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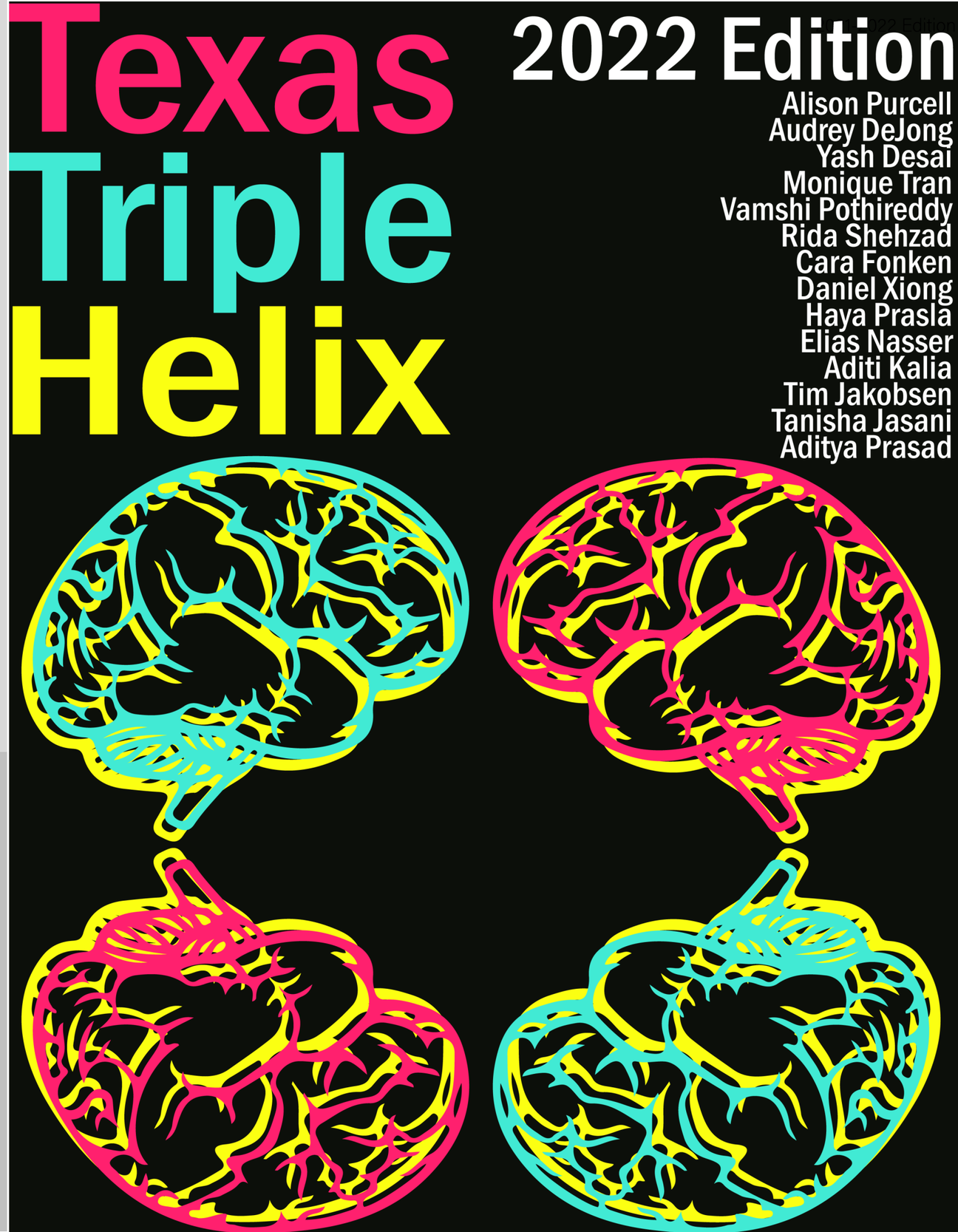

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Expert Letter

Play Outside the Shadow

By

Craig Hurwitz, M.D.

The famous Swiss psychiatrist Carl Jung coined the phrase "shadow" to refer to critical and often valued parts of our integral selves that we repress because they do not win acceptance or praise in the culture in which we live (1,2). Every culture diminishes the "wholeness" of its population by rewarding or withholding approval and judging aspects of a person in either a positive or negative manner. By placing specific characteristics of one's integral self into the "shadow," a culture effectively reinforces certain personal dimensions of its members while it negatively judges others. Thus, persons within any particular culture respond to the collective judgment of that culture by repressing those parts of themselves (i.e., placing those parts into "shadow") that do not win approval or respect. We currently live in a highly technological society that almost exclusively values intellectual and cognitive approaches to problems. According to Jung's model of the shadow, then, persons within our society who value an emotional or intuitive approach to problems will be less respected. To succeed, one would suppress these qualities and, consciously or subconsciously, put them into "shadow."

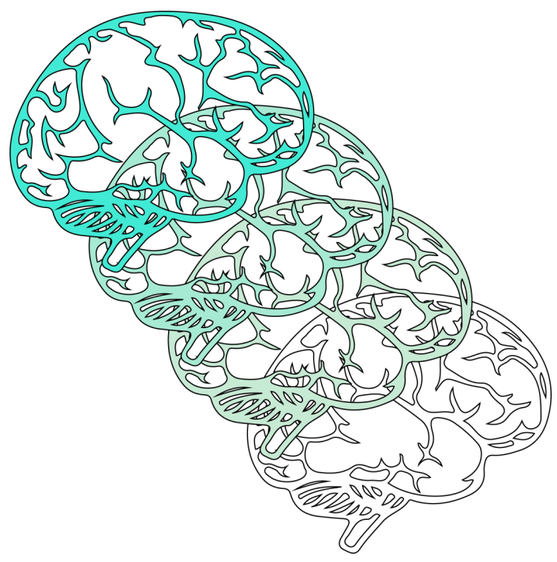
When important aspects and qualities that help define a person are placed into this "shadow," it may undermine that person's ability to achieve their fullest potential and can deeply affect the meaning of their work. In our current highly technological society, we value hard work, and we are often made to feel ashamed and guilty for playing (voluntarily participating in activities done for their own sake with no apparent purpose). Play is largely considered a waste of time for adults in our culture because it is a completely unproductive activity. But in the late 1990's, the Jet Propulsion Laboratory (JPL) at CalTech noticed something troublesome. It seems that the brilliant scientists and engineers (those who were responsible for figuring out how to put a man on the moon and who developed and constructed probes that are still exploring the solar system) who had joined JPL in the 1960's, were beginning to retire in large numbers. The JPL was consistently hiring new graduates from the top engineering schools to replace them, but something was missing in many of these new, young scientists. Unlike the older scientists and engineers, they seemed to lack certain problem-solving skills that were essential to their jobs. These new engineers had no problem excelling in the theoretical and mathematical problems at the limits of engineering, but they lacked the skill and ability to take these complex problems from theory to practice. The leadership at JPL serendipitously identified an article that described a similar problem to the one that the famed laboratory seemed to be suffering from. The article suggested that employees who had worked and played and used their hands as children were able to see possibilities and solutions that others could not. The JPL compared the retiring scientists and engineers to their new replacements and found a similar pattern. The retiring scientists and young graduates who played as children were generally able to see "solutions" and problem-solve in ways that those who had not played much, could not. Through their research, the JPL discovered that there is a kind of "magic" and a "cause to wonder" in the act of play that belies the foundations of innovation and creativity (3).

Repression of a person's highest and most valued aspects of their integral self may also dramatically alter the "personal meaning" of a person's work (4). "Meaning" is simply a person's interpretation and labeling of an experience. Everything that we do or participate in is an experience, and consciously or unconsciously is assigned a personal meaning. Taken in this context, meaning may not alter our lives, but it can certainly alter the *experience* of our lives[5]. Rachel Naomi Remen, MD writes of the Italian psychiatrist Roberto Assagioli who tells the following allegory of 3 stonecutters building a cathedral in the Middle Ages. Each stone cutter is asked what they are doing. The first indignantly replies, "Use your eyes! I take a rock and cut it into a block. It is taken away and I am given another rock. I have done this ever since I was old enough to work, and I will certainly continue doing this until the day I die!". The second stone cutter smiles and answers that he is earning a living for his family. With his earnings, he lets you know that he has been able to build a home, and there is always food for his growing children and his spouse. The third stone cutter raises his head with a look of deep joy and contentment and says, "I am building a great cathedral that will help others find strength and better know the path of their true journey." Having a personal meaning in work can open the most mundane of tasks to a dimension of great gratification, fulfillment, pride, and joy (5).

Overcoming shadow and allowing play back into your life can be difficult and challenging. Children play, but they are simply the most apparent connoisseurs of using their imaginations and creating fantasy around imagined characters through play. But all of us do it to one extent or another. We are all taught that "knowledge is power" and that the more answers you have in your toolkit, the better life will become. But it is important to focus on the questions rather than the answers because it is our questions, not the answers, that have great power to change the way we see and the way we experience things. The questions are what will eventually change our personal meanings. As the poet Ranier Rilke once wrote:

"Do not seek the answers which cannot be given you
Because you would not be able to live them
And the point is to live everything.
Live the questions now.
Perhaps you will gradually, without noticing it,
Live along some distant day
Into the answers" (6).

Perhaps it would be important as human beings to have a focus that is good with knowing just a little bit less and wondering a little bit more.



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Nutritional Psychiatry: How the Globalization of the Western Diet is Wreaking Havoc on our Mental Health

Written by Cara Fonken
Edited by Francisca Guerro

Human civilization is facing a new age in which preventable lifestyle diseases are becoming some of the largest public health issues. There's no doubt that the skyrocketing rates of diabetes, heart disease, and obesity are due in part to easy access to the highly palatable, fast, and cheap foods that comprise the so-called "Western diet". As McDonald's and Starbucks spread around the world, the negative effects of the Western diet are becoming apparent as countries slowly replace traditional diets with packaged and fast foods. There is a concurrently growing epidemic of mental illness, with depression and generalized anxiety disorder (GAD) becoming increasingly common in people of all ages. Governments around the world are becoming increasingly concerned as depression has become the leading cause of disability worldwide (1). Most people don't correlate this rise in mental illness as having similar risk factors to these other more "physical" lifestyle diseases, but, in fact, poor diet can have just as much an effect on the disease progression of depression as on that of diabetes. In 2019, before the COVID-19 pandemic started, around ⅕ of adults in America reported some form of mental illness, and around 15% of youths had a major depressive episode within the previous year (2). This is a pressing public health problem, and although there are many factors that have contributed to this increase in poor mental health, including a rise in social media use, globalization, and also the isolation and stress of the COVID-19 pandemic, the poor quality of the high-fat, high-sugar Western diet is an often underlooked player (3).

Nutritional Psychiatry

We don't tend to think about our diet as impacting our mood significantly--we tend to think in terms of weight, heart disease, and diabetes. But, the food we eat has a surprising amount of power over our mental health, as the growing field of nutritional psychiatry shows us (4). Diet is thus incredibly important in this modern age of packaged foods and rampant depression and anxiety. A fascinating aspect of human health and neuropsychiatric health in particular is the gut microbiome, which interacts with our mental health through the gut-brain axis. Our guts are home to trillions of commensal bacteria, fungi, viruses, helminths, and protists that have the ability to impact our mental health (5).

