



Grey Matters

N°02 - 2024

FREE

Georgia State University

Neuroscience on the Scene of the Crime!

Neuropsychology, Mental Health, and the Legal System.

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Also:

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Note from the Faculty Advisor



David Waxler
Faculty Advisor

The inaugural issue of GSU's *Grey Matters* Journal was published just a few months ago, and already the chapter has produced its second. The fact that a student-run organization can create such a high-quality product in such a short time is impressive and reveals the skills and expertise that undergraduates develop at GSU, both within and outside of the classroom.

The abilities that the student contributors develop and demonstrate in each issue of *Grey Matters* are exactly those that employers say they are looking for in recent college graduates. Specifically, they are ones that the National Association of Colleges and Employers (NACE) has identified as "Career Readiness Competencies," such as *teamwork, professionalism, and leadership*. Because each issue of *Grey Matters* requires the coordination and collaboration of many students—from the authors, editors, and artists who work in individual article "pods," to the editorial board members who oversee the overall issue—participating in *Grey Matters* gives students a fantastic opportunity to develop these in-demand skills. In addition, other career readiness competencies identified

by NACE, such as *critical thinking, communication skills, and proficiency with technology*, are an important part of the writing, editing, illustrating, and digital design of each issue of *Grey Matters*.

Of course, many students who participate in *Grey Matters* plan on continuing their education after graduating. For these students, including their *Grey Matters* contributions in their applications can demonstrate to an admission committee that they have the skills to succeed in post-graduate education and beyond.

Whatever career or advanced degree a student decides to pursue, contributing to *Grey Matters* can help them to stand out from other candidates. If you are currently a GSU undergraduate, I hope you will consider being a part of the next issue of *Grey Matters* and taking advantage of this unique opportunity.

Sincerely,

David Waxler
Senior Lecturer,
GSU Neuroscience Institute

Cover Artwork:
Teddy Jakim

Letter from the EIC

Coming from the position of writing the *Psychedelics as Therapeutic Agents* article for our Spring 2024 issue, I was motivated to lead the efforts of *Grey Matters* at Georgia State University as the Editor-in-Chief. As a student who struggled to find true passion at the beginning of undergraduate school, I discovered from *Grey Matters* that writing, and now leading, has brought fulfillment and joy into my experience here at the university.

I am a huge advocate for accessibility and inclusiveness, which are values that help this organization come to life through each production cycle. As an undergraduate student majoring in psychology and minoring in computer information systems, I was able to engage my interest in neuroscience while studying other topics through my degree. In a similar way, we not only have neuroscience majors on our team, but also art majors, biology majors, and other students from a wide variety of focuses. With the same goal of bridging the divide between neuroscience and the general public, they all came together to create our Fall 2024 issue. This issue would not have existed without the authors, editors, and artists who put their endless efforts and time into creating each article.

I would like to thank my editorial board for everything they have done, which ranged from organizing and overseeing the production pods to brainstorming ways to keep improving and learning. I am grateful for their efforts and for their support as we continue to establish the *Grey Matters* chapter here at Georgia State. I would like to thank our faculty advisor, Professor David Waxler, for providing the resources and an abundant amount of support through every bump or challenge that came our way. Lastly, I'd like to thank Evelyn Farkas, the last Editor-in-Chief, for initiating the start of *Grey Matters* at Georgia State University, and for laying down the foundation for us to grow on.

I am beyond proud of our team for creating this issue. Thank you for reading!

Sincerely,

Maggie Nguyen
B.S. in Psychology
Editor-in-Chief



Maggie Nguyen
Editor-in-Chief

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GREY MATTERS
Georgia State University

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WIRED CHANGE:

The Evolution of Neuroplasticity in Youth

by *Lisandra Garmendia*

editors: *Tafara Nenguke & Brent Stacyart*

art by *Seoyeon Oh*

In an era when social media is pervasive, youth development is going through a significant upheaval that is changing not just how young people interact with one another but also the architecture of the adolescent brain itself. Neuroplasticity, the brain's remarkable ability to adapt and reorganize itself by forming new neural connections in response to experiences, has long been recognized as a fundamental aspect of cognitive and emotional development [1]. Plasticity defines the brain's malleability or ability to change; it does not mean that the brain is plastic. Neurons are nerve cells that serve as the brain's and nervous system's structural building blocks. Thus, neuroplasticity enables nerve cells to alter and adjust. However, the nature of neuroplasticity is changing in ways never seen before, especially in younger generations [2]. As a result of the development of technology and the widespread use of social media, unlike prior generations, today's youth are exposed to the digital world from an early age, fundamentally altering their brain development in ways that scientists are only beginning to comprehend.

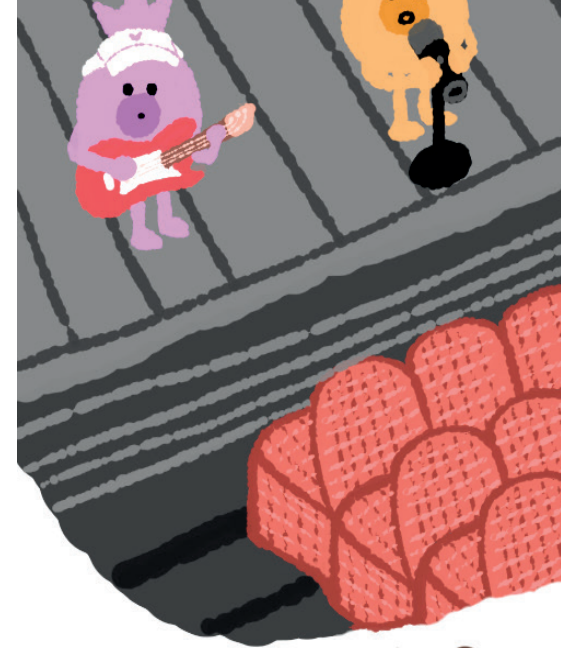
As a college student navigating a world saturated with smartphones and constant digital connections, I see how technology is not only reshaping my own mind but also transforming how my generation

engages with the world. It feels as though our brains are rewiring in real-time—whether we're staying up late on TikTok or juggling assignments amidst endless notifications. Technology now infiltrates nearly every aspect of our lives, rapidly changing how we focus, learn, and socialize. The implications for our mental health are both intriguing and somewhat concerning, as it seems we're witnessing the evolution of the human brain one video, one "like," and one tweet at a time.

The intricate link between youths' use of social media and their plasticity is something that needs to be continually explored. Our growing reliance on digital platforms necessitates further research into the long-term effects on neuroplasticity, including both the possible benefits as well as emerging hurdles [1].

