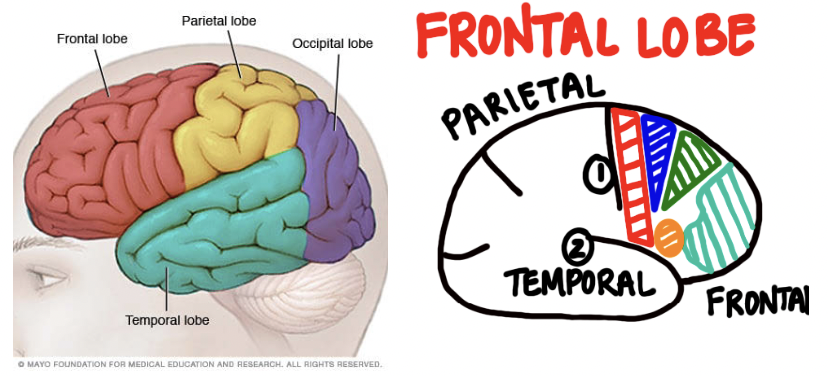
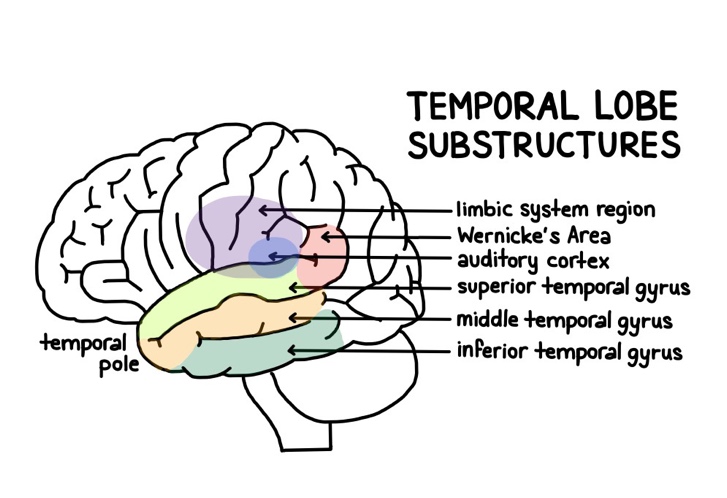
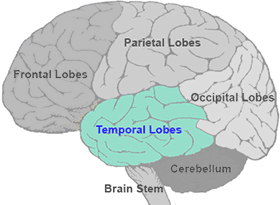
**Cerebral Cortex – Temporal Lobe Anatomy and Function**

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**Outline**

* Temporay Lobe Anatomy
* Primary Auditory Cortex
* Auditory Association Cortex
* Weirnecke’s Area
* Primary Olfactory Cortex and Association Olfactory Cortex
* Insular Cortex
* References



**TEMPORAL LOBE ANATOMY**

**Boundaries of Temporal Lobe**

* **Lateral sulcus** (Sylvian fissure)
  + Separates temporal lobe from frontal and parietal lobes
* **Preoccipital notch**: an imaginary line that can be drawn between the notch and the Lateral sulcus
  + Separates the temporal lobe from the occipital lobe

**Divisions and Functions of Temporal Lobe**

* **Primary Auditory Cortex**
  + Conscious awareness of sound
* **Auditory Association Cortex** 
  + Gives meaning or understanding of sound
* **Wernicke’s Area** 
  + Comphrehensive understanding of written or spoken language
* **Primary Olfactory Cortex and Association Olfactory Cortex**
  + Conscious awareness of smell
* **Insular Cortex**
  + Conscious awareness of gustation
  + Visceral sensations & vestibular sensations

**Diagram

Description automatically generatedPrimary Auditory Cortex** Orange in drawing

* The Primary Auditory cortex is Involved in conscious awareness of sound stimuli
* It identifies the 3 characteristics of sound:
  + Frequency
  + Pitch
  + Location

**How sound is perceived**

* Auditory pathway: → Inner hair cells in cochlea→ carried by **vestibulocochlear nerve** (CN VIII)→ cochlear nuclei in pontomedullary junction→ decussation at level of trapezoid body→ ascends as lateral lemniscus→ goes to thalamus (medial geniculate body)→ **primary auditory cortex**
* There is communication between the 2 sides
  + The neurons decussate at the level of the trapezoid body, so the information is received controlaterally (opposite side)
  + Example: a sound stimulus received by the left ear will be heard in the right Primary Auditory cortex

**Lesion of Primary Auditory Cortex**

* It will cause contralateral loss of sound stimuli
  + Includes difficulty determining the location, pitch and frequency of a sound.