These microorganisms produce metabolites that can be absorbed into the bloodstream from the intestinal lumen, from which point they can travel through the bloodstream and cross the blood-brain barrier to affect the brain. The connection between diet quality and psychiatric symptoms is mediated by this gut-brain axis, which is basically the interaction of the nervous system and the digestive tract. This connection is why the health of the gut microbiome has reached nutritional and scientific news so much recently. In fact, a study showed that a fecal transfer from humans with depression to rats induced a depressive state in the rats (6). If just the composition of microorganism taxa in the intestines can have such an obvious impact on mood, it's no wonder that our dysbiotic diets are worsening depression and anxiety. Alarmingly, the high fat, high sugar, and low fiber nature of the modern Western diet can contribute to the development of an imbalanced, low-diversity gut microbiome, which increases the risk of disease-causing neuroinflammation.

Imbalances in the gut microbiome are being increasingly implicated in various diseases, including depression. Many people don't know that the majority of serotonin (the "happy" neurotransmitter) is produced in the gut, which is just one example of how big of a role gut health plays in mood regulation (7). Good gut health is increasingly being recognized as a key to optimal health and the treatment of various medical conditions, and diet alteration is one of the best ways to improve gut health, primarily by supporting the maintenance of a diverse and balanced gut microbiome.

Food Palatability and the Addiction Pathway

In fact, just the taste of our food, not even just its nutritional content, can impact our mental health by rewiring our brains' reward circuitry (8). The overconsumption of highly palatable foods, such as those containing high amounts of fat and sugar, put Americans at risk for increased anxiety. In a study with mice fed high sucrose and high fat diets, the mice were observed to develop anhedonia, anxiety, and increased sensitivity to stressors (8). This applies to human health; continually consuming dopamine-releasing foods like sweets and fatty foods provides a sensation of pleasure in the moment, but this results in decreased sensitivity to dopamine in the long-run. This can result in anxious symptoms and a loss of pleasure in daily life, which can worsen or contribute to the development of depression.

There are various diets around the world, in which vegetables and whole, unprocessed foods comprise the majority of a person's daily food consumption, that promote good physical and mental health. However, with globalization, this "Western" diet is becoming more prevalent in countries around the world and leads to the loss of traditional, healthy diets that maintain optimal mental health. For example, the traditional "Mediterranean diet", which is a popular diet buzz word nowadays, is associated with significantly better mental health, particularly depression and anxiety (9). A higher intake of fruits and vegetables in a cohort of Iranian adults was shown to be associated with reduced depression (9). The indigestible fibers in such foods feed our gut microbiome and allow diverse microorganisms to thrive as a balanced ecosystem, contributing to optimal neuropsychiatric health. As McDonalds and Starbucks make their way around the world, these traditional, neuroprotective diets are gradually falling by the wayside in favor of highly palatable sweets and fast food. This does not bode well for mental health in the coming decades, but as nutritional psychiatry grows as a field, there is hope that we can gradually shift our food culture towards diets that nourish our bodies and minds for optimal physical and mental health.

Art by Maumita Sadhukhan

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Hiroshima and Nagasaki: Investigating Society Post-Nuclear Disaster

Written by Monique Tran
Edited by Andrew Thampoe

How can an object 173 million times smaller than a penny possess the capability to level entire cities, decimate populations, and irrevocably change the course of history? The atom, an integral constituent of all matter, remained elusive in nature until the early 20th century. Its microscopic size made it difficult to observe, and classical physics could only explain a fragment of the phenomena that was exhibited by these small particles. It was only with the dawn of quantum mechanics that scientists truly began to understand atomic behavior. In 1898, Marie and Pierre Curie discovered that radium ore emitted extraordinary amounts of radioactivity. Ernest Rutherford later determined that radium atoms were decomposing at a certain rate and transforming into different elements (1). This phenomena raised hopes in the scientific community that a novel form of energy had just been found. Forty years later, researchers could accurately determine which elements were produced from the radioactive decay of a substance; moreover, they coined the process that resulted from a splitting of the atom nuclear "fission" (2). It was now clear to the world that microscopic quantities of matter had the potential to produce incredible amounts of energy. The United States seized this opportunity and began research into weaponizing nuclear fission by splitting unstable uranium nuclei under the Manhattan Project (3). This development took place during World War II during a period where armament was at a historical high. Nations sought novel and devastating weaponry under the justification of defense and would not hesitate to use these new technologies on the frontiers of war. Thus, the United States made a sizable investment into the development of nuclear weapons, and the first nuclear test took place in 1945 in a desert in New Mexico. The destructive power unleashed by the atomic bomb was unlike anything anyone had ever seen before. Only a month later, the United States made the decision to unleash this devastating weapon on Japan (4).

On August 6, 1945, American President Harry Truman ordered that two atomic weapons, Little Boy and Fat Man, be dropped on the cities of Hiroshima and Nagasaki. One historical perspective argues that this decision was made after the United States had received word that Japanese forces intended to fight, despite low odds of victory after the defeat of their German allies. In the past month, the United States had suffered immense casualties at the hands of the Japanese. Truman had also been advised by several military commanders that an estimated one million American soldiers would be lost after invading Japan. With Pearl Harbor already leaving the United States on edge, Truman ultimately sided with proponents of this plan.

He asserted that the power of the nuclear bombs would both bring World War II to a close and leave the United States with the upper hand in developing the world in its postwar state (5). A second historical perspective argues that Japan had been ready to surrender far before the United States announced its intention to drop the nuclear bombs. Japan had been negotiating a treaty with the Soviet Union, but these efforts fell through as Soviet interests were turning towards invasion. It is believed that Japan would have surrendered had a demonstration of the nuclear weapon been performed on uninhabited Japanese land. The United States could also have renegotiated its terms of unconditional surrender, which harshly stripped the emperor from his position. The emperor has great importance to both Japanese culture as well as its political processes, and the removal of such a leader was a major point of contention. In the end, Truman's decision marked the first use of atomic weapons on humans and drastically accelerated the competitive acquisition of military power between nations (6).

In total, over 210,000 victims have been claimed by both atomic bombs. In the following decades, many survivors faced debilitating side effects. The extreme radiation they had been exposed to damaged tissues, killed cells, and caused mutations in DNA that led to uncontrollable growth of living cells. Many had severe burns or developed cancer, the most prominent form of which was leukemia. The effects were also multigenerational, as the children of survivors exposed to the radiation were found with birth defects such as significantly smaller head sizes, mental disabilities, and an impairment in physical growth (7). Pregnant women faced higher rates of miscarriage and deaths in their infants, and any survivng children had higher risk of developing cancer. Additionally, around 43% of hospitals were leveled by the atomic bombs or rendered non-functional. This prevented doctors and nurses from providing immediate care in addition to the intense levels of lingering radiation left after the bombs.

Most victims from Hiroshima and Nagasaki died without ever making it to a hospital, and many first-responders also passed away from exposure to radiation (8).

The aftermath of both nuclear bombs left the world at a loss for words. Japan surrendered shortly after, bringing World War II to a close. Many humanitarian organizations, such as the Red Cross, immediately began to advocate for the prohibition of nuclear weapons due to their effects on human health, the environment, and medical infrastructure. In 1949, the Geneva Conventions were established to create a set of international humanitarian laws to limit the collateral damage that war has on civilians. These laws concluded that weapons that cannot distinguish between civilian and military targets were to be prohibited from use altogether. Additionally, civilians could never be made the object of attack by nuclear weapons again. The use of any method of warfare that causes widespread, severe, long-term damage to the natural environment was also rendered illegal (9).

Overall, it was determined that the use of nuclear bombs in any situation would constitute a violation of international law as they caused irreparable humanitarian consequences.

Art by Maumita Sadhukhan

In 2013, it was established at a series of international conferences that the consequences of nuclear weapons heavily outweighed any advantages it might provide in wartime. The primary cause of concern was the phenomenal amount of destruction that was inflicted upon a country's infrastructure, which would displace hundreds of thousands of people and take decades to repair. This would severely hinder a country's socioeconomic development, as it affects the construction of health-care facilities, schools, trade, and international communication, and consequently affect people's quality of life and access to basic necessities. Even the use of atomic weaponry at a smaller scale for demonstrations on uninhabited land would still slowly spread radiation around the earth, as it can easily be carried downwind, and there would be no way to isolate it. This would also slowly cool the atmosphere and potentially cause severe food shortages and global famine. After reviewing the data post-atomic bombing, it was revealed that women and children were disproportionately affected, which could exacerbate societal disparities that already exist in given countries (10). Although the possession, use, and testing of nuclear weapons is currently banned, many countries and scholars remain divided on the morality of the use of nuclear weapons. One argument posits that the military advantage of atomic bombs will never trump the humanitarian consequences, therefore they should never be used. The other argument suggests that the strategic and conservative use of nuclear weapons, preferably in rural locations, is justified in self-defense. While the world remains divided on the use of nuclear weapons, it is clear that the effects of Hiroshima and Nagasaki are still felt today by survivors and their descendants, and will continue to be studied for many decades to come.

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New Alzheimer's Drug: Providing Hope and Sparking Controversy

Written by Tanisha Jasani
Edited by Jeffrey You

An estimated 6.2 million Americans aged 65 or older currently live with Alzheimer's disease, a disorder resulting in debilitating dementia, with seemingly no cure in sight.1 However, on June 7, 2021, the Food and Drug Administration (FDA) overruled its independent advising committee members and approved a new drug called Aduhelm for the treatment of Alzheimer's disease. The approval represents a beacon of hope to patients and families affected by Alzheimer's as Aduhelm is the first Alzheimer's drug in eighteen years to be granted FDA approval.2 On the other hand, the approval has ignited a civil war in the scientific and medical communities due to a lack of promising data from drug trials, the high cost and eligibility of treatment, and the approval's effects on other disease treatments.3

In order to understand the controversy surrounding Aduhelm, it is important to understand what Alzheimer's disease is and why there has not been a drug approved to treat it in decades. Alzheimer's disease is an irreversible and progressive neurologic disorder that affects memory, behavior and other mental functions and is the most common type of dementia. In our brains, there are billions of tiny cells called neurons that transmit information between different areas of the brain. These neurons are in constant communication with each other, forming a network that enables us to perform tasks ranging from simple reading to complex decision making and problem solving. Alzheimer's disease interferes with the neuron's ability to properly communicate with other neurons and eventually leads to their death.4 This neurological damage eventually affects a person's memory and other cognitive skills, significantly impedes their ability to live independently, and ultimately results in death. While scientists have not been able to point at a singular cause for this disease, it has been hypothesized that an individual's lifestyle, genetics, and environmental factors such as low socioeconomic status can contribute to development of the disease.5

Recently, the Alzheimer's research community has formed a new hypothesis in regards to the root cause of Alzheimer's. Some scientists think that a buildup of a protein called amyloid in the brain may detrimentally affect neuron function and communication, resulting in Alzheimer's.4 Aduhelm targets this plaque buildup. It has been claimed that this drug can attach itself to the protein and initiate an immune response from the body that would result in removal of the plaques. Once the plaques have been cleared out, it is theorized that brain function would stop deteriorating.6 Now, some may wonder, if this disease is so devastating and this drug can provide a solution, why are scientists rejecting it? Alternatively, if their rejection is valid, why did the FDA approve the drug? The answers to these questions lie in Aduhelm's preliminary trials and its impacts on future approvals and treatment.

