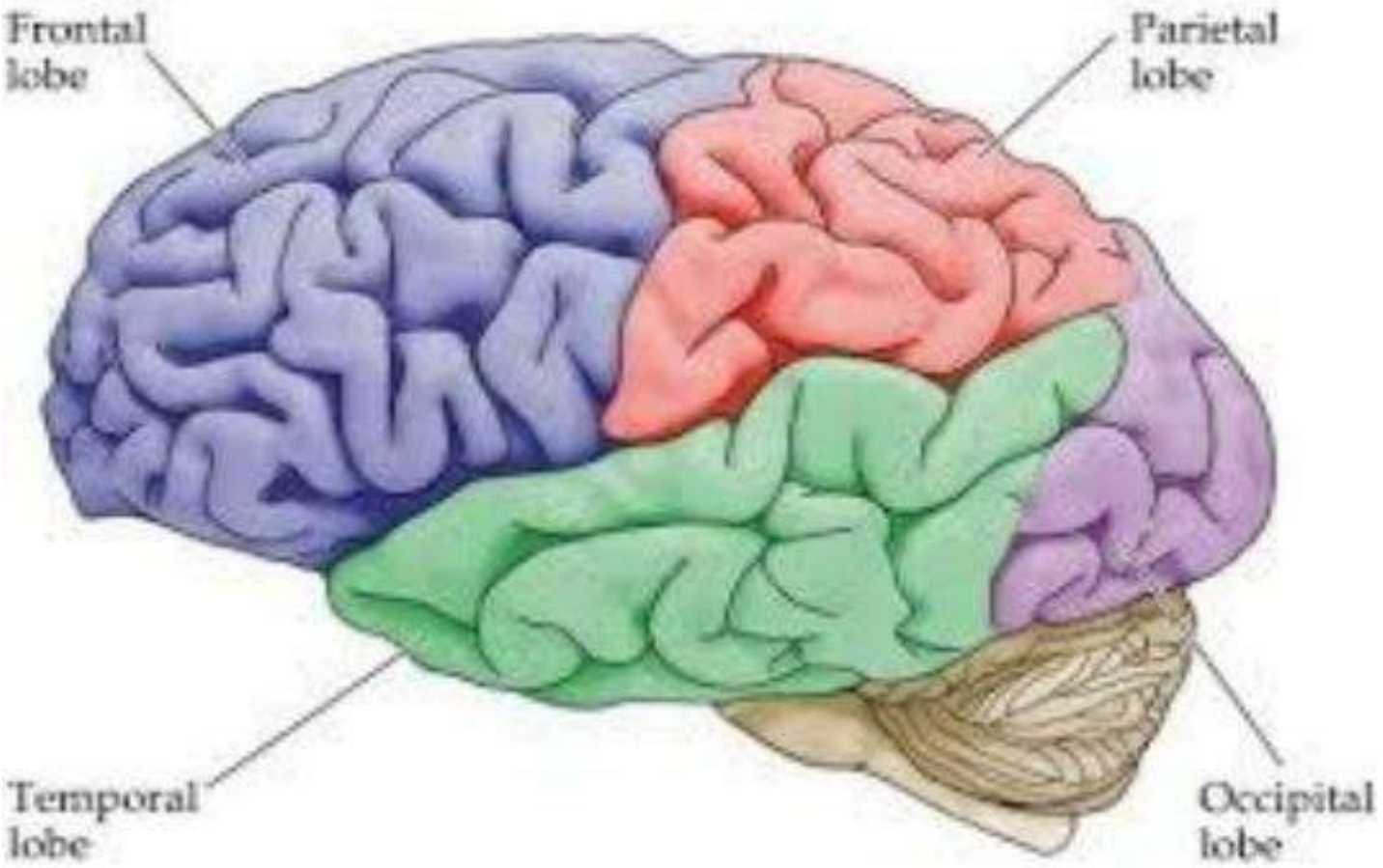
NEUROPSYCHIATRY OF TEMPORAL LOBE

INTRODUCTION -

- Lobes of brain
- Anatomy of temporal lobe
- Subdivisions
- Hippocampus
- Amygdala
- Functions of temporal lobe
- Asymmetry of temporal lobe
- Symptoms of temporal lobe damage
- Temporal lobe epilepsy

