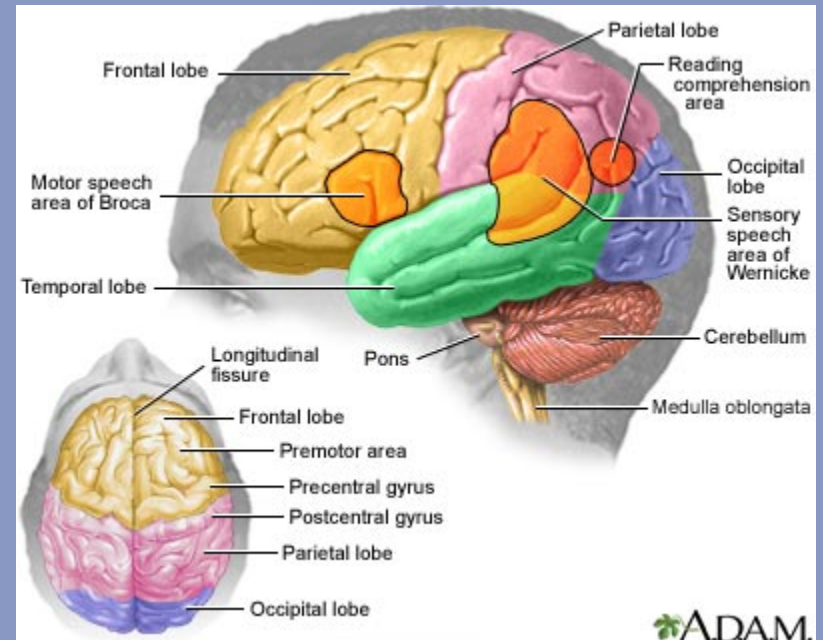


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PROMOTING SAFETY, JUSTICE AND HEALING BY RECOGNIZING AND RESPONDING TO BRAIN-INJURY

Understanding Traumatic Brain Injury



Objectives

- Recognize the anatomy and physiology of the right and left brains;
- Recognize the anatomy and physiology of the lobes of the brain;
- Distinguish the signs and symptoms of specific brain injury by location;
- Summarize the need for medical intervention, both from the victim as well as the legal perspective.