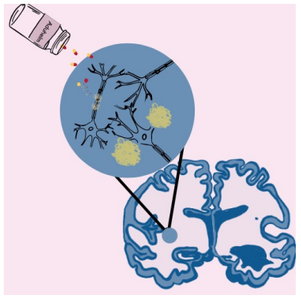
One of the major criticisms of this approval stems from the results of the trials conducted and the data that was collected. The drug is manufactured by a company called Biogen that conducted two phase III clinical trials. Phase III clinical trials are usually conducted to test long term effectiveness, and side of the drug as well as to compare effectiveness with other drugs. Initially, Biogen's both phase III trials failed to prove that the drug was effective to a statistically significant degree,and had to be shut down. However, a few months later, the company re-evaluated the data for a subset of patients that received the highest doses of Aduhelm from one of the trials. They concluded that the drug significantly reduced the severity of symptoms in one of the trials, with no evidence of benefit for the patients in the other trial. The panel advising the FDA was not convinced that the subsequent analyses were evidence enough that the drug was effective. There were also concerns about the side effects of the drug as 40% of the patients receiving the drug developed encephalitis, or brain swelling, which can be fatal. Another concern of the panelists was the design of the experiment.3 They believed that the experiment was not fully blinded since patients receiving the drug were asked to come in for additional scans, indicating that they were not part of the placebo group.5

Despite the concerns of the panelists and the rest of the scientific community, the FDA granted Aduhelm the approval. In their defense, they claimed that even though only one trial showed significant clinical symptom decline, both trials showed reduced levels of amyloid plaques. The FDA believes that a reduction in plaques would ultimately lead to a reduction in symptom severity, a concept which has not been validated by research. The FDA also granted Aduhelm Accelerated Approval, under which they would have to conduct another randomized clinical trial.

If the results of the trial do not show statistically significant clinical benefit, the approval could be reversed.6 The FDA hopes that despite current uncertainties with Aduhelm, it can at least provide some relief from a debilitating and fatal disease with no other meaningful treatment options.

While there is a fiery debate regarding the clinical effectiveness of Aduhelm there is another controversial and important issue with the drug: its accessibility. Aduhelm consists of a monoclonal antibody that is administered monthly and costs a staggering $56,000 per person per year. While patients would not need to pay the entire amount out-of-pocket, and the precise details of insurance and Medicare coverage are yet to be determined, initial estimates suggest that the upper bound of out-of-pocket costs could be $11,500, which is about 40% of the median income of Medicare recipients.[7] In addition to the high costs, patient eligibility is another unknown when it comes to prescribing the drug. Alzheimer's cannot be technically identified in a patient's brain until they have passed away. Doctors use a variety of genetic risk factor tests and other scans to diagnose the disease in patients who are still alive. These methods of diagnosis either lack research, are limited, or are expensive. Tests such as PET scans, lumbar punctures and genetic testing are usually expensive and not readily available at many hospitals. Furthermore, there are significant disparities in rates of diagnoses. For example, African American and Hispanic have lower rates of accurate diagnosis despite being more likely to develop the disease.[8]

The approval of Aduhelm may cause an increase in testing and could lead to incorrect identification of some people as eligible for the prescription. On the other hand, other patients who might benefit from the drug and are actually eligible could be denied prescription.



Art by Maumita Sadhukhan

The FDA's decision to approve Aduhelm not only affects Biogen and Alzheimer's, but is expected to have tremendous impacts on the approval of other treatments, both for Alzheimer's and other diseases. Members of the research community are concerned that this decision will prompt other amyloid reducing drugs to be approved, regardless of their clinical effects. This approval might also affect other areas of Alzheimer's research. Clinical trials are being conducted on another protein called tau to determine if its removal could also result in symptom reduction. Researchers are concerned that Aduhelm's approval would narrow the research scope down to only anti-amyloid treatments. On the other hand, the FDA decision might also have positive impacts on treatments for other diseases. The approval has generated interest in drug research for other neurodegenerative diseases such as Huntington's and Parkinson's. Accelerated Approval might be beneficial for treatments for other diseases with higher rates of effectiveness.[9] The approval has caused a lot of controversy, but has also opened new doors for other treatments and Alzheimer's patients.

So, how do doctors decide when and to whom should the drug be prescribed? What should Alzherimer's patients and families do? Aduhelm is still conducting a trial and raising questions. Right now, it is important for us to continue the conversation and remain curious. Patients should do their own research and consult with their doctors. Only time and continued experimentation will tell if the drug is actually effective.

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Coffee Break

Written by Elias Nasser
Edited by Anna Chiu

Her rich fragrance purified the dawn's intruders, who were delivered from their sleep with aching temples and weary eyes. The coffee-house: where young poets, artists, or scholars might find themselves to satisfy their fuel for productivity and engage in meaningful discourse. You might even rush to consume the intoxicating substance, but I anticipate an extra shot of espresso, or caramel syrup drizzled along the cup.

Coffee History

The coffee bean first made its contact with humans when an Ethiopian herder found his goats restless. They behaved seemingly possessed by spirits and forced into a manic dance. After identifying a peculiar red, berry-like fruit that his goats were enjoying, the herder tried the "magical" fruit and felt the symptoms he recognized in his goats: extreme focus and reduced irritation [1]. Years later, coffee became a staple to be brewed in many regions of the Middle East, prompting the opening of coffee shops all across Egypt, Turkey, and Yemen. Nicknamed "Schools of the Wise", these coffee-houses were home to Muslims of an empire that could not endure their long working hours by consuming alcoholic beverages, as was the regular practice for Europeans prior to the seventeenth century [2]. Rather, the Arab civilizations that developed our understanding of algebra and created the first hospitals may have been driven by the stimulating effects of caffeine that allowed people to detach from the circadian rhythm that predicts our waking hours [3]. For the Arabs, convening for coffee became a social engagement for academic pursuits, celebratory occasions, and religious nights of worship. Some believe coffee's Arabic name, *qahwa*, derives from the Arabic word for power; coffee was a drink that signaled wealth and status, drew intellectual potency, and delivered great fortune to those who traded the commodity. [4]

The Coffeehouse

As coffee-houses appeared in London during the late 17th century, their identities were shaped by the sociocultural landscape in which they were placed. Each house represented a home for the foundation of rhetoric, worship, commerce, or political dialogue [9]. Alcohol consumption in Europe at the time enforced a standstill of thought and academic progression. Coffee, on the other hand, promoted creativity and allowed for a social gathering where people of all backgrounds could collaborate on scholarly pursuits [10].

Noteworthy figures such as Isaac Newton, Voltaire, and Denis Diderot took part in the coffee culture established in Europe, often proposing that coffee encouraged their attention to thought. Despite the later transition from coffee to tea as the main source of caffeine in Europe, caffeine culture continued to prevail as it would come to enter the market of the United States. While the international community has sought to prevent the use of psychedelics and hallucinogens, coffee remains a drug that people of all ages and upbringings enjoy on a daily basis.

Coffee has arguably been one of the leading sources of inspiration for what we consider great works. The culture created behind the aromatic red berry has become a revolution in thought; it is the mediator of all negotiations, the inspiration of political uprising, and the muse of poetic brilliance.

Art by Maumita Sadhukhan

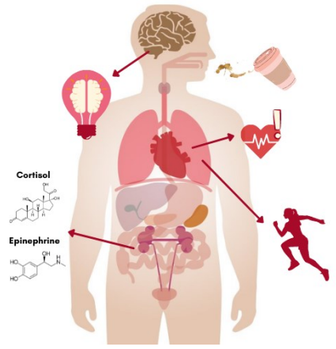
Coffee Chemistry

Caffeine, an antagonizing drug cloaked like a monarch butterfly, behaves in mimicry of the adenosine molecule that regulates neural activity. Associated with high energy output by the brain and depleted energy stores, adenosine acts as a neuromodulator that depletes arousal when binding to neural adenosine receptors, thus prompting sleep [5] With the ingestion of caffeine, a molecule similar in structure to adenosine, these receptors (A2A and A1 receptors) are being prevented from binding with adenosine due to competition with caffeine molecules, leading to a decrease in brain activity [6]. Additional studies have found the consumption of caffeine to cause an increase of catecholamines such as (epinephrine and norepinephrine) secreted by the body, which act in response to higher elevated levels of stress. These hormones stimulate various responses manifest as physiological responses commonly termed "fight-or-flight" responses, including elevated heart rate and blood pressure [7]. Moreover, some studies cited improvement in endurance, concentration, and coordination as a result of coffee consumption [8].

Coffee & Health

While some people avoid drinking a fresh brewed cup of coffee to avoid restlessness and anxiety, recent studies indicate that drinking coffee regularly may stimulate encouraging health outcomes and even lower mortality rates [12]. These findings show that coffee consumption is associated with a decreased risk of chronic diseases including Type 2 diabetes, cancer, and Alzheimer's disease [13]. A Norwegian report found that coffee provides more than six times as many antioxidants as fruits or vegetables [14].

Some findings also suggest that coffee has tremendous positive effects on mood and attentiveness, however coffee must be consumed in moderation [14]. In recent years, coffee companies in the United States have competed in a



market that now promotes up to 20 ounces of sugary, colorful, caffeinated drinks and pastries as a compliment.

Art by Maumita Sadhukhan

Office Culture

Coffee continues to dominate the culture of "workaholics" in the United States who depend on their cup of Joe for their 40 or more-hour work weeks. In the 1940s, Phil Greinetz, owner of *Los Wigwam Weavers*, a local necktie manufacturer in Denver, implemented the "coffee break" as an improvement for declines in efficiency. Greinetz immediately noticed an increase in productivity and quickly implemented the idea in his business, later adopted by other business owners [11]. While the "coffee break" is framed as an opportunity for staff to refresh themselves from the strains of work, employers encourage the break to enhance focus, energy, and creativity in the workplace. These breaks may provide benefits to the overall success of the business, yet reinforce a toxic culture that frowns upon complaints of exhaustion or burnout. Do employers truly value the well-being of their staff by providing a break from work, or is their prioritization of productivity the reason that the coffee break is a shared experience?

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Spanning Decades and Disciplines: The Loneliness Epidemic

Written by Daniel Xiong
Edited by Ashrita Duvvuri

Everyone feels lonely sometimes. It will get better tomorrow.