LOBES OF BRAIN -



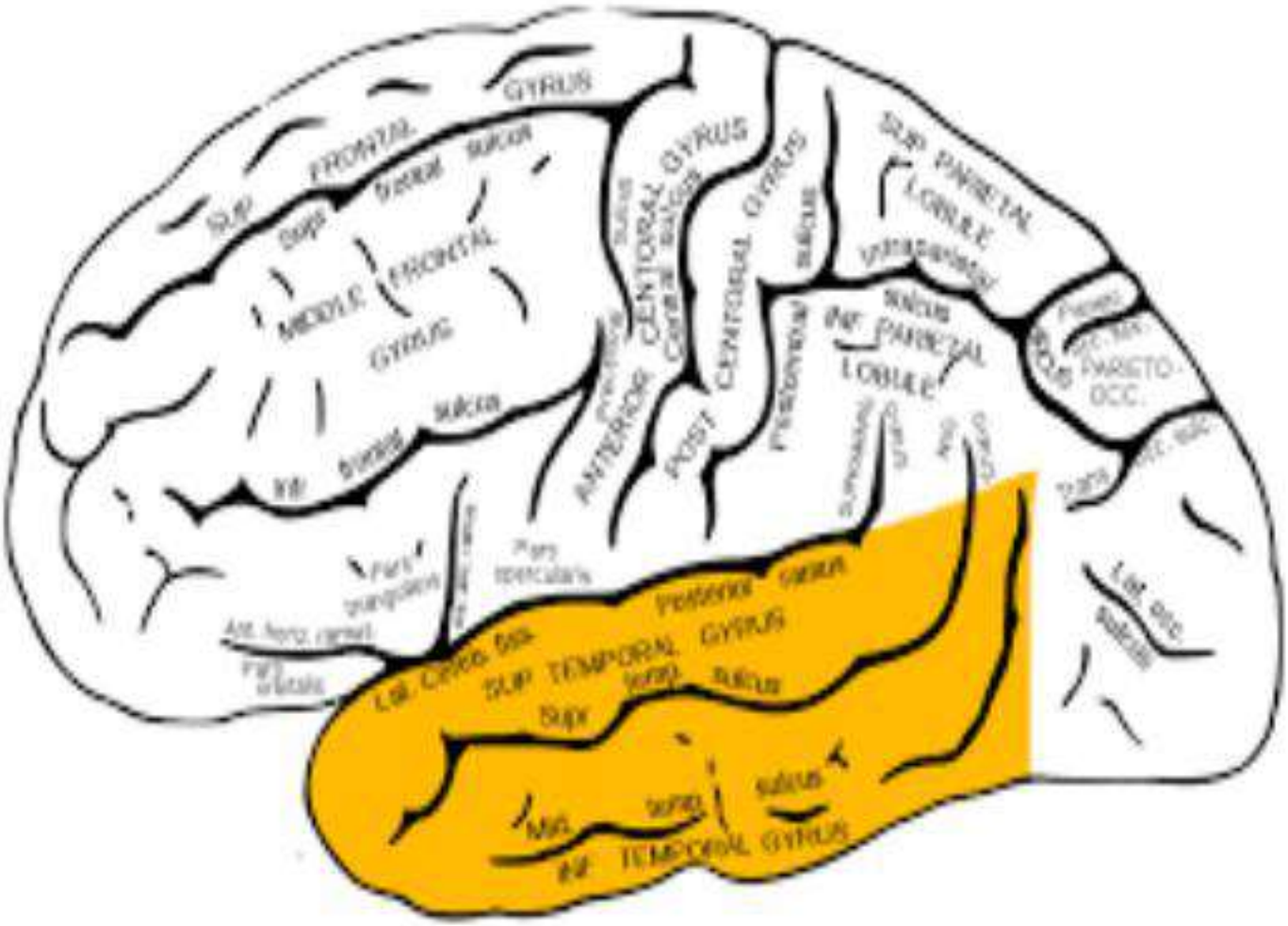
ANATOMY OF TEMPORAL LOBE -

- Temporal Lobe- occurs in primates and is the largest in humans.
- located on sides of the brain, deep to temporal bones of the skull.
- Percentage of temporal lobe in cerebral cortex = 22%.
- Temporal cortex contains auditory, vestibular, olfactory, visual senses, perception of spoken and written language.

CONTD…

- Temporal lobe also contains- white matter, part of lateral ventricle, tail of caudate nucleus, hippocampus and amygdala.