**Auditory Association Cortex** Blue in drawing above

* **Diagram

  Description automatically generated**Once the stimulus has arrived in the Primary Auditory Cortex, it’s sent to Auditory Association cortex
  + Analyzes pitch, localization and amplitude of sound
  + Compares sound characteristics with previous sounds and helps to recognize the meaning and significance of the sound stimulus
    - Example: a wife tells her husband “she's fine” in a loud manner.
* The auditory association cortex will compare that sound characteristics with previous memories and help one recognize she isn't “fine”, instead “she ticked off”.

**Wernicke’s Area** Green in drawing

* Responsible for comprehension and understanding of written and spoken language
* Receives visual cues from visual association cortex in occipital lobe and auditory information from auditory association cortex in temporal lobe
  + These information are used to help comprehend the language (written or spoken) being presented.
  + Then Wernicke’s area sends impulses to **Broca's area (**via arcuate fasciculus) which is involved in stimulating muscles of speech production
    - Example:  
      ▪ Wife is talking about various things that happened at work today and you decide to tune her out, because you are listening to a Dr. M podcast. All of a sudden she says frustratingly with her very upset facial expressions “what did I just say, were you even listening?”
* **Diagram

  Description automatically generated**Your Wernicke’s area will allow you to analyze the angry voice and frustrated face of the wife and then comprehend she is “ticked off”.
* Wernicke's area then sends that information to Broca’s area and then you respond “yeah of course I was listening”.

**Wernicke’s Aphasia (Receptive aphasia)**

* Caused by damage to Wernicke’s area, usually because of middle cerebral artery stroke.
  + Symptoms:
    - Fluent speech: the patient is able to form words and sentences since Broca’s area isn’t damaged, however the speech will make no sense
* Inability to comprehend the meaning of a word or sentence

**Primary Olfactory Cortex and Olfactory Association Area**

* Located deep to temporal lobe, at the level of uncus, on medial portion of the brain
* **A picture containing diagram

  Description automatically generated**Involved in the awareness of smell and analysis, recognize and identify smell patterns and store these smells in memory pathways
* Olfactory pathway:
  + The smell will activate the receptors located in the nasal activity → activates **olfactory nerves** (CN I), which cross cribriform plate to reach **olfactory bulb** → gives rise to olfactory tract→
    - **Medial olfactory stria**: directed towards primary orbitofrontal cortex in frontal lobe
    - **Lateral olfactory stria:** directed to primary olfactory cortex
  + From there, the stimulus is sent to Olfactory Association cortex, where it will be stored in our memory
  + The stimulus can also reach the **amygdala** (limbic system), where that particular smell will be tied to certain emotions

**Insular Cortex** Pink in drawing below

* Not actually part of the temporal lobe, makes up its own lobe
* Located deep in Lateral fissure
* Functions:
  + Receives visceral sensation: pain and temperature information from lungs, heart and GI tract
    - Information is sent to **insula** → analyzes, recognizes, and stores memory of visceral sensations
    - Example:
      * Gastroenteritis→ activates visceral sensory neurons of GIT→ sends signals to insula→ Insula remembers visceral pain from gastroenteritis
  + Receives vestibular sensations from inner ear→ **Insula** 
    - This helps us to be more aware of our dynamic and static equilibrium
    - **Diagram

      Description automatically generated**Receives gustation (taste) from **taste buds** in fungiform papillae and vallate papillae→ Cranial nerves (VII and IX)→ **nucleus of tractus solitarius**→ insula
    - Insula helps us differentiate between different tastes
      * Sweet
      * Sour
      * Salty
      * Bitter
      * Umami

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