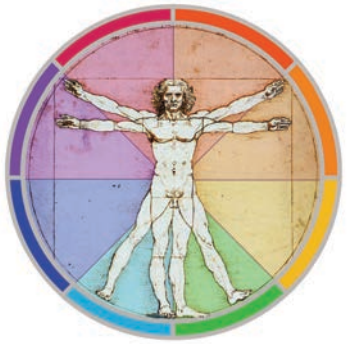
HUBS191 Lecture Material

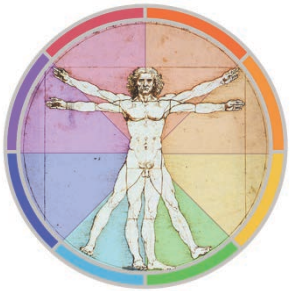
This pre-lecture material is to help you prepare for the lecture and to assist your note-taking within the lecture,

it is NOT a substitute for the lecture !



Please note that although every effort is made to ensure this pre-lecture material corresponds to the live-lecture there may be differences / additions.

Dr Christine Jasoni
Department of Anatomy



HUBS 191

Human Movement and Sensation

Theme 2: Integrating and coordinating roles of the nervous system

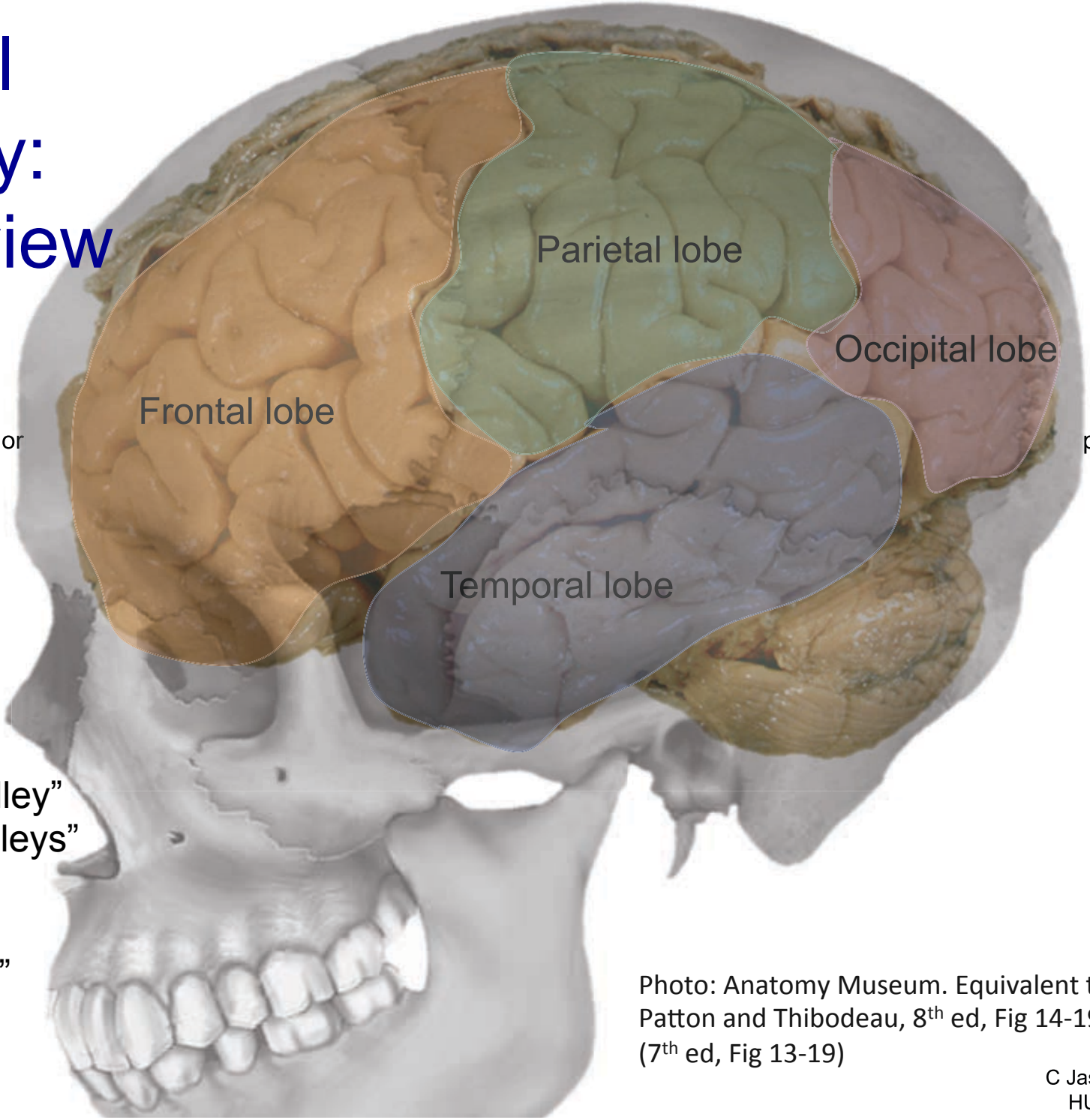
Lecture 20: Structure and layout of major brain areas; basic sensory and motor pathways