Left Brain

Analytical

Logical

Precise

Repetitive

Organized

Details

Scientific

Detached

Literal

Sequential

Right Brain

Creative

Imaginative

General

Intuitive

Conceptual

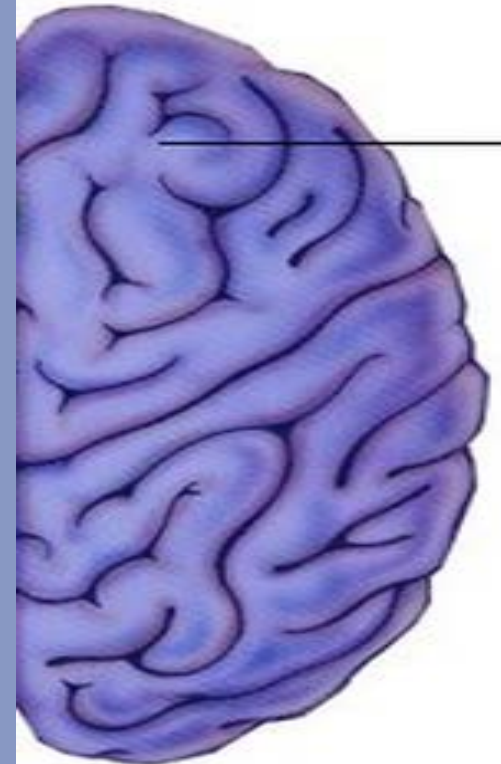
Big picture

Heuristic

Empathetic

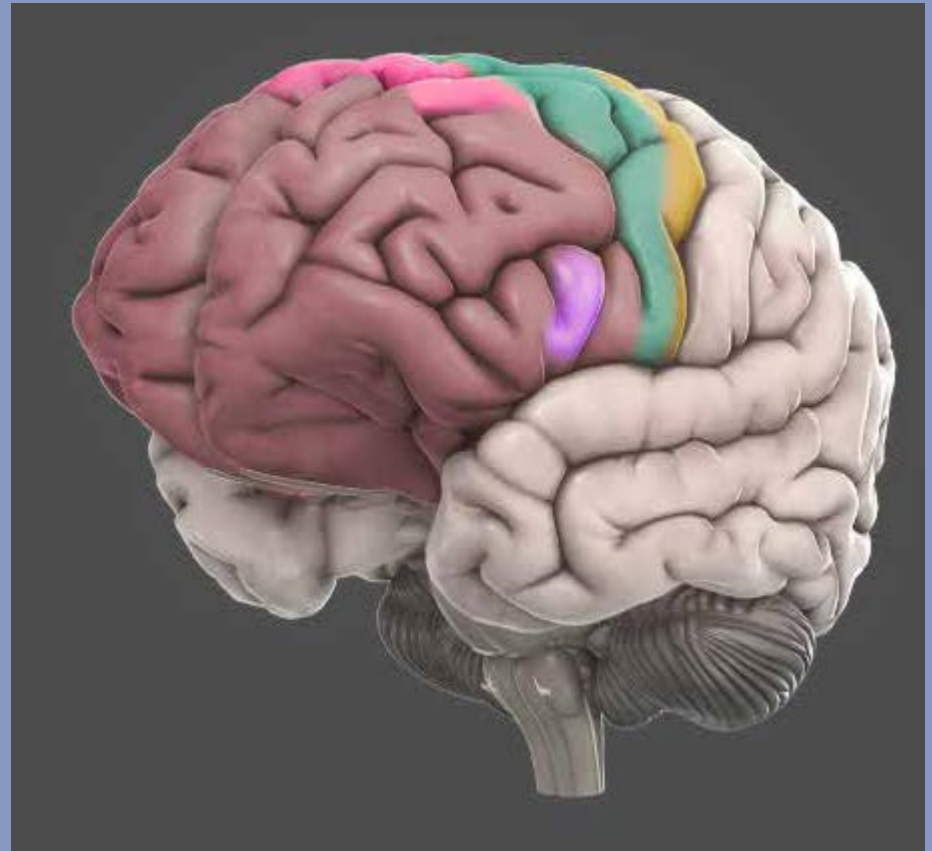
Figurative

Irregular



Frontal Lobe

- the largest of the brain's structures
- the main site of so-called 'higher' cognitive functions
- contain a number of important substructures involved in attention and thought, voluntary movement, decision-making, and language
- Executive processes (voluntary behavior such as decision making, planning, problem-solving, and thinking),
- voluntary motor control,
- cognition,
- intelligence,
- attention,
- language processing and comprehension
- Associated cognitive disorders:
 - ADHD,
 - schizophrenia, and
 - bipolar disorder (prefrontal cortex).



Damage to Frontal Lobe

- Paralysis
- Loss of spontaneity in social interactions
- Mood changes
- An inability to express language
- Atypical social skills and personality traits

Occipital Lobe

- the primary visual area of the brain
- receives projections from the retina (via the thalamus) from where different groups of neurons separately encode different visual information such as color, orientation, and motion
- Two important pathways of information originating in the occipital lobes are the dorsal and ventral streams. The dorsal stream projects to the parietal lobes and processes **where objects are located**. The ventral stream projects to structures in the temporal lobes and processes **what objects are**.
- Vision
- Associated cognitive disorders:
 - Because damage to the occipital lobes can cause visual hallucinations, the region has been investigated as a neurobiological correlate of schizophrenia and also bipolar disorder
 - A number of studies have found evidence of overgrowth in the occipital cortex in individuals with autism
 - Changes in blood flow in the occipital lobes have been correlated with depression