I "The Motherboard" *Foundations of Neuroplasticity*

The concept of neuroplasticity has changed dramatically throughout history. Early neuroscientists before the 1960s believed the brain was "fixed" after childhood, with little ability to change in development [2,3]. This viewpoint was based on an ancient belief from the Greeks that the brain was like an extraordinary machine (Aristotle's blood-cooling mechanism), capable of incredible feats but incapable of



growth and change [2,3]. However, groundbreaking research in the mid-twentieth century, conducted by Donald Hebb and later Michael Merzenich, challenged this notion, demonstrating that the brain in fact can continue to rearrange and make new connections in response to learning, experience, and injury throughout life. These findings transformed the view of cognitive development by proving that the brain is malleable far into



adulthood, a concept that has since proven central to improvements in education, rehabilitation, and mental health treatments [4].

Over the past decade, research has focused towards exploring how modern environmental elements, such as technology and social media, interact with this adaptability, particularly in young people's brains that are still developing [5]. This adaptability is achieved through

synaptic and structural plasticity. Synaptic plasticity describes changes in how neurons (brain cells) communicate, such as strengthening or weakening connections according to how frequently they are relied on. Constantly tracking social media, for example, could reinforce these synaptic connections, increasing the likelihood that the behavior will be repeated [6]. These changes cause a shift in the somatosensory cortex (the part of the brain that

processes sensory information from the body, including touch, pain, temperature, and pressure). Because young individuals frequently use their thumbs to navigate touchscreens and text, researchers discovered that their brains acquire stronger neural responses to thumb movement. This is a clear illustration of neuroplasticity, as the brain adjusts to repetitive activity by strengthening connections associated with touch sensitivity

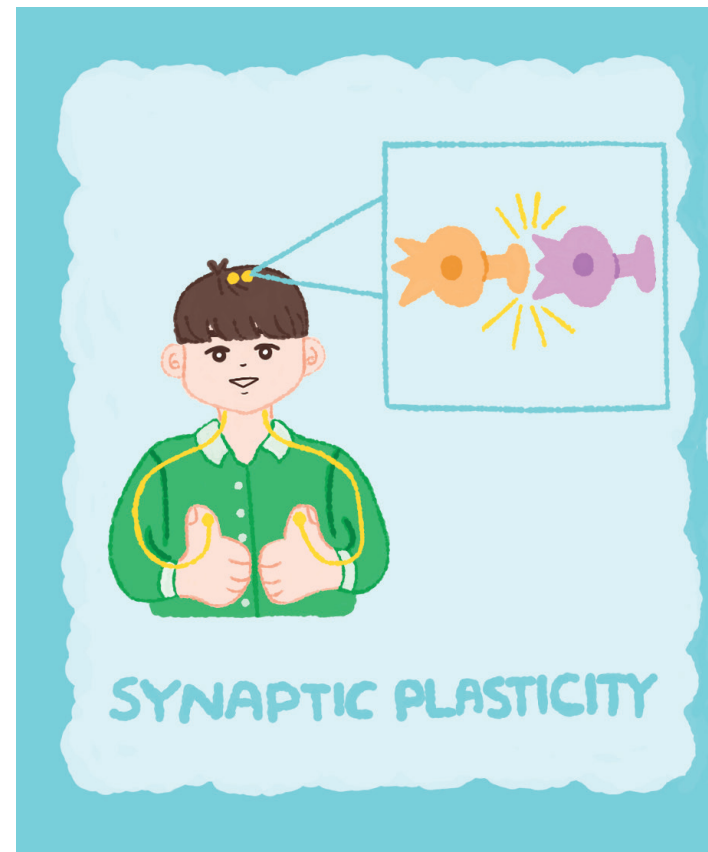
in the fingertips [6], demonstrating how youth technological habits can influence brain development. Apart from Synaptic plasticity, there is Structural plasticity, which refers to physical changes such as the formation of additional neuron branches or connections. According to research done by The U.S. Surgeon General's Advisory, spending a lot of time on social media can alter these processes, both positively and negatively, such as raising anxiety and stress, which can impair the brain's ability to make new connections [7]. While technology can enhance learning and social connection, excessive use may outweigh the positive neuroplasticity.

Critical periods of brain development are moments in early life when the brain is extremely receptive to learning and environmental stimuli, demonstrating increased neuroplasticity. This plasticity is most pronounced in children, (ages 1-9), allowing for fast brain development and the growth of fundamental abilities such as language, motor skills, and sensory processing [8]. During this stage, the brain is very malleable, changing dramatically in response to events, which is why early childhood development is critical for cognitive and social development. Neuroplasticity remains high in adolescence (10-19), but the focus shifts to refining connections, particularly in areas involved in decision-making, emotional regulation, and social interactions [8]. This stage is distinguished by synaptic pruning, in which the brain removes unneeded connections to improve efficiency [9]. Neuroplasticity persists in adults, however at a slower rate. While the ability to learn and adapt persists, the brain becomes

harder to mold and relies more on established neural connections. Nonetheless, adult brains can undergo reorganization, particularly when exposed to new experiences, learning opportunities, or in response to damage; however, these changes are often less pronounced than those in younger persons [10].

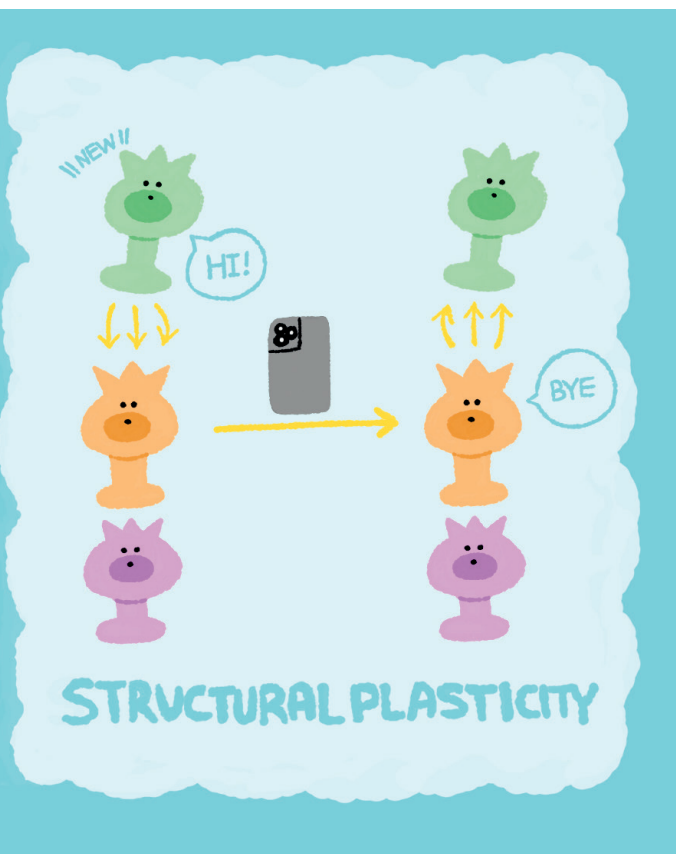
II “Digital Overload: Balancing Cognitive Health in the Age of Technology”

Compared to previous generations, technology has significantly changed the cognitive demands we face. In the past, people relied heavily on memory and manual problem-solving, but today, many of these tasks have been automated by technology, altering how we process information. For example, we no longer need to memorize phone numbers or use physical maps because our smartphones handle these tasks for us. However, this reliance on technology may weaken key cognitive functions, like memory retention, as we aren't regularly exercising those parts of the brain. Personally, I struggle with memory and often forget simple things like what I wore the day before. If I had known technology could impact my memory this way, I might have approached it differently. I often find myself thinking about how deeply technology has become embedded in our daily routines. It's almost unimaginable to function without it,



as it plays a role in nearly everything we do, from attending virtual lectures to submitting assignments online. Our phones have evolved beyond mere communication tools; they now serve as planners, research aids, and social connectors. Technology has become essential, whether we're using Google for quick information, collaborating on group projects via Zoom, or accessing online libraries for research.

