BRAIN INJURY:

QUESTIONS & ANSWERS

BiC® brain injury centre

Prevention Tips

Brain injuries are often caused by traumatic blows to the head. While most minor bumps won't cause brain injuries, there are a few things you can do to lower the risk for yourself and your family:

- Wear a seat belt every time you drive or ride in a motor vehicle.
- Always buckle your child into a child safety seat, booster seat, or seat belt (according to the child's height, weight, and age) in the car.
- Never drive while under the influence of alcohol or drugs.

Wear a helmet and make sure your children wear helmets when:

- Riding a bike, motorcycle, snowmobile, or all-terrain vehicle;
- Playing a contact sport, such as football, ice hockey, or boxing;
- Using in-line skates or riding a skateboard;
- Batting and running bases in baseball or softball;
- Riding a horse; or
- Skiing or snowboarding.

Avoid falls in the home by:

- Using a step stool with a grab bar to reach objects on high shelves;
- Installing handrails on stairways;
- Installing window guards to keep young children from falling out of open windows;
- Using safety gates at the top and bottom of stairs when young children are around;
- Removing tripping hazards such as small area rugs and loose electrical cords;
- Using non-slip mats in the bathtub and on shower floors;
- Putting grab bars next to the toilet and in the tub or shower;
- Maintaining a regular exercise program to improve strength, balance, and coordination; and
- Seeing an eye doctor regularly for a vision check to help lower the risk of falling.
- Make sure the surface on your child's playground is made of shock-absorbing material, such as hardwood, mulch, and sand.

Keep firearms stored unloaded in a locked cabinet or safe. Store bullets in a separate, secured location.

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1. Is a concussion considered to be a form of traumatic brain injury? If so, which kind?

Concussions and mild Traumatic Brain Injuries are often terms that are used interchangeably in clinical and research literature.

Typically, a concussion is referred to as the “trauma (blow to head or whiplash) that causes an altered mental state”. There are 3 grades of concussions and a mild Traumatic Brain Injury (mTBI) corresponds with the working definition of the Grade 3 concussion. When defining a Grade 3 concussion, a person loses consciousness; there are signs of noticeable disruption of brain function (exhibited in physical, cognitive, and/or behavioral ways); and the person is typically unconscious for seconds to minutes.

Just because a person suffers a Grade 3 concussion, does not mean that they have a mTBI; however, if a person is diagnosed with mTBI, the type of blow is often considered a Grade 3 concussion.

2. What symptoms should we expect from a mild to moderate traumatic brain injury? When should we expect them?

There is no single symptom or set of symptoms that is unique to or diagnostic of Traumatic Brain Injury (regardless of the severity). However, a list can be compiled of those symptoms "typically associated with mild to moderate TBI."

There are two sets of symptoms – the first set is observed directly following the injury and within the first 24 hours and the second set occurs sometime after that initial phase, but typically after the injured person has attempted to return to life as normal at home.

Initial Phase Symptoms (mild to moderate TBI):

- Loss of consciousness for a few seconds to minutes OR no loss of consciousness but a state of being confused exists
- Headache
- Nausea
- Dizziness or vertigo
- Agitation
- Disorientation, or lack of awareness of surroundings
- Amnesia
- Fatigue

The second set of symptoms is described in detail throughout questions 7-10. These symptoms can be reported in the days, weeks and even months following the injury, but do improve over time in most cases (especially those of mild to moderate TBI's). The most common of the symptoms following a mild to moderate TBI are known as Post-Concussion Syndrome (often referred to in research as PCS). PCS is defined as patients reporting symptoms that include physical complaints, cognitive changes, and psychosocial concerns. Specifically, some of the symptoms associated with PCS are as follows:

- Sleep difficulties
- Poor concentration or attention

- Irritability
- Fatigue
- Depression
- Memory problems
- Headaches
- Trouble thinking
- Anxiety
- Dizziness
- Blurry or double vision
- Ringing in the ears
- Sensitivity to bright light and/or noises
- Lightheadedness
- Bad taste in mouth
- Changes in ability to smell
- Mood changes or mood swings

