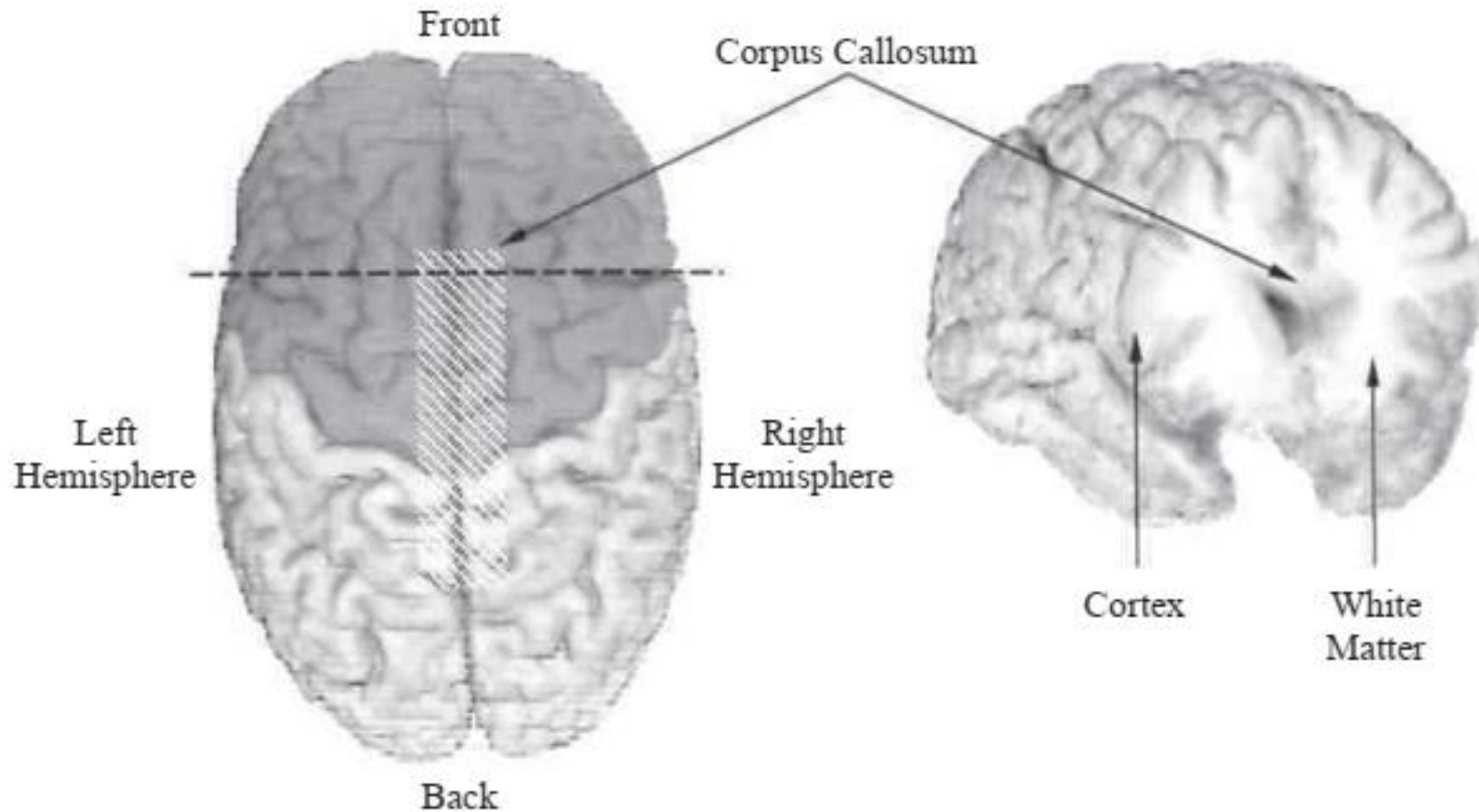


Language and the human brain

Module 7
-Yangchen Roy

The human brain

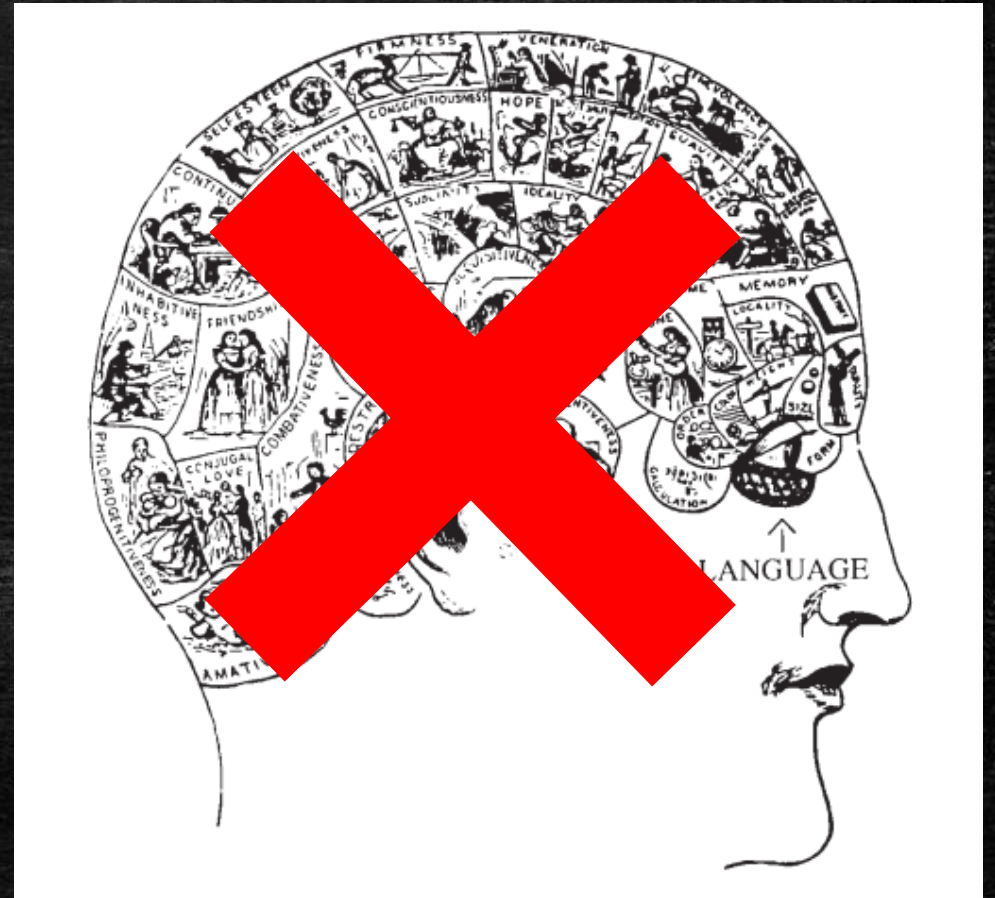


- the most complex organ of the human body

For more on the corpus callosum, read the section on Split Brains in your assigned reading