TEMPORAL LOBE-

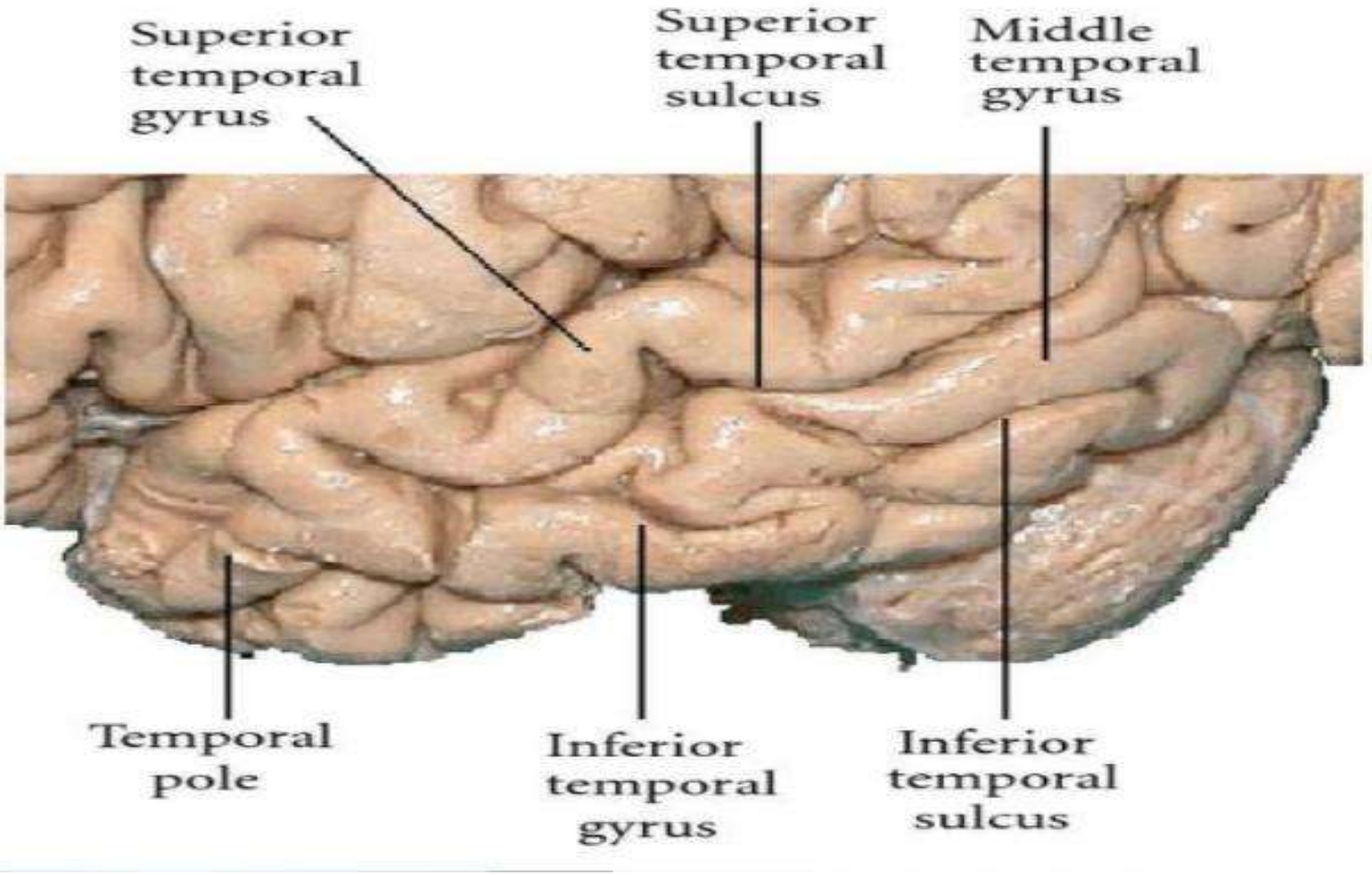


CONTD…

- Superior and Inferior Temporal sulci divide temporal lobe into three lobes-

- Superior temporal lobe
- Middle temporal lobe
- Inferior temporal lobe

Contd…

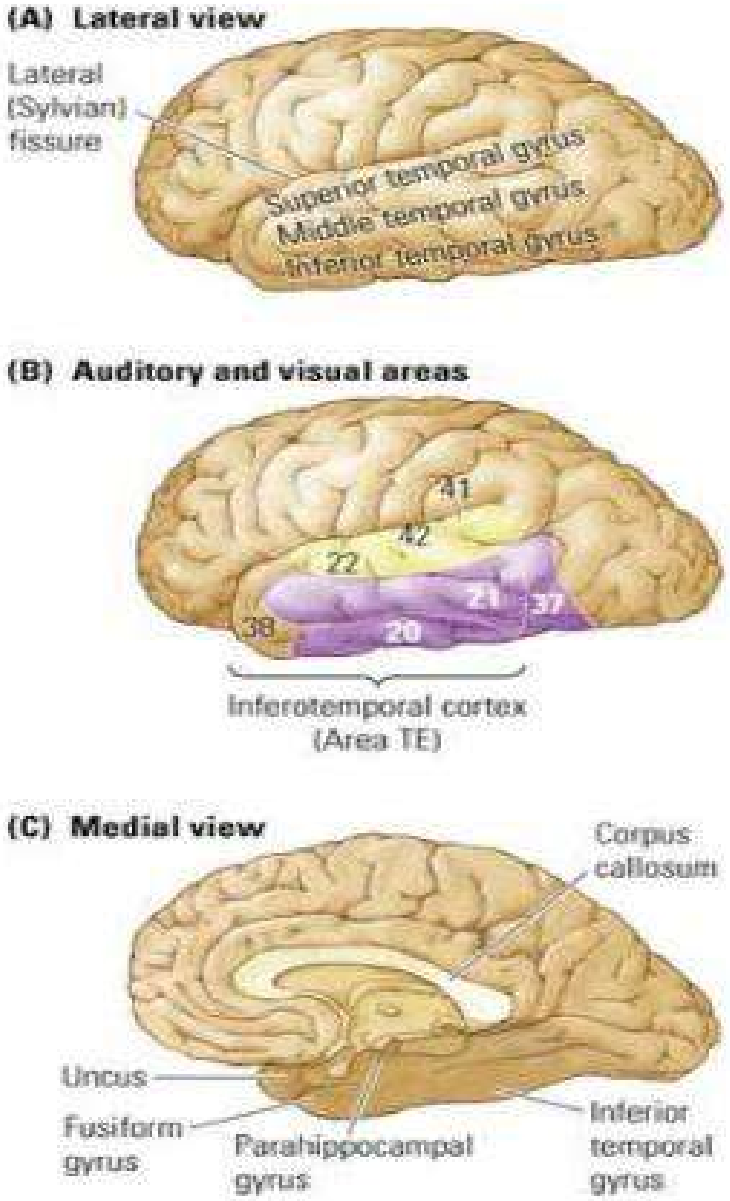

Superior temporal gyrus
Superior temporal sulcus
Middle temporal gyrus
Temporal pole
Inferior temporal gyrus
Inferior temporal sulcus

- SUPERIOR TEMPORAL LOBE -
  - Involves areas 41, 42, and 22.
  - Primary auditory area (area 41)
  - Left side of brain- helps in generation and understanding of new words.
  - Right side of brain- helps differentiate between melody, pitch and sound intensity.