Additional symptoms that are triggered by a moderate to severe brain injury are as follows:

- Persistent headaches that worsen
- Dilation of pupils or in one of the eyes
- Weakness or numbness in fingers and/or toes
- Clear fluids draining from the ears and/or nose
- Convulsions or seizures
- Slurred speech
- Profound confusion
- Combativeness or Agitation
- Coma and/or other disorders of consciousness

In reality, there are very few “simple” brain injuries. Most are complex and affect more than one aspect of brain-based functions.

3. Why is it so hard to predict the long term outcomes of a mild to moderate traumatic brain injury?
How long will it take to recover, if recovery is possible?

Doctors classify the TBI as either mild, moderate or severe. Although there is no standard definition for mild to moderate TBI, there is diagnostic criteria for the level of injury to the brain. The most widely accepted definition are based on the observable behaviors immediately following the injury, as well as images collected through scans (MRI or PET typically).

Since this is done typically on site of the injury and within the first 24 hours, and because it can take weeks to months to see all symptoms that exist, it is difficult for the medical community to give an exact prognosis. Furthermore, even though we have come a long way in the area of neuroscience and have learned much, there is still so much that is unknown about the brain. We know only a limited amount about the brain's capacity to heal following an injury. Instead of predicting outcomes, the medical community usually recommend that a rehabilitation professional create a treatment plan to assist the patient in achieving specific outcomes.

In terms of recovery, there are no guarantees. It is dependent upon severity, the amount of time spent unconscious (if any), and available resources. However, many people are able to make major strides towards resuming "normal" activities. Prompt diagnosis and treatment are the best way to ensure recovery.

With 80% of the cases being classified as mild Traumatic Brain Injuries, the bulk of the research is found in this area. After formal testing, a person with mTBI that shows signs of problems in information processing speed, memory and/or concentration will likely resolve the majority of the problems after one month (especially if a young person). After three months, there will be relatively no effects on their health or thinking. Only a few will continue to have issues and those that do, likely are back to normal by the end of six months. The longest recovery for mild to

moderate TBI's is usually a full year. By then all symptoms have either greatly improved or have disappeared altogether. Not everyone recovers at the same rate. People who are 40 and under tend to recover more quickly than those over 40. The biggest indicator of a successful recovery is dependent upon those patients that rest following the injury versus those that continue to try to "tough it out" or rush back into their daily lives. As the severity of the TBI increases, the longer recovery will take and the less likely that full recovery will occur.

4. What are some common obstacles that arise after a mild to moderate TBI? Will I be able to live independently? Will I be able to work?

TBI is treatable, but the severity of the injury will determine how quickly and if life can resume to "normal" for the injured person. It is difficult to predict how well someone will recover, mainly because there is no diagnostic test that medical personnel can use that predicts recovery. As explained above, the best a doctor or paramedic can do is to assess the situation immediately following the injury and monitor the injured person for the next 24 hours to watch what initial symptoms come forth. This allows the medical staff to determine the seriousness of the injury itself and then, allows them to somewhat predict outcomes.

The recovery is not always quick. While there are general guidelines for a timeframe, nothing is certain. Each person and each injury are different. It can take several weeks to months to recover from even the most minor of traumas to the head. Recovery is also "uneven" meaning that there will be some "good days" and some "bad days." An injured person must keep in mind that even when it is a "good day," he or she must be certain not to overdo it. This will only cause setbacks in the recovery timeframe. Even on good days, a person needs to allow themselves the time to complete tasks and to "listen" to his body.