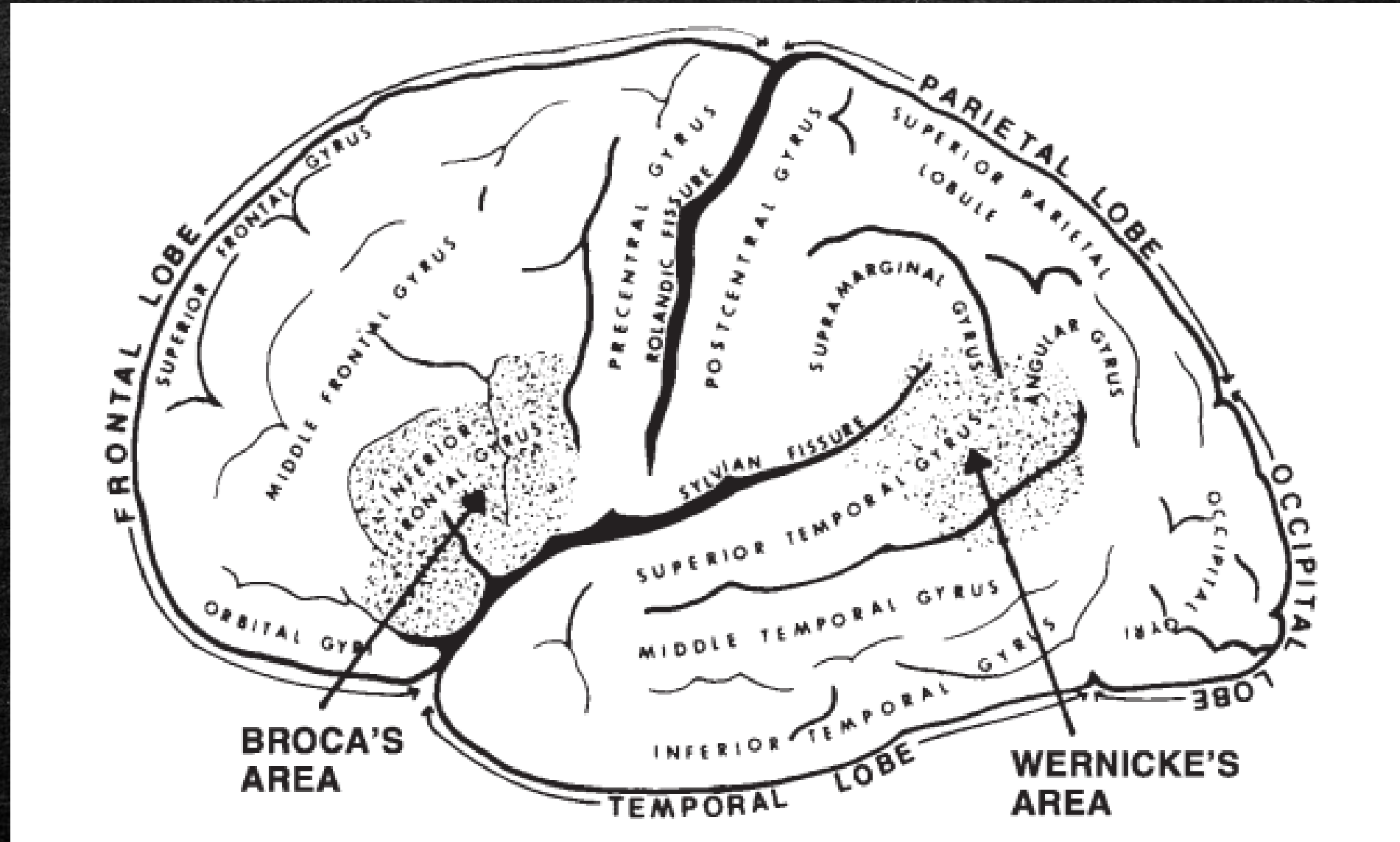
The localization of language in the brain

- Joseph Gall – different human cognitive abilities are “localized” in specific parts of the brain, brain is not unstructured
- Johann Spurzheim – phrenology – determining personality traits from bumps on the skull
- brain disorders prove that language and cognitive abilities are functions of localized brain areas.



Modularity of the brain and language

Aphasia - language disorder resulting from brain damage caused by disease or trauma



Broca's aphasia

- Broca's area – left frontal lobe area
- laboured speech
- syntax impaired
- agrammatic language – lack of articles, prepositions, pronouns, auxiliary verbs, inflections)

DOCTOR:	Could you tell me what you have been doing in the hospital?
PATIENT:	Yes, sure. Me go, er, uh, P.T. [physical therapy] none o'cot, speech . . . two times . . . read . . . r . . . ripe . . . rike . . . uh write . . . practice . . . get . . . ting . . . better.
DOCTOR:	And have you been going home on weekends?
PATIENT:	Why, yes . . . Thursday uh . . . uh . . . uh . . . no . . . Friday . . . Bar . . . ba . . . ra . . . wife . . . and oh car . . . drive . . . purpike . . . you know . . . rest . . . and TV.

Wernicke's aphasia

- Wernicke's area – temporal lobe of left hemisphere
- fluent speech with proper intonation
- adhere to rules of syntax
- semantically incoherent

How is your health?

I felt worse because I can no longer keep in mind from the mind of the minds to keep me from mind and up to the ear which can be to find among ourselves.

fork – a need for a schedule

The only thing that I can say again is madder or modder fish sudden fishing sewed into the accident to miss in the purdles.

"damage to different parts of the brain results in different kinds of linguistic impairment (e.g., syntactic versus semantic). This supports the hypothesis that the mental grammar, like the brain itself, is not an undifferentiated system, but rather consists of distinct components or modules with different functions."

