

# Traumatic Brain Injury 101: An overview

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## Big Picture Outline

- I. Neuroanatomy and neurophysiology
- II. Defining Brain Injury
  - i. Acquired Brain Injury (ABI) versus Traumatic Brain Injury (TBI)
  - ii. Severity of injury classification
  - iii. Mechanism of injury
  - iv. Primary and secondary injuries
- III. Common Sequelae after TBI and trajectory
- IV. mTBI (Concussion) – myth versus fact

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## I. Neuroanatomy and Neurophysiology

THE BASICS

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## The Brain

- Your brain weighs about 3lbs, or just under 1.5kg
- Your brain is connected to your spinal cord by the brain stem
- Part of CNS
- It is divided into 3 primary regions:
  - Forebrain (Cerebrum)
  - Midbrain (Middle of brain)
  - Hindbrain
    - (Pons, Medulla oblongata, and cerebellum)
- The cerebral cortex is the largest part of your brain.
  - It contains 4 pairs of lobes: the frontal, the temporal, occipital, and parietal lobes

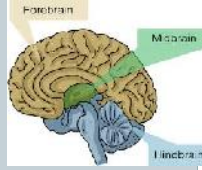


Image downloaded from [www.melbournchapter.net/explore/psychology-clipart-midbrain/](http://www.melbournchapter.net/explore/psychology-clipart-midbrain/)

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## The Brain

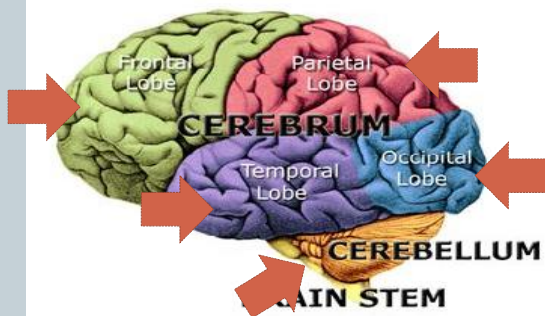


Image from <https://www.seattlecca.org/diseases/brain-spinal-cord-cancers/brain-spinal-cord-cancers-facts/anatomy-brain-and-spinal-cord> and credited to UW Department of Neurosurgery, Janet Schukar.

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## The Brain

- The skull protects the brain from penetrating injuries
- The meninges contain 3 membranous envelopes that surround the brain and spinal cord
  - Primary function to protect CNS
    - Pia, Arachnoid, and Dura
  - Each have own function
- Cerebrospinal fluid fills ventricles and the spaces between the Pia and Arachnoid

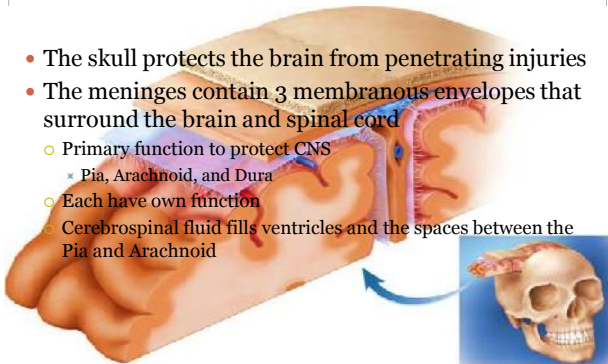


Image downloaded from <http://www.anatomyqa.com/anatomy/important-question-and-answers-on-head-and-neck-anatomy/duramater-dura-mater-sinuses/>

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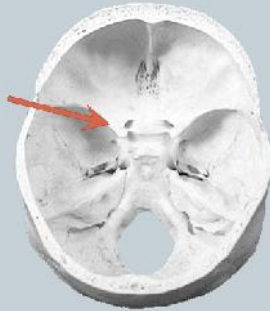
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## Skull interior anatomy

- The interior of the skull where these lobes sit in particular have bony features and protrusions



A product of the Behavioral Health Administration, The Mental Health Management Agency of Frederick County & The Howard County Mental Health Authority. Updated 2016

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## The Brain

- The brain is made up of around 100 billion nerve cells and even more support cells, which provide nourishment to the nerve cells

