

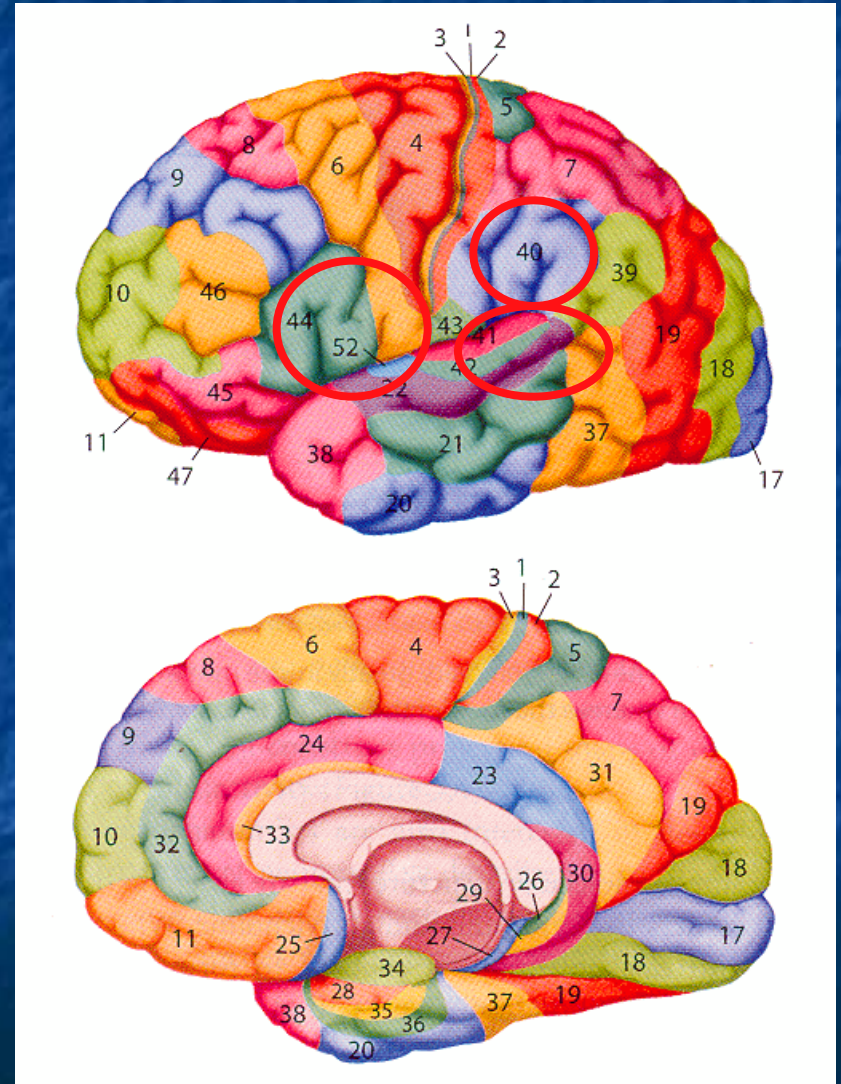
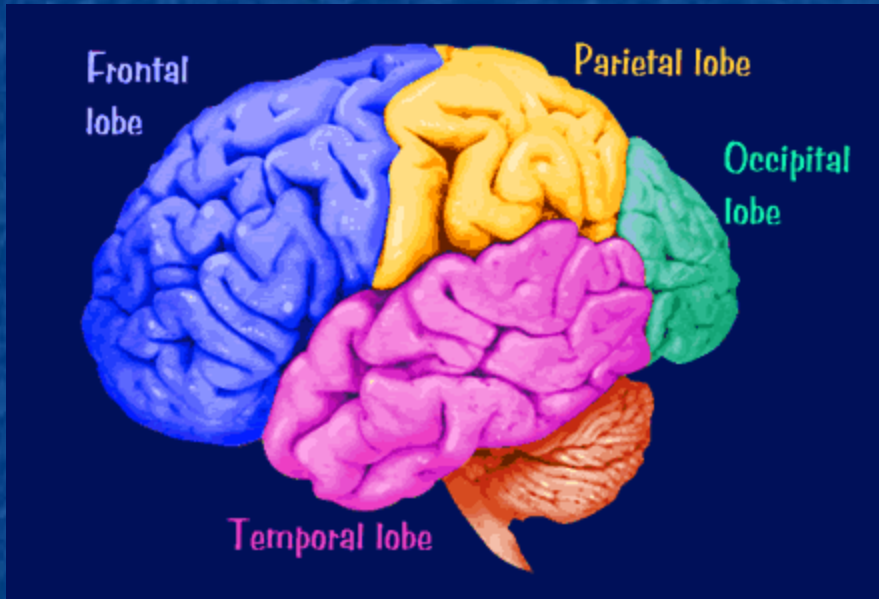
Introduction to Neuropsychology

Language

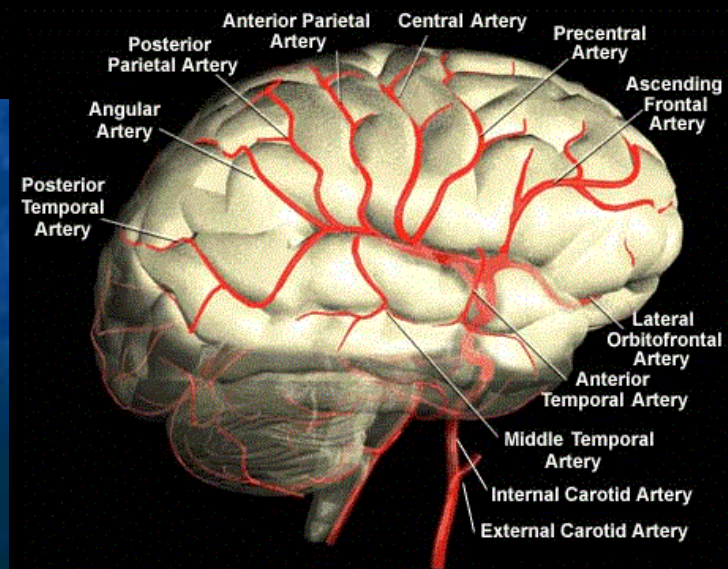
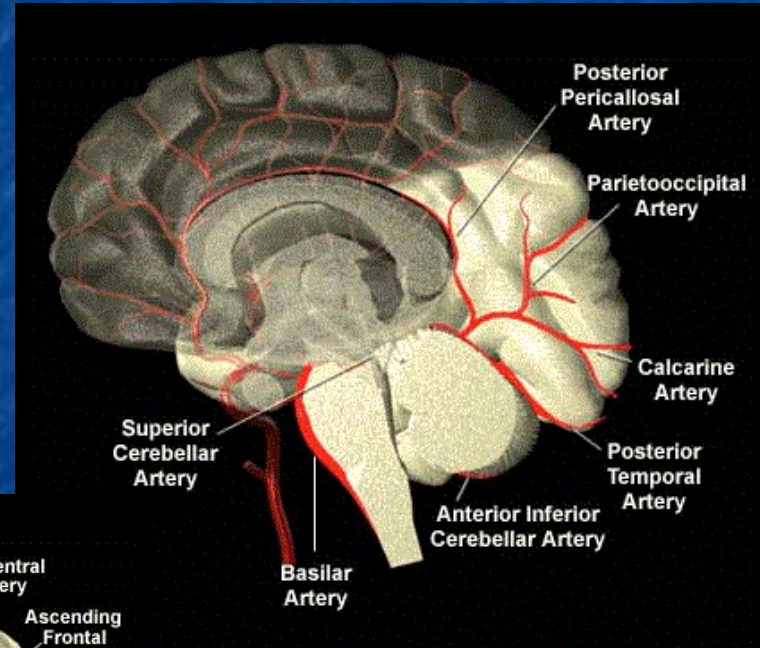
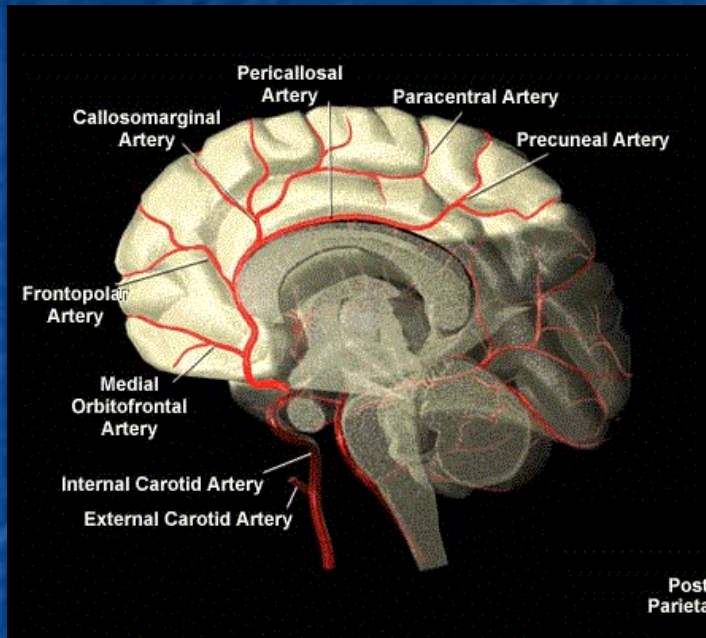
Example Exam Questions

1. How have neuropsychological investigations informed our current understanding about the neural underpinnings of language?
2. What differences exist between the behavioural deficits resulting from damage to anterior and posterior language structures?
3. How have investigations into *conduction aphasia* informed us about the layout of language in the brain?