31 March 2017

Lecture 20: Learning objectives

- Know the external anatomy of the brain, from lateral (surface) and medial views
  - including the names of the lobes of the cerebral cortex, and major sulci and gyri, and their basic functions
- Know the names of the regions of the brainstem (ventral and dorsolateral views)
- Know the internal structures of the brain and the names for collections of cell bodies and different types of white matter tracts
- Know the anatomy of the main motor pathway for voluntary movement (corticospinal tract)
- Know the anatomy of the somatosensory pathway
- Understand the basic function of the cerebellum in integrating sensory and motor function
- Know what the basal ganglia are

External anatomy: lateral view



SULCUS = “valley”
pl SULCI = “valleys”

GYRUS = “hill”
pl GYRI = “hills”

Photo: Anatomy Museum. Equivalent to Patton and Thibodeau, 8th ed, Fig 14-19 (7th ed, Fig 13-19)

External anatomy: Lobes of the cerebral cortex

- Same names as the cranial bones

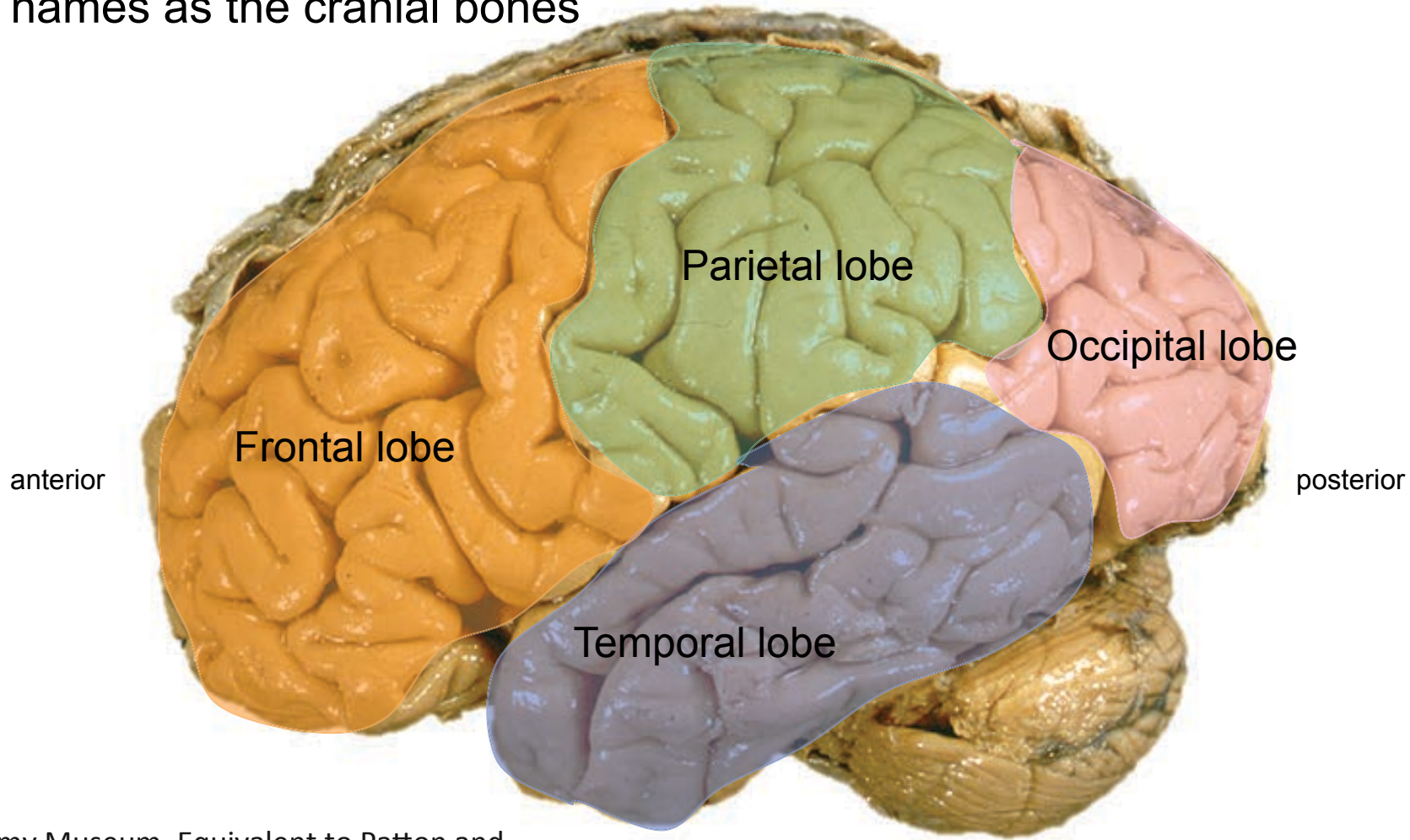


Photo: Anatomy Museum. Equivalent to Patton and Thibodeau, 8th ed, Fig 14-19 (7th ed, Fig 13-19)