Words are a network of connections, not a list

- aphasics may substitute similar sounding words for each other, or they may substitute similar meaning words for each other

1) pool – tool

2) able – fable

3) main – pane

4) chair – table

5) woman – man

6) fan – light

Agrammatism

Stimulus	Response	Stimulus	Response
witch	<i>witch</i>	which	<i>no!</i>
hour	<i>time</i>	our	<i>no!</i>
eye	<i>eyes</i>	I	<i>no!</i>
hymn	<i>bible</i>	him	<i>no!</i>
wood	<i>wood</i>	would	<i>no!</i>

“... the mental dictionary has content words and function words in different compartments, and that these two classes of words are processed in different brain areas or by different neural mechanisms ...”

Brain plasticity and lateralization

Lateralization

- Lateralization – the localization of function to one hemisphere of the brain

Additional evidence regarding hemispheric specialization is drawn from Japanese readers. The Japanese language has two main writing systems. One system, *kana*, is based on the sound system of the language; each symbol corresponds to a syllable. The other system, *kanji*, is ideographic; each symbol corresponds to a word. (More about this in chapter 11 on writing systems.) *Kanji* is not based on the sounds of the language. Japanese people with left-hemisphere damage are impaired in their ability to read *kana*, whereas people with right-hemisphere damage are impaired in their ability to read *kanji*. Also, experiments with unimpaired Japanese readers show that the right hemisphere is better and faster than the left hemisphere at reading *kanji*, and vice versa.

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- Deaf signers with damage to the left hemisphere show aphasia for sign language similar to the language breakdown in hearing aphasics, even though sign language is a visual-spatial language.
 - They have no difficulty producing non-linguistic gestures.

“the left hemisphere is lateralized for language – an abstract system of symbols and rules – and not simply for hearing and speech”

Plasticity

While the left hemisphere is innately predisposed to specialize for language, there is evidence for considerable **plasticity** or flexibility

Under certain circumstances, the right hemisphere can take over many of the functions of the left.

- left hemispherectomy in children
- but left hemispherectomy in adults causes severe loss of language function

The plasticity of the brain decreases with age, and with increased specialization of the different hemispheres and regions of the brain

But this does not mean that the right hemisphere has no role in language comprehension-production

The autonomy of language

Specific language impairment

- Children with difficulties in acquiring language, although no brain damage, no other cognitive deficits, not autistic or retarded, no perceptual problems

Specific Language Impairment (SLI)

problems with the use of function words
(prepositions, articles, auxiliary verbs)

problems with inflectional suffixes on nouns and verbs like markers of tense, agreement, plurality

Meowmeow chase mice.
Show me knife.
It not long one.

Savants

language geniuses who have acquired highly complex grammar of one or more languages, but who lack non-linguistic abilities (other cognitive functions).

Laura

- IQ 41-44
- could not count
- could draw at only pre-school level
- three unit auditory memory span
- didn't know how old she was
- "He was saying that I lost my battery-powered watch that I loved, and She does paintings, this really good friend of the kids who I went to school with and really loved, and I was like 15 or 19 when I started moving out of home ..."

Christopher

- IQ 60-70
- could not take care of himself
- sophisticated linguistic competence
- learnt languages very quickly
- could spot contradictory rules in a language

"The question as to whether the language faculty is a separate cognitive system or whether it is derivative of more general cognitive mechanisms is controversial and has received much attention and debate among linguists, psychologists, neuropsychologists, and cognitive scientists. Cases such as Laura and Christopher argue against the view that linguistic ability derives from general intelligence because these two individuals (and others like them) developed language despite other pervasive intellectual deficits. A growing body of evidence supports the view that the human animal is biologically equipped from birth with an autonomous language faculty that is highly specific and that does not derive from general human intellectual ability."

Other disorders found to be genetic

- Turners syndrome
- Williams syndrome
- Developmental dyslexia
- Klinefelter syndrome

Read "Genetic Basis of Language" from your assigned reading for more on this

“Critical Period” has been discussed
when we looked at language acquisition

Introduction “Brain and Language” (p. 3 to 28) of Fromkin

Assigned reading

“Language and the brain: Aphasia and split-brain patients”

<https://www.youtube.com/watch?v=1BqShvm4QRA>

Language and the Brain:

<https://www.youtube.com/watch?v=37oZD5kvemA>

Video resources