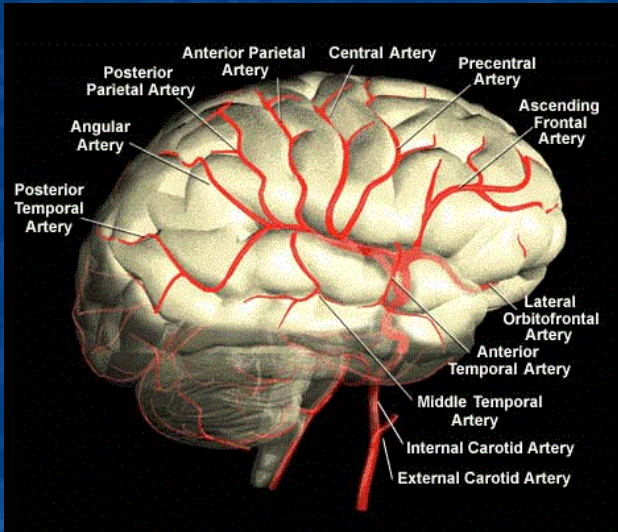
Basic Anatomy



Basic Anatomy



Basic Anatomy



Language

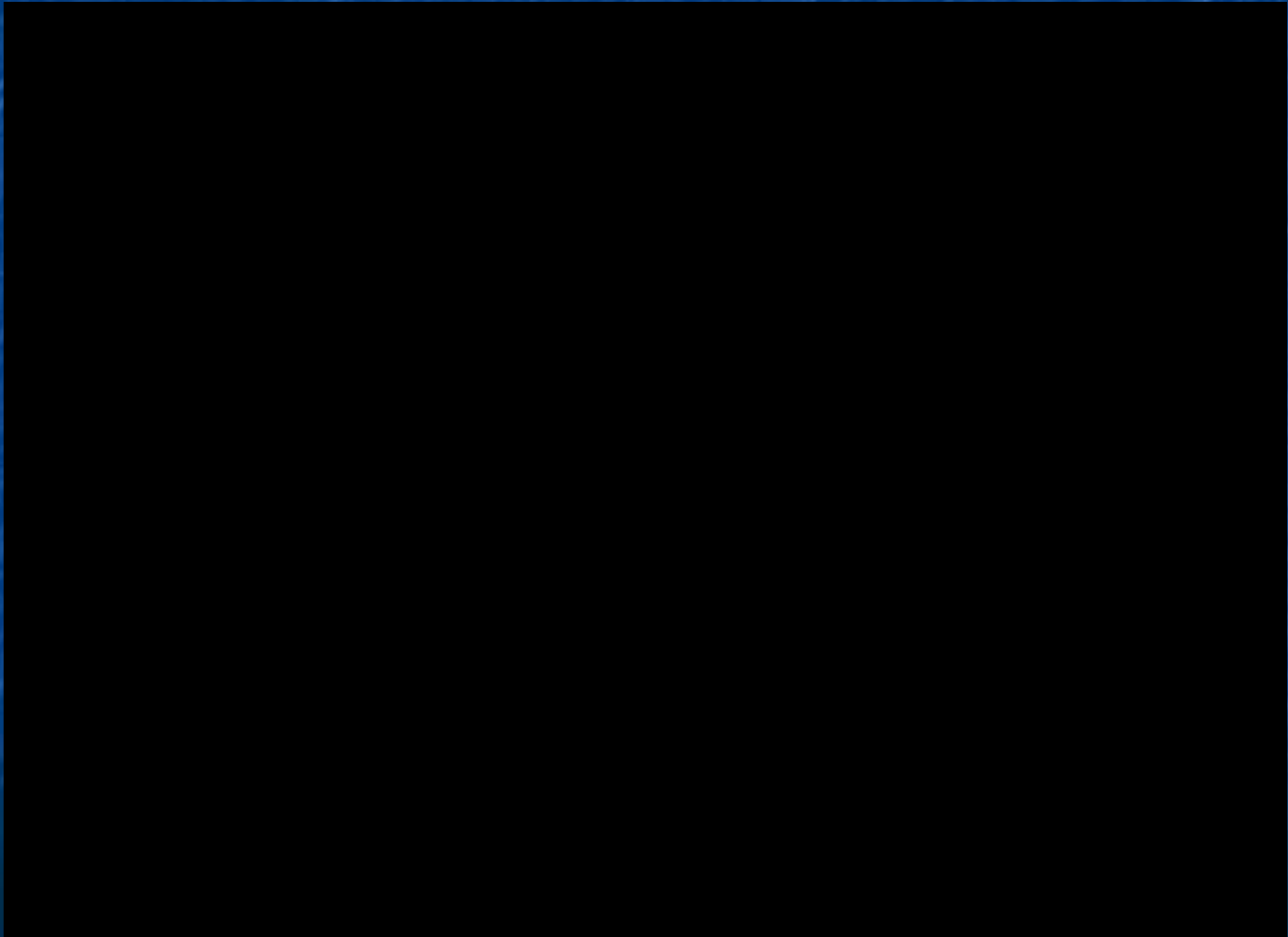
Lecture Outline

1. Expressive (Broca's) Aphasia
2. Receptive (Wernicke's) Aphasia
3. Conduction Aphasia
4. Disconnection Syndromes

Lateralisation of Language

- 70-95% demonstrate a left-sided lateralisation
 - ~95% of right-handers
 - ~70% of left-handers
 - ~20% of left-handers have right-sided lateralisation
 - ~20% of left-handers have language distributed across both hemispheres
- But what about categories of language?
- “Wada” (neuropsychological) test
 - Intra-arterial amobarbital procedure
 - Candidates for surgical resections of epileptic foci
 - Anaesthetise each hemisphere to confirm hemispheric dominance for language
- Cannot localise speech or other primary language functions

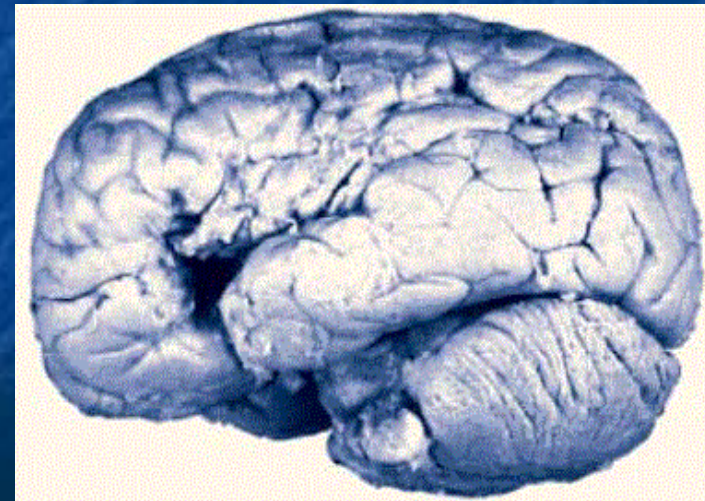
Lateralisation of Language



Expressive Aphasia

Prototypical Patient

- Leborgne (“Tan”)
 - Single syllable speech (“tan tan”) at 21yrs
 - No initial motor behaviour impairment (oral movements unimpaired)
 - Eventually right-sided hemiparesis
 - Comprehension unimpaired
 - Responded to numbers
 - Lesion to left posterior inferior frontal gyrus



Expressive Aphasia

Typical Symptomatology...

- Impairment of verbal expression (spoken and written), with (relatively) unimpaired comprehension
 - Speech limited to stereotyped expressions/expletives
 - Short, effortful agrammatical sentences with many hesitations
 - Nouns and verbs persevered, but omissions of modifiers or propositions
 - e.g. *“Me go”* vs *“I am going”*
 - Words beginning with phonemes produced at the front of the mouth (“p”, “b”, “m”) easier than others (“s”, “t”)
 - e.g. *“Peech gone, no palk”*