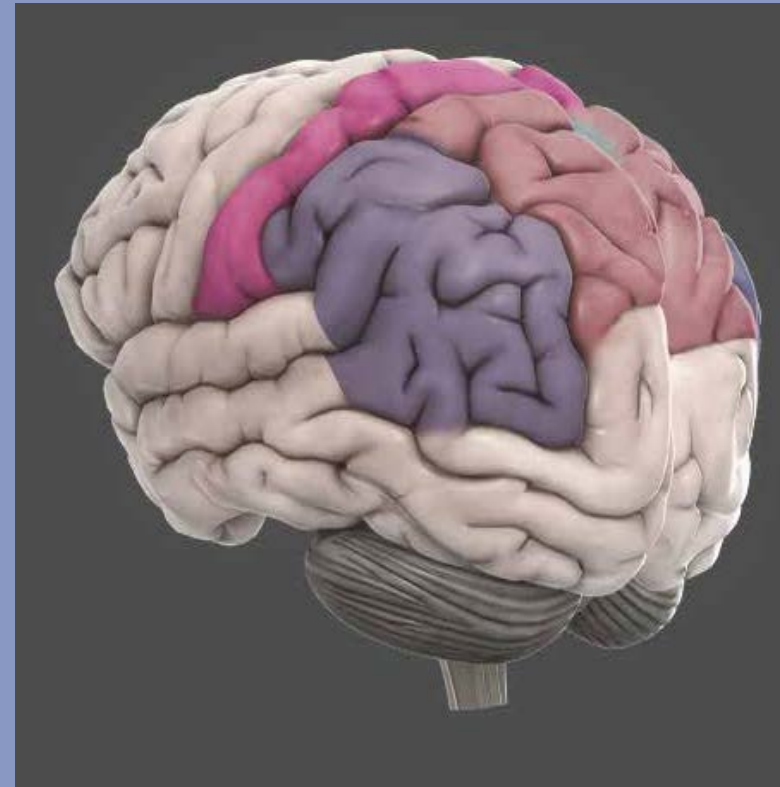


Damage to the Occipital Lobes

- Hallucinations
- Blindness
- inability to see color, motion, or orientation
- Synesthesia (a sense other than the one being stimulated)

Parietal Lobes

- role in integrating information from different senses to build a coherent picture of the world
- It integrates information from the ventral visual pathways (which process what things are) and dorsal visual pathways (which process where things are). Allows us to coordinate our movements in response to the objects in our environment.
- It contains a number of distinct reference maps of the body, near space, and distant space, which are constantly updated as we move and interact with the world.
- Processes attentional awareness of the environment
- is involved in manipulating objects, and representing numbers.
- perception and integration of somatosensory information (e.g. touch, pressure, temperature, and pain)
- Visual-spatial processing
- spatial attention
- number representation
- Associated cognitive disorders:
 - Atrophy in a number of brain structures, including the right temporo–parietal region, may be a precursor for Alzheimer's disease
 - evidence of right parietal dysfunction in a subgroup of children with ADHD.
 - an association between schizophrenia and the inferior parietal lobule.

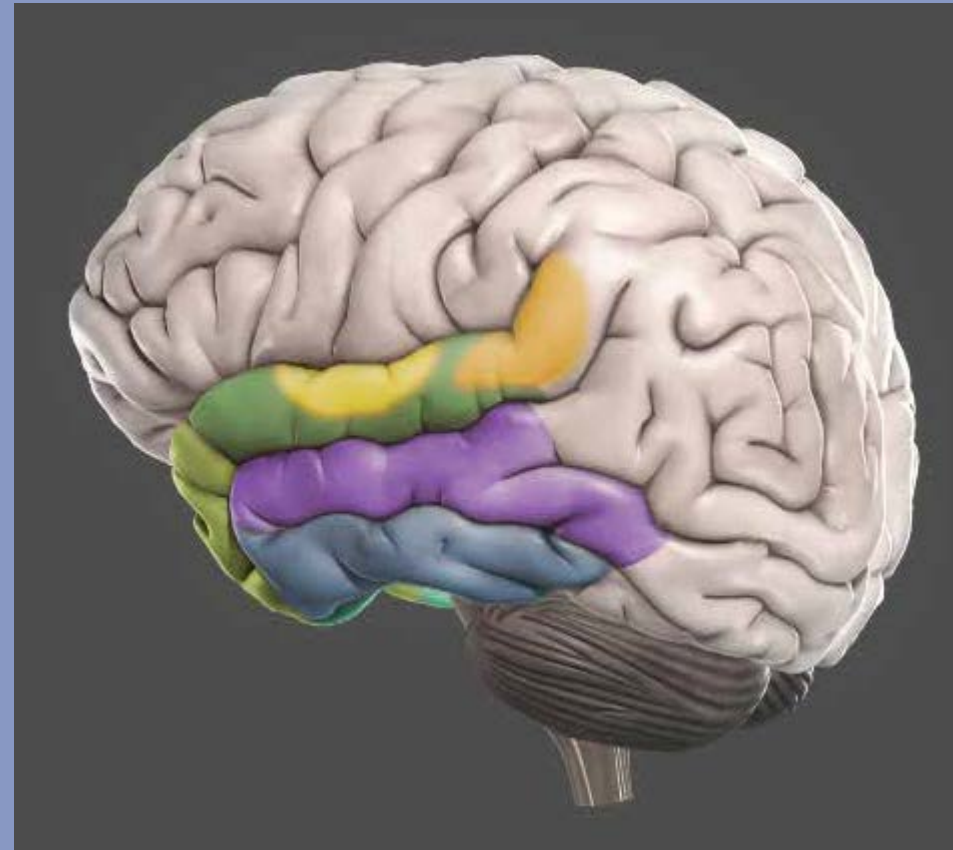


Damage to the Parietal Lobes

- inability to locate and recognize objects,
- events and
- parts of the body (hemi-spatial neglect)
- difficulty in discriminating between sensory information
- Disorientation
- lack of coordination