Art by Vibha Annaswamy

These all-too-familiar sentences are often used by concerned family and friends to console loved ones. But the harsh reality is, while the first statement is becoming ever more inevitable, the latter is becoming a lie. While viruses and infections have ruled over medical news headlines for the past few years, a silent but ever-growing disease is unfolding behind the scenes. The occasional bad day has become a severe, chronic issue for millions of people around the world: in the United States, 43% of people say they feel lonely regularly (1), and in the United Kingdom, 60% of 18 to 34 year-olds say they often experience loneliness (2). These numbers, which come during a technological boom age where humanity has never been more connected, are staggering and unprecedented. And although there may be no strict definition for loneliness in the DSM-5, that doesn't mean there are no consequences - in fact, loneliness has been linked to a wide array of repercussions, both mental and physical. With the help of the COVID-19 pandemic's effect on decreased social interaction, the loneliness epidemic is becoming an issue the scientific community can no longer afford to ignore.

Evolutionary Roots of Loneliness

It is well-known that most chronic disorders, like obesity or heart disease, disproportionately affect certain demographics and income classes. However, loneliness is a purely subjective experience unique to each individual it affects, and for that reason, no one is safer from it than anyone else (3). While humanity has developed a vast arsenal of vaccines and medicines that strengthen the body and combat even the most perplexing disorders, there is nothing to be done against loneliness. It is simply part of human biology, a bodily response as innate as hunger or thirst. However, while hunger and thirst work in response to physical needs, loneliness brings awareness to the body's social needs (4).

Humans evolved as social creatures, and it's no surprise that the brain must have developed a mechanism to evaluate the social bonds that play an instrumental part in health and happiness. In the past, social collaboration was highly rewarded by natural selection, because individuals that worked with others could better achieve common goals such as foraging for food and caring for offspring (5). To prevent the dangers of socially aversive behaviors that could lead to isolation, such as hoarding resources, the brain developed "social pain", a phenomenon that utilizes the same receptor pathways in the brain as physical pain. These neural mechanisms not only associated these negative behaviors with negative feelings, but further accentuated the universal need to be around others. As humanity continued to grow and social interaction became woven into almost all aspects of life, traits like the ability to read the emotions of others and to forge social bonds became not just desirable but indispensable: suffering from loneliness could literally be a matter of life or death.

But contemporary cultural movements, especially in the Late Renaissance, began the transition away from collectivistic societies towards individualism by preaching independent competence and responsibility (6). In combination with urbanization during the Industrial Revolution, these large-scale changes brought about the downfall of the close-knit rural villages that had dominated for centuries prior. In modern times, humanity lives in the city, leaving behind its old communities for the busy, fast-paced lifestyle of today, a lifestyle that sacrifices in-person interaction in favor of the more efficient virtual world. Close connections and long-term relationships were severed; in 1985, the average American reported having just 3 close friends–and this number dropped to 2 in 2011 (7). But despite this stark change in lifestyle, the biological wiring in the brain has not changed: humans still have the basic need to be around each other. And in a world where many face-to-face relationships are all but ephemeral, the effects of loneliness can be extremely destructive to one's physical and mental health.

Physical and Psychological Effects of Loneliness

It may seem unlikely that something as common as loneliness can cause genuine physical harm, but according to recent research, stress resulting from chronic loneliness is one of the unhealthiest things humans can experience. It weakens the immune system, expedites the aging process, and exacerbates degenerative diseases like Alzheimer's. Loneliness also leads to mental disorders, worsening depression and anxiety (8). According to a longitudinal study that surveyed thousands of British seniors, chronic loneliness is twice as deadly as obesity (9). Another study surveying 20,000 Americans finds that loneliness has the same impact on long-term mortality as smoking a pack of cigarettes a day (1). Although the generalizability of these studies are limited due to the subjective nature of loneliness, its effects on physical health are undeniable.

How could loneliness be so detrimental? The answer lies in how loneliness exploits the body's social defense and response systems. Like physical pain, the body perceives social pain from loneliness as a threat, and triggers behaviors to remove the threat. The brain neurologically alters its own perception mechanisms, and studies show that lonely individuals are much more receptive to social signals and facial expressions (10). But at the same time, they actually get worse at interpreting these signals; for example, those scoring high on loneliness are more likely to interpret neutral faces as hostile or threatening (11). Loneliness causes an individual to assume the worst of others around them, in turn causing them to appear colder and more unfriendly than they really are. Chronic loneliness is self-sustaining (12), cornering an individual by molding their cognitive perceptions of others, their behavior towards others, and finally their own physical health. Ultimately, this results in a vicious, downward spiral that gets increasingly harder to control the longer it lasts.

Combating Loneliness Through Social Perspectives

As discussed previously, loneliness is a completely unique experience for each individual it affects. It can start with simple events in childhood, such as not having anyone to sit with at lunch or being picked last during recess. Loneliness carries many negative stereotypes; while society still holds somewhat of a biased perspective towards mental disorders compared to physical ones, "many people will admit to being anxious or depressed before they'll talk about being lonely", says one psychologist (13). The general stigma is that if someone doesn't have friends, then there must be something inherently wrong with them: they have poor social skills, have generally cold personalities, or simply don't want to be around people. Additionally, media portrayals of criminals as "loners" only add to the fear of being labeled as someone affected by loneliness (13). And of course, these negative stereotypes only worsen the issue, causing those around the afflicted individual to ultimately act in the ways that caused the problem initially.

However, these stereotypes surrounding loneliness are completely false. Loneliness does not disproportionately affect any gender, race, or other classification; it also doesn't discriminate with more specific characteristics, like one's personality or how many friends one has. Some people who feel lonely may indeed rarely interact with others, but some could be surrounded by people and have thousands of "friends" on social media, yet also feel a similar or even worse level of disconnection.

For those affected by loneliness, the hardest step is admitting it. Everyone experiences it at some point, yet everyone fears the social label of a loner. However, repressing this emotion will only ignite further negative behaviors until its victims are trapped in the self-propelling cycle. And while there is still a battle to follow for those affected by it, society has a responsibility to give acceptance without judgment, the same way it treats any other disorder, mental or physical. Only when awareness and tolerance replace the current stereotypes and stigmas will humanity finally be able to begin a path of recovery against the loneliness epidemic.

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Alleviating Speech Disorders

Written by Vamshi Pothireddy
Edited by Hayden Stegall

Do you remember learning how to speak and string words together? Humans learn exponentially as a child. Learning begins alongside brain development. However, developmental barriers and slowdowns occur to many children in their infant years. Around 15% of children aged 3-17 experience at least a mild form of cognitive development (1). This delay can be related to genetics, social development, and a child's household environment. Households with less social interaction develop children with more speech disorders. Speech impediments are primarily based on the child's environment: poor family dynamics. Simply speaking, the lack of social relationships can lead to speech disorders due to inattention from family members. Consequently, many children with speech disorders tend to develop mild forms of autism. Parents need to create positive conversations and continue to develop social interactions as a child is born (2).

Art by Vibha Annaswamy

Raising a child can be stressful for parents. Hence, parents are unaware of how to properly help their children cognitively and linguistically grow. The most common form of learning to speak as a child is with a technique known as "imitation". Starting three months after birth, infants emulate their surroundings. Children naturally imitate their mothers vocally. To motivate children to develop their vocal abilities and vocabulary, good parents will praise children to create new resonating vocal sounds. When babies intentionally vocalize, they "coo" to hear their voices and repeat the sounds. A theory of language development by Noam Chomsky suggests that infants are naturally equipped with the ability to learn a language and speak when they grow up. His theory suggests that one's language develops as long as that person is exposed to conversations. According to this theory, kids with speech disorders develop their speech impediments because parents don't pay attention to their children. Parents do not spend the proper amount of time trying to make conversation with their children. Regardless of how silly it may initially seem and feel for the parents, it is important for a child's linguistic development to hear his or her parents talk and interact with the child.

It is imperative to minimize the effects of the child's speech impediment so that they can effectively communicate. As a result, language theorist Skinner suggested that language develops through reinforcement from parents. This theory implies that gestures or sounds that are encouraged and praised by the parents will increase the likelihood of repetition. This theory accounts for children who receive little attention from their parents winding up with speech disorders. Generally speaking, parents have the ability to shape the way their children can perceive their speech solely through repeating similar vocal sounds (3).

The most popular diagnosis of speech disorders consists of tests measuring and evaluating complex skills such as creating sentences, imaging, and recreating pictures with vivid language. For example, the therapist will start a sentence and story structure and the patient will have to work on completing the sentence. The patient can create sentences that describe the main character's ongoing conflicts, vivid imagery of a castle, or anything that the patient is thinking about at the moment. An example includes --- Therapist: The dog decided to stroll ….. Patient: through the winding roads of Jester, stomping on some yellow daffodils lined up along the path towards the ever-looming castle. By increasing the patient's creativity in sentence structure and thought development, a speech therapist can improve the accuracy of the patient's prognosis. Although accurate, this technique does not provide future specific treatments or methods to improve a person's speech. Since this technique requires patient-based care, there are no universal ways to fix all speech impediments. This process requires constant work and fluid feedback between the patient and the speech therapist. Current speech treatment now focuses on improvement of the thought process and clarification of the framework of social interaction and symptoms of selective speech skills. These methods are used by speech therapists to slowly start improving the patient's speech (4).

Specific research theory includes a stage called "motor planning" which is a speech therapy group that aims to identify and improve specific sequences of articulation. The goal is for the patient to adopt a complete phonetic understanding of the language. With the help of professionals, the person with a speech impediment will receive in-depth practice to smoothen their sentence structure and improve their linguistic thought process. During this process, patients work with their therapist to learn the various combinations of pronouncing vowels and consonants. For example, people will learn the difference between pronouncing the "æ" in "apple" and the "ɑ" in "ball" (5).

In addition to "motor planning", the research also targets "motor programming" which entails researchers inducing muscle-specific motor skills in their patients. This method takes into consideration the articulation of the mouth, sensory understanding, and enunciation. Within this process, the patient is constantly repeating facial movements to train the muscles to coordinate the brain and mouth. This process, although strenuous, is very effective in creating good repetition to strengthen the patient's understanding of the language. Eventually, through motor planning and motor programming, a person with a speech impediment can learn how to speak and handle themselves comfortably in social situations (6).

Therapists are crucial in their role of directly shaping the attitude of the patient. Therapists work on incorporating various techniques that complement reinforcement. Praise is an important factor in learning and development. Every time a patient or child learns a new linguistic skill, it should be mentioned the importance of rewarding the person with praise. Beyond reinforcement, therapists train children in a social context because it is important to utilize the skills learned in social situations rather than in a room with the therapist. Oftentimes, a therapist will give a child a situation where the child has to utilize social clues to make judgments about the syntax, grammar, and general meaning of the sentence (7).

There is a correlation between children with language disorders and poor auditory skills. Discussions link poor auditory understanding as a problem in understanding language. Thus, therapists can focus on heightening the child's attention to auditory stimuli in order to have a more effective therapeutic intervention. Since the child's auditory factor is lacking compared to their other factors such as visual, therapists can use this information to leverage the way that the child learns language and speech development, such as by showing the child pictures or appealing to their other stimuli. For example, those that are proficient visual learners tend to slightly improve their speech by working with therapists on how to utilize visual information about the mouth's movement.