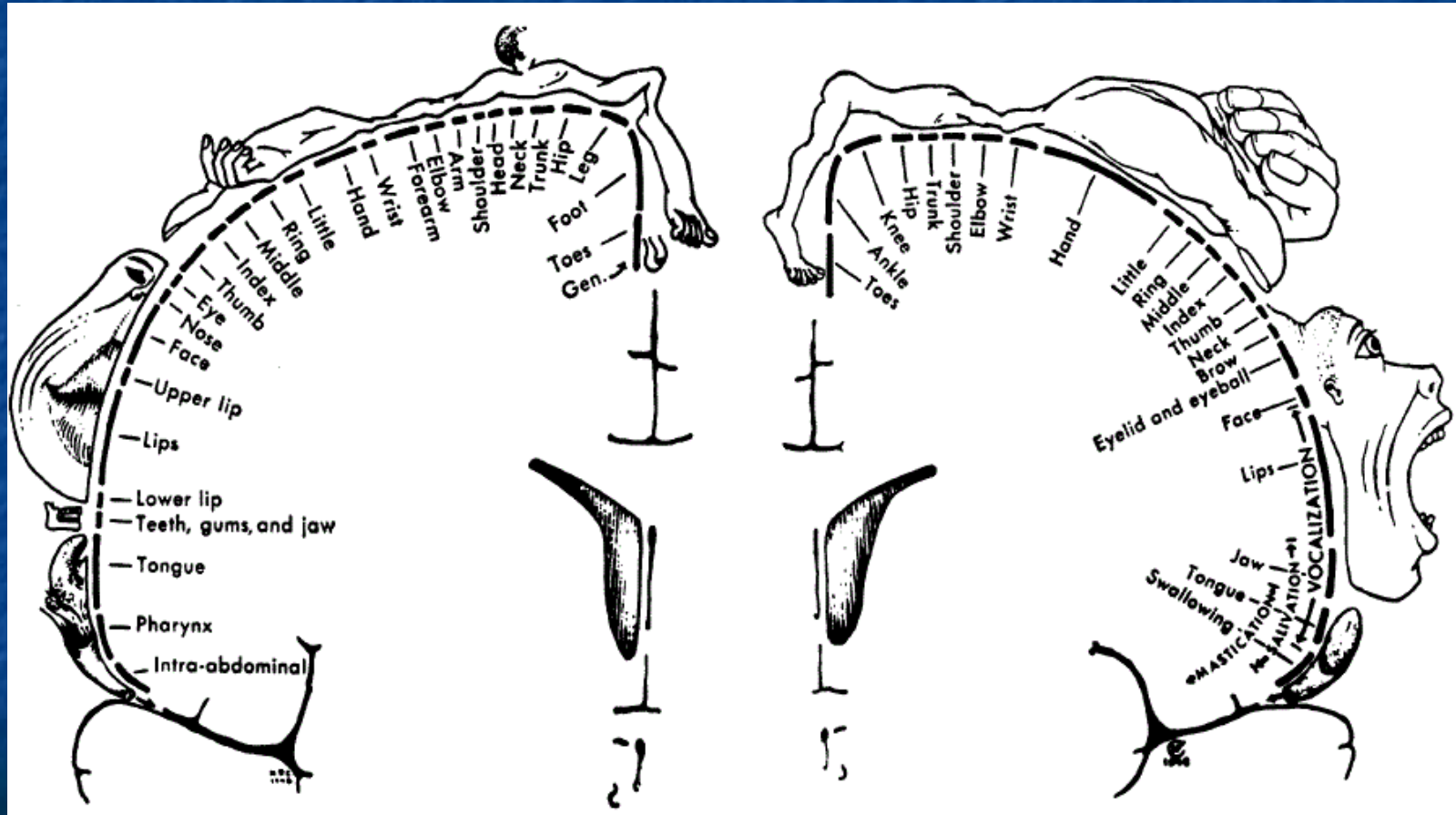
Expressive Aphasia

...Typical Symptomatology...

- Copying better than spontaneous writing or diction
- Impaired prosody (melody)
- Oral apraxia
 - Impaired performance of learned motor skills (e.g. tongue poking) on command
- Contralateral hemiparesis of arm

Expressive Aphasia

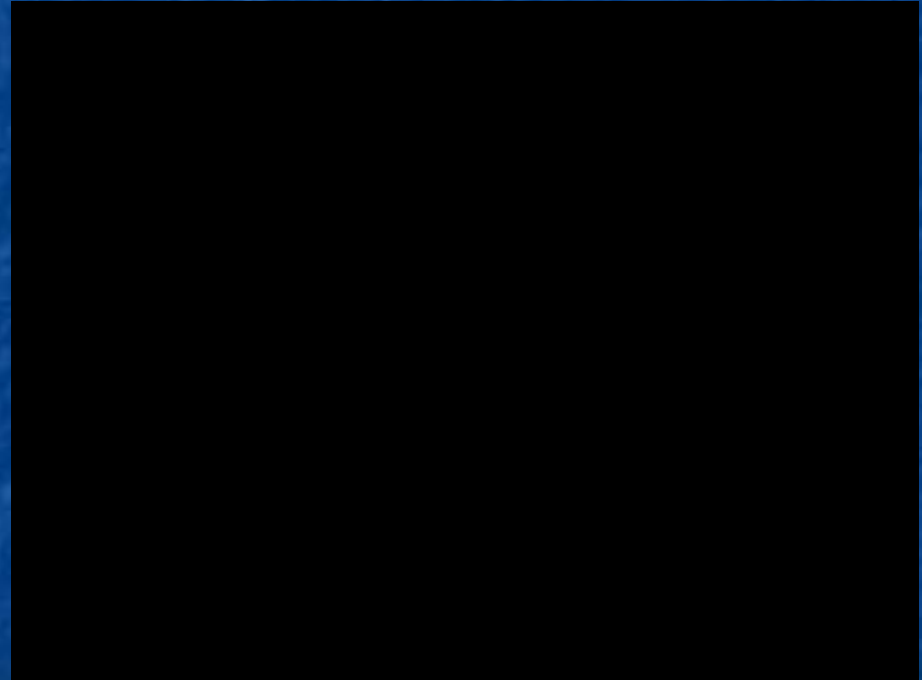
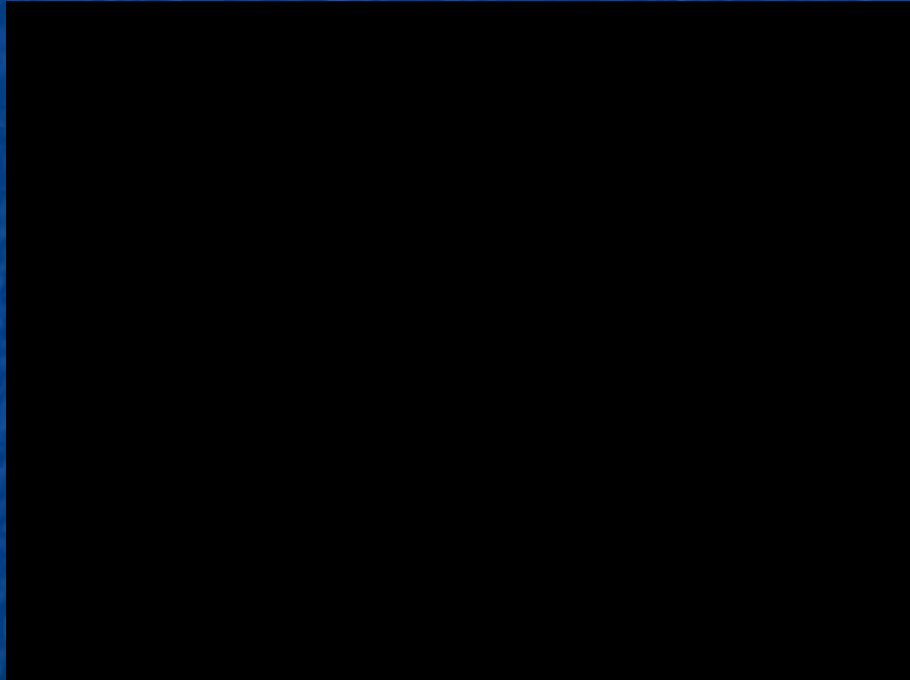
...Typical Symptomatology...



(Penfield & Rasmussen, 1950; see Schott, 1993)

Expressive Aphasia

...Typical Symptomatology



Receptive Aphasia

Typical Symptomatology...

- Impairment of verbal comprehension (spoken and written), with (relatively) unimpaired fluent expression
 - Spoken and written language is fluent and grammatically correct, but nonsensical
 - Contain *paraphasias* (*phonetic* – “dell” for “bell”; *semantic* – “ding ding” for “bell”) and *neologisms* (non-existent)
 - Repetition impaired

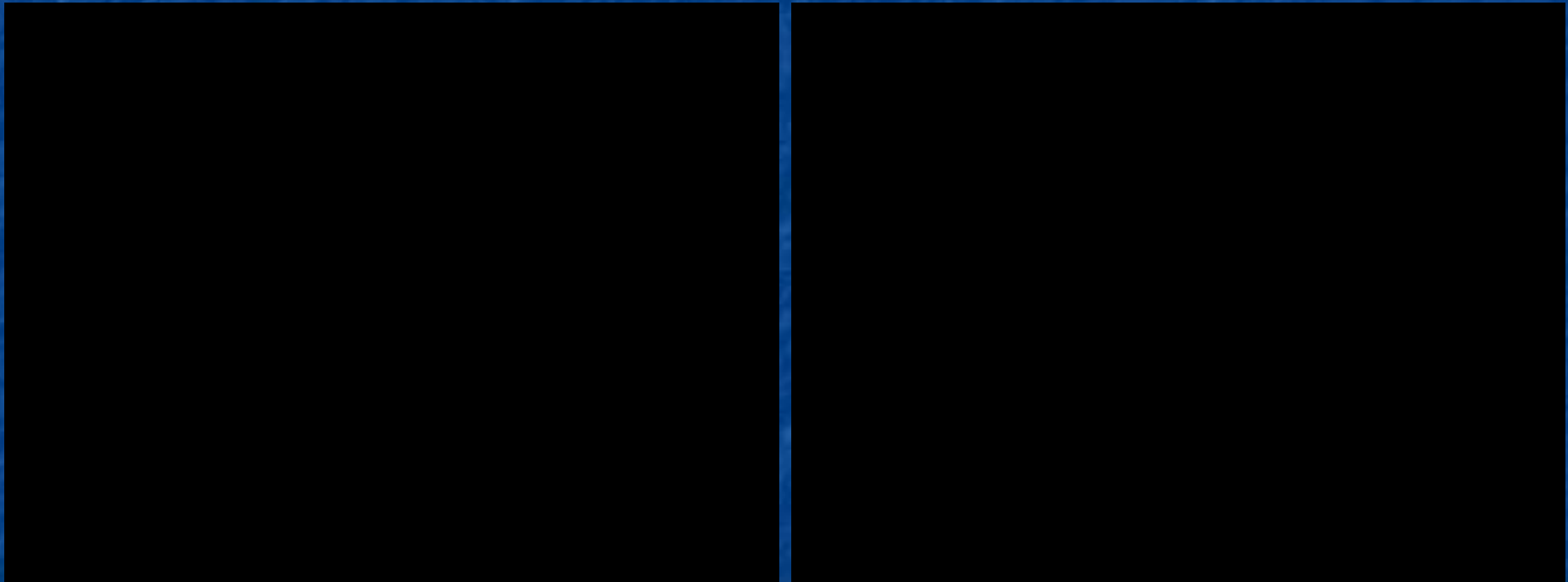
Receptive Aphasia

...Typical Symptomatology...