Temporal Lobes

- contain a large number of substructures, whose functions include perception, face recognition, object recognition, memory acquisition, understanding language, and emotional reactions.
- Damage to the temporal lobes can result in neurological deficits called agnosias, which refer to the inability to recognize specific categories (body parts, colors, faces, music, smells).
- Recognition
- Perception (hearing, vision, smell)
- Understanding language
- Learning and memory
- Associated cognitive disorders:
 - Schizophrenia is the cognitive disorder most closely aligned to temporal lobe dysfunction
 - The primary impairment in early Alzheimer's may be traced to the medial temporal lobe,
 - speech and social dysfunction in autism has been linked to the superior temporal sulcus



Damage to the temporal lobes

- Difficulties in understanding speech (Wernicke's aphasia),
- faces (prosopagnosia), and
- objects (agnosia)
- Inability to attend to sensory input
- Persistent talking
- Long– and short–term memory loss
- Increased/decreased interest in sexual behavior
- Aggression

Thalamus

- involved in relaying information between the cortex and brain stem and within different cortical structures
- contributes to many processes in the brain including perception, attention, timing, and movement
- plays a central role in alertness and awareness
- relays motor and sensory information
- Memory
- Alertness
- Consciousness
- contributes to perception and cognition
- Associated cognitive disorders:
 - a small but significant reduction in thalamus volume in schizophrenia, which correlates deficits in language, motor, and executive processes
 - linked to many other cognitive disorders including bipolar disorder, ADHD, Alzheimer's, autism, and depression.



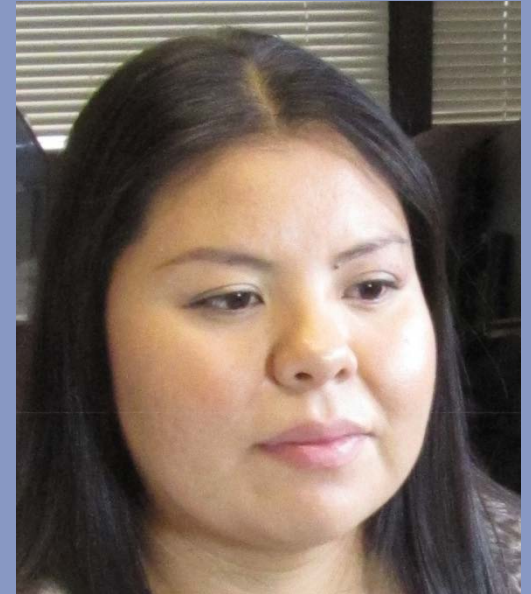
Damage to the Thalamus

- Amnesia
- Apathy
- Coma
- Dementia
- difficulty speaking (aphasia)
- loss of alertness and activation
- Sleepiness
- impaired processing of sensory information
- Inattention
- impaired movements and posture
- pain

Traumatic Brain Injury

- TBI is **the leading cause** of injury-related death in children and young adults in the United States
- A leading cause of injury death and disability in the United States
- Approximately **1.7 million** U.S. civilians sustain a TBI **annually** (2002-2006)
- 1.4 million of these are treated and released from emergency departments (EDs)
- 275,000 were hospitalized and discharged alive
- 52,000 died
- TBI-related deaths represent one third of all injury-related deaths
- This **does NOT include** TBI sustained while serving abroad in the **U.S. military** or those who did not seek medical care
- the highest combined rates of TBI-related ED visits, hospitalizations, and deaths occur in **young children (aged <5 years)**
- followed **by adolescents (aged 15--19 years)** and
- adults aged **≥75 years**
- Males make up 59%, females 41%
- The leading causes of TBI are
 - falls (35%),
 - motor vehicle--related injuries (17%), and
 - a strike or blow to the head from or against an object (e.g., workplace or sports-related injuries [16.5%],
 - **assaults [10%]**, and
 - other and unknown causes [21%]

Who's Missing?