After surveying 30 students on the Georgia State University campus, I gathered that on average students have an average screen time of 8-10 hours per day. From a range of academic use, social media and communication, and entertainment. Apart from that, even in the workplace, most job applications and tasks are conducted online, making it even more difficult to disconnect from the digital realm.



Studies predict, 9 out of 10 of all jobs in the future will require some level of digital skills [11]. The consciousness and efficiency technology brings to our lives create a sense of dependence that's hard to escape.

Another issue is multitasking, most think that this is an important skill to learn but it can come with some complications. Frequently engaging in multitasking can lead to cognitive overload, which adversely affects memory formation and attention. Multitasking, such as texting while studying, reduces young people's capacity to encode and retain information [12]. Research has shown that regular multitasking might result in lower academic achievement and greater difficulty in maintaining focus[12]. This constant cognitive strain can impair the brain's capacity to acquire and store memories, potentially altering the neuroplasticity

of young individuals. This technological evolution's dual nature emphasizes how crucial it is to keep a balanced approach to technology use and provide focused learning environments in order to support cognitive growth that is healthy [13,14].

III "Mind Over Tech: Social Media and Mental Health Concerns"

Dopamine, a neurotransmitter tied to pleasure and reward [15], Overall plays a major role in the addictive nature of social media. When younger people receive "likes" or notifications, The nucleus accumbens (NAc) which is a subcortical brain structure known primarily for its roles in pleasure, reward, and addiction; Activates the brain's reward system, releasing dopamine and driving a stronger urge for more social approval [16]. 95% of teens now report they have a smartphone or access to one. These mobile connections are in turn fueling more persistent online activities: 45% of teens now say they are online on a near-constant basis [17]. This continuous cycle of dopamine-driven reward-seeking can lead to compulsive social media use, which negatively affects focus, academic performance, and mental health [18]. Over time, this behavior mirrors addictive patterns, where users increasingly crave dopamine bursts from notifications, causing them to spend more time on social media at the expense of other important activities.

The rapid increase in social media use has been strongly tied to declining emotional stability, rising anxiety levels, and a growing number of depression cases, especially among younger individuals. Research highlights a clear connection between heavy social media consumption and the spike in mental health issues among adolescents. In the U.S., teen depression rates surged by 63% between 2013 and 2020, while suicide rates for those aged 10-24 rose by 57.4% from 2007 to 2018 [19]. This troubling trend is partly driven by the constant exposure to online content that promotes unhealthy comparisons, cyberbullying, and pressure to gain social approval. Comparison culture, often driven by social media and societal pressures, can severely impact the mental health of young people. There are several key reasons why this phenomenon is harmful.

Decreased Self-Esteem: What adolescents frequently compare themselves to others who seem more successful or attractive, it often leads to feelings of inadequacy which result in lowered self-worth, increased feelings of failure, and a negative self-image.[20]

Decreased Self-Esteem:

When adolescents frequently compare themselves to others who seem more successful or attractive, it often leads to feelings of inadequacy which results in lowered self-worth, increased feelings of failure, and a negative self-image [20].

Anxiety and Depression:

The pressure to meet these perceived standards creates significant anxiety and can trigger depressive symptoms. Young people may feel the constant need to prove themselves, fear not being good enough, and

become overwhelmed by unrealistic expectations [21].

Social Isolation:

Comparison culture can lead to social withdrawal as individuals, feeling inadequate, may avoid social situations. This can result in difficulty forming authentic relationships and an increased reliance on virtual interactions over real-world connections [22].

Body Image Issues:

The barrage of idealized body types and lifestyles on social media can contribute to unhealthy eating habits, excessive exercise, and, in extreme cases, body dysmorphic disorders [23].

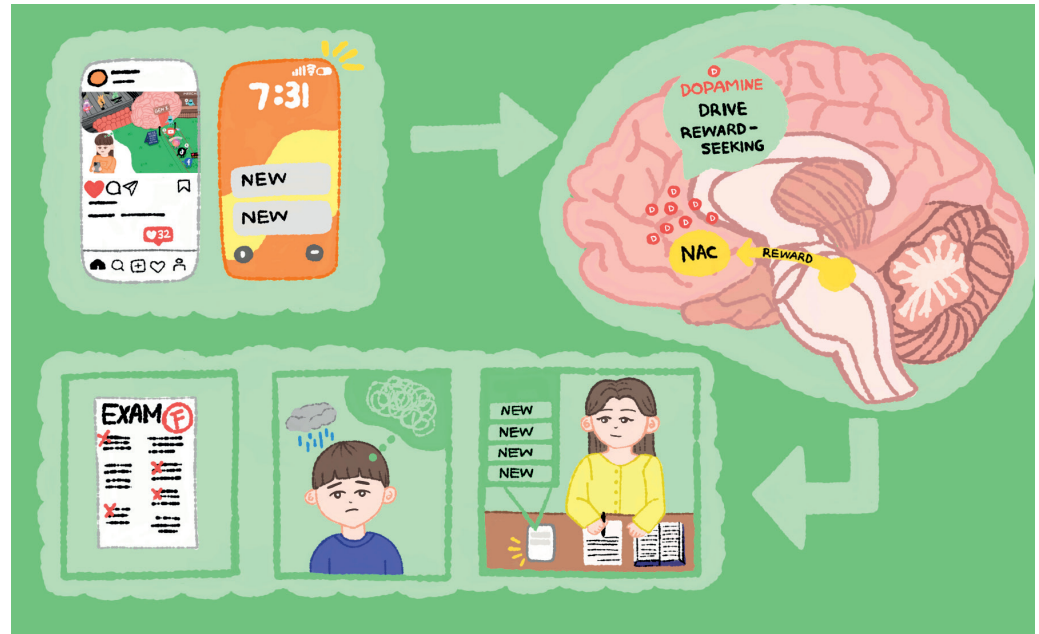
Fear of Missing Out(FOMO):

Constant comparisons often fuel a sense of FOMO, where young people believe they are missing out on experiences others are enjoying. This can heighten anxiety, create pressure to participate in risky behaviors and diminish enjoyment of their own personal experiences [24].