- No limb weakness
- Frequent visual field defect
 - Contralateral upper quadrant or entire visual field (*homonymous hemianopia*)

Receptive Aphasia

...Typical Symptomatology



Double Dissociations

■ Single Dissociation

- Damage to brain structure A causes a deficit in behaviour A but not in behaviour B
 - Suggest that behaviours A and B are independent of one another and associated with the brain structure(s)
 - But *resource artefact*

■ Double Dissociation

- Damage to brain structure A causes a deficit in behaviour A but not in behaviour B, and damage to brain structure B causes a deficit in behaviour B but not in behaviour A
 - Behaviours A and B are independent of one another and associated with independent brain structures

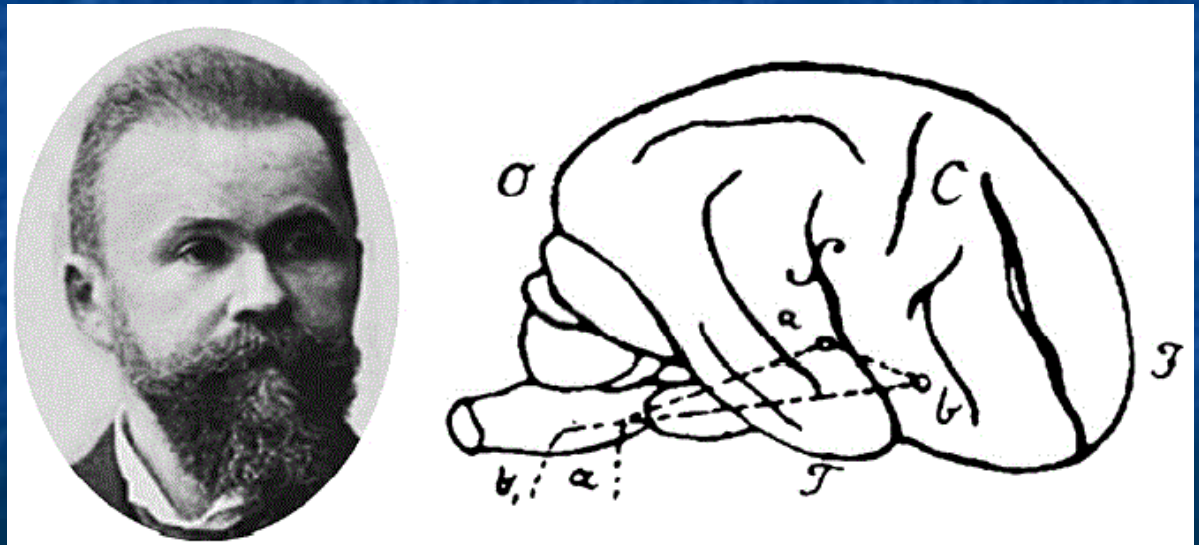
Global Aphasia

- “Speech is non-fluent, and comprehension, repetition, and naming are severely impaired. The patient cannot read or write. Most patients have a right hemiplegia.” (Ogden, 2005)

Wernicke's Theory

The Arcuate Fasciculus

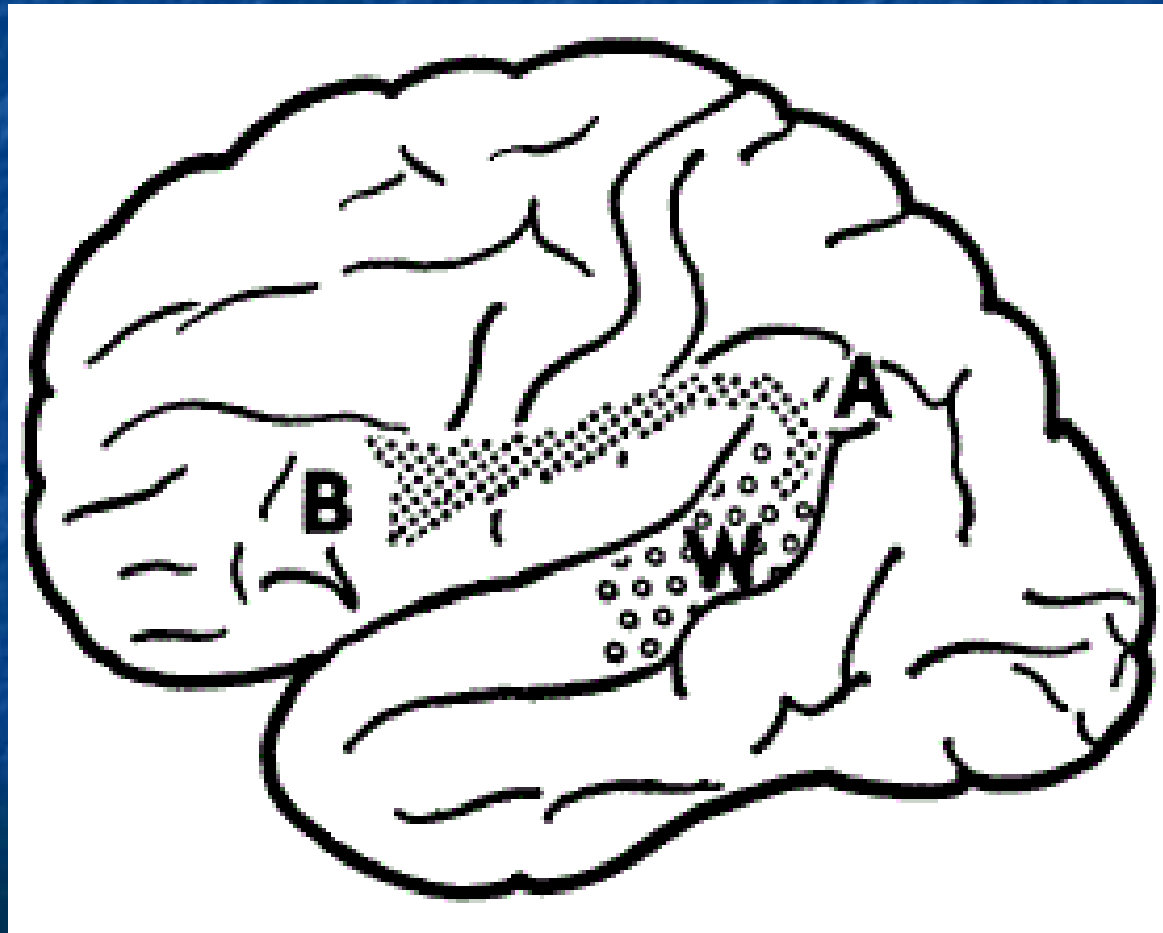
- *"...the first frontal gyrus, which has motor function, acts as center for motor imagery; the first temporal gyrus, which is sensory in nature, may be regarded as the centre of acoustic images; the fibrae propriae, converging into the insular cortex, form the mediating arc reflex... aphasia may be caused by any disruption of this pathway."*
(Wernicke, 1874)



(Catani & Mesulam, 2008)

Wernicke's Theory

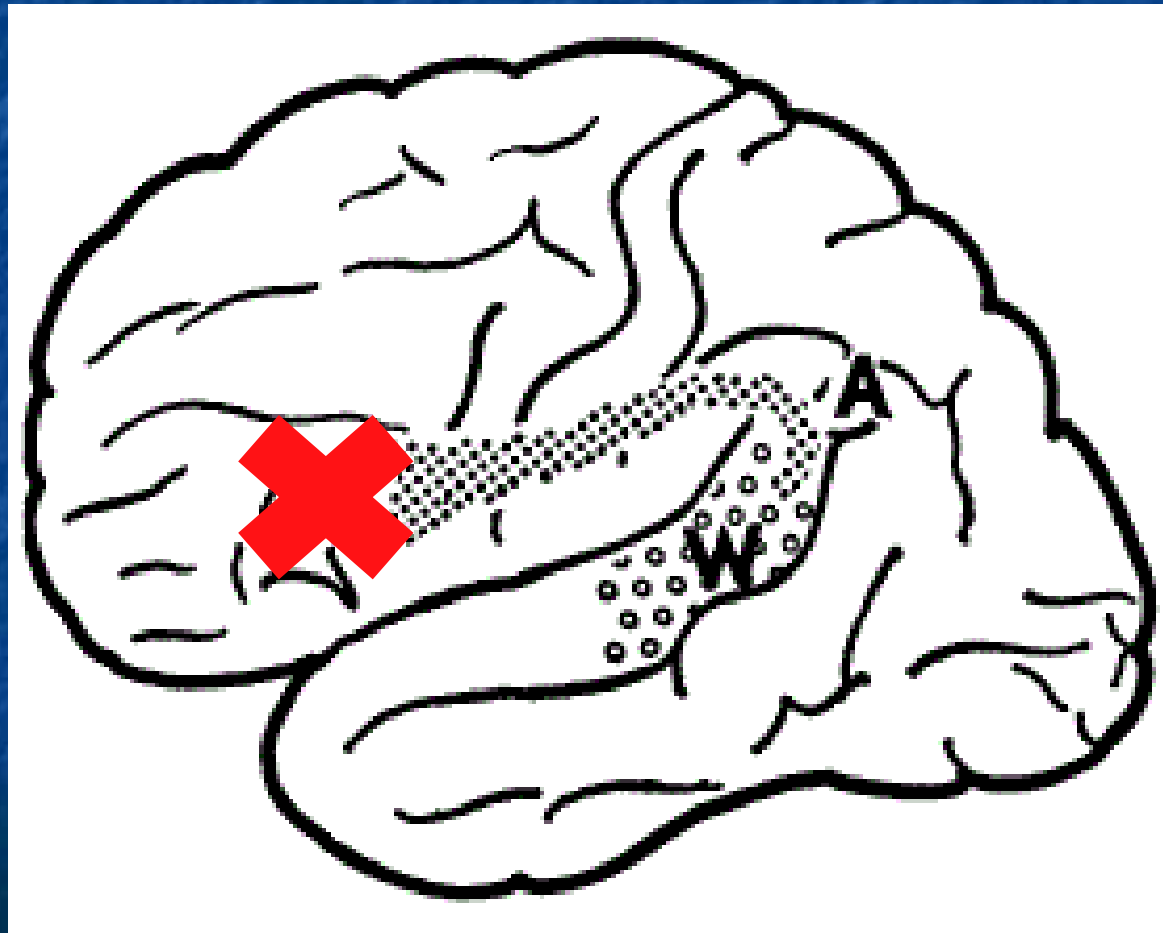
The Arcuate Fasciculus



(Geschwind, 1965; 1970)