In terms of work and independent living, this is also considered on a case by case basis. But, most people who suffer mild to moderate TBIs are able to return to their previous occupations. A person may require additional assistance or accommodations (i.e. voice recorders, visual aids, organizers, etc.) upon returning to work and assuming the regular duties of the position. The accommodations might be a short-term solution or may be needed long-term but regardless, most people are able to participate in their previous occupation with little to no difficulty. Scientific studies done in the Netherlands suggest that those patients with mTBI's that were released from the hospital and instructed to spend the first week home relaxing and resting. Then, the second week after the injury, they were instructed to

gradually increase daily activities. Patients who received this advice and did as instructed normally were back to normal at work and/or school within 3 to 4 weeks of the injury. However, those patients that were released and NOT given those instructions OR did not follow those instructions took 5-12 weeks at a minimum to return to their normal routines. These patients also had more post-concussion symptoms, especially irritability, trouble concentrating and memory problems as compared to the patients who completed a week of rest and returned to their activities gradually.

5. What sort of care will I need long term?

Since the injury was a mild to moderate TBI, most people's symptoms will improve over time. However, when symptoms go unrecognized or untreated, it can disrupt an individual's work and/or setting as well as relationships. People frequently report that they are left feeling like they are "going crazy." Healthcare providers, who are unaware of the head trauma, may fail to properly diagnose the TBI. Instead, they may attempt to treat the individual symptoms when in fact, the person is suffering from a TBI.

Remember, these symptoms (both initial and secondary, or PCS) are part of the normal recovery process and are not signs of brain damage or complications. These are expected symptoms and at a maximum last up to 6 months. The majority of patients recover completely within 3 to 6 months. For around 20% of patients with PCS, symptoms may persist for a longer period of time.

6. What should I expect during rehabilitation, if required?
Will rehab help?

Rehabilitation, if recommended by your doctor, should definitely be completed. Rehabilitation helps the body heal and provides assistance to the brain in relearning processes so the person can recover as quickly and efficiently as possible. Rehabilitation can also help the injured person regain any previous abilities that might have been lost or delayed.

One must remember that the brain injury itself can impair the person's ability to recognize or to assess their own abilities and needs. Once the problems (or symptoms) have been identified by the patient, working with a trained, brain injury professional will help the patient to quickly identify effective strategies to compensate those weakened or problem-areas.

With most moderate TBI's, some form of rehabilitation will be needed. The extent of the rehabilitation and the activities will vary for each person. The individualized rehabilitation plan will feature things such as the expected length of time per visit, the length of time expected for the whole plan and even the specific activities that need completed. Of course, this plan is developed based upon the severity of the injury and the symptoms experienced (memory loss versus trouble walking). Rehabilitation may or may not be recommended for a mild TBI, again depending upon the symptoms being experienced. Either type of injured patient will benefit from rehabilitation though.

The goal of any rehabilitation program is to assist the injured person in resuming normal, daily activities as soon as possible OR to adjust their life enough that the person can function independently – learning to manage any cognitive difficulties, reducing any conditions of a physical issue create by the injury or even assisting in coping with psychological or emotional changes caused by the TBI. This process normally begins in the hospital and continues to an outpatient rehabilitation unit, a inpatient unit or even a residential facility (unlikely for moderate TBI but there are no guarantees).

7. How will a mild to moderate traumatic brain injury affect my ability to learn (cognitive functioning)?

Many who suffer a mild to moderate TBI experience changes in their thinking or processing skills, also known as cognitive skills. There are two levels of skills that can be affected. The first level is simple cognitive skills. Patients that have moderate to severe TBI's are more likely to have cognitive issues that patients with mTBI.

A partial list of common cognitive changes following mild to moderate TBI's are as follows:

- Memory issues
- Learning new information (either using old information or acquiring completely new)
- Shortened attention span
- Filtering issues
- Reasoning
- Speed of mental processing
- General confusion
- Partial loss or complete loss of reading and writing skills
- Inability to understand abstract concepts
- Self-awareness
- Impulsivity
- Agression

The second area is higher order thinking, referred to as the Executive Order in research.

