## Brain Stem

### “Traffic Cop”

Major structures include:

- **Midbrain**
- **Pons**
- **Medulla oblongata**

The brain stem also contains ascending and descending pathways that carry sensory and motor information to and from higher brain regions.

The sensory and motor output of the brain stem is carried by the 12 cranial nerves. The spinal cord mediates sensation and motor control of the trunk and limbs, whereas the brain stem is concerned with sensation from skin and joints in the head, neck, and face, as well as with specialized senses such as hearing, taste, and balance. Motor neurons in the brain stem control the muscles of the head and neck.

1) Disorders of midbrain cause problems with the direct control of eye movements as well as in the motor control of skeletal muscles and the relay of sight and hearing to the cortex.

2) Disorders of pons involve the 5th, 6th, 7th, 8th cranial nerves.

3) Disorders of medulla involve the 9th, 10th, 11th, 12 cranial nerves, the regulation of breathing, vomiting, and hiccupping. Also affected is the relay of impulses between brain and spinal cord.

### Reticular Formation

Also known as the Reticular Activating System (RAS).

Extends from the upper part of the spinal cord forward through brain stem to the diencephalon.

Receives somatosensory input from the spinal cords and helps coordinate the planning, timing, and patterning of skeletal muscle contractions during movement. Maintains equilibrium by receiving input about balance from the vestibular organs of the inner ear. Maintains posture and helps coordinate head and eye movements.

1) Difficulty learning motor skills

2) Problems regulating the force and range of movements

3) Disorders of balance, incoordination

4) Difficulty walking upright
### BASAL GANGLIA

“B.G.’s”.

1. **Striatum**
   a. Caudate nucleus
   b. Putamen
2. Globus pallidus
3. Subthalamic nucleus
4. Substantia nigra

Located at the base of each hemisphere. They receive input from all four lobes of the cortex, thalamus, and substantia nigra but only have output to the frontal cortex via the thalamus. Major activities include the planning of movement and all cognitive functions.

1) Thought process disorders
2) Disorders of affect
3) Disorders of cognition
4) Parkinson’s disease
5) Huntington’s chorea
6) Extrapyramidal movement disorders from psychotropic medications

### THALAMUS

“Hal”.

Located deep within the brain between the cerebral hemispheres and the midbrain.

Monitors, processes, integrates, and distributes (similar to a relay station) almost all sensory and motor information going to the cerebral cortex by connecting cerebral cortex, basal ganglia, hypothalamus, and brain stem.

1) Unable to regulate and integrate levels of awareness
2) Difficulty integrating the emotional aspects of sensory experiences
3) Unable to have an impression of the agreeableness or disagreeableness of a sensation
4) Hyper/hyposensitivity to pain

### HYPOTHALAMUS

“Little Hal”.

Located beneath the thalamus and on either side of the third ventricle. It is often considered part of the limbic system.

With the pituitary, it constitutes the master endocrine gland to function as a major CNS integrating and output system control center for the pituitary gland and head ganglion of the ANS. Has extensive afferent and efferent connections with the thalamus, mid-brain, and some cortical areas that receive information from the ANS. It also appears to have a role in the control of biological rhythms and immune system regulation. Mediates emotions and fear, anger, pleasure, and contentment.

