

AACBIS
American Academy for the Certification
of Brain Injury Specialists

CERTIFICATION EXAM PREPARATION COURSE
**Chapter 3: Understanding the Brain and
Brain Injury**

MODULE OBJECTIVES


- Identify basic brain structures and functions.
- Describe brain-behavior relationships.
- Describe how an injury to the brain can result in various behaviors and challenges.

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INTRODUCTION

The brain is the main organ of learning.

- It makes it possible for us to think, communicate, act, behave, move about, and create.




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ANATOMY OF THE BRAIN

The brain . . .

- Is a soft organ, like the consistency of gelatin
- Weighs less than ? lb. at birth and grows to about ? lbs.
- Sits inside a rough and bony skull and is bathed in a ?
- Receives oxygen and glucose through a sophisticated system of blood vessels that carry blood to and from the heart



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ANATOMY OF THE BRAIN *CONTINUED*

Three membranes or ? cover the brain:

- The outer ? or hard matter, which is like a heavy plastic covering.
- The ? which is like a spider web that bridges the brain's many wrinkles and folds.
- The ? or tender matter, which molds around every tiny crook and crevice on the brain's surface.
- Between the pia mater and the arachnoid, there is 145cc of cerebrospinal fluid.

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ANATOMY OF THE BRAIN *CONTINUED*

There are four ? which make, store, and circulate cerebrospinal fluid.

- The fluid helps cushion the brain and protect brain tissue when swelling occurs.

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MECHANISMS OF TRAUMATIC BRAIN INJURY

After a sudden jolt or bang, the result can be...

- **Contusion**: Injury at the site of impact and on the opposite side from the movement of the brain against the skull (either front to back or side to side)
- Diffuse Axonal injuries: Delicate nerve tissues rip, tear, and stretch
- Swelling: Brain tissue swells preventing blood and CSF circulation
 - Hematoma: Accumulation of blood causing pressure
 - Hydrocephalus: Blockage of CSF causing pressure
- Anoxia & Hypoxia: Oxygen deprivation from suffocation, drowning, bloodloss, or cardiac failure that kills brain cells
- Hemorrhages: Major bleeding from when the brain rubs against the inside of the skull, which is ragged with sharp bony ridges

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WHEN THE BRAIN IS INJURED

A brain injury is often the result of two injuries:

- A **primary** injury caused by the initial blow or insult to the brain
- A **secondary** injury caused by the swelling, bleeding, compression and contusions (bruises) to the brain.

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SEVERITY OF BRAIN INJURIES

Glasgow Coma Score (GSC)

- Is a measure of brain injury severity.
- Measures **eye opening** + **verbal response** + **motor response** = Total Score
- Scores range between 3 and 15
 - The **lower** the score, the more severe the brain injury

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SEVERITY OF BRAIN INJURIES *CONTINUED*

Mild brain injury:

- Loss of consciousness for [redacted] ? minutes (possibly no loss of consciousness)
- Glasgow Coma Scale of [redacted] ?
- Posttraumatic amnesia for less than 24 hours
- Temporary or permanently altered mental or neurological state
- Post-concussion symptoms

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SEVERITY OF BRAIN INJURIES *CONTINUED*

Moderate brain injury:

- Coma more than [redacted] ? , but [redacted] ?
- Glasgow Coma Scale of [redacted] ?
- Possible skull fractures with bruising & bleeding
- Signs on EEG, CAT or MRI scans
- Some long term problems in one or more areas of life (i.e., home, work, community)

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SEVERITY OF BRAIN INJURIES *CONTINUED*

Post concussion symptoms of cognitive and psychiatric nature that may or may not persist include:

headache	changes in personality
dizziness	memory problems
vomiting	depression
sleep disturbance	difficulty problem solving
irritability	diminished attention span

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SEVERITY OF BRAIN INJURIES *CONTINUED*

Severe brain injury:

- Coma longer than [?], often lasting days or weeks
- Glasgow Coma Scale of [?]
- Bruising, bleeding in brain
- Signs on EEG, CAT or MRI scans
- Long term impairments in one or more areas of life (i.e., home, work, community)

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NEURONS

- Neurons: the billions and billions of tiny brain cells making up the nervous system
- [?] ("glue"): non-communicating cells support and nourish the neurons.
- Three main parts of the neuron:

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NEURONS *CONTINUED*


- The neurons communicate with each other via a unique "electro-chemical" process.
- [?] are chemical messengers that relay the electrical signal of one nerve cell to the next.
- Neurochemical transmitters leap the [?]
- After a person sustains a brain injury, many of the neuron pathways may be torn apart or stretched so that information processing is no longer possible.

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THE CEREBRAL CORTEX

- **?**: the most complicated structural component of the brain
- Made up of two hemispheres: the right hemisphere and left hemisphere
- Dedicated to the highest levels of thinking, moving, and acting.
- Each hemisphere is divided into **?** – frontal, parietal, temporal, and occipital
- The cortex is full of wrinkles and folds.
 - If you took out and flattened the cortex, it would be the size of a **?**

Left Hemisphere



Right Hemisphere

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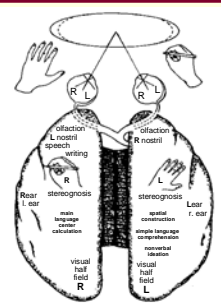
THE CEREBRAL CORTEX *CONTINUED*

- The two hemispheres of the brain have unique ways of processing information.
 - The right hemisphere is more holistic, visual-spatial, and intuitive.
 - The left hemisphere processes language and is more linear, verbal-analytic, and logical.
 - The cerebral hemispheres control **?** sides of the body.
- The cerebral hemispheres communicate to each other a thousand times a second through the **?** (the 4 inch long, pencil thick band of complex nerve fibers).