A list of possible cognitive changes in this area are as follows:

- Problem solving
- Multi-tasking
- Organization and planning
- Decision making or Judgment
- Seeing a task from beginning to end

8. How will a mild to moderate traumatic brain injury affect my physical abilities? This would include sensory issues (such as smelling, hearing, etc.)

The physical effects of a mild to moderate TBI also vary but they tend to fall into three categories. The first being motor control (typically if the motor cortex is injured but other parts can disturb these issues as well), the second is more generalized behaviors and the final area, being the sensory issues.

Motor control:

- Loss of balance
- Poor coordination
- Trouble initiating a movement
- Maintaining muscle control

General:

- Weakness and fatigue
- Dizziness
- Headaches
- Nausea
- Sleep disturbances
- Appetite change
- Numbness (especially in extremities)

Sensory:

- Hypersensitivity in one or all five senses
- Blurred vision
- Light sensitivity
- Ringing in ears
- Altered taste or smell
- Impaired hand/eye coordination
- Blind spots or double vision
- Auditory manifestations (peripheral and central auditory disorders, tinnitus)
- Aural fullness (results in muffled hearing)

9. How will a mild to moderate traumatic brain injury affect my emotional abilities (behaviors)?

Neurobehavioral problems are those emotional/behavior problems that are attributed to specific aspects of brain injury. Many times this is because of an injury to or near the frontal lobe. As mentioned above, sometimes normal inhibitions and judgment are reduced because of the injuries and with the loss of self-awareness, often comes loss of self-control causing issues in frustration tolerance, patience, impulse control, over-arousal and perception. Some of the problems associated with TBI's and emotion, personality and/or behaviors are as follows:

- Difficulty recognizing with social skills
- Inability to empathize
- Over-reacting in common situations
- Getting angry without provocation or generally aggressive behavior
- Increased irritability
- Depression
- Extreme mood swings
- Anxiety
- Tendency to be more self-centered
- Apathy
- Paranoia

10. How will a mild to moderate traumatic brain injury affect my communication abilities?

Communication and language issues are often common after a mild to moderate Traumatic Brain Injury. These problems tend to cause frustration as well as misunderstandings by those trying to communicate with the injured person. These issues may include some, all or none of the following:

- Difficulty understanding the spoken or written word
- Difficulty speaking or writing
- Loss of vocabulary
- Inability to organize thoughts and ideas
- Trouble following conversations
- Trouble taking turns during conversations or with topic selection
- Difficulty understanding/reading nonverbal cues
- Inability to read cues from listeners
- Problems recognizing changes in pitch, volume or emphasis to express subtle differences in meaning, attitudes or to express a specific emotion
- Prone to verbal outbursts

Just like there is overlap in the parts of the brain function, there is also overlap in symptoms. For example, sensory issues fall under physical issues; however, if an individual does suffer from auditory issues following the TBI, clearly communication and language will be affected as well.

11. What are some suggestions or strategies to help me (or my family member) cope with complications that affect everyday life?

There are a number of strategies that can be used to assist a person who suffered a mild to moderate TBI. Depending on the part of the brain injured and the severity of the injury will determine the exact needs of the individual; the rehabilitation professionals that create the short-term and long-term plans might be able to assist in narrowing down this list (or adding to) in order to meet the needs of a specific loved one. One must remember that the recovery process for each person is different because no two brain injuries are alike. Recovery can be lengthy, all depending upon the severity and extent of the injury and upon the individual.

General suggestions for you or your loved one include the following:

- Resume activities and responsibilities gradually.
- Pace yourself and get lots of rest.
- If symptoms that had previously stopped or gone away suddenly reappear, it is likely a sign that you are pushing yourself too hard. SLOW DOWN.
- Try not to think about or worry about the symptoms as that will likely make the condition or symptom worse. This is, of course, easier to say than to do, but this is something that the patient should try to not worry about.
- Avoid doing anything that could cause another blow or jolt to the head
- Ask the doctor when it is safe to drive a car, ride a bike, play sports or use heavy equipment. Reaction time may be slower after a brain injury.
- Take prescription medicines according to the doctor's instructions
- Do not drink alcohol or use street drugs.
- Write things down to assist with memory problems.
- Follow any rehabilitation instructions and/or suggestions
- Join a support group. Remember that therapy is something that many people need at different points in their lives.
- Follow a routine, including a regular sleep schedule.
- Take breaks.