1) Disorders of appetite
2) Disorders of water balance
3) Difficulty responding to visceral stimuli
4) Disorders of sexual function/sexual behavior
5) Disorders of pituitary hormonal secretions
6) Disorders of thermoregulation
7) Disorders of emotional expression of anger, rage, placidity, pleasure, fear, and social attraction even when survival depends upon these emotions
8) Difficulty regulating vital functions of blood pressure and blood osmolality due to inability to respond to blood water and salt content
9) Abnormal sleep/wake cycle
<table>
<thead>
<tr>
<th>BRAIN STRUCTURE</th>
<th>MAJOR FUNCTIONS</th>
<th>CLINICAL EFFECTS OF DYSFUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LIMBIC AREA</strong></td>
<td>Limbic neurons form complex circuits that collectively play an important role in learning, memory, and emotions. Limbic lobe coordinates visceral responses with motivational states; interprets smell; regulates emotional responses such as anger, fear, anxiety, pleasure, sorrow, rage, and sexual arousal.</td>
<td>1) Excessive emotional responses to new stimuli 2) Increased drinking of fluids and eating 3) Changes in taste preferences 4) Inability of emotions to reach consciousness 5) Decreased ability of cognition to affect emotion 6) Unable to integrate the behavioral expression of emotion and motivation 7) Decreased ability of central reward system to respond to basic drives and instincts 8) Inability to interpret smell; olfactory hallucinations</td>
</tr>
<tr>
<td><strong>HIPPOCAMPUS</strong></td>
<td>Receives input from the paralimbic areas, hypothalamus, amygdala, and septal region and is therefore involved with control of the endocrine system, regulation of the immune system, and memory storage.</td>
<td>1) Difficulty with behavioral arousal 2) Many short and long-term memory problems 3) Inability to discriminate and inhibit behavioral responses 4) May generate epileptic discharges 5) Inability to process complex sensory information 6) Difficulty acquiring new learning</td>
</tr>
<tr>
<td><strong>AMYGDALA</strong></td>
<td>Interacts with the olfactory bulb, brainstem, hypothalamus, and neocortex and is implicated in sampling physical aspects of the environment. Helps coordinate the actions of the autonomic and endocrine systems and is involved in emotions, especially anxiety and fear.</td>
<td>1) Inability to attach motivational and autonomic significance to sensory stimuli 2) Over/under response to anxiety and fear 3) Unable to compare incoming and previously experienced stimuli 4) Unable to discriminate responses based on consequences of past experiences</td>
</tr>
<tr>
<td>BRAIN STRUCTURE</td>
<td>MAJOR FUNCTIONS</td>
<td>CLINICAL EFFECTS OF DYSFUNCTION</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>TEMPORAL LOBES</td>
<td>Hearing, learning, complex memory, and emotion.</td>
<td>1) Difficulty controlling sexual and aggressive drives 2) Memory impairment: inability to recall stored information or to have newly learned information reach long-term storage sites in hippocampus 3) Types of aphasia: difficulty with production and analysis of speech 4) Difficulty attaching meanings to spoken words 5) Emotional identity: difficulty recognizing own emotions 6) Sexual identity: confusion about masculinity/femininity—not to be confused with sexual orientation 7) Auditory hallucinations</td>
</tr>
<tr>
<td>PARIETAL LOBES</td>
<td>Receiving and identifying sensory information from tactile receptors.</td>
<td>1) Inability to recognize sensations from the skin including pain, touch stimuli, and temperature changes 2) Body image disturbance 3) Inability to recognize body parts 4) Impaired spatial abilities, loss of ability to visualize three dimensions 5) Denial of illness (anosognosia) 6) Difficulty dressing 7) Impaired right/left orientation (gets lost easily) 8) Impaired association and sensory aspects of speech: inability to recognize written words by processing visual and auditory sensations 9) Loss of proprioception: inability to recognize the relationship of your body to the environment 10) Loss of ability to evaluate muscular activity: unable to sense pain from an uncomfortable body position 11) Loss of memory association: unable to learn from the past; loss of ability to apply previous learning to the present and future</td>
</tr>
<tr>
<td>OCCIPITAL LOBES</td>
<td>All aspects of vision.</td>
<td>1) Disturbed spatial orientation--difficulty with physical and environmental boundaries 2) Visual illusions; visual hallucinations 3) Simulated hysteria 4) Loss of visual memory; loss of object constancy (unable to recognize objects, people, places by sight) 5) Loss of visual speech (ability to understand the meanings of written words)</td>
</tr>
<tr>
<td>BRAIN STRUCTURE</td>
<td>MAJOR FUNCTIONS</td>
<td>CLINICAL EFFECTS OF DYSFUNCTION</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td><strong>CORTEX</strong></td>
<td>Interpreting, processing, and integrating sensory and motor functions.</td>
<td>1) Errors in processing of sight, taste, touch, smell, and hearing, and movements can result in inappropriate responses, inability to distinguish objects by touch, hallucinations, delusions, and bizarre behavior 2) <strong>Incoordination</strong> and lack of control of motor aspects of muscle movement (motor impersistence); disturbance in balance; strange eye movements 3) Inability to integrate information from several stimuli for purposeful action 4) Inability to control perceptions, movements, and motivation</td>
</tr>
<tr>
<td>“The corporation”.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FRONTAL LOBES</strong></td>
<td>Decision-making, planning for future action and control of movements.</td>
<td>1) <strong>Inappropriate</strong> or <strong>uninhibited</strong> behavior 2) <strong>Impulsiveness</strong>, inability to evaluate and control emotions, judgment, and conduct 3) <strong>Emotional impoverishment</strong> 4) <strong>Irritability</strong> 5) Labile affect 6) Lack of motivation, ambition, and/or responsibility 7) Difficulty with all cognitive functions, especially attention, concentration, memory, and follow-through 8) Difficulty with the motor aspects of speech (words are garbled and difficult to understand) 9) Difficulty with written communication (unintelligible and illogical writing) 10) Difficulty with abstract thinking</td>
</tr>
<tr>
<td>The “Boss” or “CEO”.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>