Mild TBI (Post Concussion)

- A concussion is a type of mild TBI
- Caused by a bump, blow, or jolt to the head that can change the way your brain normally works
- Can be from a fall or a blow that causes the head and brain to move quickly back and forth
- Usually not life-threatening
- Effects can be serious

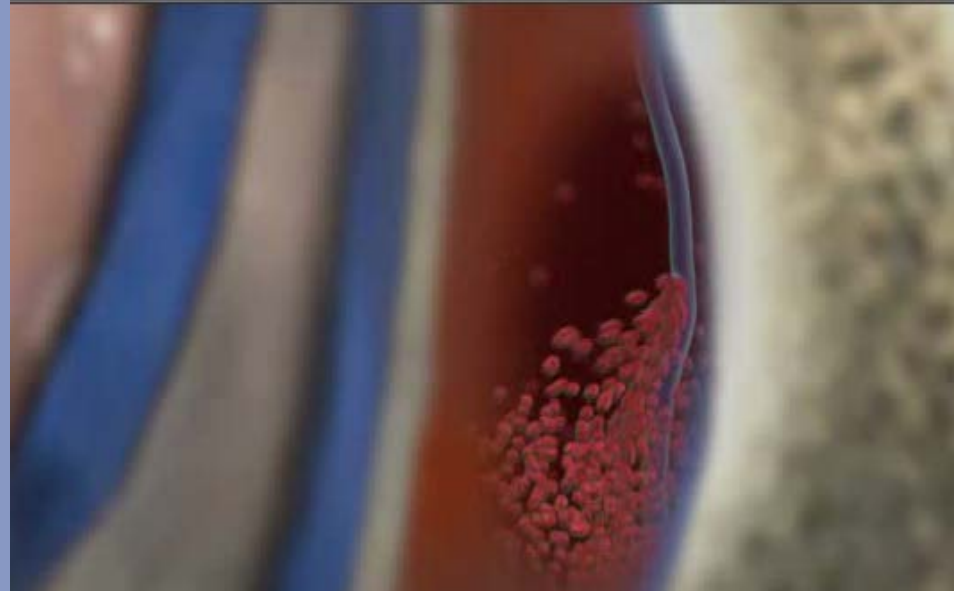
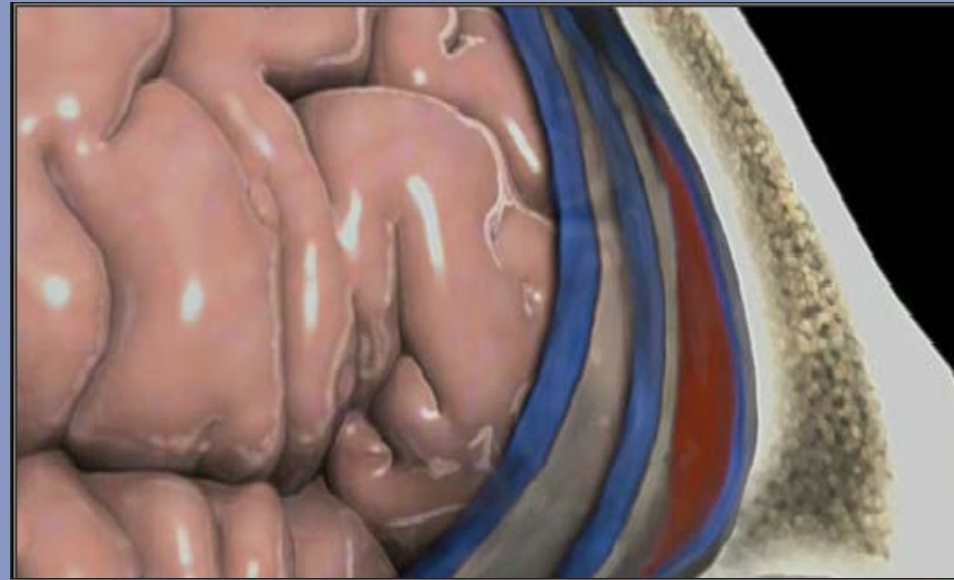
Remembering	Physical	Emotional/ Mood	Sleep
Difficulty thinking clearly	Headache Fuzzy or blurry vision	Irritability	Sleeping more than usual
Feeling slowed down	Nausea or vomiting (early on) Dizziness	Sadness	Sleep less than usual
Difficulty concentrating	Sensitivity to noise or light Balance problems	More emotional	Trouble falling asleep
Difficulty remembering new information	Feeling tired, having no energy	Nervousness or anxiety	

Severe TBI

- **Closed** – an injury to the brain caused by movement of the brain within the skull. Causes may include falls, motor vehicle crash, or being struck by or with an object.
- **Penetrating** – an injury to the brain caused by a foreign object entering the skull. Causes may include firearm injuries or being struck with a sharp object.

