Cognition 1

• The 2 hemispheres of the brain exchange information primarily through the corpus callosum

• other (smaller) connections include:
  – anterior commissure
  – hippocampal commissure
  – few other small commissures
Left and Right Hemispheres

• Division of labor between the 2 hemispheres is known as lateralization
• E.g, In most people, the left side is specialized for language – especially language production
• The left hemisphere is dominant for speech in 95% of right-handed people
• Left-handers are more variable
  – Most left-handers have left-hemisphere dominance
  – Some have right-hemisphere or mixed-dominance
Left and Right Hemispheres

• Each hemisphere is generally connected to the contralateral side of the body

• For example, skin receptors and muscles on the right side of the body are connected to the left hemisphere

• Each hemisphere processes visual information from the opposite side of the visual field (but in humans, the left eye is NOT only connected to right hemisphere!)
Visual Connections to the Hemispheres

- The visual field is what is visible at any moment

- Light from the right half of the visual field shines onto the left half of both retinas

- Light from the left half of the visual field shines onto the right half of both retinas
• Half of the axons from each retina cross to the opposite side of the brain at the optic chiasm.

• Half of the axons from each retina do NOT cross.

• Thus, each hemisphere of the brain gets input from the opposite half of the visual field.
Cutting the Corpus Callosum

• Damage to the corpus callosum prevents the 2 hemispheres from exchanging information

• Epilepsy - repeated episodes of excessive synchronized neural activity (seizure)
  – can result from mutation in GABA receptor, brain tumor etc.

• In the past, doctors cut the corpus callosum to prevent the seizure from spreading to the opposite side of the brain
Cutting the Corpus Callosum

- People who have undergone surgery to the corpus callosum: split-brain people

- Spit-brain people maintain normal intellect and motivation but they tend to:
  - Use hands independently in a way others cannot
  - Respond differently to stimuli presented to only one side of the body
Cutting the Corpus Callosum


- Because the left side of the brain is dominant for language in most people, most split-brain people:
  - e.g., have difficulty naming objects briefly viewed in the left visual field.
https://www.youtube.com/watch?v=aCv4K5aStdU
**FIGURE 14.4 The anterior and hippocampal commissures**
These commissures exchange information between the two hemispheres, as does the larger corpus callosum. *(Based on Nieuwenhuys, Voogd, & vanHulzen, 1988, and others)*
Cutting the Corpus Callosum

• Immediately after surgery, each hemisphere can only quickly and accurately respond to information that reaches it directly
  – Smaller commissures allow a slower response

• The brain later learns to use the smaller connections

• Integrating information between both remains difficult
FIGURE 14.5  A split-brain person draws with the left hand  He saw the word sky in the left visual field and scraper in the right visual field. His left hemisphere controlled the left hand enough to draw a scraper, and his right hemisphere controlled it enough to draw a sky. (From “Subcortical Transfer of Higher Order Information: More Illusory Than Real?” by A. Kingstone and M. S. Gazzaniga, 1995. Neuropsychology, 9, pp. 321–328. Copyright © 1995 American Psychological Association. Reprinted by permission.)
Cutting the Corpus Callosum

• Right hemisphere is better at perceiving emotions
• Damage to parts of the right hemisphere causes difficulty perceiving other’s emotions, failure to understand humor and sarcasm, monotone voice
FIGURE 14.6 Half of a smiling face combined with half of a neutral face
Which looks happier to you—(a) the one with a smile on your left or (b) the one with a smile on your right? Your answer suggests which hemisphere of your brain is dominant for interpreting emotional expressions.
Development of Lateralization and Handedness

- The corpus callosum gradually matures as myelin increases around certain axons from childhood through adolescence
  - Young children have difficulty comparing information from the left and right hand
  - Research suggests that children younger than 6 do not have a mature corpus callosum
Development of Lateralization and Handedness

- The corpus callosum does not completely develop in some people
- Compensatory hypertrophy (growth) of
  - Anterior commissure
  - Hippocampal commissure
- Allows better performance on some tasks compared with split-brain people
Avoiding Overstatements

- Research on hemisphere dominance should not be over-emphasized
- Doubtful that any one person habitually relies only on one hemisphere
- Most tasks require cooperation from both hemispheres