External anatomy: Major sulci, gyri and fissures

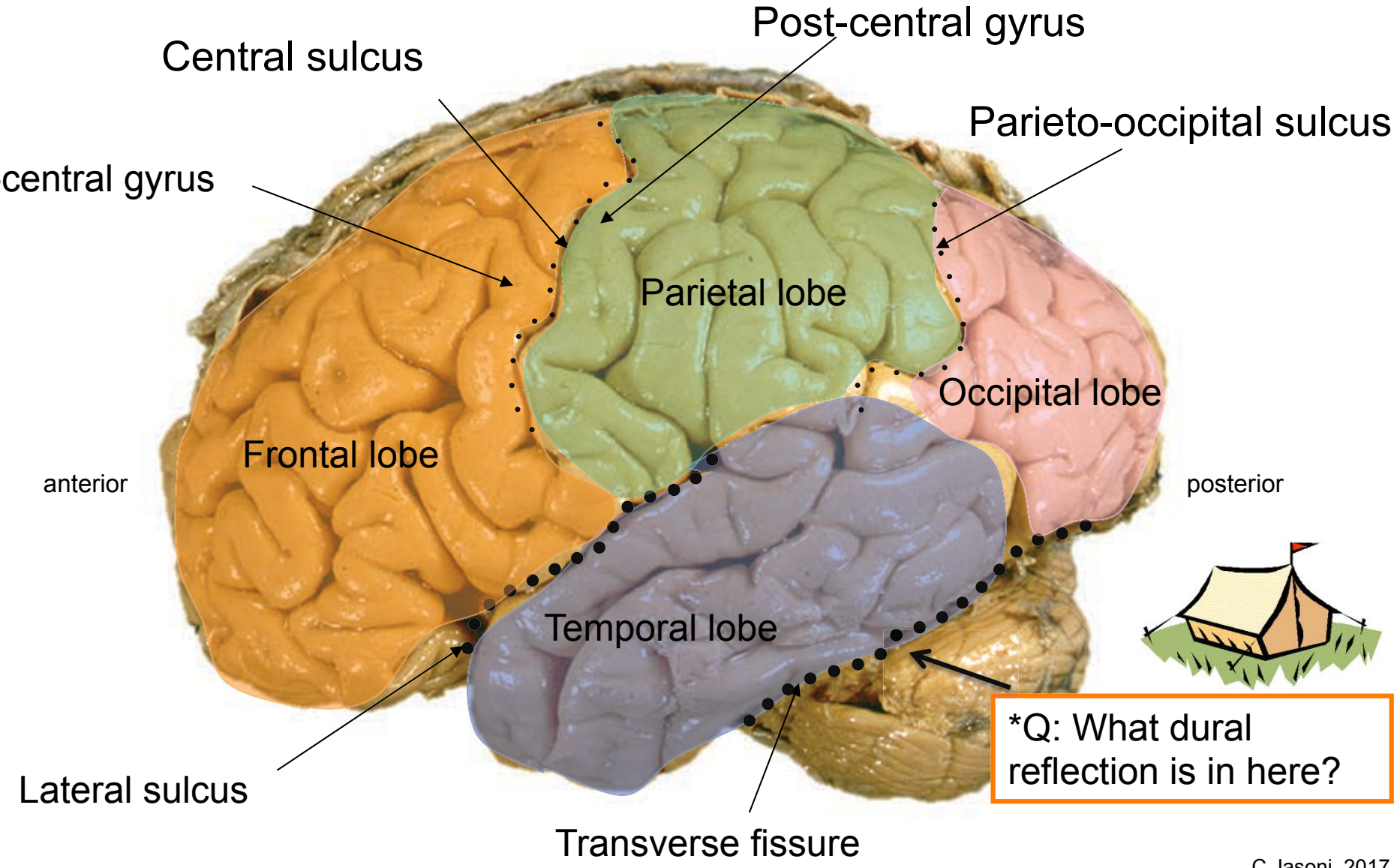


Photo: Anatomy Museum. See also Patton and Thibodeau, 8th ed, Fig 14-19 (7th ed, Fig 13-19)