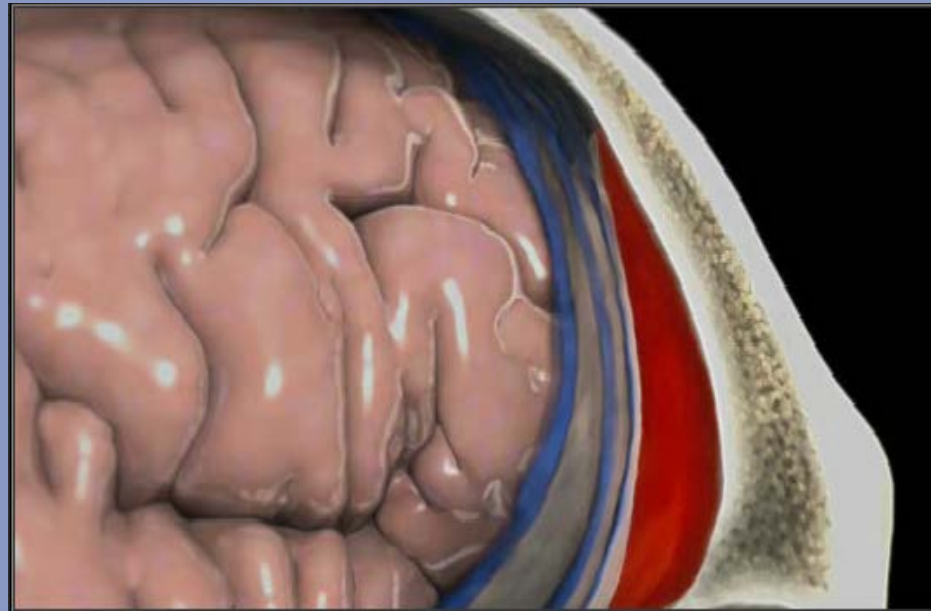
Subdural Hematoma

- The blood builds up beneath the tough outer layer of the brain's protective cover, called the dura mater, or dura for short.
- A subdural hematoma is most often caused by torn, bleeding veins on the inside of the dura caused by a blow to the head.



Epidural Hematoma

- A pocket of blood that forms between the skull and the dura mater
- Epidural means outside the dura, and hematoma means mass of blood. Epidural hematomas are not as common as subdural hematomas, and are most often the result of bleeding from higher-pressure arteries



Intracerebral Hematoma

- bleeding in the brain caused by the rupture of a blood vessel within the brain.
- occur after a trauma tears axons in the brain's white matter.
- Axons are the connections that carry messages, from the neurons in the brain to the rest of the body.
- When this connection is sheared, serious brain damage can result because the neurons can no longer communicate.
- Internal bleeding can occur in any part of the brain.
- The bleeding may be isolated to part of one hemisphere, called a lobar intracerebral hemorrhage, or the bleeding may occur in other brain structures, such as the thalamus, basal ganglia, pons, or cerebellum.

Diffuse Axonal Injury (DAI)

- damage to the brain occurs over a large area
- is one of the major causes of unconsciousness and long-term coma
- DAI is the result of the twisting and tearing of the connections between the cells of the brain.
- is caused when the head violently starts or stops a movement, such as in auto collisions, falls, and assaults.
- This type of injury usually results from rotational forces or violent stopping.
- Vehicle collisions are the most frequent causes of DAI.
- Other common causes include child abuse, for example shaken baby syndrome. Though diffuse axonal injury seldom kills, the outcome is often not predictable.