IV “Model 2.0: Neuroplasticity and the Evolution of Generations”

Older generations often find it difficult to grasp how social media and cultural pressures drive many teenagers to engage in suicidal thoughts and behaviors, mostly as a result of the differences in the social and technological contexts of their own upbringing. Due to these differences, older generations exhibit a distinct pattern of neuroplasticity. Their brain development was more influenced by activities that enhanced language, memory, and problem-solving skills without relying on digital devices. My father

constantly brags about the fact he has better vision, better memory, and better navigational skills than me and it impresses me to see how true it actually is, and how much I have been affected by technology in such a little span of my lifetime.



However, he, like many older people, develops mental processes that have been developed over time by substantial life experiences. While neuroplasticity decreases over time with age, older adults can still form new brain connections, through their ability to adapt and change occurs more slowly than in younger individuals. This variation in neuroplasticity also impacts how different generations respond to technology; older adults often find it harder to adapt to the rapid flow of information that digital natives process with ease. Overall, these changes in neuroplasticity over time demonstrate how diverse life experiences and early exposure to technology shape the brain differently, resulting in unique cognitive strengths across generations [25].

In conclusion, neuroplasticity has advanced remarkably especially when considering our ever-evolving interaction with social media and technology. As we learned neuroplasticity- the brain's capability to reorganize itself by creating new

neural connections-has not only reimagined a fascinating subject of study but also adjusted to the profound changes brought about by the digital age. It is essential for college students navigating this environment to comprehend the impact of these changes. Our cognitive processes can be altered by the continual stimulus from digital gadgets and social media platforms, which can affect everything from attention spans to emotional regulation. Our brains are constantly reorganizing to meet the fast-paced demands of modern-day living as a result of the extraordinary speeds we are consuming information. It is critical that educators, parents, and legislatures grasp how technology affects neuroplasticity and create settings that prompt well-rounded, productive learning experiences; the

call for further research is essential if we want to know more about how technology affects brain development and cognitive function over time. If we want to remain as the future leaders of this world, I strongly encourage anyone who is reading this article to practice mindfulness, focus on your personal growth, and surround yourself with loving and supportive communities. By being mindful of our technology consumption and actively working towards self-love, we can mitigate the adverse effects of social pressures and cultivate a healthier mind and self.

Ultimately, the evolution in the age of social media and technology demonstrates our brains' incredible adaptability. As we continue to the digital world, let us embrace it and turn it into an opportunity for growth, learning, and connection.



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An abstract illustration featuring a brain at the top, a hand holding a wooden beam across the middle, and a green ribbon-like shape at the bottom. The background is a mix of orange, yellow, and green with various textures and patterns.

FEATURE

Neuroscience on **THE SCENE OF THE CRIME!**

by Mariyam Syed
editors: Cassandra Rosales
& Rayna Swafford
art by Teddy Jakim

Historically, neuropsychology was defined by Meier as “the scientific study of brain-behavior relationships,” which provides the foundation for its forensic applications. Horton and Hartlage further refined forensic neuropsychology as “the application of the science of brain-behavior relationships to legal decision-making” [1, 4]. Forensic neuropsychology plays a crucial role in bridging the gap between neuroscience, psychology, and the legal system, offering significant benefits to the mental health discipline and society at large. As the field continues to professionalize, neuropsychologists practicing in legal contexts have had to build upon their existing clinical expertise. They must possess a deep understanding of brain-behavior relationships, while also acquiring expertise in legal procedures to successfully meet the unique demands and challenges of forensic practice [10].

In essence, forensic neuropsychology is a specialized branch of neuropsychology that applies the understanding of brain-behavior relationships to legal matters. This interdisciplinary field leverages clinical neuropsychological principles to navigate complex legal issues that involve cognitive, emotional, and behavioral functioning in convicts. Significant advances in research and clinical practice have enabled clinical neuropsychology, and its related subfields, to make significant strides. These developments have, in turn, helped pave the way for many forensic applications. As criminal investigations and scientific research continue to expand on principles in applied neuropsychology, the demand for expert testimonies from

neuropsychologists in legal settings has grown exponentially [3].

“Forensic neuropsychologists play a crucial role at the intersection of psychology and law.”

To understand their impact on criminal procedures, it’s essential to explore various roles and responsibilities that forensic neuropsychologists must fulfill in legal settings. In such spaces, attorneys seek out neuropsychologists to enlist their expertise in evaluating and assessing the competency of individuals standing trial. Their evaluations and related testimonies are largely accepted within our legal systems to provide insight into defendants’ pre-existing cognitive impairments or psychological conditions [5]. In some jurisdictions, neuropsychologists are also asked to give opinions about the potential causes of such cognitive impairments, further influencing legal outcomes [13]. Forensic assessments also assist in determining whether such psychological conditions contributed to their criminal actions. Although this specialized knowledge allows neuropsychologists to provide valuable insights to the courts, it also places them in ethically challenging positions. Neuropsychologists who find this level of responsibility uncomfortable may find forensic work challenging, as it requires maintaining neutrality even when the potential for harm is high [18].

Clinical neuropsychology is a specialized field that bridges neuroscience and psychology, focusing on the practical applications of brain-behavior relationships in clinical settings. Forensic neuropsychology differs from clinical neuropsychology, particularly in criminal cases

and within the forensic context. While clinical neuropsychologists seek to assess, diagnose, and treat mentally ill individuals, forensic neuropsychologists aim to determine whether an individual’s psychological state meets a specific legal standard. Tasked with applying their knowledge of brain-behavior relationships, forensic neuropsychologists maintain a unique and vital role in both civil and criminal legal proceedings [6]. Their forensic evaluations center around examining the psychological aspects of a given case and using their findings to inform legal decision-making.

One of the most striking differences between clinical and forensic neuropsychology is the role and ethical stance that neuropsychologists must adopt in a forensic setting. In clinical settings, the goal is to alleviate suffering and improve an individual’s quality of life. Conversely, forensic neuropsychologists must adopt a neutral, unbiased position as “seekers of truth” [17]. This objectivity is essential in legal cases, where their evaluations may have significant consequences, such as determining competence in capital cases. In such cases, the evaluator’s opinion greatly influences the court’s decision to either refrain from or proceed with sentencing a defendant to execution. Evaluations are often complex in nature since they must address both legal and psychological aspects of a given case. Malingering, or intentionally faking symptoms, is a frequent issue in both civil and criminal cases [12]. Individuals seeking compensation for work-related injuries may exaggerate symptoms, while criminal defendants may feign cognitive impairments or psychosis to avoid sentencing or execution. Forensic



neuropsychologists must therefore remain vigilant for dishonest responses and thoroughly skilled at detecting deception.