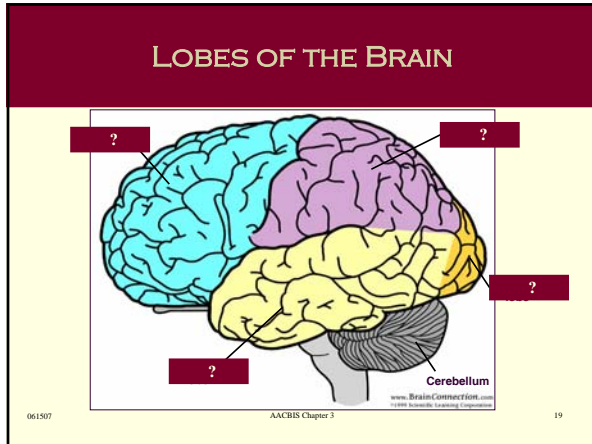
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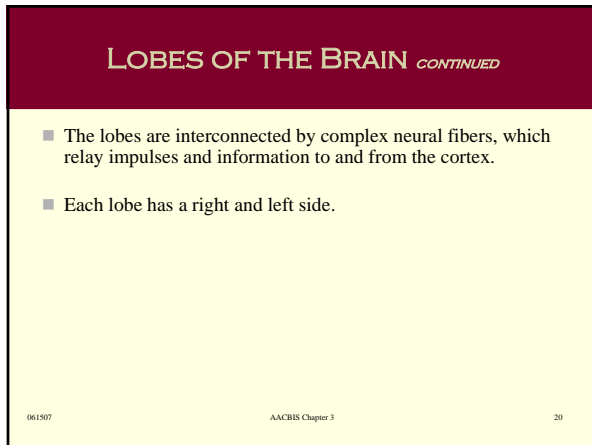
LATERALIZED SKILLS OF THE BRAIN

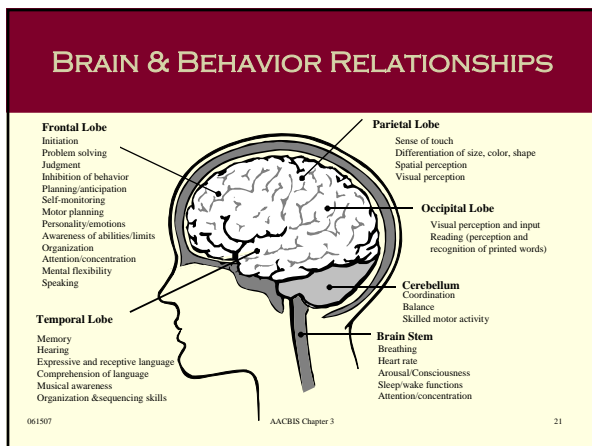
Two Hemispheres - Controlling Input and Regulating Output



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FRONTAL LOBES

- Vulnerable to injury since they sit just inside the front of the skull near a rough bony area
- Have extensive connections with many brain regions, especially with the ? lobe and the ? (emotions).
- Includes the ?
 - Sends signals to the muscles of the body, telling them what to do



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FRONTAL LOBES *CONTINUED*

- ?: located at the very front part of the frontal lobes
 - Helps hold information in memory for several minutes (referred to as ?)
 - Regulates ?, motivation, executive functions, working memory
 - Responsible for teaching a person to learn from ?

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FRONTAL LOBE INJURY

Injury damages an individual's ability to . . .


- Synthesize signals from the environment
- Assign priorities
- Make decisions
- Initiate actions
- Attend to tasks
- Control emotions
- Behave and interact socially
- Make plans

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FRONTAL LOBE INJURY IN CHILDREN

- Prefrontal lobe injuries in young children sometimes go [redacted] ?
 - Parents and teachers typically function as their frontal lobes—they organize, plan, and direct their children’s lives.
 - As the child gets older and enters early adolescence, they are expected to be more independent and learn to manage themselves over time.

- In the child with a brain injury, the capability for more independent frontal lobe functioning has been diminished.




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PARIETAL LOBE

- Situated behind [redacted] ? lobes

- Includes the [redacted] ? which is posterior to the motor strip.
 - The first part of the brain to consciously register physical sensations.

- Regulates responses to touch, heat, cold, pain, and body awareness



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PARIETAL LOBE INJURY

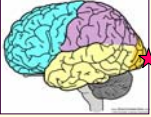
- When one side of the lobe is injured, a person may not recognize that anything is wrong with movement on the [redacted] ?

- Even more complex functions like attention can be affected by damage to the parietal lobes.

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OCCIPITAL LOBE


- Located in the lower back part of the brain
- The primary ? center of the brain
- Involves the visual cortex
 - Connected to the eyes by ?
 - Optic nerves carrying signals meet at a "crossing" called the ?
 - The left optic track carries signals from the right-side field of vision, and the right optic track takes signals from the left so that both sides of the brain "see" the same thing.
- Most of what a person "sees" derives its meaning from prior learning and symbolic representations.



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TEMPORAL LOBES

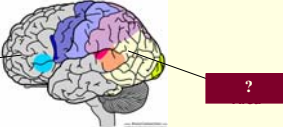
- Rest on both sides of the brain
- The centers for language, hearing, and, with their connections to the ?, help in the long-term storage of permanent memories.



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TEMPORAL LOBES *CONTINUED*

- ?: located in the lower portion of the motor cortex in the left frontal-temporal lobe
 - Controls muscles of the face and mouth and enables the ? of speech



- ?: located left temporal-parietal lobe
 - Governs a person's ? of speech

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