- Alter expectations at work and/or school. Don't feel ashamed or stressed that certain accommodations might be needed upon returning (at least initially). These can be phased out over time, if the injured person is capable of the task without the accommodation.
- Avoid or reduce distractions.
- Stay focused – choose to work on only one task at a time.

12. Does the location of the brain injury matter in terms of outcomes?

Yes and no. Of course, just like any part in the human body, each area of the brain has its own set of specific tasks that it performs for the body. So, if a person is injured in an area that controls another part of the body or in the area that impacts most memories, there will be a difference in these two patients' symptoms and therefore, possibly their outcomes.

However, when dealing or looking at the outcomes of a patient, the severity of the injury (the extent to which that portion of the brain was injured) is going to be far more of a predictor than the area that was injured. The area that was injured tends to be a predictor of the symptoms a patient experiences (and the severity of those problems) more than the outcomes. Of course, the symptoms that persist will be driven by the area injured. The following information includes areas of the brain where TBIs can often occur and what the impact of that area might be.

All injuries to the brain have some sort of "Contra Coup injuries" associated with the trauma. This type of injury is usually plural because it normally involves injuries in more than one place in the brain because this type of injury is driven by the brain being moved in a back and forth motion, striking the skull. Keep in mind that the brain almost "floats" in our skull, surrounded by cerebral-spine fluids within the hard skull. The brain itself not only "floats" but is also a soft, almost Jell-O-like substance in consistency and is made up of millions of very fine, nerve fibers. When the head is shaken violently, strikes a stationary object or collides with another moving object, the mechanical force of the motion is transferred to the brain, immediately causing one or more contra-coup injuries. When the brain suffers such a violent movement or blow, the floating brain is slammed against the skull and often multiple times. The skull is a bony, hard rough, uneven surface. The skull easily damages, rips and/or tears the fragile tissues as it moves throughout. Imagine a pinball, when it is put in motion, it doesn't just "bang" off of something once, it usually responds with a back and forth motion amongst other objects. Our brain responds similarly. The brain can even rotate during this process, many times resulting in another injury called a "rotational" or "shearing" injury where a portion of the brain is stretched and torn, damaging critical neurons that form essential connections in our neural network.

This can occur all over the brain, just like a “contra coup” injury and both types are simply injuries caused by the brain moving and hitting the skull in different places. The unfortunate part of both these two kinds of injuries is that they can literally occur ANYWHERE in the brain. So the neurons that lose connection could be ones that developed our personality in the front lobe, whereas another may be the neural connections that were developed when we learned to walk. The locations of these injuries determine the type of connections that are lost and therefore, the symptoms the injured person might encounter.

The next easiest way is to examine the main areas of the brain and determine what their functions are and if it is injured, then these functions would likely be the ones to exhibit symptoms. The six major portions of the brain are as follows: the Lobes (4 of them), Motor and Somatosensory Cortexes, Brain Stem, Limbic System, Cerebrum and Cerebellum. Keep in mind that no part of the human brain “stands alone” as all these parts interact consistently to allow tasks to be thought through and completed. However, when a part of that system is injured, the system breaks down (even if only for a while). The injured area will help one determine what portion of the system might be broken.

Although the minor wrinkles are unique in each brain, several major wrinkles and folds occur in everyone’s brain. These folds form a group of four lobes in each hemisphere. Each lobe specializes for certain functions.