Functional anatomy: What each of the lobes does

- Multiple, sophisticated functions
- Conscious awareness
- Association

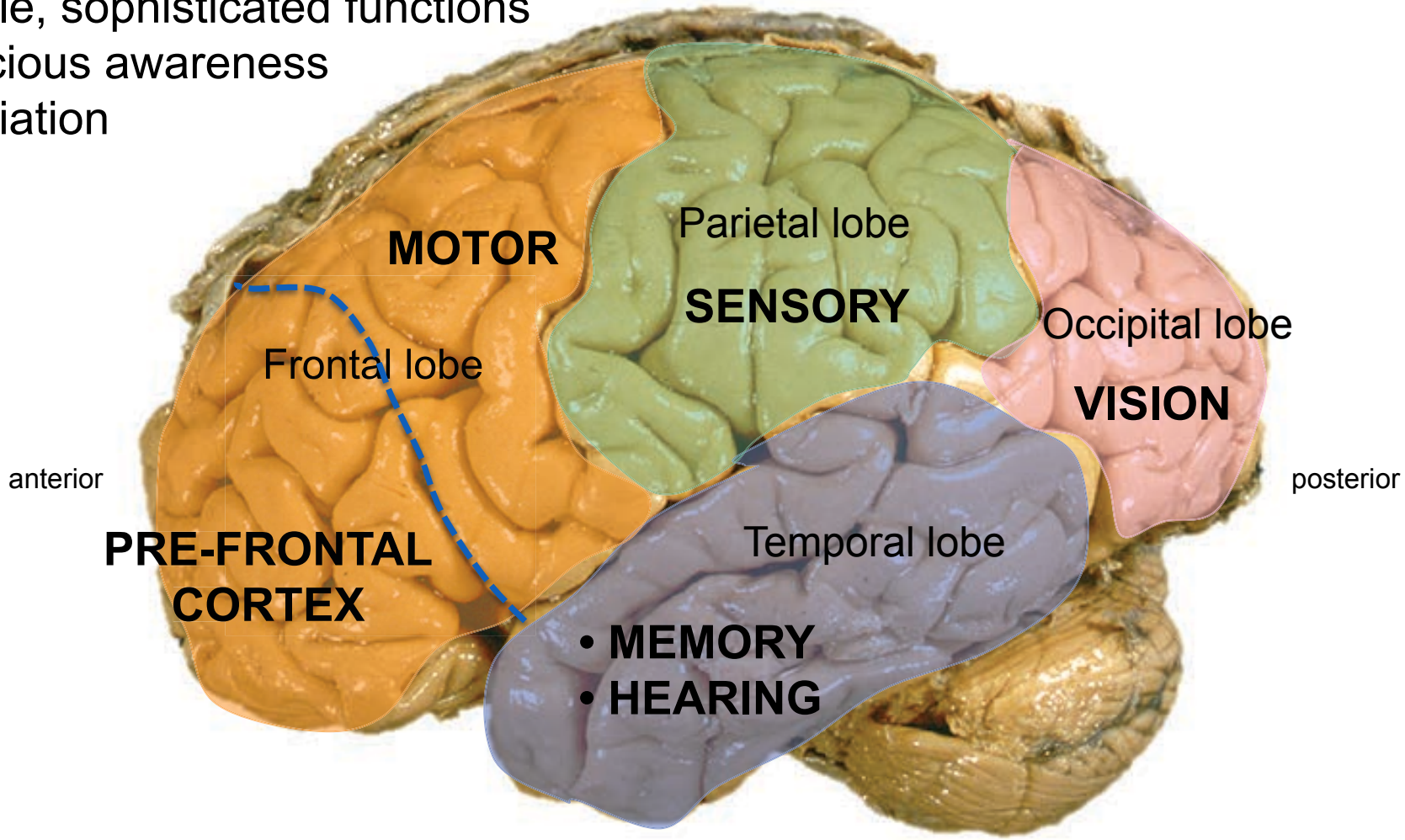


Photo: Anatomy Museum. See also Patton and Thibodeau, 8th ed, Fig 14-19 (7th ed, Fig 13-19)