Forensic neuropsychologists play a crucial role at the intersection of psychology and law, offering specialized knowledge to help the courts determine and assess the psychological state of defendants. Their role differs significantly from

that of clinical neuropsychologists, requiring a neutral and objective stance, especially in criminal cases where the consequences of their evaluations can be severe [8]. Their insights help courts understand how various psychosocial variables influence brain function and dysfunction. This type of expertise is vital in both criminal and civil proceedings, where neuropsychologists may be asked to

provide evaluations on matters such as an individual's competency to stand trial, capacity to make medical decisions, or the potential danger an individual may pose to themselves or others [10]. While their work is essential in assisting with legal decisions, it also presents significant ethical challenges, particularly in cases involving competency or capital punishment. As a result, forensic neuropsychologists must balance their responsibility as truth-seekers with the potential consequences of their assessments [8].

Forensic neuropsychologists perform their evaluations in various settings, including clinical offices, nursing homes, hospitals, and private residences. For civil cases, most evaluations occur in the practitioner's office, but depending on the context, other facilities, such as nursing homes or hospitals, may be involved. In criminal cases, out-of-custody defendants may also be evaluated in clinical offices, only if appropriate safety measures are in place.

Essentially, forensic neuropsychology serves as a critical link between mental health, neuroscience, and the legal system. This discipline is especially critical in informing legal decisions and providing valuable insights to improve mental health treatment, enhance public safety, and design effective rehabilitative services for offenders [15]. As society continues to recognize the complex interplay between mental health and criminal behavior, forensic neuropsychology will undoubtedly contribute to shaping a more ethical and compassionate approach to offenders with mental health conditions.

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Neuroanthropology

Where Cultural Fascination of the Unknown Meets the Human Brain

by Nneka Otuonye

editors: Jada Hilton & Jonila Shehu

art by Trinity Baker

Since the dawn of time, religion and mythology have been vessels to understand the functions within the natural and unnatural world. Ranging from Taoism to Celtic mythology, beliefs have served as a way for humans to culturally understand the social phenomena around them locally and globally. Recently though, neuroscientific research has guided scientists towards investigating the cognitive reasons as to why and how cultural customs are performed. Given that humans have a natural curiosity towards comprehending the unknown, the question comes to mind of what mechanisms within the brain contribute and relate to religious and mythological beliefs? This paper seeks to showcase the intersection between religion, mythology, and the brain through the lenses of anthropology and neuroscience — more specifically, neuroanthropology. By understanding how these disciplines intersect, humans can become more open-minded to the diversity present in belief systems. Through the implementation of cultural relativism, which is where a culture is viewed within its own context and cultural practices [1], future scientists and physicians can provide better care towards

sustainable community wellbeing and health by practicing cultural competency.

Broadening Horizons: Redefining Health Care through Cultural Consideration

A background of cultural awareness is vital within the realm of healthcare for marginalized communities. Research has demonstrated that mental health diagnoses within racial and ethnic minority groups are less likely to receive resources or treatment; in 2015, 48% of White Americans were more likely to receive mental health care in comparison to 31% of both Black and Hispanic Americans, followed by 22% of Asian Americans [2]. The lack of access to mental health treatment within marginalized communities can be ascribed to a multitude of factors, such as the lack of cultural competency within medical care and potential cultural stigma surrounding mental health.

Cultural relativism is vital within medicine and neuroscience, as it reveals the cultural background that shapes understanding of neuropsychiatric disorders. By practicing medicine in a culturally competent manner that recognizes community values, a respectful

environment considerate of differing cultures is established. Through these established environments attentive to cultural values, medical professionals can ensure that effective treatment coincides with community beliefs. Not only does this pave the way to better overall wellbeing, but it can also incorporate the potential fusion of traditional healing practices and contemporary neuropsychiatric treatments. An example in which this fusion has been present is ancient Incan use of trepanation. Trepanation, the process of creating holes into the skull for medical purposes, was used in Incan society to perform brain surgery using obsidian, bifacial tools [3]. The use of trepanation was created long before the introduction of modern day surgeries, which not only reflects traditional practices of utilizing natural resources, like obsidian, but also highlights how cultural practices and medicine can be combined.

Neuroscience of Belief: The Science Behind Practices

The study of neuroscience focuses on the nervous system, which is divided into the central and peripheral nervous system. The brain is considered a component

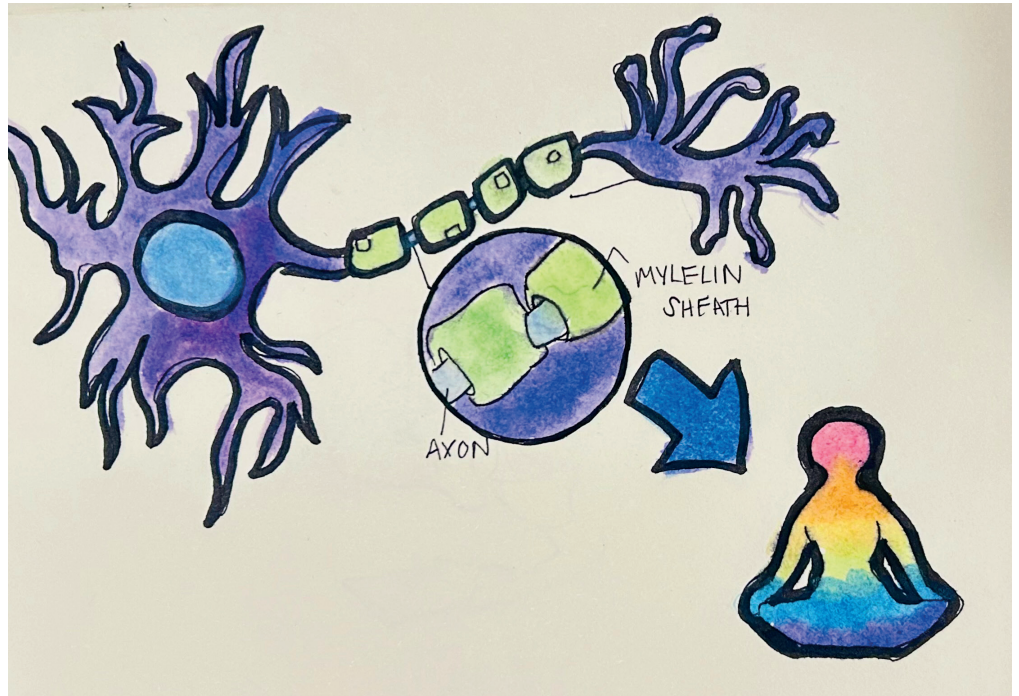
of the central nervous system and is often a focal research point of neuroscience due to its function, development, and degeneration. In an attempt to explain human actions, brain behavior and cognition are investigated in neuroscience to understand the processes that are occurring in the brain. Seeing how the brain is hardwired to prove itself right, as exhibited through cultural or confirmation bias, viewing the world from a culturally relative perspective can be difficult. However, developing awareness of bias can be accomplished through understanding the brain's activity. Generally, brain activity changes based on circumstances, such as during exercise or sleep [4]. Research has found that even spiritual and religious practices are associated with changes in the brain [5]. With this in mind, neuroscience can provide foundational knowledge towards understanding the brain's activity during an individual's interpretation of spiritual texts and experiences.