Part One: The Lobes

Frontal Lobes. At the front of the brain are the frontal lobes, and the part lying just behind the forehead is called the prefrontal cortex. This area is often referred to as the control center or even more specifically as the “executive control center.” These lobes deal with all planning and thinking. Specifically, this part of the brain monitors higher-order thinking, directs any problem solving, and regulates the emotional system and therefore, behavioral “reactions.” The frontal lobe also contains our self-will area, which many call our personality. Trauma to the frontal lobe can cause dramatic—and sometimes permanent—behavior and personality changes. Because most of the working memory (formerly known as short-term memory, it is now

understood better in terms of complexity) is located here, it is the area where focus occurs.

Temporal Lobes. Located just above the ears are the brain's temporal lobes, which unsprisingly deal with sound, music, as well as face and object recognition. It also serves part of human's long—term memory. The temporal lobes also hold the speech centers, although this is usually on the left side only.

Occipital Lobes. At the back are the paired occipital lobes, which are used almost exclusively for visual processing.

Parietal Lobes. Near the top are the parietal lobes, which deal mainly with spatial orientation, calculation, and certain types of recognition.

Part Two: The Motor Cortex and Somatosensory Cortex

Motor Cortex and Somatosensory Cortex. This area of the between the parietal and frontal lobes are two bands across the top of the brain from ear to ear. The band closer to the front is the motor cortex. This strip controls body movement and, as we will learn later, works with the cerebellum to coordinate the learning of motor skills. Just behind the motor cortex, at the beginning of the parietal lobe, is the somatosensory cortex, which processes touch signals received from various parts of the body.

Part Three: Brain Stem

Brain Stem. An injury to this portion is likely to create problems in central functions, motor control and mobility because this portion of the brain controls most physiologic systems. In other words, a person with an injury to the brain stem would like experience symptoms (both short and long term, again, it depends on severity) in activities such as standing, walking, getting in and out of a bed or chair, lifting, throwing, catching, feeding oneself, and other "normal day activities." Of the 12 body nerves that go to the brain, 11 of them end in the brain stem. Only one (the olfactory nerve, used for smell) goes directly into the Limbic System. Typically, people with brain stem injuries require prolonged medical supervision after the injury and may have long-term physical deficits related to the TBI.

Part Four: The Limbic System

The Limbic System. Located just above the brain stem, but below the cerebrum is a group of structures most commonly called the limbic system. Researchers no longer regard this system as its own entity, as it was once thought to be, because each of its structures interacts with other parts of the brain. Most of the structures found in the limbic system are duplicated in both hemispheres of the brain. These structures allow for many different functions including the generation of emotion or the processing of memories. The placement of this system between the brain stem and the cerebrum allows for the interactions between emotion and reason. There are four parts of the system that impact learning and memory. They are the Thalamus, the Hypothalamus, the hippocampus and the amygdala.

The Thalamus. Other than smell, all incoming information from the senses enter into the (except smell) the thalamus (Greek for “inner chamber”). The thalamus then directs this information to other parts of the brain for additional processing. From here it is directed to other parts of the brain for additional processing. Both the cerebrum and cerebellum interact with the thalamus, showing it plays a part in memories.

The Hypothalamus. Just below the thalamus is the hypothalamus. The hypothalamus is responsible for monitoring all the internal systems of the body, controlling functions like the release of hormones, moderates sleep and body temperature. It also moderates food and liquid intake. If any of these get out of balance, the individual will find it very difficult to concentrate on any information he/she is attempting to process or learn.

The Hippocampus. This part of the brain is located just under the limbic system. This part of the brain plays a critical role in moving information from working memory (short-term memory) to long-term memory regions in the brain. This process of using electrical signals to move this information is a process that can take days or even months to move the information. The hippocampus is constantly checking to see if the information in working memory compares to any previously stored information. This process is critical for the creation of meaning.