Wernicke's Theory

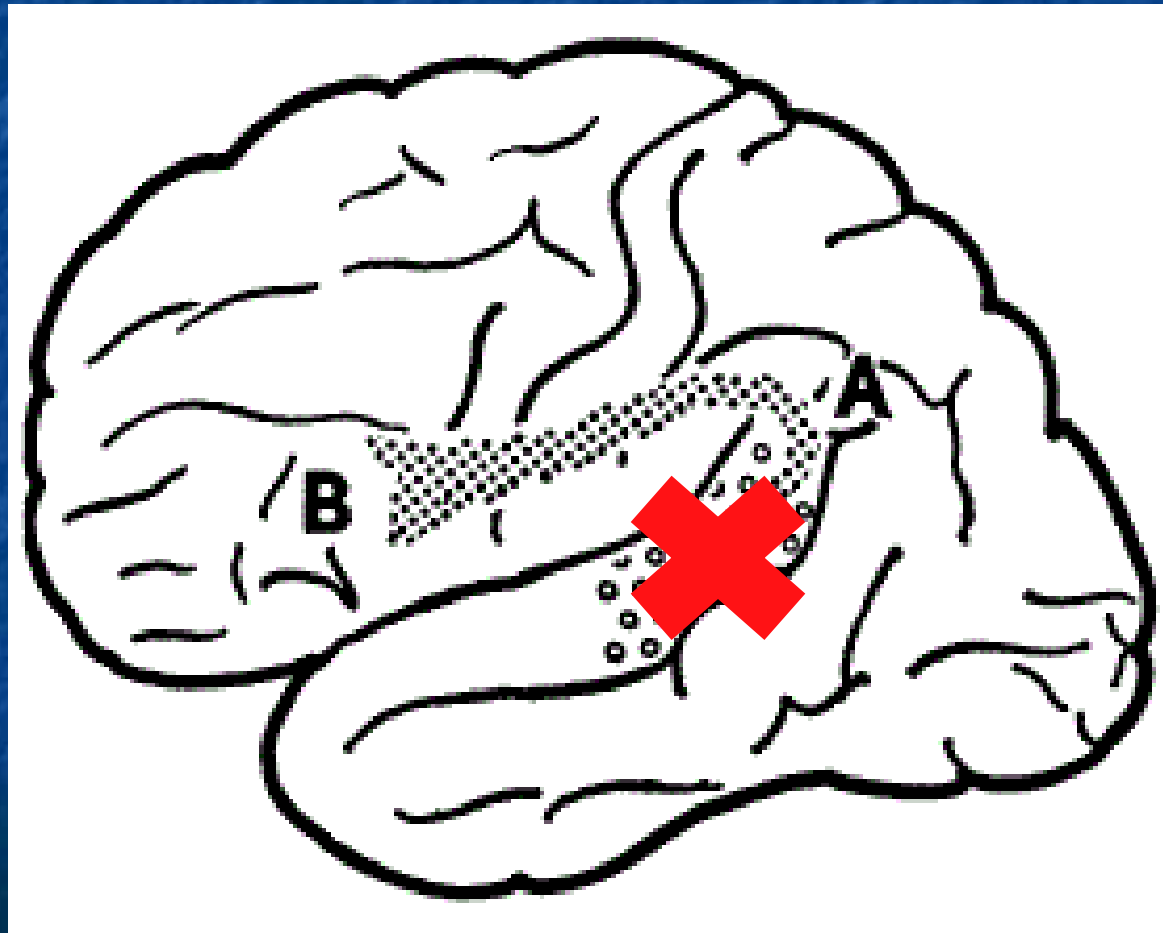
The Arcuate Fasciculus



(Geschwind, 1965; 1970)

Wernicke's Theory

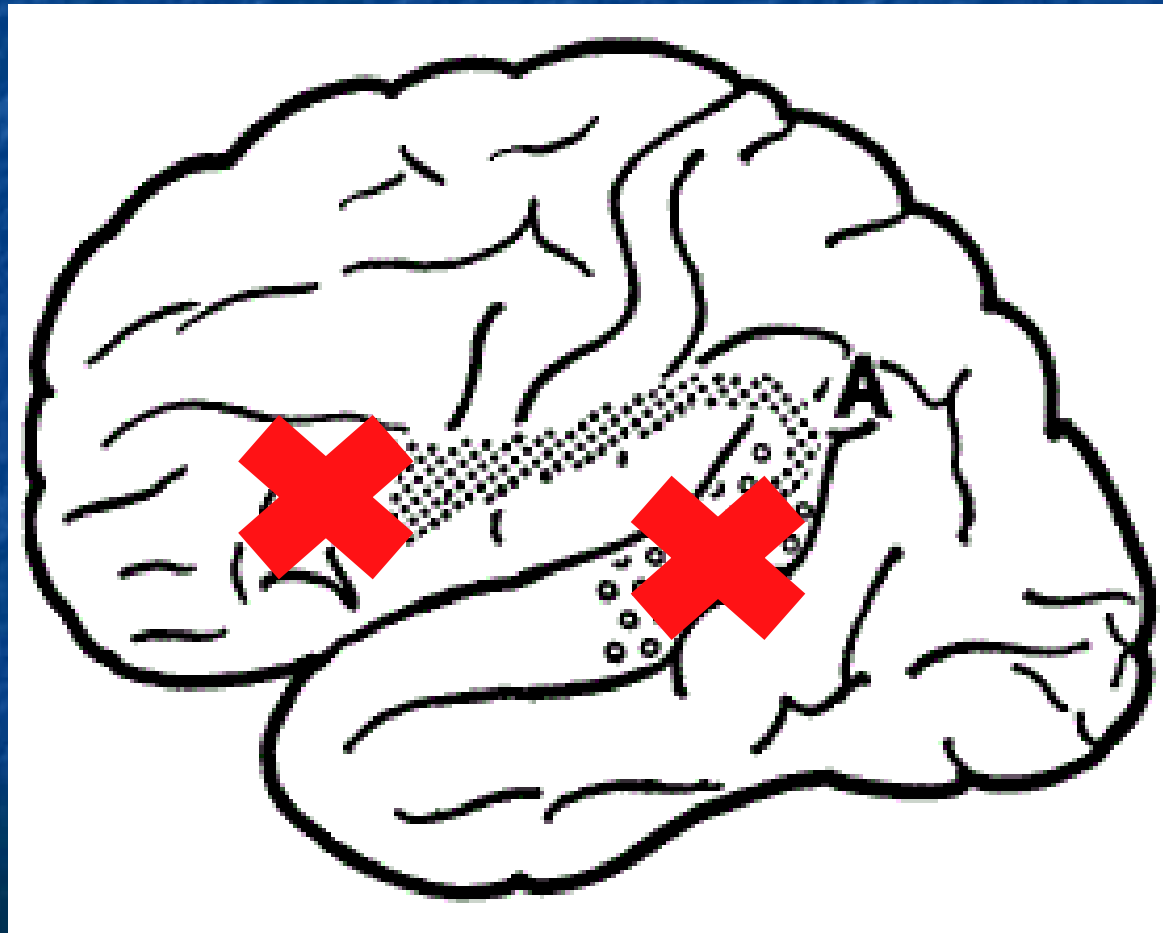
The Arcuate Fasciculus



(Geschwind, 1965; 1970)