Prayer and meditation activate different regions of the brain, such as the prefrontal cortex which contributes to stress regulation and emotional responses [6]. Given that the prefrontal cortex is associated with emotional control, it is pivotal towards diagnosing anxiety and depression, both of which are characterized by symptoms of emotional dysregulation and aberrations in effect. Prayer and meditation are often used as means to promote good overall well being, which could call to action more investigation towards the role such practices have towards mental

health and brain functionality.

There has been pioneering research towards the use of neurofeedback systems in understanding the embodied consciousness, especially in the contexts of prayer and meditation [6]. Neurofeedback is a training technique that stimulates neuroplasticity, which

often associated with increased cognitive and behavioral performance [6]. A merit of Kober's study was that it focused on the frequency of religious practice rather than a specified religion. This approach was culturally encompassing as it demonstrated that despite the religious system, there was commonality that a



is the brain's ability to adapt and change as a result of experiences and stimuli [7]. Research by Silvia Kober and her colleagues noted that individuals who participate in spirituality or religious practices had high neurofeedback performance. Their findings were detected by electroencephalogram (EEG) tests, which measure changes in brain waves through electrical activity, utilized in Kober and her colleagues' study monitoring neural activity during spiritual practice [8]. Having an increased ability to cognitive control the brain during neurofeedback is

higher frequency of religious or spiritual practice resulted in better neurofeedback performance. Although neurofeedback is still a developing practice and therapy treatment, it is believed to be a remedy for brain dysfunctions and disorders [9]. It would be insightful to learn how neurofeedback can be studied and thereby offer neuropsychiatric treatments that consider the roles spirituality and neural health play together. Further investigation of neurofeedback could enable current and future physicians to tailor medical practices that are

culturally considerate of diverse patient populations. This can, herefore, open the horizons and accessibility communities have to personalized medicine, also known as precision medicine.

To further understand the relation of neural health to spiritual practices, consider the basic unit of the nervous system: the neuron. Santiago Ramón y Cajal, often regarded as the father of modern neuroscience, first discovered the neuron in the late 1880s [10]. Neurons, which are specialized cells that transmit electrical signals to nearby neurons, are composed of a cell body (also known as the soma), dendrites, axon, myelin sheath, and axon terminals [11]. The myelin sheath acts as a protective layer around the axon and generates a rapid action potential, which helps electrical signals travel the axon at a much safer rate from external damage [12]. An analogy to consider is myelin sheath is to axon as religious practice is to wellbeing. This comparison portrays similarities between religious practices and neuroscience related to the neuron. Individuals can view religious practices, such as prayer and meditation, as a protective medium that allows for better mental wellbeing and health. Current literature pertaining to the myelin sheath provides strong evidence that it is a protective layer for message communication along the axon. Similarly, cultures often view their

religious practices as protection of mental wellbeing and health for their community members. This comparison showcases how micro-level structures within the brain, like the neuron, can be attributed to macro-level cultural practices of spirituality and religion in communities.



Mythological Archetypes & Brain Functionality Illuminated by Anthropology

Anthropology seeks to holistically understand how cultural components, such as religion and mythology, shape humans and their societies. Within the discipline of anthropology, mythology, also known as myths, can provide an understanding of story morals and how these morals relate to societies. Archetypes are a common component of myths, and describe roles that are symbolic of society (i.e. heroes, villains); archetypes can be viewed as social facts within societies, as individuals are often taught them. In relation

to neuroscience, archetypes can present patterns that determine social behavior within cultural context and can perhaps provide insight towards neuroscientific health. In Greek mythology, archetypes are commonly found to describe characters within the stories of myth and legend.

Examples of relevant archetypes are Hercules and Athena, as described below.

→ Hercules – The Hero & Embodiment of Resilience; Roots to Epilepsy

The Hero archetype is often portrayed in stories to describe how an individual has to overcome obstacles in order to continue their journey. In the 12 Labors of Hercules, the demigod, Hercules, faced a variety of monsters, such as the

hydra, in order to prove himself as a hero [13]. During Hercules's last labors, he was sent to the Underworld and was maddened by Hera's servants Iris and Lyssa; it is noted that Hercules "... was no longer himself. . . His pupils were rolling around in his eyes... and foam was dripping into his beard..." [13]. Although afflicted with madness, the description of Hercules's condition is similar to the symptoms of the neurological disorder, epilepsy. Epilepsy is a neurological condition that can cause neuropsychiatric implications related to seizures and a change in behavior [14]. Epilepsy was also often regarded as Morbus Herculi, which is demonstrated by

its etymological roots from Greek mythology [15].

Amidst hardships and adversity, Hercules exhibited traits of persistence and strength. These traits resonate with the ordinary person, as the values present in The Hero archetype evoke the humanistic pursuit of persevering amidst challenges and trials through motivation. Within the basal ganglia of the brain, the ventral striatum is a region associated with reward systems, motivation and behavior; fMRI studies have suggested that activation of this brain region is involved with trial-and-error learning [16], which can be argued to be seen in Hercules's completion of his twelve labors. Through Hercules's trial-and-error learning present in his trials, he was able to achieve the completion of his labors even with adversity. It is also noted that the ventral striatum is involved in the control and propagation of seizures, which is associated with epilepsy [17]. It is interesting how symbolism and description present in myths can be similarly associated to regions of the brain or brain-related disorders.

→ Athena — The Sage & Acquirer of Knowledge

Similarly, the archetype of The Sage idealizes knowledge and wisdom acquisition. The goddess Athena is often regarded as The Sage due to her continuous efforts to provide insight to individuals. In The Odyssey, Athena provides Odysseus with resources and knowledge that helps him on his journey home to Ithaca [18]. Athena's continuous

advocacy for the pursuit of knowledge can be vibrant within individuals' desires to continue their academic journey to widen their fostered understanding of the world. These values of continued learning are echoed within Greek

is echoed in the previous examples demonstrating how Greek mythology can be used as morals that relate to the everyday person's life. Through the shared narratives of myths, communities can generate a collective identity



society. There appears to be a Greek societal importance towards obtaining a higher education as exhibited by their 2024 literacy rate of 95.29% [19].

In short, myths provide social solidarity in communities, which is a shared sense of belonging and shared societal values in communities [20]. Social solidarity

that provides unity and solidarity amongst its members. In the realm of anthropology, myths can provide an understanding of story morals and how they relate to societies, thereby enabling individuals to understand the contexts around them.

Neuroanthropology: Its Potential Role in Community Health and

Well-Being

The fusion of neuroscience and anthropology provides an interdisciplinary opportunity to conduct scientific research, whilst being aware of cultural factors, stressors, and determinants at play. Neuroscience provides an understanding of how the brain, such as through behaviors and emotion, can unveil the biochemical mechanisms present during religious practices. This can be pivotal towards the development of culturally congruent interventions, like neurofeedback, that can provide effective strategies to increase accessibility to mental wellbeing and health-related resources. Anthropology, in a similar manner, can contribute towards the understanding of underlying cultural elements and morals that shape societies, which can be considered during these intervention processes. Through ethnographic and cognitive training, the neuroanthropological approach can shape a more culturally sound and inclusive health environment.