A closer look at the frontal lobe: Motor cortex

- Two types
- Control of voluntary movement

1.) Primary motor cortex
→ Execution of movement

Pre-central gyrus

2.) Pre-motor cortex
→ Planning of movement

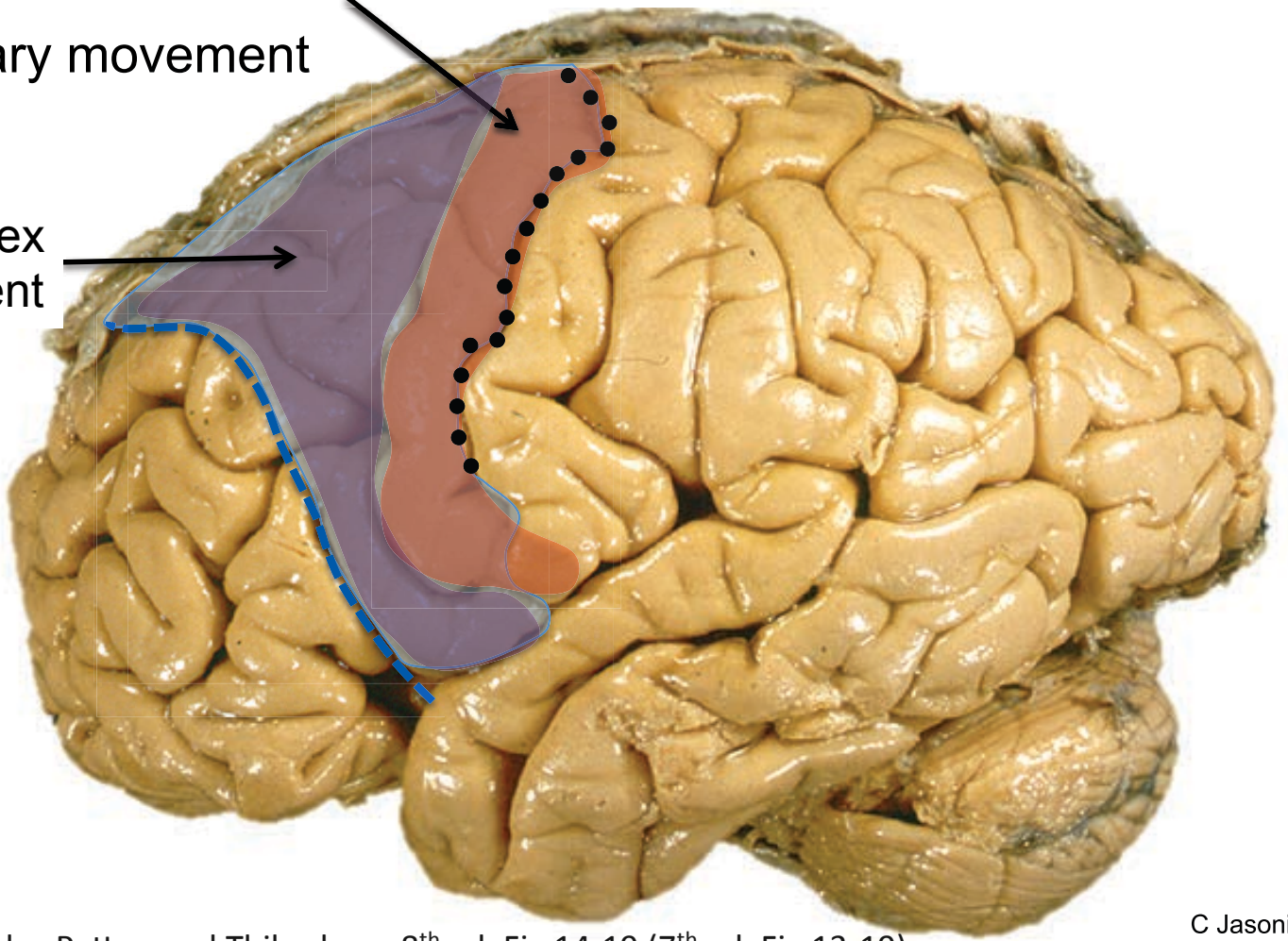


Photo: Anatomy Museum. See also Patton and Thibodeau, 8th ed, Fig 14-19 (7th ed, Fig 13-19)