The aforementioned research showed that the use of language, whether spoken or thought, increased neural activity and promoted habitual speech tendencies. According to the newest research studies, this indicates that the practice of continual speech improvement will activate more regions of the supplementary motor area of the brain. In terms of neuroscience, these skills are working on expanding the neuroplasticity of the neurons to make more connections. Through constant modification and firing of the neurons, the brain starts to forge a new path for signals to pass through and shape itself. This research helps scientists understand the underlying modulations and future research studies to diagnose and treat speech disorders in order to help those with speech disorders gain a voice.

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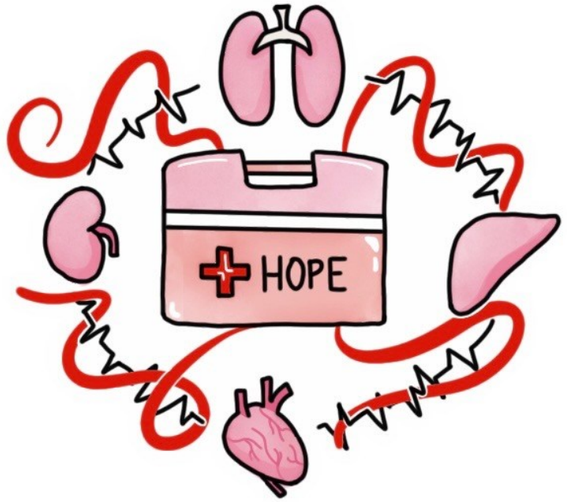
Donor: A Dive into the Limitations of Organ Donation

Written by Aditi Kalia
Edited by Karim Ladak

Organ donation has been subject to extensive regulations and legal stipulations over the course of the end of the twentieth century, to the point where it is now a viable and accessible option for most patients in need. Since its discovery, organ donation has saved millions of lives and changed many more for the better.



Art by Vibha Annaswamy

Even though this process has expanded the horizons of medical procedures, there are still several problems that require more attention in the way organ donation is managed. In the best-case scenario, a single person's organs can go on to save the lives of 5-6 patients, but only if the organs are collected and donated on time. Waitlists house hundreds of thousands of hopeful names a year, yet only a few lucky thousand receive a healthy organ. Every year, nearly a quarter of willing donors are unable to donate their organs due to organ deterioration caused by aggressive treatments by their physicians. This problem presents itself as an ethical dilemma: at what point can a physician stop treating their current patient to preserve their organs so they may be donated upon the patient's death? How, in good faith, can a doctor plan for their patient's death, and essentially give up trying to save the patient's life?

For the purposes of this article, only patients who have tried multiple treatments unsuccessfully will be considered, as well as terminally ill patients with little to no chance of survival. In these cases, in an effort to find a miracle, a lot of doctors attempt aggressive "last-ditch" treatments, which often leads to organ deterioration. The solution to this problem can be found through a series of guidelines.

Obviously, it is near impossible to come up with a series of real, enforceable parameters regarding this difficult ethical quandary over the course of such a short article. However, as an overview, these parameters should focus on multiple aspects of a patient's care. These can be divided into biological, ethical, and emotional frameworks. Firstly, from a biological standpoint, the point at which to stop treatment and preserve organs for donation is simple. No doctor prescribes therapy or medication without the research to back it up. This research includes exactly how this new attempt will damage the organs as it wills the body to fight. Quite simply put, when the chance of the treatment damaging donatable organs outweighs the realistic chance of the patient making a recovery, the doctor should advise the patient with full transparency (6). Next, and perhaps the most complicated sector for these parameters, is the ethical ramifications of preparing for a patient's death. Every doctor makes an oath to do whatever is possible to save their patients' lives. However, part of that is respecting the patient's mental integrity and bodily autonomy as well as allowing the patient to make the decision on what happens next. Lastly, there is the emotional component. As humans (and perhaps more so for doctors) empathy and compassion drive a community's actions. It is a natural emotional response to want to try as many intense therapies to save a patient, going as far as ECMO, aggressive IV drug cocktails, and unproved clinical trials (3). However, such treatments often end up doing more harm than good. As this is an incredibly difficult topic to fully address, the above parameters do not fully encompass the nuances and complexities of this issue. However, there are several actionable steps physicians can take to start moving in a direction that increases the number of donatable organs and improves donor/doctor relations.

A simple first step for greater efficiency in the Donation Process is greater transparency between donors and their doctors. If there is complete informed consent between the patient and the doctor, and the patient knows exactly how the treatment they are about to receive will affect the state of their organs, then there is an opportunity for the patient to make a clear and educated decision. If there is a chance that the treatment will damage their organs to the point where they aren't viable for donation, then the patient has the right to refuse that treatment, even if it proves fatal.

The second step that doctors should take is respecting the Donation Process. Legally and by nature, this process is set up to readily take the patient's desire into consideration, giving it the utmost priority (3). The most common example is the lack of strength to keep fighting in terminally ill patients. Understandably, these patients who have often withstood months, if not years, of aggressive treatment, deserve the right to refuse new attempts and prepare to donate their organs to save more lives. However, their physicians, who have often been with the same patient for the course of their treatments, fight just as hard to keep them alive. In this instance, respecting the Donation Process would mean respecting the patient's wishes to stop trying new therapies.

If these parameters were to be enforced, there would be a wide variety of changes that would occur in the medical field and in the Process. First, there would be a substantially larger number of organs available for transplantation. This will result in a shorter waitlist time and a greater chance of finding a qualified donor. Second, these parameters could also lead to a higher form of transparency in doctor-patient relationships. Currently, a lot of doctors, while thorough in their briefs, may present certain information in a skewed manner to avoid causing anxiety in their patients, potentially leading them into a worsened health state (1). However, since doctors have to be extra thorough with their patients in order to respect the patient's desire to be a donor, there needs to be a higher level of mutual respect. For someone passionate about donating their organs, not being able to do so because of a treatment that did not even cure them can be heartbreaking.

On the flip side, these parameters could have adverse repercussions. If there are significantly more organs available for transplantation, then the system might be abused by those in power by making organs more expensive to obtain or by increasing legal risks. Unfortunately, there will always be those who try to profit off of others' misfortunes, which is why illegal markets distributing organs have existed for decades. Some legal risks that could arise from this new influx of healthy donated organs include the rich and privileged buying their way up recipient lists, or an unfair allocation of organs to recipients. Additionally, a lot of doctors rely on the power of a patient believing they are improving to actually supplement their recovery (8). If doctors take away that hope from a patient, it would theoretically lead to many more unsuccessful treatments as patients will instead focus on the preparations being made for their death.

Organ donation is truly one of the most innovative and important medical breakthroughs, perhaps in the history of healthcare. For those with family on waitlists, there is nothing more relieving than seeing these miracles being marched into the hospital in preservation chambers, filling those around them with the hope that their loved one could survive. While organ donation is not a perfect process by any means, there are certain initiatives that can be taken, through biological, ethical, and emotional avenues, to make organs more accessible to those who need them. If even a fraction of the process is made more efficient, it would lead to thousands more patients receiving a new lease on life each year.

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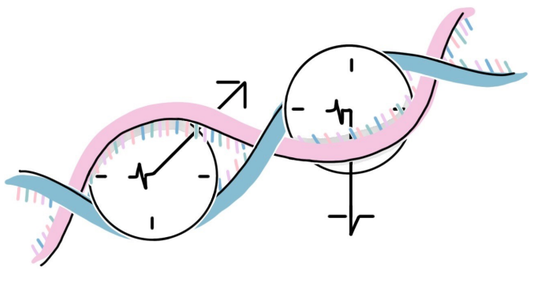
A 5 Year Age Gap: What Gender Reveals About Lifespan

Written by Audrey Dejong
Edited by Sahar Elchehabi

Life expectancy is an important demographic factor that indicates more than just average life span. It can reveal a country's relative state of development, its level of health technology, the prevalence of prenatal care, and underlying health differences between sexes. As of 2020, the average life expectancy in the United States was 77 years, but the breakdown of life expectancy on the basis of gender revealed that women are expected to live over 5 years longer than men (1). The fact that women outlive their male counterparts is not a new trend. In fact, the gender gap in life expectancy has continued to widen since 1870; now, it can now be observed in every single country in the world (2).

Marcia Stefanick, a professor of epidemiology and population health at Stanford University, said that researchers know "men and women age differently," but are still "kind of guessing how" (3). That said, current research on the biological basis of gender, characteristic behaviors, and cultural disparities have pointed to certain genetic explanations for the male-female lifespan gap. It is likely, however, that the lifespan gap is a product of many more undiscovered societal, hormonal, and environmental factors.

To an extent, genetics pre-determines body size, shape, and muscle composition. Men have about a 10% higher metabolic rate than women and are more likely to convert calories into visceral fat. Visceral fat, which surrounds the internal organs, is linked to higher levels of cholesterol, type 2 diabetes, obesity, and high blood pressure compared to subcutaneous fat, which women are more likely to have (4). Altogether, this translates into higher rates of cardiovascular morbidity for men — and at a shocking level. Data published by the Center for Disease Control shows that men are 60% more likely to die from heart disease than women, and with cardiovascular death as the leading cause of death nationwide, this results in a substantial difference in male-female longevity patterns (5).



Art by Vibha Annaswamy

Although not as widely known, the production of sex hormones plays a role in determining longevity on a molecular level. Testosterone, produced 20 times more by men than women, has been linked to increased levels of low-density lipoprotein (LDL) cholesterol and a decrease in immune function (6,7). High levels of LDL can cause a build-up of plaque in the bloodstream, leading to higher incidences of stroke and heart disease. And as an immunosuppressant, testosterone increases the risk for prostate, breast, and endometrial cancers, although the mechanism remains unclear (7). On the other hand, a lack of testosterone in humans and animals correlates with longer male lifespans. Min, Lee, and Park published a retrospective study summarizing the lifespans of eunuchs (castrated men who do not produce testosterone) in the Korean Chosun Dynasty. Their findings — the eunuchs lived to be 14 -19 years older than non-castrated men — is a powerful demonstration of testosterone's antagonistic health properties (8).

Estradiol, the main estrogen produced by women, has the opposite effect. This hormone decreases the amount of LDL in the body and aids in DNA repair by preventing oxidative stress. Oxidative stress causes damage to proteins and DNA, and eventually, the accumulation of DNA damage can lead to cancer. Estrogen also indirectly causes expression of certain longevity-related genes and enzymes that work to prevent oxidative stress associated with cellular aging (9). Thus, the hormone's antioxidant properties help maintain good health while it continues to be produced. An observational study of 29,000 women supports this phenomenon: women who underwent bilateral oophorectomies (removal of both ovaries) had a higher overall rate of mortality and heart disease than those who did not (10). This is a very different physiological response than what was observed in castrated men and it supports the proposed function of estrogen in maintaining good health. While estrogen and testosterone are both sex hormones, they play seemingly opposite roles in determining human longevity. As such, the biological basis of sex-specific hormones goes far in elucidating the gender-age gap.