Wernicke's Theory

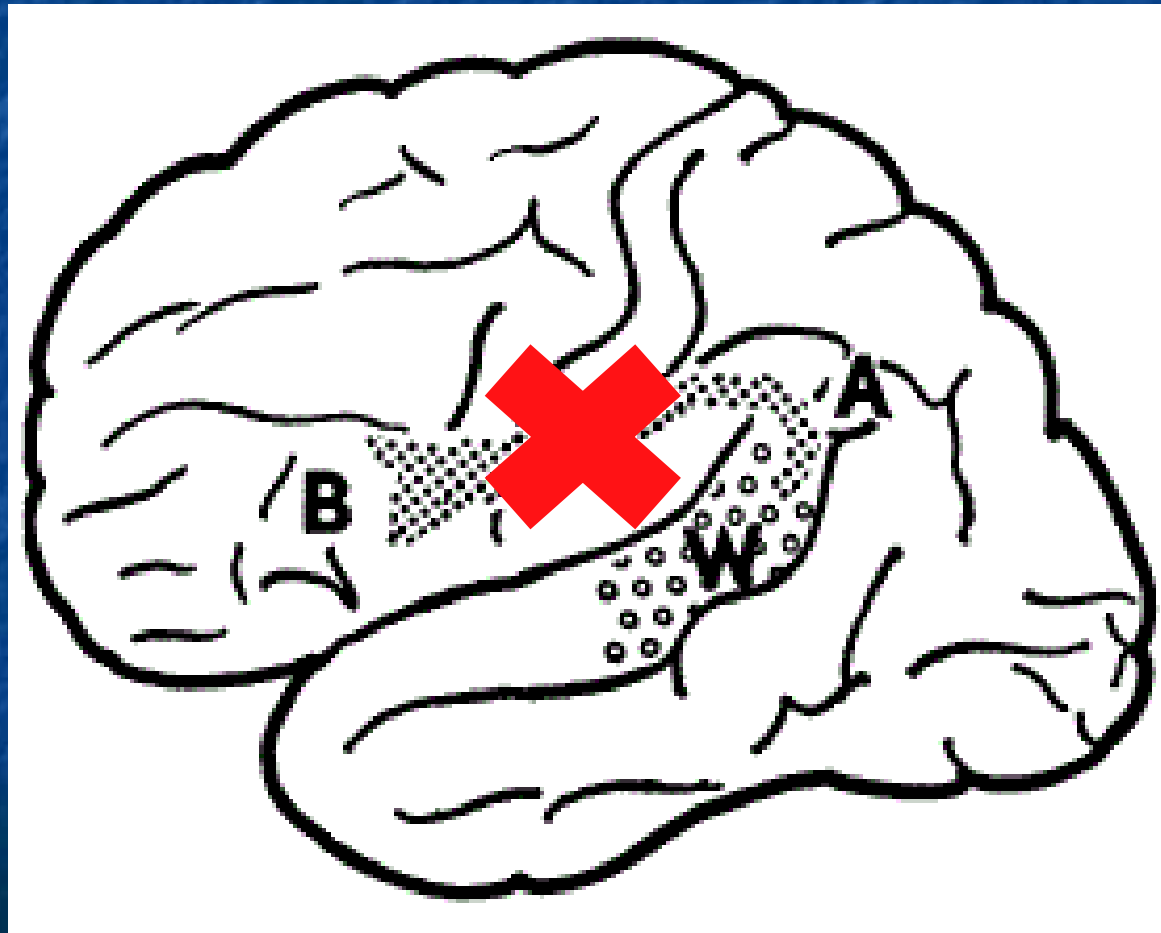
The Arcuate Fasciculus



(Geschwind, 1965; 1970)

Wernicke's Theory

The Arcuate Fasciculus



(Geschwind, 1965; 1970)

Conduction Aphasia

Typical Symptomatology...

- Impairment of repetition, with (relatively) unimpaired fluent expression and verbal comprehension
 - Repetition severely impaired
 - Spoken language is fluent and grammatically correct
 - Contains many *phonemic paraphasias*
 - Comprehension is unimpaired
 - Writing is impaired
 - Spelling errors; syntax errors; word omission
 - Reading aloud is impaired; Silent reading for comprehension unimpaired

Conduction Aphasia

...Typical Symptomatology...

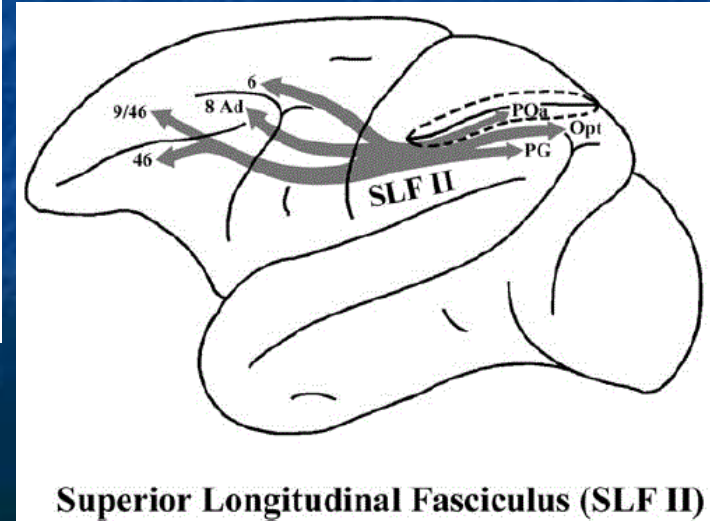
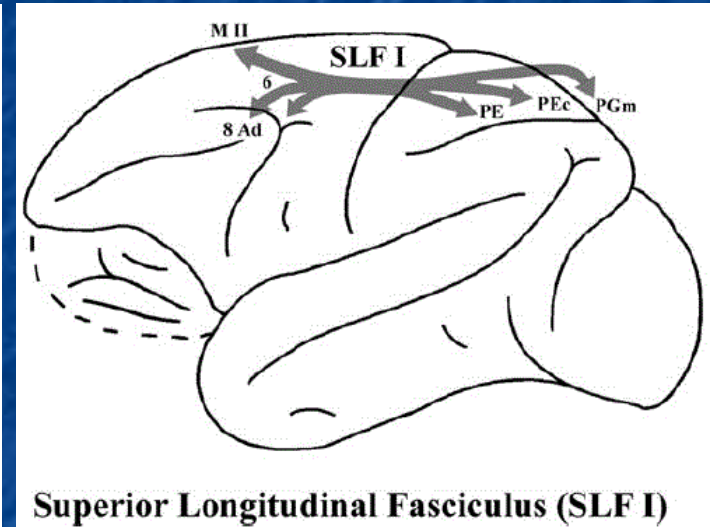
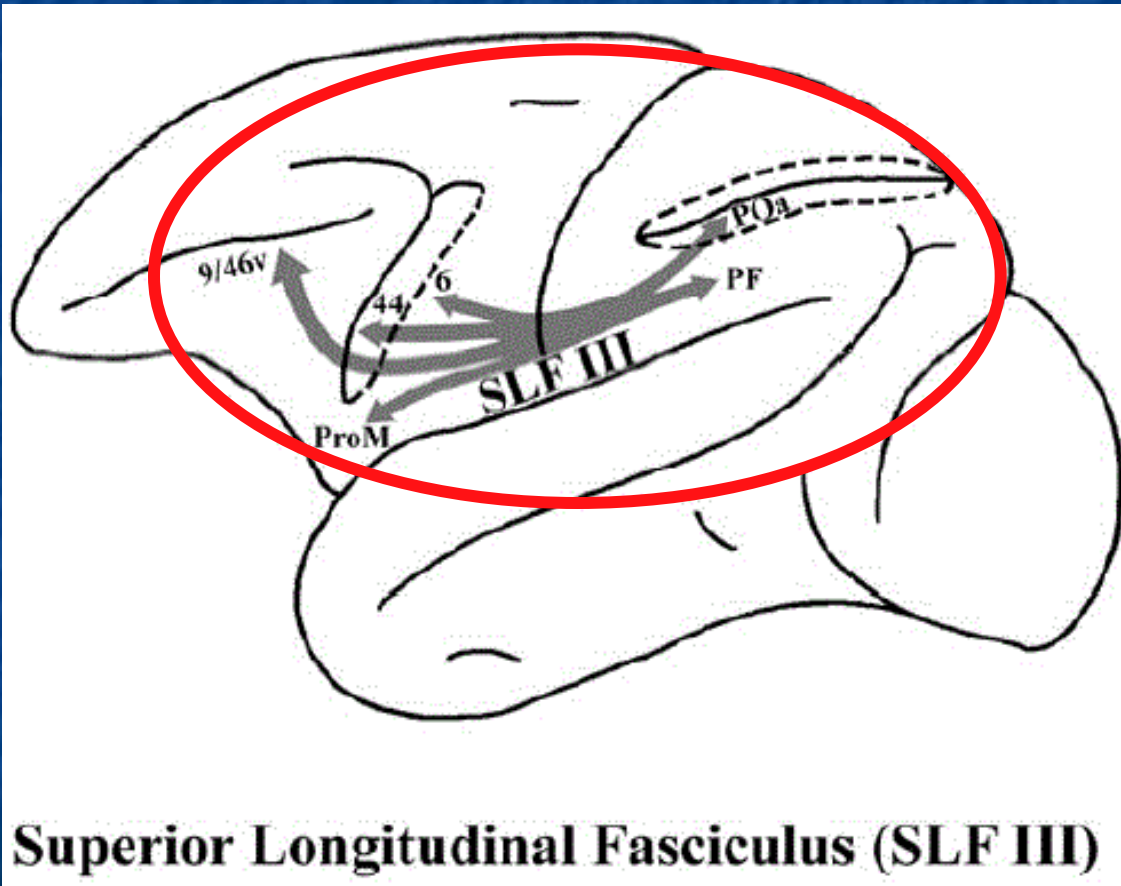
- Little or no hemiplegia
 - But can be accompanied by minor motor or visual-field deficits contralateral to lesion
- Apraxia on verbal command and imitation
- *“Aphasia of the insula region”* (Wernicke, 1874)