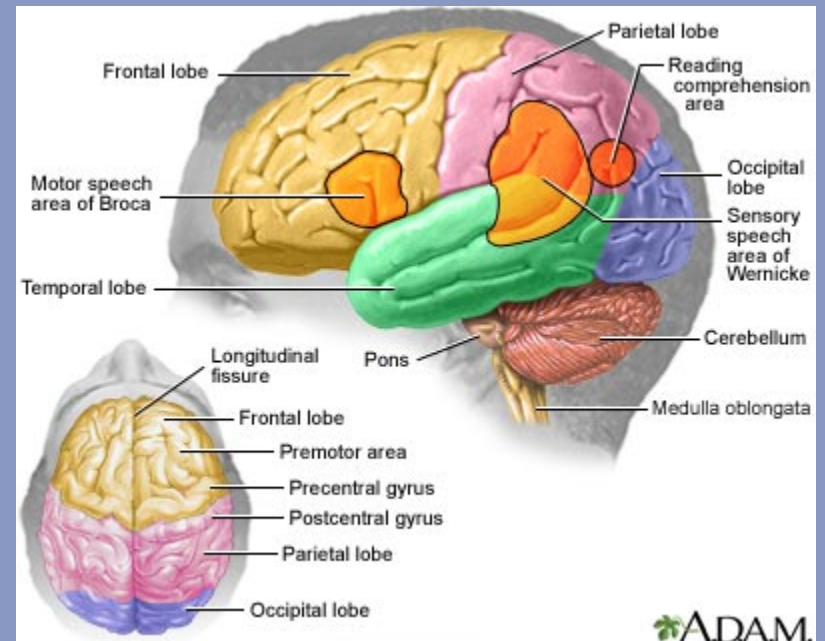
Injuries Associated with Mod to Severe TBI

- Skull Fractures
 - A simple skull fracture – which is a break in the skull without damage to the surrounding skin.
 - A linear skull fracture – meaning a break in the skull that looks like a thin line, without any additional damage to the bone.
 - A compound skull fracture – which refers to a splintering of the bone.
 - A depressed skull fracture – which is when a broken or "crushed" portion of the skull presses in towards the brain, and
 - A penetrating skull fracture – which occurs when the skull is pierced by an object, such as a bullet or debris from an explosion
- Ocular/Eye Injuries
 - Blurred vision
 - Sensitivity to light, glare sensitivity
 - Reading difficulties; words appear to move
 - Comprehension difficulty
 - Attention and concentration difficulty
 - Memory difficulty
 - Double vision
 - Aching eyes
 - Headaches with visual tasks
 - Inability to maintain visual contact
 - Reduction or loss of visual field
 - Difficulties with eye movements, such as:
 - Reduced eye tracking ability
 - Difficulty shifting gaze quickly from one point to the other
 - Problems focusing
 - Problems with eye alignment
 - Visual field loss
- Contusions

Complications

- Increased ICP
- Hypoxia
- Anoxia
- Hypertension
- Seizures

Assessment



PHYSICAL CHALLENGES

- Sleep disorders
- Loss of stamina
- Appetite changes
- Physical paralysis/spasticity
- Chronic pain
- Control of bowel and bladder
- Seizures
- Difficulty regulating body temperature

COGNITIVE DIFFICULTIES

- Attention
- Concentration
- Distractibility
- Memory
- Speed of Processing
- Confusion
- Perseveration
- Impulsiveness
- Language Processing
- Executive function
 - planning,
 - cognitive flexibility,
 - abstract thinking,
 - rule acquisition,
 - initiating appropriate actions
 - inhibiting inappropriate actions
 - selecting relevant sensory information.

SPEECH AND LANGUAGE EFFECTS

- Receptive Aphasia – difficulty understanding the spoken word
- Expressive Aphasia - knows what he wishes to say but is unable to get the words out.
- In some cases, the patient is able to perceive and comprehend both spoken and written language but is unable to repeat what he sees or hears.
- Slurred speech
- Speaking very fast or very slow
- Problems reading
- Problems writing

SENSORY

- Difficulty relating to the interpretation of:
- Touch
- Temperature
- Movement
- Limb position
- Fine discrimination

- Difficulty integrating and understanding information gained through the five senses

PERCEPTUAL

- **Vision:**
 - Partial or total loss of vision
 - Weakness of eye muscles and double vision (diplopia)
 - Blurred vision
 - Problems judging distance
 - Involuntary eye movements (nystagmus)
 - Intolerance of light (photophobia)
- **Hearing:**
 - Decrease or loss of hearing
 - Ringing in the ears (tinnitus)
 - Increased sensitivity to sounds
- **Smell:**
 - Loss or diminished sense of smell (anosmia)
- **Taste:**
 - Loss or diminished sense of taste

SOCIAL/EMOTIONAL EFFECTS

- Dependent behaviors
- Fluctuating emotions
- Lack of motivation
- Irritability
- Aggression
- Depression
- Lack of inhibition
- Denial/lack of awareness