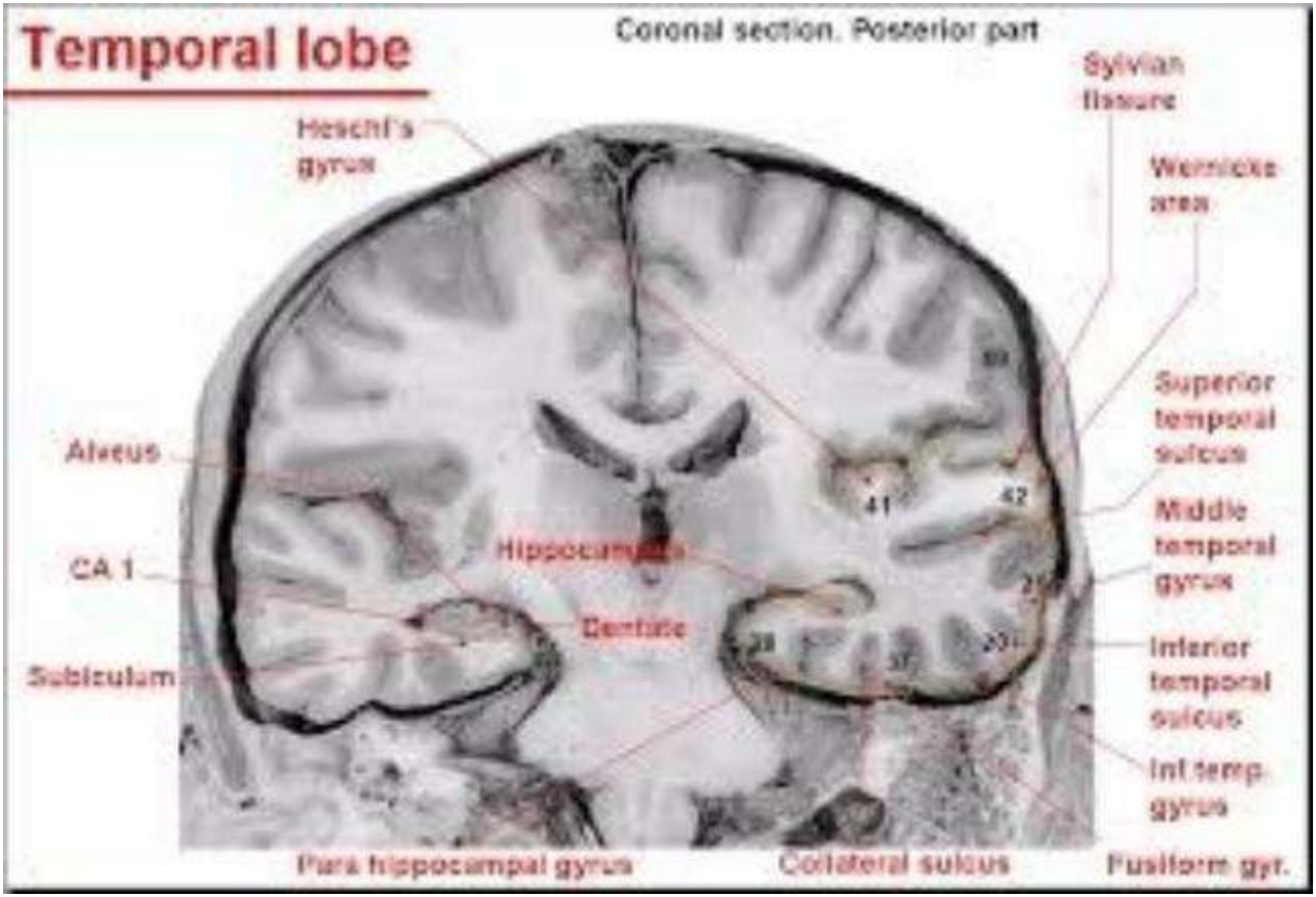
Contd…

- MIDDLE TEMPORAL LOBE -
  - It encompasses most of the lateral temporal cortex which plays role in auditory processing and language (Brodmann's area 21)
- INFERIOR TEMPORAL LOBE -
  - Corresponds to inferior temporal gyrus.
  - Brodmann's area 20.
  - Encompasses ventral temporal cortex which plays role in visual processing and recognition memory.

