap between diabetic patients and accessible medication.

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Modern Brain Drug Delivery: Innovative or Obsolete?

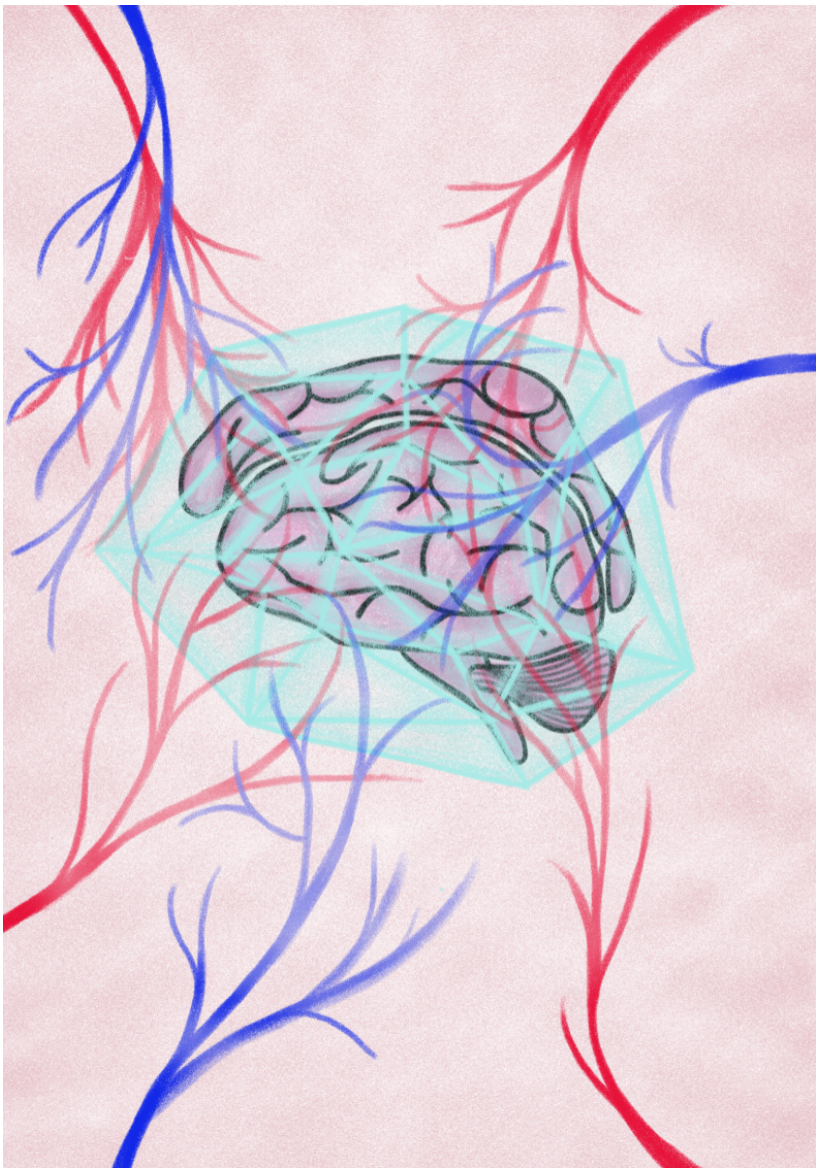
by Gwen Schway, Psychology '25

You may be familiar with various names of common therapeutics responsible for treating brain disorders such as Prozac which generic name is fluoxetine, Lexapro which generic name is escitalopram, Zoloft which generic name is sertraline, and so on. However, a lesser known fact is these therapeutics deliver a limited amount that can actually penetrate the blood brain barrier, which grants entry to the central nervous system. In fact, less than ten percent of small molecule therapeutics and less than one percent of large molecule therapeutics are able to penetrate this barrier [1]. The blood-brain barrier only allows drugs which are lipophilic, consist of positively-charged molecules, and have a molecular weight lower than 400 Da to penetrate [1]. This severely limits the range of drugs available to treat brain disorders. Larger molecules are unable to penetrate due to size while the membranes of cell molecules which are hydrophilic repel other hydrophilic molecules.