Conduction Aphasia

...Typical Symptomatology

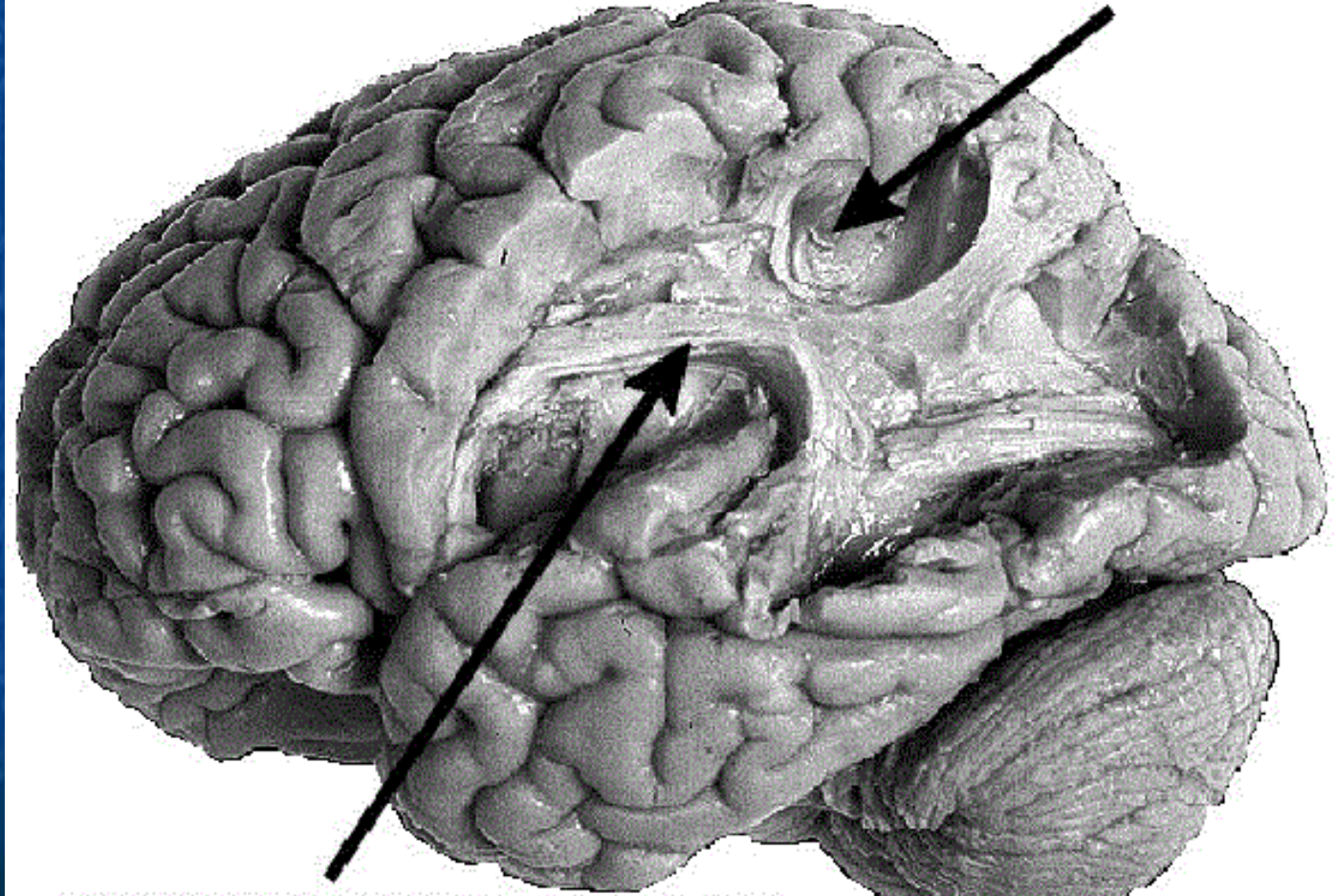


Superior Longitudinal Fasciculus



(Petrides & Pandya, 1984;
see Mariën & Abutalebi, 2008)

Superior Longitudinal Fasciculus



Geschwind's Theory

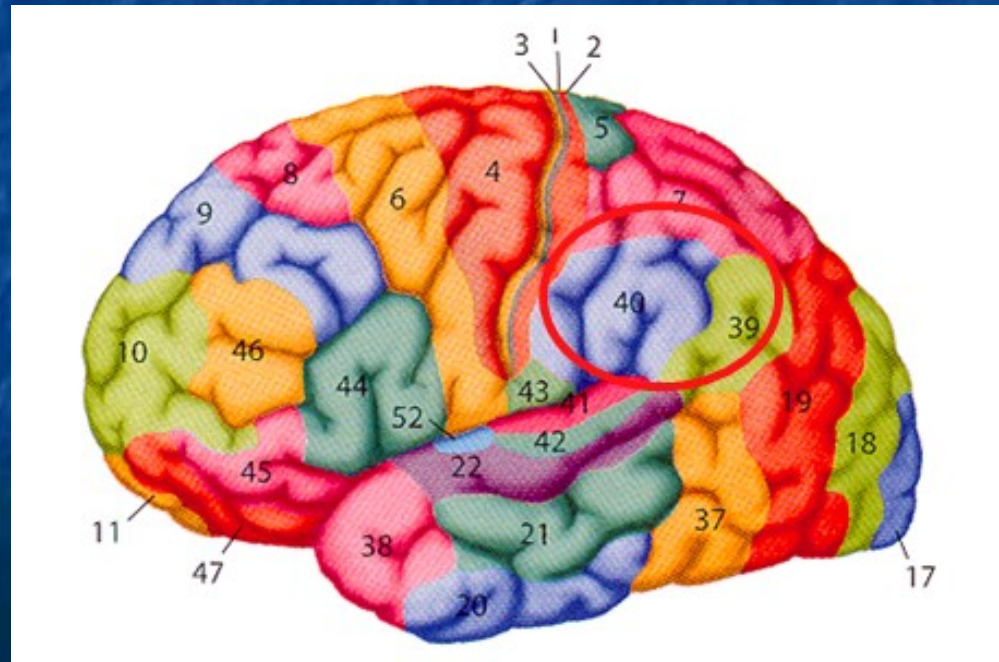
Inferior Parietal Lobule

- *“...lesions of association cortex, if extensive enough, act to disconnect primary receptive or motor areas from other regions of the cortex in the same or in the opposite hemisphere.. Thus a ‘disconnexion lesion’ will be a large lesion either of association cortex or of the white matter leading from this association cortex...”*
- *Stressed “...the importance of the angular gyrus in acting as a region involved in cross-modal associations... A name passes through Wernicke’s area, then via the angular gyrus arouses associations in the other parts of the brain...”*

Geschwind's Theory

Echolalia

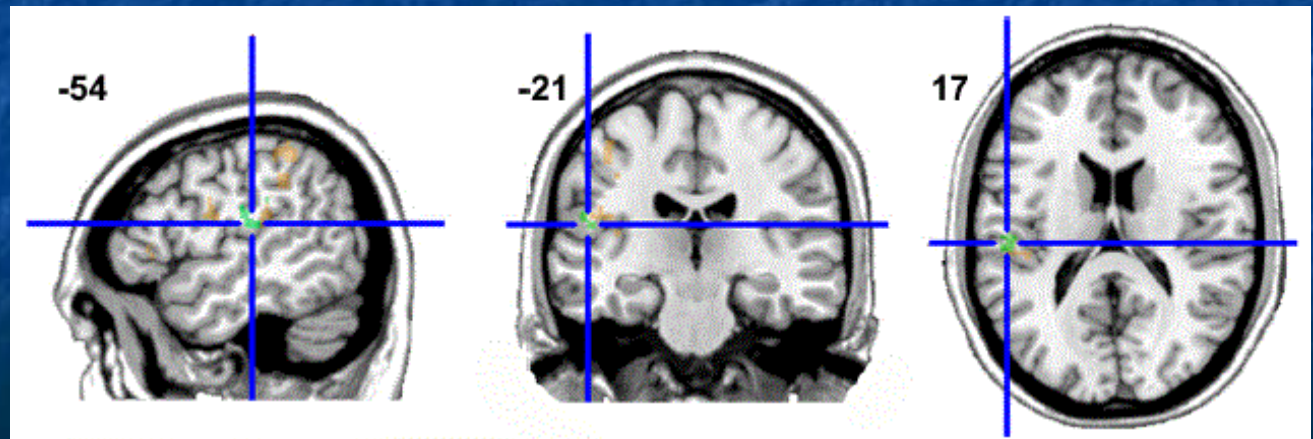
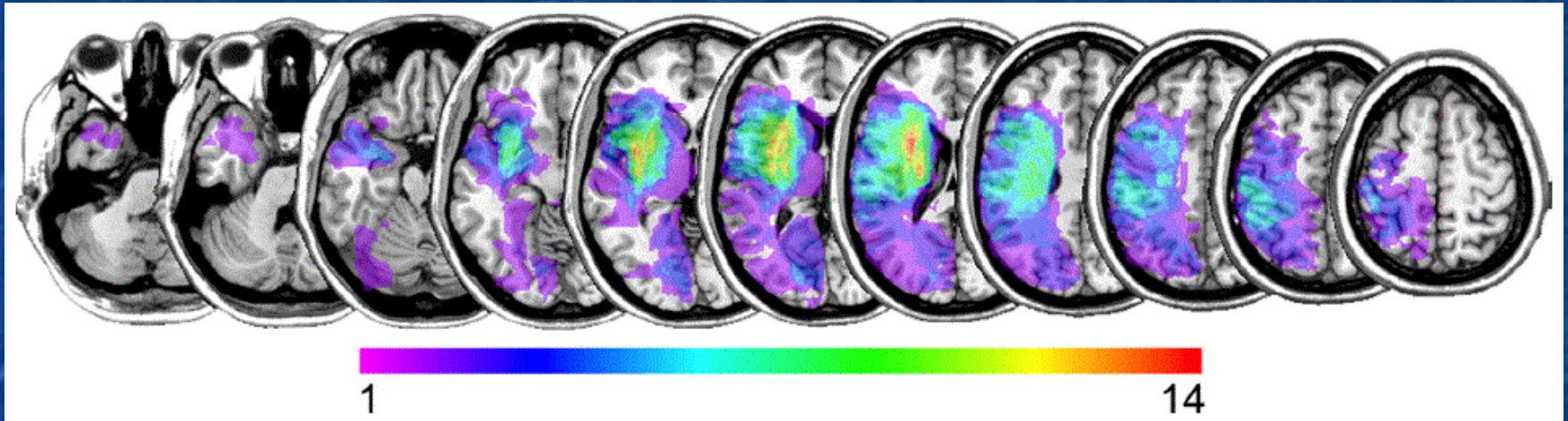
- Impairment of spontaneous speech, with (relatively) unimpaired repetition and verbal comprehension
 - Intact production (Broca's area) and comprehension (Wernicke's area), and intact connection between them (arcuate fasciculus)