- Brodmanm areas on lateral suraface of Temporal lobe –
  - Auditory area (area 41, 42)
  - Auditory association cortex (area 22)
  - Ventral visual stream areas
    (area 20, 21, 37 & 38)



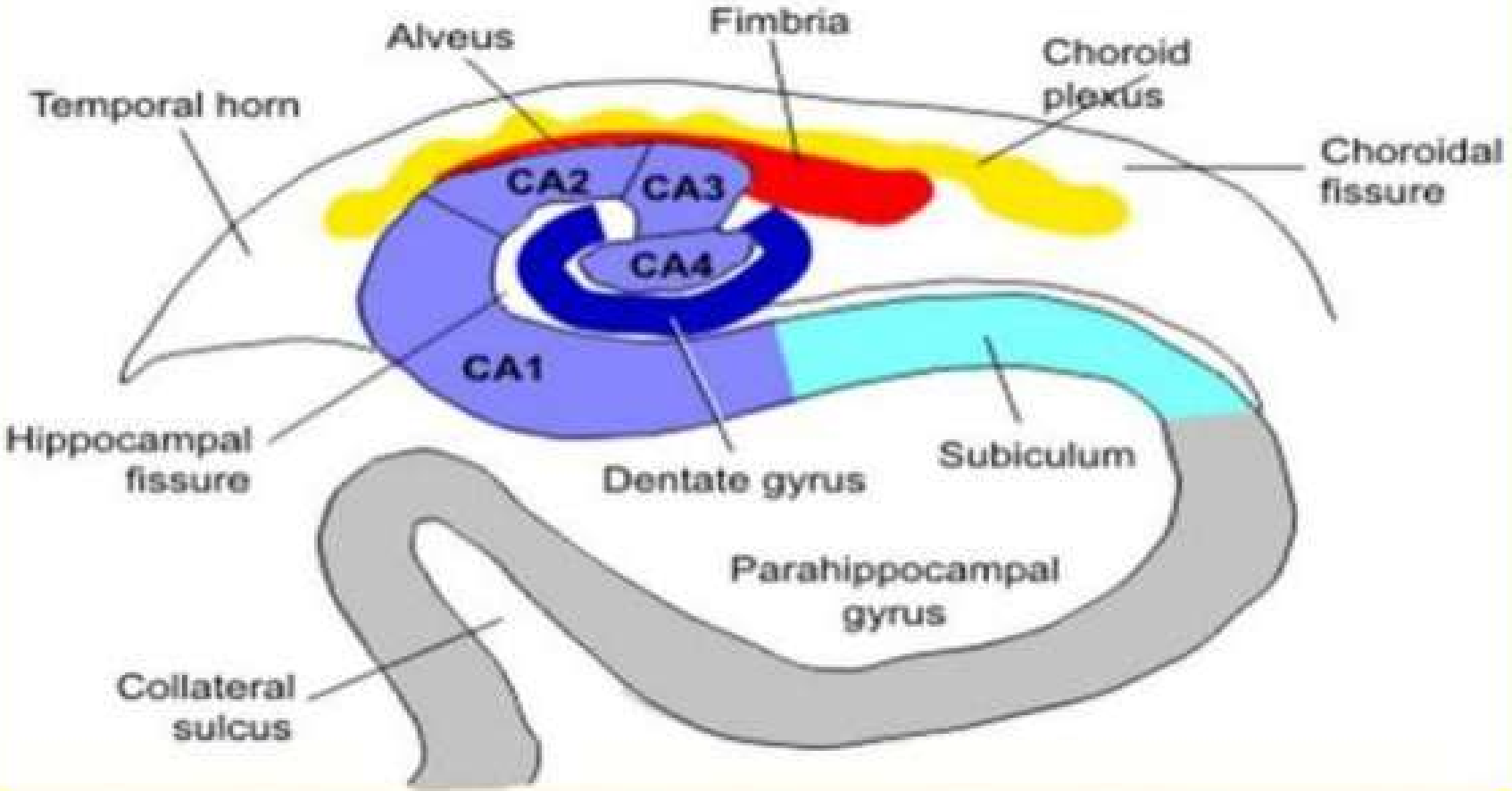
CORONAL SECTION –



HIPPOCAMPUS -

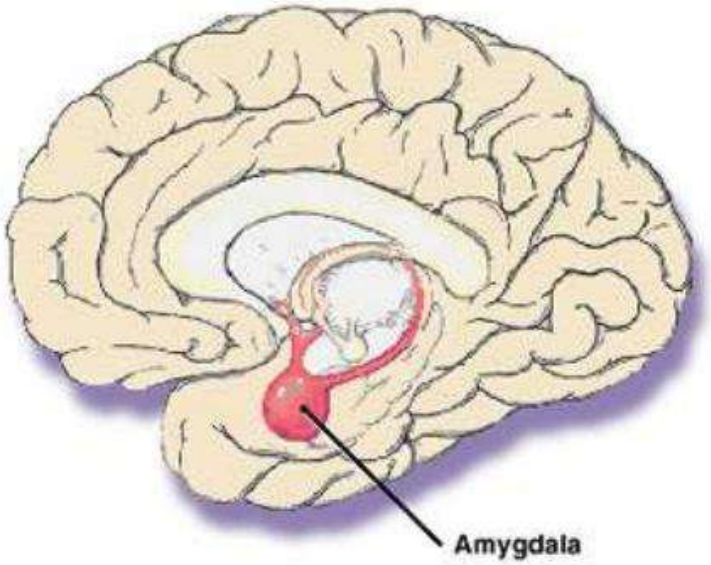
- Scrolled structure located in medial temporal lobe.
- Dentate gyrus- dark layer of cells.
- Represents free edge of pallidum and associated white matter, alveus, fornix, fimbria.
- Areas CA1, CA3, CA2 are present.
- Cortex adjacent to hippocampus is entorhinal area, present along whole length of parahippocampal gyrus.
- Subiculum - base of hippocampus. Continuous with entorhinal cortex.
- Has indirect afferent connections from cerebral cortex.

