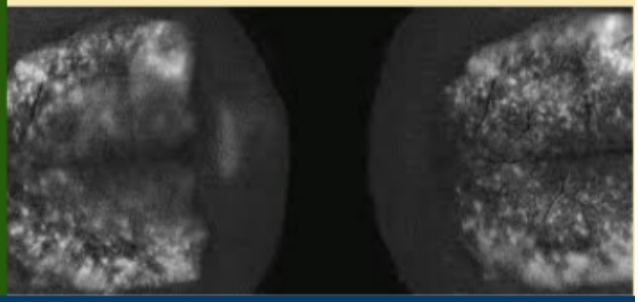
HYPOTHALAMIC NEWSLETTER

Welcome to this edition's Hypothalamic Newsletter! We will be discussing Project COSMOS, the cerebrum, the tip of the tongue phenomenon, and more!

Project COSMOS

Have you ever wondered what goes on in your brain when you think? Well, now scientists have created technology that allows the visualization of decision making processes in the brain. The COSMOS (Cortical Observation by Synchronous Multifunctional Optical Sampling) technique has allowed never before seen detail of the flashing of multiple neurons across the cerebral cortex of a mouse when faced with a moment of decision making. However, this is not the first time scientists have been able to track brain activity visually; by using a special dye that is able to penetrate the membranes of neurons, scientists have been able to see the fluorescent dye flash momentarily when exposed to a higher voltage. These voltage shifts are known as transmembrane potential and can provide lots of information regarding the activity of neurotransmitters. However with COSMOS, scientists are now able to see the neurons themselves light up in response to making a decision.

This is done with the use of a bifocal microscope, a special microscope that allows the visualization of two parts of the brain at the same time. The sides and top of the brain are captured in a video, and from these measurements can be extracted from the timing, frequency, and intensity of these flashes to make measurements. This technique has provided for a deeper understanding of the brain function, and could possibly be developed further for an even more advanced method of viewing the brain and understanding its functioning.



September 30th, 2021

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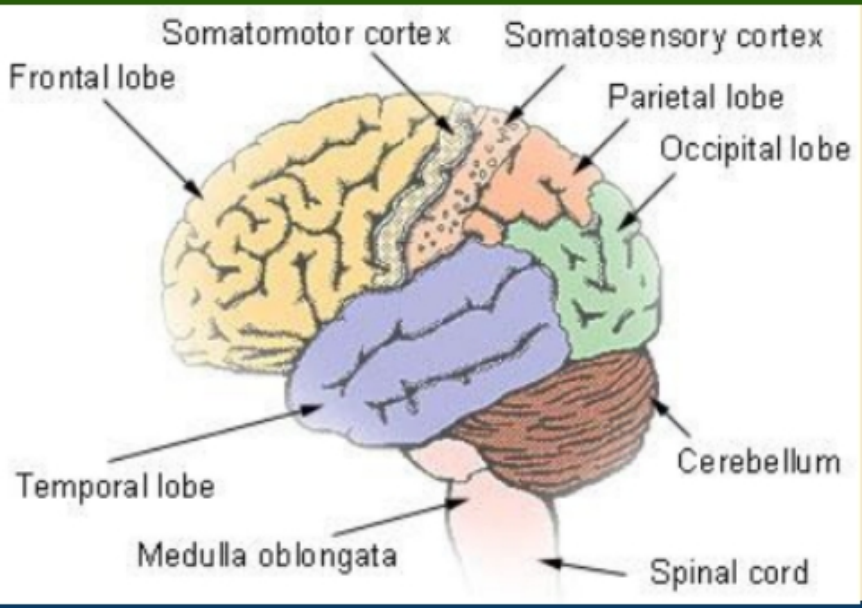
The Cerebrum

and the folds serve to increase surface area for the maximization of neurons for higher brain functioning. While every part of the brain works together to allow the functioning of the animal or human being, the cerebrum is the largest and carries out advanced functions that are essential not only to survival but to live a life full of higher cognitive functioning.