- Axons are part of the nerve cell

- Carries information quickly
- Myelin are akin to insulation
- Can be very long

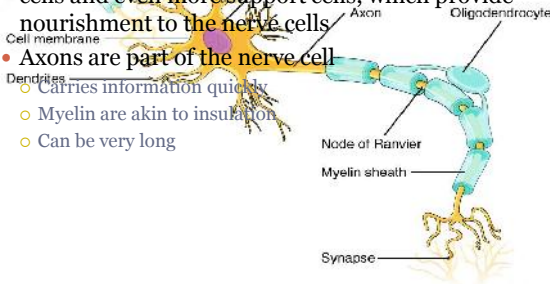


Image modified from "Neurons and glial cells: Figure 2a." by OpenStax College, Biology (CC BY 3.0).

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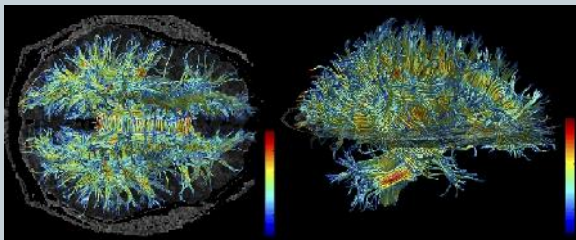
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## White matter tracts



By Wemplex - Kubicki M., McCarley R.W., Westin C-F., Park H-J., Maier S.E., Kikinis R., Jolesz F.A., Shenton M.E. A review of diffusion tensor imaging studies in schizophrenia. J Psychiatr Res. 2007 Jan-Feb;41(1-2):15-30. PMID: 16023676. PMCID: PMC2768134. CC BY-SA 3.0. <https://commons.wikimedia.org/w/index.php?curid=10267934>

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- ✓ Attention
- ✓ Language
- ✓ Motivation
- ✓ Judgment
- ✓ Social behavior
- ✓ Emotion Regulation
- ✓ Conscious Movement
- ✓ Executive Functioning
  - ✓ Problem solving
  - ✓ Impulse Control
  - ✓ Working memory



**Frontal Lobes**

Image downloaded from <https://www.picswe.com/find/frontal-lobe-pics-08.html>

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- ✓ Memory
- ✓ Language
- ✓ Smell
- ✓ Auditory processing
- ✓ Aggression
- ✓ Sexual behavior
- ✓ Emotions

**Potential Deficits**

- ✓ Difficulty understanding
- ✓ Verbal Problem solving
- ✓ Recognition of faces and objects
- ✓ Difficulty understanding tone
- ✓ Difficulty learning new information
- ✓ Aphasia
- ✓ Difficulty with emotional regulation



**Temporal Lobes**

Image downloaded from <https://www.picswe.com/pics/temporal-lobe-74.html>

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- ✓ Spatial Awareness
- ✓ Perception
- ✓ Body awareness with objects and interacting with space

**Potential Deficits**

- ✓ Reading
- ✓ Neglect
- ✓ Right/Left Confusion
- ✓ Impaired navigation of environments
- ✓ Impaired sense of touch
- ✓ Difficulty with visual attention



**Parietal Lobes**

Image downloaded from <http://podemosmadridchamartin.info/parietal#>

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- ✓ Visual processing
- ✓ Vision

**Potential Deficits**

- ✓ Visual field cuts
- ✓ Word blindness
- ✓ Hallucinations
- ✓ Inability to recognize movement
- ✓ Difficulty reading and writing
- ✓ Difficulty identifying colors and locating objects



**Occipital Lobes**

[Image downloaded from https://www.medicalnewstoday.com/articles/322136.php](https://www.medicalnewstoday.com/articles/322136.php)

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- ✓ Balance
- ✓ Coordination
- ✓ Skilled motor activity
- ✓ A little bit of everything

- ✓ Language
- ✓ Executive Functioning
- ✓ Visual-Spatial processing



**Cerebellum**

[https://news-media.stanford.edu/wp-content/uploads/2017/03/15145109/cerebellum\\_feature.jpg](https://news-media.stanford.edu/wp-content/uploads/2017/03/15145109/cerebellum_feature.jpg)

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- ✓ Breathing
- ✓ Heart rate
- ✓ Arousal/ consciousness
- ✓ Sleep/wake functions
- ✓ Attention/ Concentration



**Brain Stem**

<https://gomerblog.com/2014/12/fearless-neurologist/>

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