Hippocampal Anatomy



AMYGDALA

•The **amygdala** (Latin,meaning 'almond') are almond-shaped groups of neurons located deep within the medial temporal lobes of the brain, in close relation to anterior end of inferior horn of lateral ventricle, located at anterior end of hippocampal formation.



- Located in medial part of temporal pole, anterior to and partly overlapping hippocampal head.
- Receives fibres of olfactory tract.
- Lateral part of amygdala like hippocampal formation receives direct and indirect input from cerebral cortex.

CONTD…

- INPUTS –
  - Association areas of visual, auditory and somato- sensory cortices are main inputs to amygdala.
- OUTPUTS –
  - Main outputs to amygdala are hypothalamus and brainstem autonomic centers including vagal nuclei and sympathetic nuclei.
  - Amygdala is interconnected with frontal cortex, medio dorsal thalamus and medial striatum.

CONTD…

- Amygdala is the heart of the emotional system.
- Processes and interprets sensory data.
- Modulates autonomic, endocrine and affective responses.
- Hence, lesions of amygdala result in symptoms such as irritability and agitation.

KLUVER - BUCY SYNDROME -

- Results due to bilateral destruction of amygdaloid body and inferior temporal cortex.
- Characterized by -
  - Visual agnosia
  - Placidity
  - Hypermetamorphosis
  - Hyperorality
  - Hypersexuality
- Causes -
  - Cerebral trauma
  - Alzheimer's disease
  - Niemann - Pick disease
  - Herpes infection
  - Cerebrovascular disease.

CONTD…

- Causes –
- Cerebral trauma
- Alzheimer’s disease
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FUNCTIONS OF TEMPORAL LOBE -

- Processing auditory input -
  - Sends ventral and dorsal streams for object identification and movement planning.
- Visual object recognition -
  - Ventral visual stream
- Biological motion perception -
  - Superior temporal sulcus
- Long term storage of information -
  - Memory - hippocampus.

CONTD…

- Sensory processes –
  - Identification and categorization of stimuli
  - Process of visual and auditory information.
- Affective responses –
  - Emotional response is associated with particular stimuli.
- Spatial navigation –
  - Hippocampus – spatial memory

LANGUAGE AND COMPREHENSION

- LANGUAGE AREAS –
  - Wernicke's area found in posterior temporal lobe is called the speech area.
  - Wernicke's area surrounds and encompasses part of auditory association area.

- AFFECTIVE LANGUAGE AREAS –
  - Involved in non verbal emotional components.
  - Present in non dominant hemisphere opposite Broca's and Wernicke's area.
  - Allows tone of our voice and gestures to express our emotions when we speak and comprehend the emotional content of what we hear.

- Lesions in this area cause aprosodia.
- Speech is flat and emotionless.
- Lacks intonations that modify meaning of our spoken words.

APHASIA -

- Any disturbance in comprehension or expression of language caused by a brain lesion.
- NON FLUENT APHASIA -

  Lesion in Broca's area results in slow speech, difficulty in choosing words, or use words that approximate the correct word.

  Eg a person says tssair instead of chair.
- FLUENT APHASIA -

  Lesion in Wernicke's area. Person speaks normally but uses jargon and invented words which makes very little sense.

  Eg choss for chair.

  Person fails to comprehend written and spoken words.

ASYMMETRY OF TEMPORAL LOBE FUNCTION –

- LEFT TEMPORAL LOBE –
  - Verbal memory
  - Speech processing

- RIGHT TEMPORAL LOBE –
  - Non verbal memory
  - Musical processing
  - Facial processing

SYMPTOMS OF TEMPORAL LOBE DAMAGE -

- Disturbance of auditory and sensation and perception.
- Disturbance of selective attention of auditory and visual input.
- Disorders of visual perception.
- Impaired organization and categorization of verbal material.
- Disturbance of language comprehension.
- Impaired long term memory.
- Altered personality and affective behavior.
- Altered sexual behavior.

DISORDERS OF AUDITORY PERCEPTION -

- Lesions of left superior temporal gyrus-

  Problems of speech perception and difficulty in discriminating speech and temporal order of sounds.

- Lesions of right superior temporal gyrus-

  Disorder of perception of music with inability to discriminate melodies and produce prosody.