Biology and behavior are extremely interrelated. Testosterone has been linked to traits like aggression, risky behavior, and anger. These traits, in turn, have caused a higher incidence of risk taking among young males, who are more likely to participate in aggressive and competitive behavior. The frontal lobe of the brain (which controls decision-making) in young males develops at a slower rate than young women (11). Altogether, this helps explain the fact that males tend to be involved in more accidents, from risky driving, suicide, and accidents related to alcohol intoxication. But not just young males are prone to risky behavior, males *across all ages* are more likely to be involved in fatal accidents than females (12). In addition, the number of men in dangerous jobs — construction, policing, military — significantly outweighs the number of women. Men are also more likely to be smokers and start smoking before the age of 16, which has health costs down the line (13). While the behavior of large populations is difficult to generalize, the demographic patterns point to certain tendencies displayed by men that are conducive to higher levels of injury and disease.

Giles Tremblay, a research scientist at the Laval University in Quebec, stated that "one year is biological, and the rest is cultural". While this is an oversimplification of longevity, a country's culture does play a role in informing health habits and dictating gender norms. Russia has one of the highest gender age gaps, at about 11 years in favor of women (2). Russia also has one of the most intense and historic drinking cultures, although the practice of social drinking, binge drinking, and drinking harder alcohols does not extend to women. Socially, Russia has attempted to combat excessive drinking culture in light of the rates of male mortality, cardiovascular disease, and certain cancers, but the deep rooted tradition will be hard to correct—and demographic patterns will likely not see improvement for decades.

The United States credits itself for spending the most amount of money per person on healthcare expenses.While this is true, women account for 25% more of this budget than men (14). The extent of this spending disparity is a signal of something larger at play. Masculine gender norms are an underlying cause of certain health care decisions and have unfortunate consequences for men's health and wellness. Traits associated with masculinity — self-reliance, strength, emotional suppression — are not associated with getting check-ups, confiding in doctors, and even in acknowledging pain. Therefore, the culture around health and receiving care from a health care provider should be less stigmatized and more encouraged, especially for men. While masculinization standards are not the primary cause of higher male mortality, poor health practices due to the perceptions of "manliness" can exacerbate underlying health conditions and cause higher rates of late-stage cancer diagnoses.

Longevity data is an advantageous tool to measure health progress and gender disparity. Demographic descriptors like longevity and mortality are efficient at describing populations and the general factors that contribute to them, although health choices are ultimately up to the individual regardless of sex. The various biological and cultural causes of the lifespan gap should still be addressed collectively, through health awareness movements, improvements in medical technology, and more individualized care. With an active effort to improve health outcomes, the lifespan gap is expected to shorten to 4.1 years in 2030 and 3.4 years in 2060 (15). This optimistic outlook is not only a sign of improvements in gender-specific health, it is an indication of longer, healthier, lives filled with better quality care.

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Children, Parental Autonomy, and the Integrity of Public Health: A Moral Compulsion for Vaccine Mandates

Written by Teo Jakobsen
Edited by Zara Khan

With the onset of the COVID-19 pandemic, an incredible amount of time, money, and labor has been poured into the development of mRNA-based vaccines.[1] The approval and implementation of such vaccines into populations across the globe has certainly been an extraordinary scientific feat. But despite an expanse of evidence upholding vaccine safety and efficacy[2], many question the ethicality of a mandate which forces a parent to vaccinate their child. Without a doubt, investigating the propriety of such a mandate is important, especially in America where we place utmost value on personal freedoms. But should we let disease run rampant in places where vaccination requirements would otherwise preserve public health?[3]

A 2015 Measles outbreak in Disneyland illustrates this contention between personal choice and the integrity of public health. An unidentified traveler infected with Measles entered Disneyland (which does not require proof of any vaccination) and spread the disease to 147 other visitors, many of whom were unvaccinated children.[4] The failure of parents to vaccinate their children put others at risk and created a microcosm of disease outbreak representing what the depletion of herd immunity might look like on a larger scale. Soon after this outbreak made national headlines, California passed Senate Bill 277 into law, removing "personal belief" as a reason for exemption from vaccination requirements in public schools.[5] Disneyland has never seen a Measles outbreak since.

How can personal freedoms, like the option for a parent to choose whether to vaccinate their child, be balanced with the integrity of public health? In a broad sense, there are four main arguments against vaccine mandates for children[6]:

1. Established religious beliefs
2. Safety concerns
3. Lack of accessible vaccine information
4. Personal beliefs

Religious beliefs aren't easily voided – the first amendment is a cornerstone of American society. Nor can vaccinations be forced upon immunosuppressed individuals or others who could be harmed by a vaccine.[7] And while questions of vaccine safety and accessibility are valid, the plethora of scientific study upholding vaccine efficacy alongside recent expansions of government programming for vaccine administration suggests that these concerns are increasingly separable from personal belief.[2,8] With these arguments sifted out, the integrity of the personal belief argument can be exclusively examined.

Undeniably, children are undeveloped humans. They do not have the mental capacity of an adult and correspondingly require parental care and guidance. This is done to accomplish two broad goals:

a. To prevent a child from becoming a danger to his or herself

b. To prevent a child from becoming a danger to other people

A parent is vested with the liberty and responsibility to restrict their child's actions for their child's own safety, and for the safety of others. Of course, parental liberty is not unchecked; parents do not have the liberty to punish children with starvation, nor can they knowingly expose their child to unnecessary danger. Because of these limitations and in the interest of a child's wellbeing, laws against child abuse are made and are found morally justified violations of parental liberty.[9] Moreover, parents can be held responsible when they fail to keep their child from recklessly endangering the lives of others. In many states, if a child gets ahold of their parent's firearm and shoots someone else, their parent will be held morally culpable.[10] For this reason and in the interest of public safety, many states require that parents keep firearms locked up and out of reach from children.[10] Indeed, this restricts a parent's liberty to arm their child, but it protects the wellbeing of others and is morally justified.

Does it follow that a vaccine mandate may be a justified restriction of parental autonomy? Vaccines amply protect children from dangerous diseases they may not fully understand.[11] Proponents of the personal belief argument may object here, arguing that healthy children don't need protection from statistically non-threatening diseases. While this claim has serious problems,[11] the integrity of public health yields a better rationale to mandate vaccination. Failing to vaccinate a child puts others at risk of contracting disease and spreading it within society, especially to those who cannot be safely vaccinated.[12] Most children might easily recover from a disease, but other children or community members may not, meaning an unvaccinated child poses a dangerous yet preventable risk to the wellbeing of vulnerable populations.

Revoking a personal liberty seems contrary to well-established democratic values, however there is a substantial philosophical basis for doing so. In his seminal work *On Liberty,* J.S. Mill argues that legal coercion of personal liberties cannot be morally implemented to preserve one's own wellbeing, yet he makes an essential distinction: it is morally permissible when done to protect others.[13] For instance, every adult has the liberty to eat and drink as much as they like. We may deeply discourage one from getting dangerously intoxicated, but we would be morally wrong in limiting the number of beers they can consume in their own home where they represent no danger to anyone else. But if that intoxicated individual attempts to operate a motor vehicle, we are justified in restricting their car-driving freedoms. Such restriction is not paternalistic, in the sense that we are protecting a drunk driver from crashing and killing themself, but rather is done for the greater good, so that a drunk driver does not kill innocent bystanders. By Mill's standards, restrictions of personal liberties are justified if, and only if, they protect others.

But how may a vaccine be mandated if it grants direct immunity only to the child who receives it? Such a mandate initially seems paternalistic: it is done for the good of the child, and by Mill's standards this is wrong. However, vaccine mandates are *not* established for paternalistic measures like the strengthening of individual health, but rather for the safeguarding of public health.[12] Like the drunk driving analogy, one who chooses to remain unvaccinated poses no threat to others in the isolation of their home. But as soon as they come into physical contact with other people, the prevention of disease transmission becomes a concern of law. And because children inevitably come into close contact with one another in schools and other social settings, a parent's liberty to not vaccinate their child is ethically overridden by a mandate.

Beyond moral compulsion, there is a psychological element of human behavior, illustrated by Garett Hardin's *Tragedy of the Commons,* which gives reason to mandate vaccination for eligible children. The *Tragedy of the Commons* is a scenario where people with free access to a common resource take advantage of that resource, simply because it is free.[14] This resource is then depleted as people dissociate themselves from the responsibility of maintaining it – they do not own it, nor do they feel personally responsible for its upkeep.[15] In a similar sense, herd immunity is a common good which all people benefit from when physically interacting with one another. It is true that establishing herd immunity requires only a certain percentage of a population to be vaccinated -- we fundamentally do not need to vaccinate every single eligible person.[16] But if one person believes they can reap the benefits of herd immunity without vaccinating themself or their child, what's to say others won't follow the same rationale? If we leave the vaccination of children up to parental discretion, many parents will fall into the *Tragedy of the Commons.* Herd immunity will be depleted, and disease transmission will intensify.

From philosophical perspectives to psychological frameworks, there are substantial grounds for the implementation of vaccine mandates for children. Failing to vaccinate one's child and pleading personal preference threatens the integrity of public health, giving a moral compulsion to prohibit such behavior under law.

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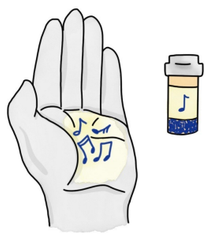
Classical Music and Clinical Medicine: Never the Twain Shall Meet?

Written by Aditya Prasad
Edited by Sahar Elchehabi

From Bach's *Goldberg Variations* to Beethoven's *Hammerklavier*, the elegant compositions and ethereal melodies within classical music are truly universal. In times of stress or anxiety, countless turn to classical music to soothe their 'nerves' and lessen their worries. Within hospitals and clinical settings, patients experience a complex amalgamation of pain, distress, apprehension, and a multitude of other adversities. Is classical music the medicine that can be prescribed? Can piped music act as a pill to address myriad challenges patients face?

Numerous scientific studies on the most sickly patients in intensive care units and those undergoing major surgeries have substantiated that classical music contributes to positive outcomes. Multiple studies have shown statistically significant evidence of marked improvements in several patient parameters including easing of stress (3,6), reductions in hemodynamic variability (4), lessening of sensations of pain (5,7), and augmentations in patient health. However, the constructive effects of music therapy are not restricted to critical care settings. Music has been shown to have profound favorable implications for patients with devastating neurodegenerative diseases such as Parkinsonism (12) and Alzheimer's Disease (13,14). The potential benefits of the powerful field of music therapy are indeed variable, ranging from facilitating the healing of a wide spectrum of diseases to alleviating patient distress. The pairing of music and medicine in clinical settings as well as treating 'music as medicine' has distinct advantages for patients.