(Geschwind, 1965)

Geschwind's Theory

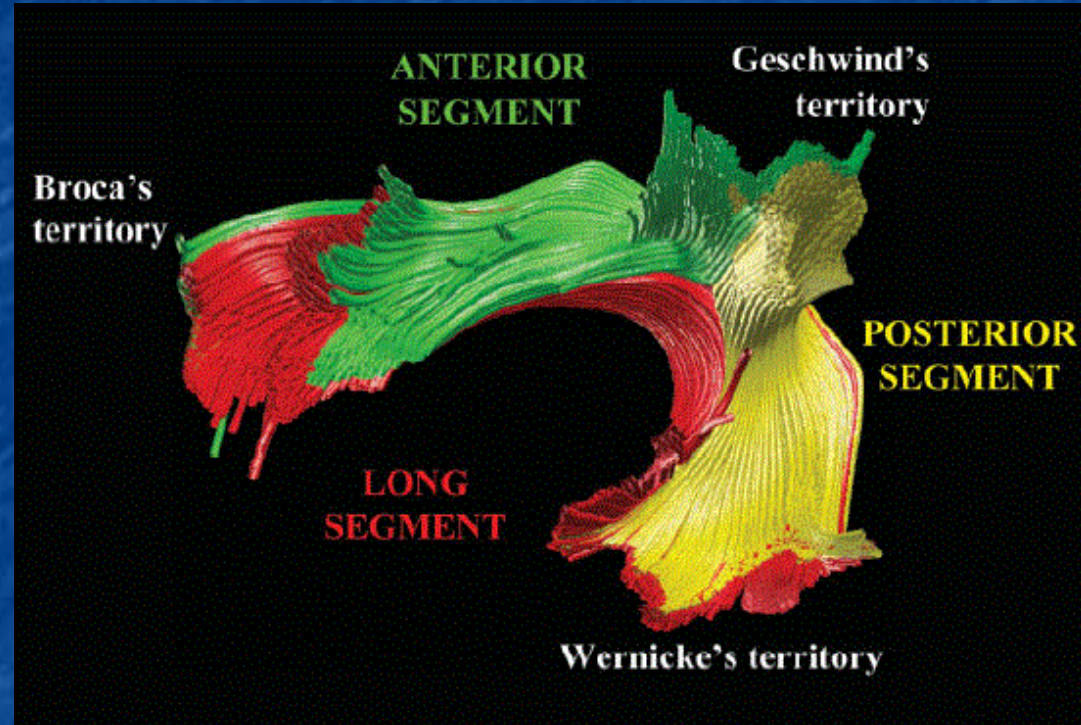
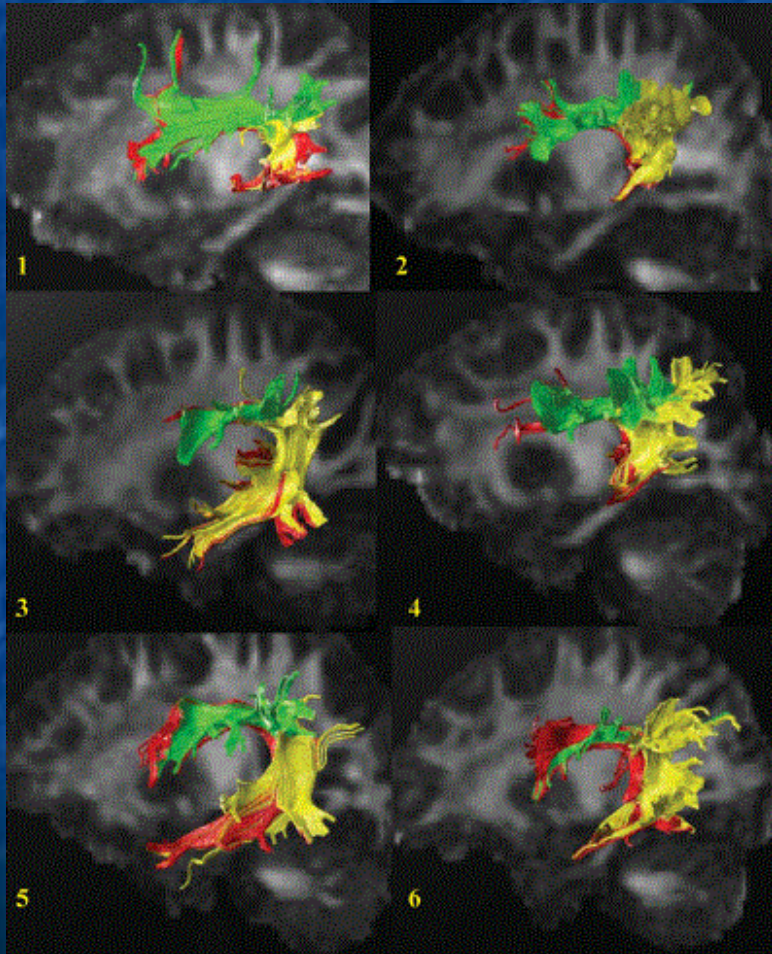
Inferior Parietal Lobule



(Fridriksson et al., 2010)

Geschwind's Theory

Inferior Parietal Lobule



(Catani et al., 2005)

Discussion

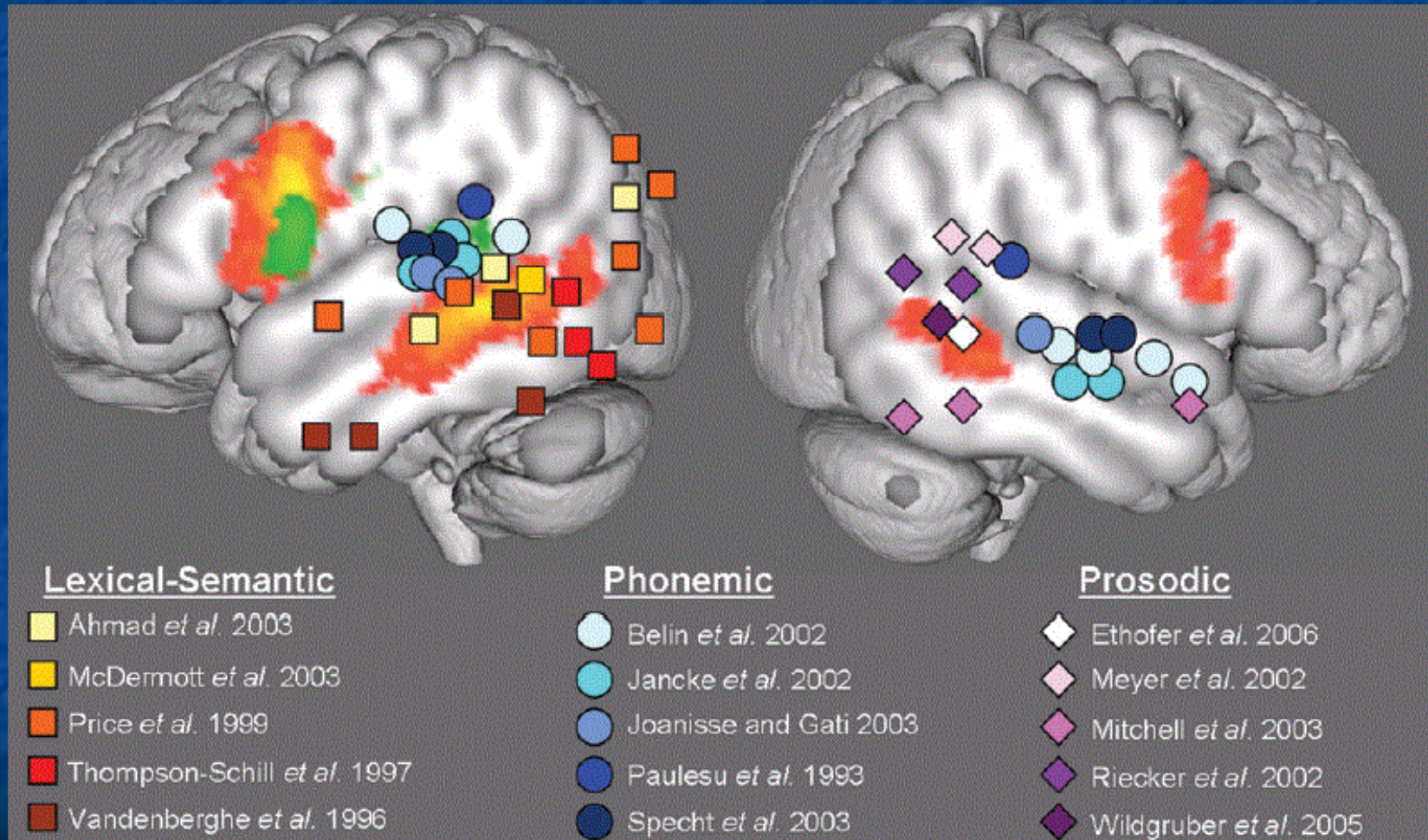
■ Advantages

1. Animals models can't be used to investigate language
2. Clear double dissociations permit strong inferences and models

■ Limitations

1. Lesions often effect diffuse brain structures
2. The lesion approach ignores subtle facets of language

Limitations



(Glasser & Rilling, 2008)

The End