CONTD…

- Inferior temporal cortex responsible for visual perception and lesions produce inability to recognize faces – prosopagnosia.
- There may occur disturbance in visual and auditory input selection. This presents as impairment of short term memory also called working memory and judgment about recent events.

DISORDERS OF MEMORY –

- The medial and inferior temporal cortex and hippocampus are responsible for memory.
- There occurs complete anterograde amnesia following bilateral removal of medial temporal lobe and hippocampus and amygdala.
- Left side for verbal material and right side for non verbal memory such as faces, tunes and drawings.

TEMPORAL LOBE PERSONALITY–

- Presents with –
  - Egocentricity
  - Pedantic speech
  - Perseveration of speech
  - Paranoia
  - Religious preoccupations
  - Tendency to aggressive and violent outbursts

DISTURBANCE OF TIME PERCEPTION -

- Most common type of disruptions of sense of time occur as part of confusional states.
- In temporal lobe seizure originating on either side, time may seem to stand still or pass with great speed.
- Patient with Korsakoff amnesic state is unable to understand events in proper time relationships, because of failure of retentive memory which is a function of medial temporal lobe.

VESTIBULAR DISTURBANCES -

- In superior and posterior part of temporal lobe there is an area which responds to vestibular stimulation.
- Epileptic activation of this area induces vertigo or a sense of disequilibrium.

DISTURBANCES OF SMELL AND TASTE –

- Seizure foci in medial part of temporal lobe causes olfactory hallucinations.
- This type of ‘uncinate fit’ as pointed out by Stewart and Jackson is often accompanied by dreamy state.
- Penfield described it as intellectual aura.
- Hallucinations of taste are less common.

TEMPORAL LOBE EPILEPSY -

- Chronic disorder of the nervous system
- Characterized by recurrent, unprovoked focal seizures(also known as partial seizures)
- Lasts about one or two minutes.
- People with TLE may experience simple partial seizures that only affect the temporal lobe or complex partial seizures that spread to other regions of the brain.
- TLE patients may experience chest discomfort, nausea, unexplained emotions (e.g., intense joy or fear), or loss of awareness (e.g., staring or repetitive behaviors like blinking, twitching, pacing, etc.)

- They might also be in a dream-like state and have changes in consciousness,
  have hallucinations and

  see, hear, feel, smell, or taste things that are

  not real.
- Some people report auras (warnings that a seizure is approaching),usually described as intense feelings of déjà vu or fear.

SIMPLE PARTIAL SEIZURES -

- Simple partial seizures (SPS) involve small areas of the temporal lobe such as the amygdala and hippocampus.
- The term "simple" means that the level of consciousness of the patient is not altered during the seizure.
- In temporal lobe epilepsy, a simple partial seizure usually causes abnormal sensations only.

- These may be mnestic sensations such as déjà vu (a feeling of familiarity), jamais vu (a feeling of unfamiliarity);
- amnesia or a single memory or set of memories; auditory (an abnormal sound or tune); gustatory (an abnormal taste); olfactory (a smell that is not physically present); visual; or sensory (involving feelings on the skin or in the internal organs) sensations.
- Sensory disturbances may seem to move over the body.
- Synesthesia (stimulation of one sense experienced in a second sense) may transpire.
- Dysphoric or euphoric feelings, fear, anger, and other emotions may also occur.

COMPLEX PARTIAL SEIZURES -

- Complex partial seizures (CPS) are seizures which impair consciousness to some extent: they alter the person's ability to interact normally with their environment.
- Begin with a simple partial seizure, then spread to a larger portion of the temporal lobe, resulting in impaired consciousness.
- Signs may include motionless staring, automatic movements of the hands or mouth, altered ability to respond to others, unusual speech, or other unusual behaviors.

- These seizures tend to have a warning or aura before they occur
- Lasts only 1-2 minutes.
- It is not uncommon for an individual to be tired or confused for up to 15 minutes after a seizure has occurred.
- For example, if a person with complex partial seizures is driving alone, this can cause them to run into the ditch, or worse cause an accident involving multiple people.
- With this type, some people do not even realize they are having a seizure and most of the time their memory from right before or after the seizure is wiped.
- First-aid is only required if there has been an