Current research on patients who have experienced a TBI (any level) shows that the even though the hippocampus does have role in recalling facts, places, objects, etc., it does not seem to play a major role in recalling personal memories. This area of the brain has the capability to produce new neurons – called neurogenesis – throughout the entire life of a human. This research forever changed how neurologists thought about neural cells and learning. The fact that the hippocampus can produce new cells, especially those that have a significant effect on learning and memory, gives much hope to not only TBI patients that destroyed or damaged neural networks or cells, it gives hope to many diseases of the brain.

The Amygdala. Attached to the end of the hippocampus is the amygdala. This structures main function is to regulate a person's interactions with the environment that affect survival; one common response triggered by the amygdala is "fight or flight." Since the amygdala has this role, it certainly plays a role in emotions, especially fear. Because it is so close to the hippocampus (as well as have been evidenced in brain imaging scans), it is believed that this structure encodes an "emotion message," if one exists, into any memory that is slated for movement to long term memory. This "emotional message" is recalled whenever the memory is recalled. So, when a person recalls this memory, that is why it seems like the "feelings come back."

Part Five: The Cerebrum

Cerebrum:
A soft, jellylike mass, the cerebrum is the largest area, representing nearly 80 percent of the brain by weight. Its surface is pale gray, wrinkled, and marked by deep furrows called fissures and shallow ones called sulci (singular, sulcus). Raised folds are called gyri (singular, gyrus). One large sulcus runs from front to back and divides the cerebrum into two halves, called the cerebral hemispheres. For some still unexplained reason, the nerves from the left side of the body cross over to the right hemisphere, and those from the right side of the body cross to the left hemisphere.

The two hemispheres are connected by a thick cable of more than 200 million nerve fibers called the corpus callosum (Latin for "large body"). The hemispheres use this bridge to communicate with each other and coordinate activities.

The hemispheres are covered by a thin but tough laminated cortex (meaning “tree bark”), rich in cells, that is about one tenth of an inch thick and, because of its folds, has a surface area of about two square feet. That is about the size of a large dinner napkin. The cortex is composed of six layers of cells meshed in about 10,000 miles of connecting fibers per cubic inch! Here is where most of the action takes place. Thinking, memory, speech, and muscular movement are controlled by areas in the cerebrum. The cortex is often referred to as the brain’s gray matter.

The neurons in the thin cortex form columns whose branches extend through the cortical layer into a dense web below known as the white matter. Here, neurons connect with each other to form vast arrays of neural networks that carry out specific functions.

Part Six: The Cerebellum

Cerebellum:

The cerebellum (Latin for “little brain”) is a two-hemisphere structure located just below the rear part of the cerebrum, right behind the brain stem. Representing about 11 percent of the brain’s weight, it is a deeply folded and highly organized structure containing more neurons than all of the rest of the brain put together. The surface area of the entire cerebellum is about the same as that of one of the cerebral hemispheres.

This area coordinates movement. Because the cerebellum monitors impulses from nerve endings in the muscles, it is important in the performance and timing of complex motor tasks. It modifies and coordinates commands to swing a golf club, smooth a dancer’s footsteps, and allow a hand to bring a cup to the lips without spilling its contents. The cerebellum may also store the memory of automated movements, such as touch-typing and tying a shoelace. Through such automation, performance can be improved as the sequences of movements can be made with greater speed, greater accuracy, and less effort. The cerebellum also is known to be involved in the mental rehearsal of motor tasks, which also can improve performance and make it more skilled. A person whose cerebellum is damaged slows down and simplifies movement, and would have difficulty with finely tuned motion, such as catching a ball or completing a handshake.

Recent studies indicate that the role of the cerebellum has been underestimated. Researchers now believe that it also acts as a support structure in cognitive processing by coordinating and fine-tuning our thoughts, emotions, senses (especially touch), and memories. Because the cerebellum is connected also to regions of the brain that perform mental and sensory tasks, it can perform these skills automatically, without conscious attention to detail. This allows the conscious part of the brain the freedom to attend to other mental activities, thus enlarging its cognitive scope. Such enlargement of human capabilities is attributable in no small part to the cerebellum and its contribution to the automation of numerous mental activities.

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