Have you ever wondered what the most important part of the brain would be? The truth is, virtually every part of the brain is critical to staying alive as a functional human being. But some would argue that the cerebrum is the most significant region of the brain, due to its size and variety of functions.

The three major regions of the brain are the brain stem, cerebellum, and cerebrum. The brainstem is responsible for connecting the brain to the spinal cord. The cerebellum is responsible for muscle movements and balance and is located beneath the cerebrum. The cerebrum is responsible for touch, vision, hearing, touch, reasoning, emotions, learning capabilities, and motor control. It is divided into two hemispheres, commonly referred to as the left and right brain, with the two sides controlling different functions.

The cerebrum has a complex structure, composed of four lobes (frontal, temporal, parietal, and occipital) each responsible for different functions as well. And even the lobes can be divided into several areas and strips. And within this area, there are deeper structures such as the pituitary and pineal gland, hypothalamus, thalamus, basal ganglia, and limbic system that play roles in regulating hormones, sleep, emotion, memory, and emotions. And covering all of this is the cortex, flesh composed of wrinkles and folds (called gyri). The cortex contains approximately 16 billion neurons,



Tip of the Tongue Phenomenon

Have you ever had an experience where there's a word in the back of your head which you can almost recall but you just can't seem to put your finger on it? You're not alone. In fact, this phenomenon is so common that there's a term for it. It is called the Tip of the Tongue phenomenon, (TOT) is the phenomenon of failing to retrieve a word or term from memory, combined with partial recall and the feeling that retrieval is imminent.

People experiencing the tip-of-the-tongue phenomenon can usually recall one or several features of the word that they are trying to recall. Some examples include the first letter, its syllabic stress, and words similar in sound or meaning, or both sound and meaning. Individuals report a feeling of "being seized by the state", feeling something like mild anguish while searching for the word, and a sense of relief when the word is found.

Emotion and the strength of the emotional association to what is trying to be remembered can also have an impact on the TOT phenomenon. The stronger the emotional connection, the longer it takes to retrieve the item from memory.

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Tip of the Tongue Phenomenon

However, the TOT phenomenon should not be confused with the FOK (feeling of knowing) phenomenon. FOK, in contrast, is the feeling that one will be able to recognize an item that is currently inaccessible on a list of given items. While the two states and the processes underlying these concepts are definitely associated to a rather great extent, there is some evidence that TOTs and FOKs draw on different parts of the brain.

Multilingualism and the Brain

The neuroscience of multilingualism is particularly well researched. Through centuries of research to discover functional neuroimaging, electrophysiology, neurologists are now able to identify the specific regions of the brain that deal with language and give us the ability to switch between languages. First off, activation of the brain occurs in the same regions regardless of the language used. A majority of these regions are found in the perisylvian cortex of the left hemisphere. The other parts critical for language control are dispersed throughout the right and left hemispheres.While the brain activities involved in articulating a familiar and less familiar language are almost identical, there still exist differences in the activation of the brain. Though cerebral blood flow distribution and neural structures used have been found to be comparable, differences in neural activation are observed in the left putamen when individuals translate words into a less familiar language. The process requires substantially higher demand on the brain resources, especially if the second language is learned late in life. Additionally, activation can be observed in the supplementary motor area and parietal lobe. Hence the increased familiarity with a language reduces the activation of the brain. Many other aspects of multilingualism have yet to be discovered and are still in the exploration stage. With new technologies, neurologists can soon analyze brain changes due to differences in the specific characteristics such as grammar and difficulty of different languages.

