Cerebral Cortex
Structure, Function, Dysfunction

*Reading Ch 10 Waxman*

Dental Neuroanatomy Lecture

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March 7, 2012
Anatomy Review

• Lobes and layers
• Brodmann’s areas
• Vascular Supply
• Major Neurological Findings
  – Frontal, Parietal, Temporal, Occipital, Limbic
• Quiz Questions?
Types of Cortex

- Sensory (Primary)
- Motor (Primary)
- Unimodal association
- Association and Multimodal necessary for language, reason, plan, imagine, create
Structure of neocortex (6 layers)
The general pattern of primary, association and multimodal association cortex (Mesulam)
Brodmann, Lateral Left Hemisphere
MCA left hemisphere

from D.Haines
ACA and PCA
-Haines
Issues of Functional Localization

- Earliest studies - Signs, symptoms and note location at autopsy
- Electrical discharge (epilepsy) suggested function
- Ablation - deficit suggest function
- Reappearance of infant functions suggest loss of inhibition (disinhibition), i.e. grasp, suck, Babinski
- Linked networks of afferent and efferent neurons in several regions working to accomplish a task (attention)
- Functional imaging does not always equate with abnormal function associated with location of lesion
- fMRI activation of several cortical regions
- Same sign from lesions in different areas – i.e. paraphasias
- Notion of the right hemisphere as "emotional" in contrast to the left one as "logical" has no basis in fact.
Limbic System (not a true lobe) involves

- Cingulate gyrus - affect, pain, memory
- Hippocampus - short term memory
- Amygdala - fear, aggression, mating
- Fornix pathway to hypothalamus
- Hypothalamus - ANS & endocr control
- Prefrontal Cortex - appropriate behavior
Schematic Diagram of principal limbic areas

From College of DuPage Biology 1152 Syllabus
Amygdala and relationship to ventricle and hippocampus
Classic Hippocampal Circuit
Hippocampal Formation & Amygdala
Hippocampus
Hypothalamus
Lateral view gross brain. Left hemisphere **Frontal Lobe**
Frontal Lobe Motor areas

• Contralateral weakness or paralysis (area 4)
• Premotor planning of action (area 6)
• Frontal eye fields for moving eyes to opposite side (area 8) e.g. Epileptic discharge
• Speech production (Broca’s area 44, 45)
• Prefrontal areas
Apraxia
(Error in execution of learned movements without coexisting weakness)

- Damage to dominant parietal, premotor, and supplementary motor areas
- Dominant hemisphere association areas
- Parietal - integrates motor sequences with vision and somatic sensory info
- Frontal lobe - execution of act
Frontal Lobe prefrontal association cortex

• **Bilateral** prefrontal damage
  – distractible, apathetic
  – lack foresight, abstract reasoning, initiative
  – stubborn,
  – perseverate,
  – lack ambition, responsibility, judgment or social graces
Parietal Lobe

• Somatosensory Cortex-paresthesias
• Dominant Parietal lobe-reading, writing, naming
  • L. Angular gyrus
  • L. Supramarginal gyrus
  • L. Multimodal cortex
• Agraphia can be frontal or parietal
Contralateral Neglect
(asomatognosia)

- **Right** parietal
- Right side is dominant for attention - do not attend to opposite side, ie. Dressing apraxia
- Severe - failure to recognize one’s opposite limb
- Impaired visuospatial ability (drawing, copying, 3D, manipulate objects in space)
- Fail to appreciate humor
Temporal Lobe

- Association auditory cortex
- Speech comprehension
- Important in naming
- Memory - bilateral medial temporal lobe near hippocampus
- Superior part of contralateral visual field
Aphasias - Motor

• Full Broca's involves operculum, insula and subjacent white matter with contralateral hemiparesis of face, arm
• Telegraphic speech
• Agrammatism - syntax more affected than semantics
• Usually agraphia too
• Transcortical - interruption of inferred linkage paths inward to Broca's area

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Global aphasia

- Dominant hemisphere
- Frontal
- Temporal
- Parietal
- Head of caudate associated with language disorders
- Internal carotid or proximal MCA, hemorrhage, or large tumor
Aphasias-Sensory

• Wernicke’s
• Dominant (left usually) hemisphere
• Fluent, paraphasias, poor comprehension,
• Naming, repetition, reading and writing impaired
• Less aware and less frustrated than motor aphasias
Right hemisphere and aphasia

- Emotional tone modulation
- Propositional prosody
- Body language gestures
Temporal Lobe Functions

• Wernicke speech comprehension - dominant side
• Verbal learning- dominant
• Inferior temporal gyrus naming and faces - bilateral R or L
• Superior homonymous quadrantanopia - (Meyers loop)
• Hallucination incld gustatory, visual, auditory with emotion
• Lyrics in dominant lobe
• Harmony and melody is impaired by lesions of the nondominant,
• Visual learning- nondominant
• Visual agnosia dominant, auditory agnosia nondominant hemisphere
• Bilateral: cortical deafness. Otherwise subtle
• Bilateral: psychic blindness, Klüver-Bucy rarely full in man.
• Bilateral hippocampal formation : Amnesia
Agnosia-impaired perception or recognition with OK vision, hearing, sensation, attention, intelligence

- Visual: colors, faces, letters
- Auditory: tunes, spoken words, pure word deafness
- Somatosensory - stereognosis, graphesthesia
- May not have other signs: aphasia, apraxia
- Atrophy or metastatic disease
- Disconnections of specific sensory association areas
- Corpus callosum, deep white matter near main sensory areas
Occipital Lobe

Brodmann, Lateral
Ventral and dorsal Stream, MT
Medial Gross Brain
Visual Path

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Ventral, Gross Brain
PCA ventral view
right hemisphere
from D.Haines
Write the patient history
Posterior view, angiogram

FIRST ANGIO

SECOND ANGIO next day
Doctors say a bystander can recognize a stroke by asking three simple questions:

**STROKE:** Remember the 1st Four Letters... **S.T.R.O.**

If everyone can remember something this simple, we could save some folks.
Ask four simple questions:

• **S** Ask the person to **SMILE**
• **T** Ask the person to **TALK** and **SPEAK A SIMPLE SENTENCE** (Coherently) (i.e. It is sunny out today)
• **R** Ask them to **RAISE BOTH ARMS.**
• **O** Ask them to **open** their mouth and **STICK OUT** your tongue. (Does it deviate to one side?)
• **K** Kall 911
• **E** Every minute counts (180 mins)
End of Dental lecture