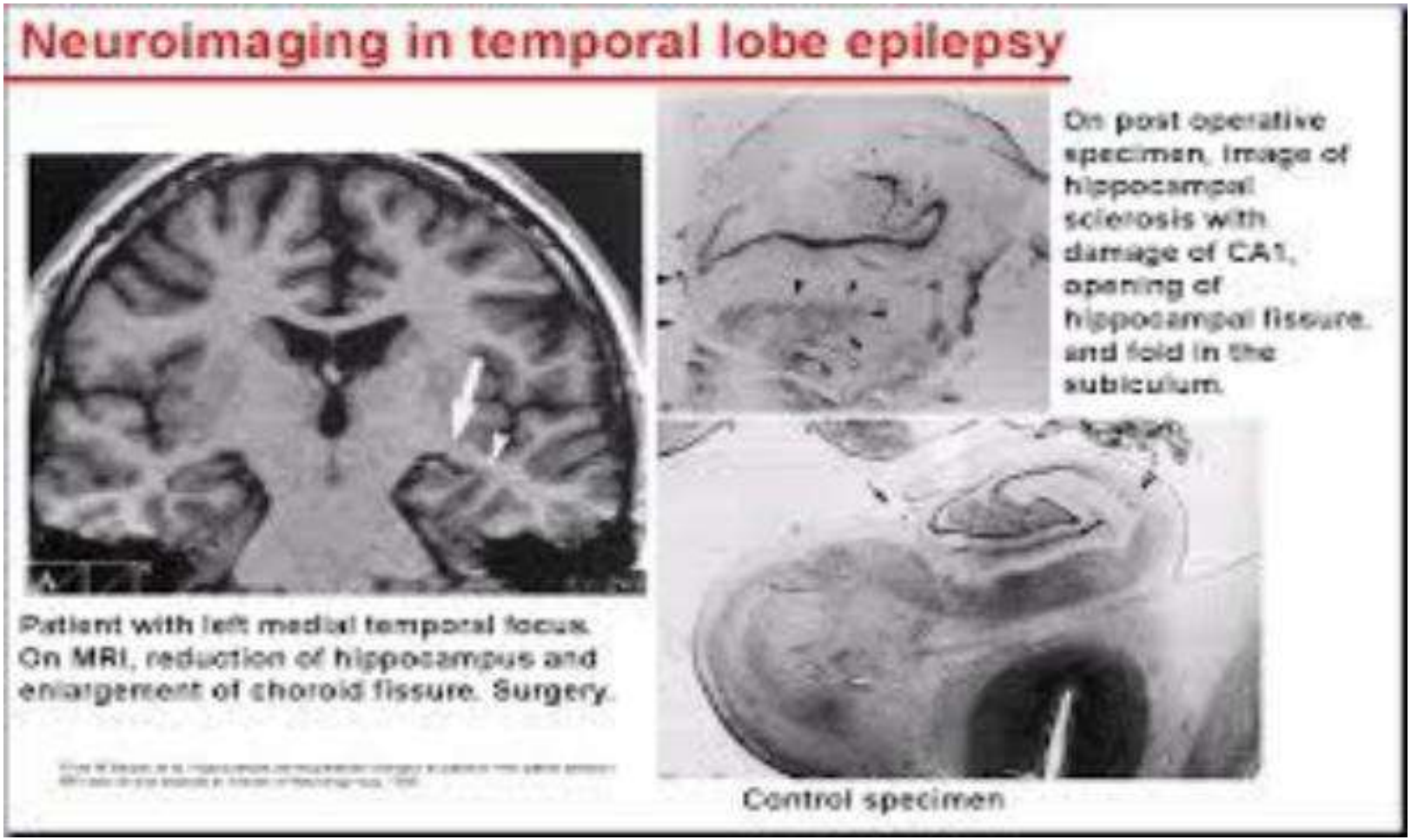
CAUSES –

- Mesial temporal sclerosis
- Traumatic brain injury
- Brain infections such as encephalitis and meningitis
- Hypoxic brain injury
- Stroke
- Cerebral tumors.
- Temporal lobe epilepsy is not the result of mental health disorders or fragility of the personality

DIAGNOSIS & TREATMENT -

- TLE is usually diagnosed in childhood or by the teenage years. Physicians diagnose TLE by taking a medical history, blood tests, and brain imaging (EEG, CT scan, PET, and/or MRI).
- The first line of treatment is through anticonvulsant medication.
- Surgery may be an option especially when there is an observable abnormality in the brain.
- Electrical stimulation of the brain through an implantation called the vagus nerve stimulation.

NEURO-IMAGING -



GESCHWIND SYNDROME-

- Also known as Gestant - Geschwind syndrome.
- Behavioral phenomena observed in patients of temporal lobe epilepsy.
- Characterized by -
  - Hypergraphia
  - Hyper religiosity
  - Atypical sexuality
  - Circumstantiality

RESEARCH STUDIES –

- F. Gibbs conducted a study on 163 patients of having epileptic foci with focus on anterior temporal areas.

  He found that 49% constituted total psychiatric disorders out of which 32% suffered from Personality disorder and

  17% from Psychoses.

- In a cross sectional study carried out by Guilherene et al in Brazil (South America) to evaluate frequency and intensity of psychiatric disorders in group of Temporal lobe epilepsy patients wherein 73 cases were studied, showed high frequency of lifetime

CONTD…

- A study was conducted by Yoshio et al in patients of McLean /Harvard was carried out to study MRI studies of schizophrenic patients with low volume of grey matter in left superior temporal gyrus and medial temporal lobe structure and it revealed that patients with 1st episode schizophrenia had significantly smaller grey matter volume in left posterior superior temporal gyrus than 1st episode affective Psychosis or normal subjects.

SUMMARY –

- TEMPORAL LOBE AND ITS IMPORTANCE –
  - Temporal lobe is an important part of the cortex.
  - It serves many functions such as auditory perception, visual perception, memory, speech, language comprehension, emotional response, facial recognition etc.
  - Hence damage to temporal lobe affects the functioning and causes disturbances.
  - Temporal lobe epilepsy as discussed is an important entity by itself especially concerning the neuro psychiatric aspects and therefore carries much significance for

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Thank you