"Drunk Brain" - A Look at Astasia Abasia

Most of us have probably experienced the clumsiness that comes with a little too much alcohol. Giddiness, dizziness, and poor decision-making are symptoms of drunken behavior, elicited by overconsumption of these intoxicants. However, there are those who experience such symptoms without drinking; this is the plight of those who suffer from Astasia Abasia, or Blocq Syndrome, after Paul Blocq, the French doctor who first described it. It is classified as the inability to stand or walk properly, which gives the appearance of the patient being very drunk. Patients also lurch when they try to stand and may seem dangerous to themselves as they overbalance and attempt to move over extravagantly. There's a catch though- and that is that they always catch themselves. People suffering from Blocq's disease almost never hurt themselves. They somehow seemingly limit their falls to when they are in the presence of a doctor, loved one, or soft landing. The phenomenon is thought to be in response to stress, where the most famous cases saw patients in the 1960s, where two cadets at the same high-pressure training school of West Point were diagnosed with the condition. Doctors believed it to

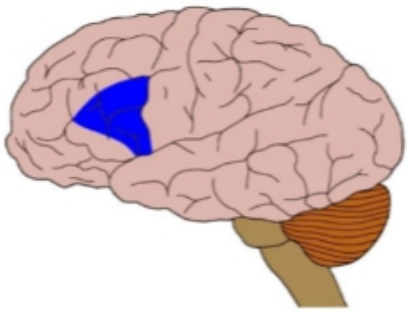
Astasia Abasia

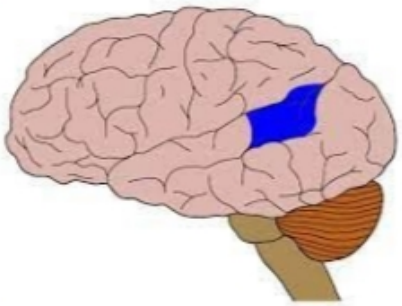
be in response to the stress of their environment and subsequently made the connection between the two.
The inability to walk or stand, despite sparing motor function that underlies balance and gesture, is an interesting but nonetheless harmless look into the quirks and subsequent impact of our brains.

Phantom Limb Pain and Neuroprostheses

Our daily lives are filled with the constant synthesis of thought, sensation, proaction, and reaction to stimuli. Neurons collect into nerves in our fingertips, linking somatosensory information back into our brain which then transmits signals indicating movement to continue our material actions. Individuals who are paralyzed or without certain limbs experience a significant handicap in their day-to-day activities. Amputees often even experience the phenomenon known as phantom limb pain. Once thought to be a psychological issue, new research shows that it is the brain's continuous attempt at receiving information from the cut neurons. The brain is highly plastic, rewiring itself to existing areas of the nervous system when it loses activity in another. These underused areas may, in fact, be the key to having a second chance at limb function.Neuroprosthetics are artificial devices that are wired with the brain and nervous system to regain, repair, or newly stimulate a certain function. With limb neuroprosthetics, neurostimulators are implanted into the muscle, which fires signals to the brain. If the brain is able to interpret this data, it can activate the neuroprosthetic

like it would with a normal limb. These brain-computer interfaces are a tremendous advancement that can improve the lives of those affected by disabilities.





Wernicke's and Broca's Areas in the Brain

Something as simple as conversation has deep rooted connections to the human brain. The ability to comprehend language and deliver through speech and articulation is directly related to the Wernicke's and Broca's areas in the left hemisphere of the brain.
The Wernicke's area is located in the posterior superior temporal lobe and is directly associated with comprehension. If a person's Wernicke's area was to get damaged, they would not be able to understand speech/gestures easily, even at all. Damage to the Wernicke's area in the brain is associated with Wenicke's aphasia, a language impairment that affects someone's ability to speak, produce, and understand verbal and written communication. Also known as "fluent" aphasia, the person will be able to formulate normal sentences, however their understanding of external speech will be extremely flawed.
The Broca's area is located in the frontal cortex of the brain and works closely with the temporal and motor cortices to plan and deliver the speech process. If the Broca's area was to get damaged in the brain, a person will not be able to; the physical movements of a person's mouth to produce speech will be impaired. Known as nonfluent aphasia, people with damage to this part of the brain cannot produce fluent, cohesive sentences. Though their language production will be damaged to some degree, people with a working Wenicke's area but a dysfunctional Broca's will still be able to comprehend speech.