As noted previously, precision medicine offers an opportunity for more personalized health resources and can shape a community's distinct wellbeing. Throughout history, medicine has been all but personalized. Medicine has been conducted on a basis in which it targets diseases on a wide-spread population level — meaning specific treatments may be effective, yet they are timely and often set aside for general treatments [21]. Many argue that physicians already use a personalized medical approach

when they inquire about a patient's demographic, family history, and previous medical history during the patient screening process. However, this approach often compiles patients into a general population that is characterized by a certain disease, and it neglects considering the cultural and personal determinants related to a patient's health. Future advancements in research could allow for personalized medicine to become a step towards decreasing health inequities present in communities; incorporating culture as an ingredient for personalized medicine can expand the scope of treatments and therapeutics. This personalized approach of medicine could provide movements toward medical models focused on predictive prevention of health, rather than treatment.

Neuroanthropology emphasizes the importance of culturally relative and inclusive strategies for those in marginalized communities with unique experiences, especially in relation to medical care. Both neuroscience and anthropology provide a background in pattern recognition that is crucial when considering differences, whether that is biochemically within the brain or amidst diverse cultural groups. Focus towards research strategies that encompass neurobiological and psychosocial factors has been proposed by the National Institute of Mental Health Research Domain Criteria, but still awaits unanimous support and following [22]. With greater consideration of the cultural, environmental, and neurobiological influences on a community's health standards,

there could, perhaps, be a future in which precision medicine is more attainable for marginalized communities and their mental wellbeing. Threading a needle between cultural knowledge and modern science is a stepping stone towards a more equitable future.

“Through the interdisciplinary approach of neuroanthropology, cultural fascination of the unknown can exist harmoniously with the workings of the human brain.”

Nneka Otuonye

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Physical Activity & Well-Being in College Students

by *Sujay Vijayakumar*
editors: *Veda Yeruvuri & Emma Exum*
art by *Farzana Faiza*

Imagine yourself in the middle of a grueling study session, eyelids heavy, coffee cup empty, and brain on the edge of burning out. Now just picture this: you put the book down. Put your sneakers on and head to the gym, and within minutes the rhythm of your feet on the treadmill and the weights in your hands start to fight off the mental fog. You feel the motivation, energy, and adrenaline pumping through your veins. Many college students believe exercising at least 3 times a week will not make a difference in their daily lives. Still, research shows that exercising three or more times a week can supercharge your brain, boost your mood, and even improve your academic performance. This article will explore the science behind why college students who take part in consistent exercise routines - whether playing sports, lifting weights, or jogging in the park - find themselves sharper in the classroom, more resilient, and less mentally drained

Physical exercise is known to strengthen one's body and profoundly impact the brain [1]. Studies

have shown that regular exercise, particularly aerobic activities like swimming, jogging, or cycling, stimulates new neuron growth, a process called neurogenesis. According to the National Library of Medicine, physical activity increases hippocampal neurogenesis, leading to cognitive processing and improved memory retention [1].

This relates to college students as it translates to better grades and improved test performances [2]. Research from the University of Illinois suggests that college students who engage in regular exercise report enhanced problem-solving skills, improved cognitive flexibility, and higher GPAs. Physical activity causes a



“Studies have shown that regular exercise, particularly aerobic activities like swimming, jogging, or cycling, stimulates new neuron growth, a process called neurogenesis.”

blood flow increase in the brain, which helps deliver oxygen and essential nutrients, directly impacting cognitive functions. Exercise also assists in releasing brain-derived neurotrophic factor (BDNF), a protein that aids learning and supports neuron growth. According to Sleiman, BDNF is linked to improved learning and memory [3]. Dr. Sleiman and a team of scientists experimented using mice

to test the correlation between exercise and BDNF levels, where mice used a running wheel for 30 days, compared to controls that did not. The comparison showed that the exercising mice had higher levels of BDNF in their brains than the control mice, which confirms the relationship between exercise and BDNF levels [3].

Furthermore, exercise plays a pivotal role in maintaining and regulating dopamine levels. Dopamine is a chemical released in our brains that is critical for motivation and reward processing, influencing how students approach certain problems and learning experiences. Dopamine levels can be

properly regulated through systematic activities such as a consistent gym routine. According to a study by the NYU Grossman School of Medicine, elevated dopamine levels may shed light on the positive effects of exercise on mood in healthy individuals as well as the symptoms that are relieved in people with neuropsychiatric disorders like anxiety and depression which are common in college students [4].

Consistent workouts have many compelling benefits, but one that is occasionally disregarded is their positive impact on social well-being. Physical activities like working out at the gym, going for a jog, or playing sports provide an ideal environment for building lifelong friendships and social ties during college. Group exercise programs and sports are natural social hubs, fostering a sense of welcome and teamwork among participants. On a neurological level, exercise influences key neurotransmitters like dopamine and serotonin, which have key links to social behaviors and mood. Research published by the National Library of Medicine suggests that regular exercise increases levels of serotonin and dopamine, which enhance mood, encourage positive social interactions, and reduce social anxiety [5]. Regularly engaging in group exercise causes the release of endorphins—also known as “feel-good” hormones—that create a sense of satisfaction and well-being. This chemical boost has been shown to help students navigate social challenges with better resilience and self-confidence.

Take the example of a student who experiences anxiety in social situations. Promoting participation through organized activities, team sports, or even group exercise classes can help reduce anxiety. According to Dr. John J. Ratey, an associate clinical professor of Psychiatry at Harvard Medical School, aerobic exercises are especially helpful [6]. A bike ride, playing pickleball with friends, or even a light jog can be a great tool for those suffering from chronic anxiety or depression. Activities like these also help people who are feeling overly anticipating and anxious about an upcoming test, a presentation, or a critical meeting.

As we all know college life can be beyond stressful at times and unfortunately mental health challenges such as anxiety and depression can be common in

“According to the University of Michigan, survey results showed that 44% of students reported symptoms of depression, 37% reported anxiety disorders, and 15% recorded having seriously considered suicide in the past year.”



students. According to the University of Michigan, survey results showed that 44% of students reported symptoms of depression, 37% reported anxiety disorders, and 15% recorded having seriously considered suicide in the past year [7]. However, exercise has been shown to combat these issues. Cortisol is a hormone associated with stress. Elevated levels of cortisol can negatively impact the mind and body. Physical activity helps lower cortisol, supporting overall stress reduction and mood balance.

Along with its effects on cortisol, exercise also plays a role in the production of gamma-aminobutyric acid

(GABA), a neurotransmitter that plays an important role in the regulation of anxiety and the promotion of relaxation. A study from the National Library of Medicine indicates that physical activities such as yoga, cycling, and aerobic exercise can promote GABA production, leading to a calming effect in the brain [8]. This soothing impact assists college students in managing stress more successfully, particularly during rigorous academic periods.