The question then arises: how do we get a drug into the brain without meeting these stringent criteria? The process is far from straightforward. Various methods have been explored such as osmotic disruption of the blood brain barrier [2], enhanced cellular transport [1], and nanoparticle delivery [3]. These are only a few of the methods that have been tested to allow drug delivery. Though efforts have been extensive, each strategy is associated with various limitations. Osmotic disruption of the blood-brain barrier is maximally invasive, enhanced cellular transport is associated with cell toxicity, while nanoparticle delivery is inefficient. How are we then able to contract diseases such as meningitis, AIDS, and leukemia, if it is such a difficult process?

The answer lies within evolution. Meningitis, AIDS, and leukemia have evolved the ability to bypass the blood brain barrier. In order to expedite the natural process, we are able to use the method of directed evolution. During research, genes that express proteins by the name of LY6C1 and CA-IV proved to be crucial targets associated with penetration of the blood-brain barrier. Though CA-IV is not novel, there was no previous association with mechanisms necessary to the penetration of the blood-brain barrier.

The team, understanding these evolutionary mechanisms, isolated LY6C1 and CA-IV, amplified, and ultimately subjected it to mutagenesis [4]. Using a cell culture screen, researchers tested each individual protein's ability to infect vectors. Scientists use a simulator to observe how the proteins would interact with each vector. This allowed the discovery of which vectors and protein pairings were most optimal to allow crossing which has the potential to further advance clinically effective neurotherapeutics.



Artwork by Michelle Choi

Researchers are excited about the potential of discovering additional methods to cross the blood-brain barrier. In the future, LY6C1 and CA-IV may prove integral to expanding the quantity and range of neuropharmaceuticals available to treat brain disorders [4]. The blood-brain barrier is highly complex, varying over an organism's lifetime. A greater comprehension of the mechanisms needed to cross the blood-brain barrier may enable personalized treatments across a wide array of populations [5]. This is undoubtedly a promising step to the advancement of delivering a wider range of neuropharmaceuticals.

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Case Closed? Neuroscience's Biggest Mystery, Uncovered

by Carissa Nair

The human brain is an enigma. While the neural processes that dictate our daily lives derive from this all-important organ, it is still unchartered territory. In short, there is much we don't know about neurological function and disorders. In the last decade, however, there have been several developments in the scientific field of connectomics in an attempt to address the uncertainty surrounding neural structure and function [1]. Connectomics involves the process of neural mapping, by which networks, cell types, and regions within the brain are charted and systematized to understand their implications for the field of diagnostic healthcare [2].

In the past few years, newly formed connections between pathology and neural structure have influenced significant advances in neuroscience. Zhu et al. explored how neural mapping algorithms that integrated functional and structural knowledge could be used to uncover diagnosis possibilities for epilepsy in 2021. While machine-learning had long been considered an effective tool of diagnosis for neurological disorders, there were some limitations to existing neural network models which these researchers addressed [3]. On the subject of treatments and disease—in 2022, Ye et al. observed the pathways of hippocampal neural circuits in mice with a virus tracking mechanism. Researchers were able to detect and map differences in circuits between control mice and mice that overexpressed the amyloid protein (a characteristic linked to Alzheimer's disease) [4]. Additionally, there were some attempts at refining this technology, stemming from the need to conclusively address the knowledge gap in neuroscience. Siddiqi et al. detailed the transition from correlational to causal neural mapping in a 2022 article, explaining how these techniques, when combined with imaging methods, could yield valuable information for disease treatments. These combinatorial methods could include altering disease symptoms through neural stimulation, comparative data processing from different brain regions, and understanding precise details of circuitry. These techniques have already yielded promising results for neuropsychiatric disorders and Parkinson's disease [5].

The implications of neural mapping do not, however, solely extend to pathophysiological progress. Some experiments with this technique are attempts to understand neural structure through improvement of imaging techniques, such as in the case of Sun et al. in 2022. These researchers attempted to investigate how a combination of PET and diffusion MRI imaging could improve images of gray/white matter in the brain through denoising [6]. Another example of this trend in structural discovery is the BRAIN Initiative Cell Census Network, where scientists mapped the mammalian primary motor cortex with combinatorial imaging and genomic analysis methods [7]. This scientific development is a sign of immense progress in understanding the previously-unknown complete structure of many functional regions of the brain—one of which *was* the primary motor cortex.

Neural mapping is a technique that can provide insight into a variety of medical disciplines. Mapping is the key to the future of neuroscience, especially considering the sheer amount of international initiatives created to address this novel technology. Some approaches to neural mapping deal with structure, while others determine influences on pathology and disease progression. Both are immeasurably important for healthcare, medicine, and scientific exploration.

Artwork by Audrey Trivedi

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