Art by Vibha Annaswamy

From the quiet shuffling in the waiting room to the moments up to the administration of anesthesia, patients suffer from creeping stress and apprehension for what is to come. Countless worries inundate the mind, with thoughts from "How much longer do I have to wait?" to "Will the surgery go well?" to the incessant, back-of-the-mind doubt of "What if something goes wrong?" This flood of concerns can lead to the 'sympathetic system' acting up; this leads to accelerated heart rate, hypertension (high blood pressure), diminished awareness of surroundings, overwhelming panic, and an overall coalescence of adverse bodily responses. Furthermore, these reactions may hinder one's ability to listen attentively to the instructions of the medical staff (1). In the worst case, patients may lose control and attempt to resist the situation, effectively putting both the hospital staff and themselves at risk. In response to this predictable, recurrent pattern of patient anxiety, doctors and nurses are trained to communicate openly and normalize the ill feelings of the patient. Despite this, the distress and uneasiness encumbering these patients are inevitable. In hopes of prevention, physicians may administer low doses of sedatives. A commonly-used drug is Midazolam, an oral drug that has been proven to have adverse side effects, including nausea, vomiting, and forgetfulness (2). In a study by Bringman et al., out of a total of 336 patients undergoing surgery, 177 patients were administered music therapy and the other 159 received small doses of Midazolam prior to being taken to the operating room. It was determined that the decrease in anxiety after utilizing music therapy was statistically significantly greater than the decrease within the group who received Midazolam (3). Remarkably, non-invasive therapeutic music was more effective at relaxing patients than the pill. Indeed, music is a potent tool to ensure patient stability within preoperative settings without the detrimental impacts of many pharmaceutical medicines.

Surgeries with regional anesthesia (anesthesia administered only to specific target areas), such as reproductive surgeries, leave patients conscious for the entire duration of the operation. Thus, with exception to the region under surgery, patients retain their sensory abilities, including hearing members of the operating team and the utilization of surgical equipment as well as potentially seeing disturbing images. These perceptions compound into an experience that may prove to be jarring, possibly leading to hypertension or even an intraprocedural agitated physical response. A spike in blood pressure has adverse implications on a multitude of health factors, including cardiovascular stability and blood flow. Thus, it is essential that patients remain calm during regional anesthetic procedures. A 2019 study revealed that music therapy contributes to reducing hemodynamic variability within such surgical settings (4). The intricate yet simple musical harmonies assuage patients' fears stemming from the relatively quiet 'hustle and bustle' of the operating room.

The time period after surgical operations is often the most difficult time for patients. Grappling with the inability to return to normalcy, navigating recovery, dealing with post-operative pain, and accepting their dependence on others are incredibly onerous tasks that, at times, are seemingly insurmountable. It has been shown that subsequent to gynecological surgeries, the administration of music therapy helps to alleviate rising blood pressure and heart rate as well as to lessen the need for painkillers in patients (5). Music therapy after cardiovascular surgery increases oxytocin levels. Oxytocin is a beneficial hormone that facilitates greater relaxation, lesser apprehension, and heightened anti-stress response (6). Additionally, after open-heart surgeries, listening to music results in both a statistically significant reduction in pain intensity (7) and an increase in oxygen saturation (8). Within the context of cardiovascular operations, subsequent to such procedures, there is a documented depletion of oxygen within the red blood cells, which is correlated to greater mortality and negative effects on postoperative health (9). Thus, the increase in oxygen saturation resulting from the administration of music therapy is all the more relevant.

Intensive care units house postoperative and severely ill patients who require constant care and close supervision. Especially within these settings, there is an apparent predominance of depression and infirmity, as cognition deteriorates and feelings of isolation and helplessness are exacerbated. According to a 2012 study, out of all music therapies, classical music yields the best results for intensive care patient health and has the greatest capacity of heightening immune response, alleviating depression, and combating cardiovascular irregularities. More specifically, in accordance with the aforementioned target groups, specific classical pieces may be prescribed. To combat depressive conditions, the prescription of music such as the fast-paced movements of Mozart's *Piano Concertos* would be ideal. On the other hand, slower tempos such as Giuseppe Tartini's *Adagio Cantabile* would alleviate cardiovascular troubles (10). As alluded to, delirium and the mental capabilities of those in intensive care may stagnate and deteriorate. A recent investigation found that prescribing relaxing, classical music is appropriate for treating delirium, reducing coma induction, and accomplishing holistically healthier patient outcomes (11).

In addition, the prescription of classical music has profound implications on the treatment of many neurodegenerative diseases, from Parkinson's to Alzheimer's Disease. Parkinson's Disease is characterized by loss of motor control, foundational movement patterns, and balance. However, treatment through musical rhythm effectively revitalizes key perceptions such as balance and institutes greater motor control, including basic movements such as walking (12). A small-scale case study found that distress and irritative behavior characterizing patients with dementia, the most common symptom of Alzheimer's disease, were greatly reduced in response to a 6-week regimen of therapy through music from the Baroque Period (13). On a related note, a recent study interestingly found that in response to music therapy, there is resultant upregulation of microRNA that play roles in maintaining dopamine levels and memory retention, both of which decline in patients with Alzheimer's disease (14).

"How do we lessen the pain and suffering of patients?" This overarching concept of medicine has driven innovations over centuries. Although it encompasses numerous facets, from easing patients' worries to enhancing the efficacy of treatments, music therapy has proven to be a versatile, robust tool that is and will be increasingly consequential in this perpetual pursuit. Indeed, classical music being a spontaneous yet highly sophisticated expression of the human spirit is ideally suited to heal the body and the mind. Slowly yet surely, from Bach to Mozart, the transcendental essence of classical music shall reverberate in hospitals and clinics around the world.

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Censoring Music: Yay or Nay?

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Edited by Niels Levy-Thiebaut

Designed by Julia Zheng

Introduction

Self-awareness, relatability, and a dopamine rush: these are the reasons we often have our favorite songs on repeat. The catchy tunes and lyrical content can throw us into a state of self-reflection, a very private relationship we have with our favorite music and our inner thoughts. Listeners of the same artists can also find comfort in the connection they share to the same music (1). Throughout the entire musical journey of a song, our body is hard at work releasing dopamine in anticipation of and during the most pleasurable moments of the songs (2). The dopamine rush makes us click the replay button over and over. As the lyrics run continuously through our minds, chemical reactions between synapses enable the words and underlying message of the song to become a part of our long-term memory (3). In turn, many feel influenced by the words of songs to behave and think more like the artists. Music is teens' most popular preferred media outlet today, with almost 66% of adolescents listening to their favorite songs every single day (4). Although we cannot say with certainty that music causes mental or behavioral changes amongst listeners, studies have found a link between aggressive music and a hostile state of mind. We need to consider the influence music can have on the moods of impressionable teens, given that many songs nowadays contain expletives and negative ideas.

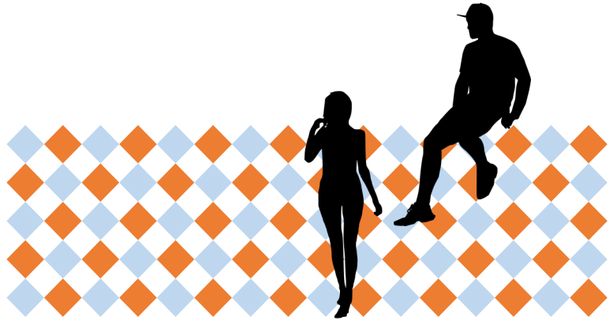
Researchers Cynthia Frisby and Elizabeth Behm-Morawitz from the University of Missouri found that 99.5% of the 198 pop hits they analyzed contained "more profanity, misogyny, and references to stereotypical sex roles than lyrics found in R&B, country, alternative, Latin, jazz, and rock music" (5). Though many believe that music is just for entertainment purposes and that lyrics are not to be taken seriously, a study conducted by OMEGA, the Journal of Death and Dying, determined that 25% of female adolescents along with 17% of male adolescents chose the music that they listen to based on the lyrics and their reflection of the listeners' emotions (6). It is clear that the growing preference among the youth is belligerent lyrics, specifically those that objectify women and glorify the use of weapons. Exposure to antagonistic and hostile imagery produces aggressive thoughts and feelings, as concluded by the American Psychological Association (7). The frequent exposure teenagers have to extreme amounts of violent imagery raises the question: does the depiction of violence in modern-day music result in an increase of acts of violence in the United States? Though we cannot examine all aspects of delinquency to answer this question, we can focus on the most common: suicide, suicide-related activities, sexual harassment, and drug use among teens.

Suicide and Suicide-Related Activities

In an attempt to lower suicides rates among adolescents, psychologists treat teen patients as soon as they display suicidal thoughts. Music often is not considered a factor influencing self-harm; however, some researchers believe there is a connection. One study cited by the US National Library of Medicine National Institutes of Health found a correlation between preference of music and suicide-related behaviors. In the study, students chosen from two random high schools were asked to fill out a survey that asked about their music preference, mental health, and suicide-related thoughts. The results determined the following: 74% of the female students preferred pop music, whereas 71% of the male students preferred rock/metal or rap. Students with a preference for any of these music genres "displayed suicidal thoughts, acts of deliberate self-harm, depression, delinquency, drug taking, and family dysfunction" (8).

Rape Culture and Objectification of Women

Violent lyrics in music may normalize the objectification of women and promote rape culture, "an environment in which rape is prevalent and in which sexual violence against women is normalized and excused in the media and popular culture" (9). One report cites that in American music lyrics, 20% of the lyrics were about men and their role in power, 18.3% were about the objectification of women, 18.3% discussed sex being a priority for men, 16.7% spoke about sexual violence, 10.8% promoted the idea of a woman being defined by "having a man," and 5.5% of the lyrics were about women not valuing themselves (10). With lyrics becoming more explicit in their references to sex and women, the youth's perception of these topics is significantly skewed. According to a study in a journal by the American Academy of Pediatrics, males who listened to "misogynistic" lyrics or those containing sexually violent ideas "showed increased aggressive responses toward women as well as a more negative perception of them" (11). At an impressionable age in which many adolescents are looking for answers, teenagers are being influenced by these hostile lyrics full of misconceptions. Misogynistic lyrics instill the idea in the youth that men and women are unequal, along with the belief that women are simply objects to be desired by men.



The Impact of Music on Drug Use and Substance Abuse

Similar to their glamorization of sexual violence, modern music lyrics were shown to glorify drug use in 69% of the 125 most popular rap songs between 1994 and 1997 (12). In modern-day music, 51.4% of musicians sing about alcohol, 24.9% about marijuana, 7.3% contain references to cocaine, 6.2% sing about methamphetamines, 4.9% include references to heroin, 3.7% about ecstasy, 1% about prescription painkillers, and 0.5% sing about benzodiazepines (10). Continuously exposed to references to mind-altering substances, adolescents are more inclined to experiment with the drugs they hear about. In addition, the correlation between substance abuse and aggressive behavior is clear, as the Journal of Substance Abuse Treatment found that more than 75 percent of people being treated for a drug addiction "report[ed] having performed various acts of violence," such as attacking others with a weapon, mugging, and physical assault (13). By inciting teenagers to experiment with drugs, rap and hip hop music are threatening to create a generation prone to act in aggression.

Conclusion

The violent content of many songs carries the potential to influence suicidal behavior, a hurtful perception of women and sex, and drug use in the next generation. In attempts to prevent suicide, substance abuse, and sexual assault, shouldn't artists censor their content? It sounds like an obvious solution: if no violent themes were present in music, harmful influence could be prevented, right?