“College students who prioritize exercise improve not only their physical health, but also their cognitive, social, and emotional well-being.”

The habit of consistent workouts also enhances mental health through the release of myokines, which are proteins produced by the contractions of muscles that communicate with the brain and other organs of the body. A particular myokine called irisin, has been shown to support brain plasticity and stimulate the growth of brain cells, which is important for learning and taking on new challenges. A study by the National Library of Medicine explains that the irisin produced from exercise can encourage the growth of new brain cells in the dentate gyrus, which helps keep these areas functioning well [9]. By supporting this cell growth and strengthening connections between brain cells, irisin can improve memory and protect against excess stress. Myokines also help to create an anti-inflammatory environment in the brain, which protects against stress-induced damage and promotes mental clarity. Furthermore, regular exercise promotes good sleep, which is necessary for emotional management and cognitive performance. Students who maintain a consistent workout regimen have fewer sleep problems, allowing them to wake up feeling refreshed and better prepared to face the demands of college life. Because of the improved sleep quality and the good influence of myokines, exercise is an effective technique for enhancing general mental health and resilience.

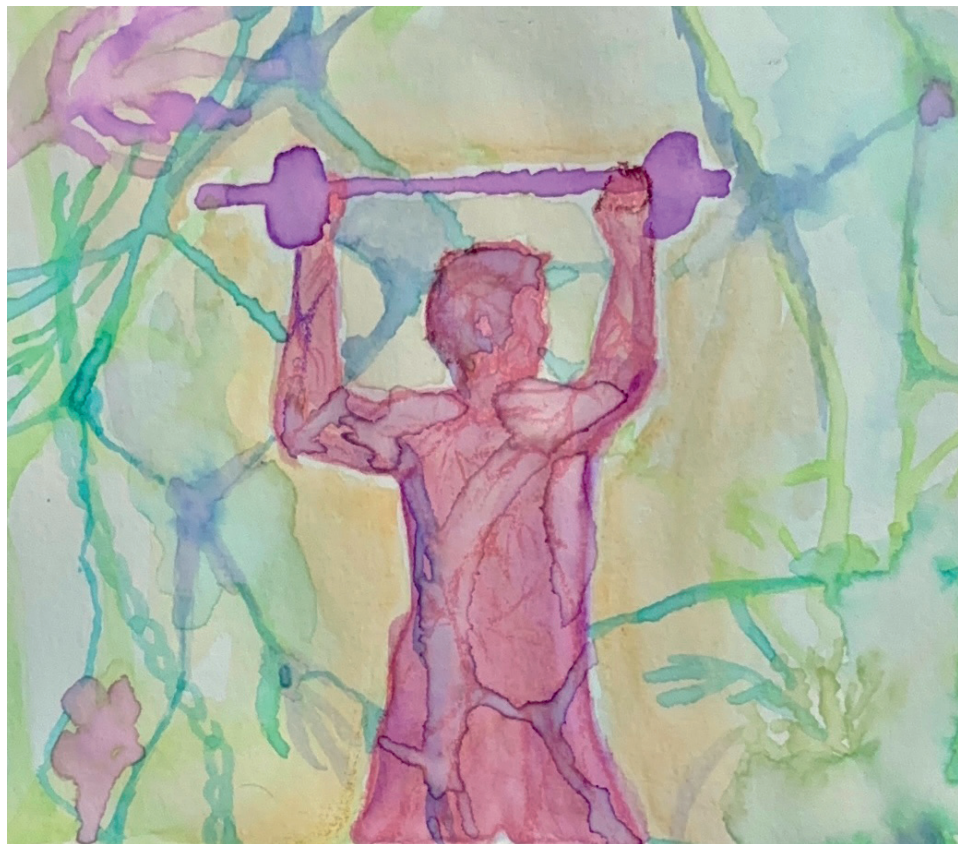
Regular physical activity is more than just a means to achieve physical fitness; it also leads to academic performance, stronger social relationships, and mental resilience. College students who prioritize exercise improve not only their physical health, but also their cognitive, social, and emotional well-

being. Exercise allows kids to reach their maximum intellectual potential by boosting neurogenesis and neurotransmitter balance. Through physical activities, adolescents connect with others and form friendships that provide support and encouragement. They build the mental resilience required to excel in college and beyond by lowering stress and promoting emotional well-being.

As college students, we confront numerous problems; yet, by embracing the benefits of physical activity, we may overcome them. The next time you're feeling overwhelmed or isolated, take a break and do some physical activity. It will make you feel better in the present and lay the groundwork for a healthier, happier, and more successful future.

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LAST ISSUE

Don't miss these
neuro reads:

Psychedelics as Therapeutic Agents

by Maggie Nguyen
art by Nakya Bynum

Albert Hofmann synthesized a new drug by isolating compounds found in ergot, which is a fungus affecting rye [1]. While working with the substance, the Swiss scientist was forced to proceed home in the middle of his work due to what he later called a “remarkable experience.” He felt restless and slightly dizzy and sank into a “not-unpleasant” dream-like state. He said he had perceived uninterrupted streams of shapes with an intense, kaleidoscopic play of colors. This drug later became known as lysergic acid diethylamide, better known as LSD or “acid.” After his encounter, he began to self-experiment, documenting his exposure to the drug in a journal, later turned book, called *LSD: My Problem Child*. On April 19, 1943, three days after the initial experience, he ingested a minuscule amount and began having several reactions while biking home with his laboratory assistant. Hofmann reported experiencing distorted vision and intense, altered perceptions of the environment around him. After the terrifying perceptions around him began to fade, he started to experience feelings of good fortune and gratitude while viewing those kaleidoscopic, colorful images spinning and swirling behind his closed eyes, which wore off after a few hours. The next morning, he woke up feeling refreshed, with a clear head and sensations of well-being and rejuvenation. He claimed that breakfast was as delicious as ever and that life had been renewed [1]. This day was named “Bicycle Day” for its historical significance.

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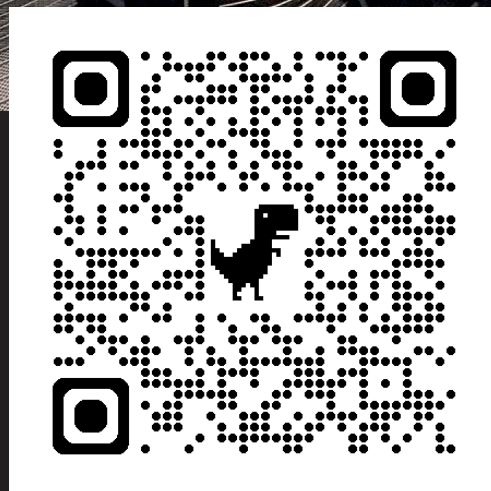
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