Immediate

- Immediate medical needs are met
- Decreasing ICP

Intermediate

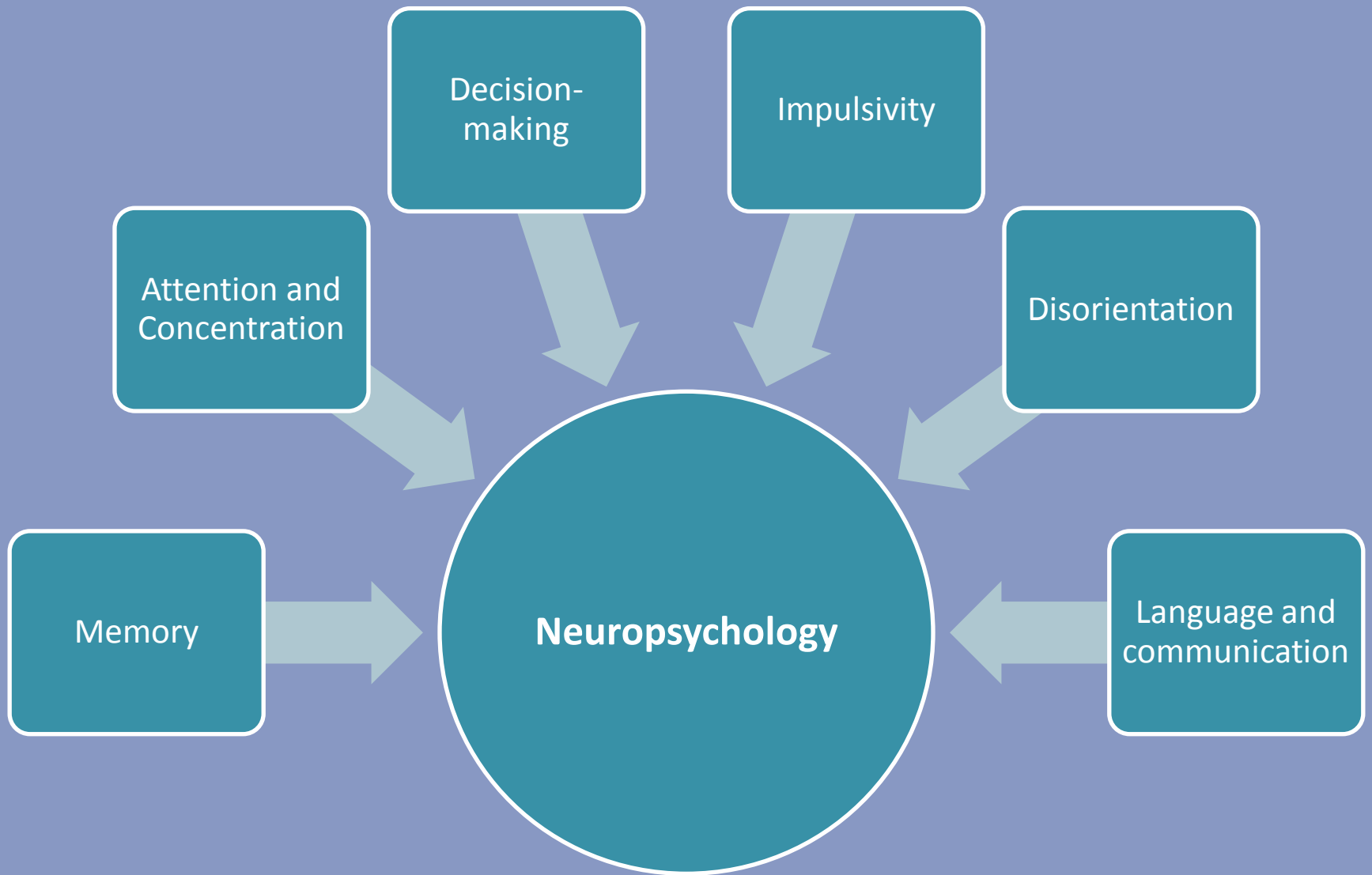
- Finding and treating complications as soon as possible
- Evaluating and planning for recovery
- Preventing additional injuries, and
- Preparing for rehabilitation, if necessary

Rehabilitation

- care is delivered by a specialized medical team that may include case managers, speech therapists, physical therapists, occupational therapists, and a variety of others.

Transitional

- Disabilities from moderate to severe TBI can last a lifetime, and treatment may be appropriate many years after the injury.
- It's important for survivors, their families, and caregivers to be involved in designing and putting into place a long-term care plan.



How can you help?

- Recognize the importance of medical intervention
- Understand that there are long term effects from TBI
- Encourage victims to seek medical care after TBI



Questions?

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