During the 1960s, radio shows began censoring songs that spoke on "indecent" topics. Artists such as The Beatles, Queen, and Rolling Stones suffered as their songs were rejected by radio stations across the nation. Around the same time, television programs began regulating what content was released to the audience. For instance, The Rolling Stones, when invited on the Ed Sullivan Show in 1967, were not allowed to perform their hit No Satisfaction due to its suggestive sexual lyrics. Artist Loretta Lynn's song The Pill was another song rejected for its references to birth control (14). The battle between artists and media-releasing platforms regarding censorship continues to this day, with artists fighting for their right to present their work.

As sensible as it seems, censorship of music can be viewed as infringing on songwriters' freedom of speech. Since artists are not causing direct harm to others through their songs, they hold the right to express their emotions and are not responsible for how others perceive their songs. From a governmental point of view, banning music with violent content cannot be done for two reasons: first, we have no sound way to objectively determine what qualifies as "violent content" and second, a ban would impede the freedom of citizens. Censorship, if any, must take place at a parental level in an attempt to protect impressionable children from the influences of hostile music lyrics (15).

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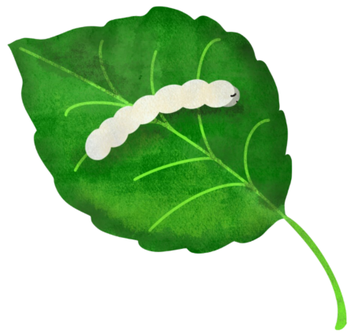
Mother Nature's Design

By Haya Prasla

Edited by Neha Donthineni

Designed by Julia Zheng



In 2012, MIT Media Lab built the world's first silk pavilion, constructed entirely by silk-spinning silkworms. The idea behind the dome was to innovate new ideas of designing with nature instead of against it. Silk fibers are traditionally sourced by boiling the silkworm cocoons, thereby killing the silkworms alive inside. The researchers, however, did not use this method; instead, they let the silkworms do the fabrication for them. Not only was the pavilion an incredible success and a testament to innovative design, the number of silk moths that survived would be able to produce another 1.5 million eggs that could potentially fabricate an additional 250 pavilions (1).

This innovative approach to silk production is an example of 'sustainable design.' According to the U.S. General Services Administration, sustainable design "seeks to reduce negative impacts on the environment, and the health and comfort of building occupants" (2). Of course, sustainable design goes beyond architecture and construction. It extends to virtually all facets of design, from aesthetics to product manufacturing.

Sustainable design has been a hot topic in the fashion industry for the past couple of years, and it's no secret that the industry has, recently, taken a turn for the worse. Overconsumption of trendy clothing, especially from fast fashion giants like Zara and H&M, has left behind a graveyard of discarded, barely-used clothing. Unfortunately, these habits show no sign of stopping. According to the U.S. Environmental Protection Agency, about 17 million tons of clothing were generated in 2018 -- 11.3 million tons of this went straight to the landfill. (3)

Moreover, the fashion industry is gradually shifting away from natural fibers like cotton and linen. Synthetic fibers like polyester and nylon are some of the most popular blend fibers today. Blend fibers, while easy to produce, are difficult to break down, taking anywhere from 20-200 years to naturally biodegrade (4). With clothing piling up in landfills, it is clearly infeasible to continue designing with these sorts of synthetic materials. So what's the solution?

Simply put, there isn't one solution, but rather a spectrum of possibilities. Corporate accountability, labor rights, carbon emissions—these are all issues in the fashion industry that must be addressed right now. The next step is a paradigm shift in fashion design thinking and sustainability.

Fashion, at the end of the day, is two things: creativity and functionality. Therefore, sustainable design must fulfill both of these requirements. Luckily for us, several trailblazing designers, brands and companies have pioneered designs, materials, and methods that take fashion design to the next level.

Take silk, for example. As mentioned previously, traditional silk is harvested by boiling silkworm cocoons alive. Some designers have taken on the challenge of devising silk alternatives: fabrics that function and feel like silk but are produced ethically with consideration for the environment. In 2017, luxury brand Ferragamo released the Orange Fiber Collection, featuring the world's first citrus-made fabric (5). The fabric, which has the look and feel of silk, is sourced exclusively from citrus peels. The goal behind it is to divert and reuse the 700,000+ tons of citrus waste in Italy. Stella McCartney, another luxury fashion brand, partnered with Cali-based biotech company Bold Threads to create a vegan, closed-loop alternative called Microsilk™, inspired by the tensile features of spider silk (6).

Closed-loop production is another area of growth in the fashion industry since it focuses on reducing, reusing, and recycling material waste to create new products. TENCEL™ Lyocell and Modal fibers are the golden children of the materials industry, known for their eco-friendly textiles. They've gained quite a reputation for their virtually zero-waste production which utilizes renewable wood products to create cellulosic fibers (7).

Renewcell is another up-and-coming technology that focuses on recycling cellulosic fibers like cotton and viscose to be "fed back into the textile production value chain" (8).

These technologies are offering solutions to our waste problems. Granted, some of these methods are expensive and not yet reproducible on an industry-wide scale. But it does give a taste of what lies ahead. These are all examples of how a paradigm shift in fashion design can emphasize preventative design over damage control, in which designers can anticipate problems (like waste) and plan around them. Sustainable design is about prioritizing the integrity of the process and product over cutting costs.

However, environmental considerations do not have to restrict the design process. There is still plenty of room for creativity and imagination, as biomaterial designer Alice Potts demonstrates through her work. Potts specializes in producing sweat crystals (yes, crystals made from human sweat). Sweat particles are extracted from used clothing and crystallized into solid accessories—all in a lab (9). Also grown in labs are pigment-producing bacteria, cultivated by Dutch designer duo Laura Luchtman and Ilfa Siebenhaar for their project "Living Colour" that focuses on utilizing bacteria to produce natural pigments that can be used to dye fibers (10). Other designers like Roya Aghighi are pushing the field of biogarmentry, a "transdisciplinary collaboration of synthetic biology, material science and design." Her work focuses on creating photosynthetic textiles that emphasize and enhance the give-and-take relationships between consumers and their garments (10).

While these advances in fashion design may seem far-fetched, all great advances begin as crazy ideas. This is the spirit of design. Of course, these ideas are not meant to be immediate solutions to our world's most pressing problems. Rather, they are the next step—what we consider to be 'the future' of design. Dr. Neri Oxman, the designer at the forefront of the Silk Pavilion project, once asked "Can we design our way out of this [environmental crisis]?" (11).

Her response: "If we are to survive, we *must.*"

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Southern Louisiana's Petrochemical Nightmare

By: Yash Desai
Edited by: Francisca Guerrero
Designed by: Julia Zheng

This past summer (2021), I participated in a 4,000 mile, 70-day charity bicycle ride with twenty other teammates through an organization called Texas 4000 for Cancer. The goal of the ride is to engage with people and communities impacted by cancer. Much of our route passed through regions of the American South that have been disproportionately impacted by high rates of cancer incidence. This region is aptly named the "American Cancer Belt." Bicycling through parts of East Texas, Louisiana, Mississippi, Arkansas, and Missouri, my teammates and I passed through a multitude of small towns that did not have major critical care facilities close by, and were surrounded by industrial plants and factories which employed many of the local residents.

One specific conversation that struck a chord with me was with a host of ours: a pastor named Richard. Richard talked to me about how he knew countless people with cancer in Lake Charles who either have to drive two hours to Ochsner Medical Center in New Orleans or two hours to MD Anderson Cancer Center in Houston to receive appropriate medical care. Richard also explained that as a healthcare administrator at the local Lake Charles Memorial Hospital, he had been trying to expand the hospital's cancer center for a long time, but had not received sufficient funding to do so. It became apparent, then, why these regions have high rates of cancer: it is a combination of lack of access to adequate healthcare resources within the local community, as well as sustained environmental pollution on part of local industry.

"Cancer Alley" refers to a region in Louisiana, along the Mississippi River, between Baton Rouge and New Orleans, with disproportionately high rates of cancer incidence [1]. Spanning just about 85 miles, the region is home to 136 petrochemical plants and seven oil refineries [1]. Due to the alarming density of petrochemical plants, the region is also often referred to as the "Chemical Corridor" [5]. As the name suggests, Cancer Alley is effectively a hotbed of cancer. The Environmental Protection Agency's National Air Toxic Assessment Map suggests the cancer risk in St. James Parish, one of the most industrially populated parishes in Louisiana, approaches 105 cases per million [6]. For reference, the EPA's "Maximum Individual Risk" threshold is 100 cases per million [3]. Given that the EPA's measurements of cancer risk are based on toxicity levels in breathable air, here is a more startling statistic: altogether, the 136 petrochemical plants and seven oil refineries that make up the Chemical Corridor release upwards of 129 million pounds of toxins every year (this is just around 6% of the total toxic output of the United States, by weight) [4].

As mentioned previously, St. James Parish is a notable region within Cancer Alley that is worth examining. Within St. James Parish, the already high concentration of industrial facilities is even worse in areas with some of the lowest average household incomes, lowest levels of educational attainment, and a high African American population (around 92.6%, according to 2016 Census Data) [2]. In 2015 alone, over 755,000 tons of air pollution were released by industrial facilities, with the most common pollutants being ammonia, methanol, styrene, ethylene, and benzine – all of which are associated with petrochemical facilities [2]. Even more startling, about 70.6% of the total minority population of St. James Parish lives within a kilometer from a major polluting facility, compared to 23.1% of white residents who live within the same distance of a major polluting facility [2]. What we see is an issue that, once again, exists largely along racial and socioeconomic lines. This revelation is nothing new: the burden of industrial pollution is almost always carried by racial minorities and the socioeconomically disadvantaged. The fact remains that the petrochemical industry continues to engage in a brazen display of environmental racism. In a way, the industry can be labeled a mass murderer – or at the very least a mass poisoner, if such a term exists.

So why does the petrochemical industry seem to be able to get away with this? To answer this question, it is important to first understand the power dynamic between the industry and the local residents of Southern Louisiana. In a fashion similar to that of most capitalist industrial giants, the petrochemical industry takes the "path of least resistance" when deciding where and how to host its factory operations. Essentially, the industry opts to deliberately place operations within areas where residents lack political power. Usually, these communities are home to low-income racial minorities – a demographic that lacks access to the privilege of national lobbying and representation. This constitutes a major problem. Given that 16.2% of Louisiana's labor force is employed in oil and gas, these communities are effectively financially beholden to the industry, and the industry is simultaneously large enough to strong-arm its way into influencing Louisiana's politics [1]. Residents and local interest groups are thus rendered powerless.

So then what is the solution? Primarily, a solution lies in politically empowering people from low-income minority communities. But to get there, it is important that those with relative political privilege – middle and upper-class Americans – start to care about the problem, and become advocates for these populations. Collective citizen involvement in local environmental and labor policy can, to a large degree, help offset the power dynamic from which the petrochemical industry operates. This means advocating for regulations on petrochemical corporations, oversight from government agencies for the sake of air quality and environmental protection, and more effective health care coverage for employees who are exposed to risk. This, in turn, will work to hold legislators and policymakers accountable to the people, and not to a petrochemical corporation's bottom line.

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