A closer look at the frontal lobe: Prefrontal cortex

- Decision making
- Anticipating consequences of our actions
- Emotion

- Damage can change “who we are”
- Development may be altered by alcohol

- Involved in mental illnesses that change who we are, e.g. schizophrenia

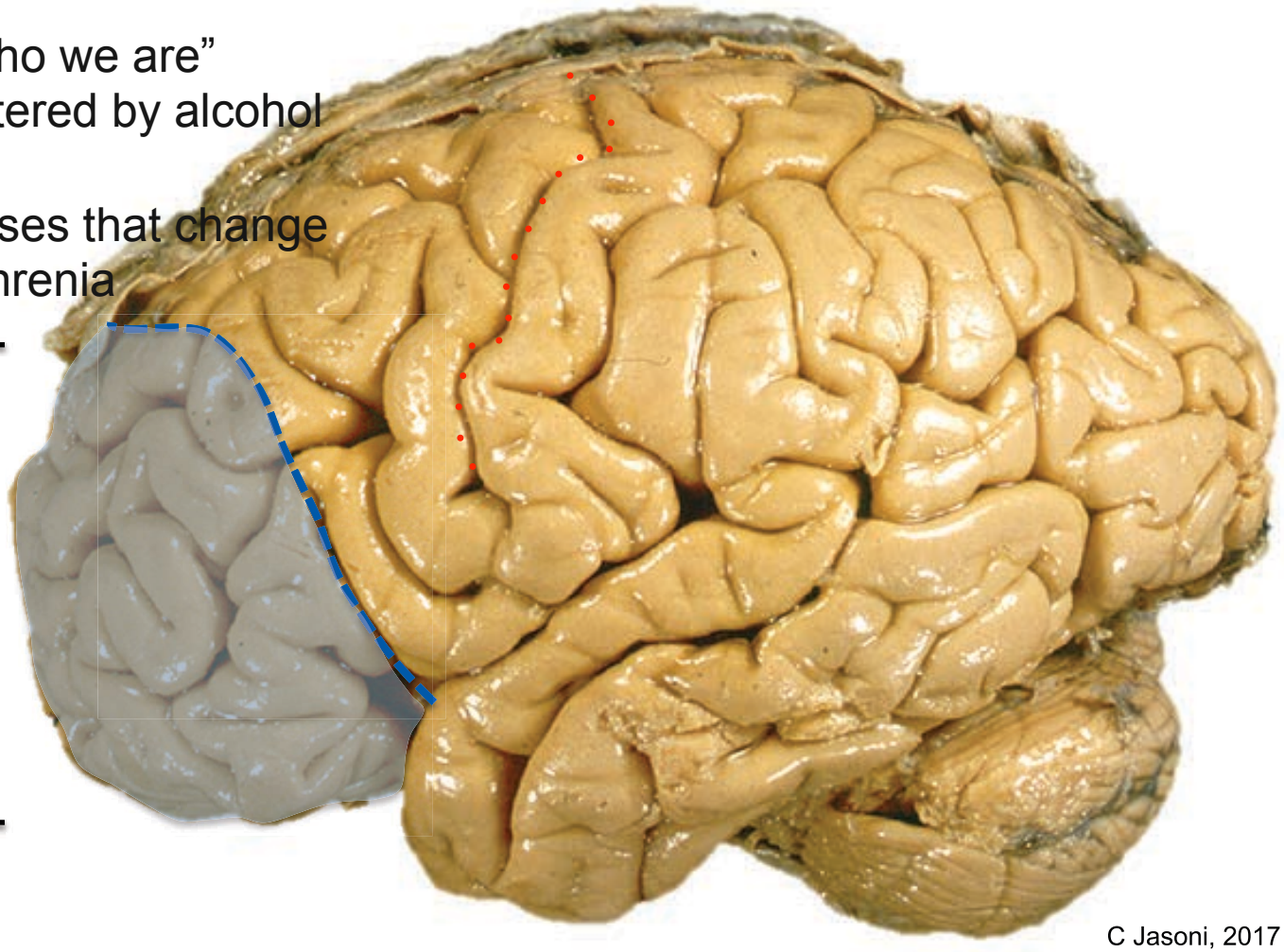
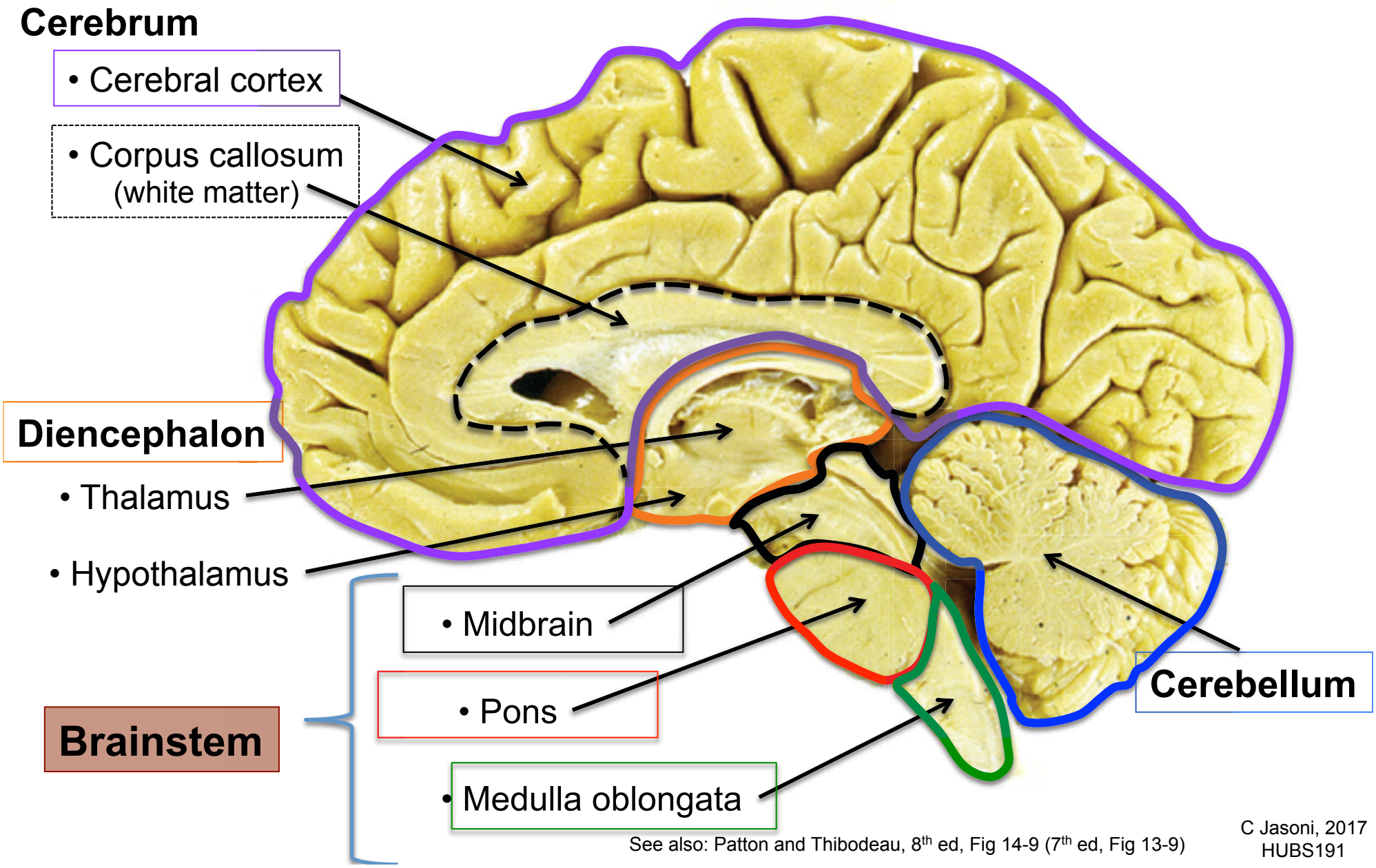


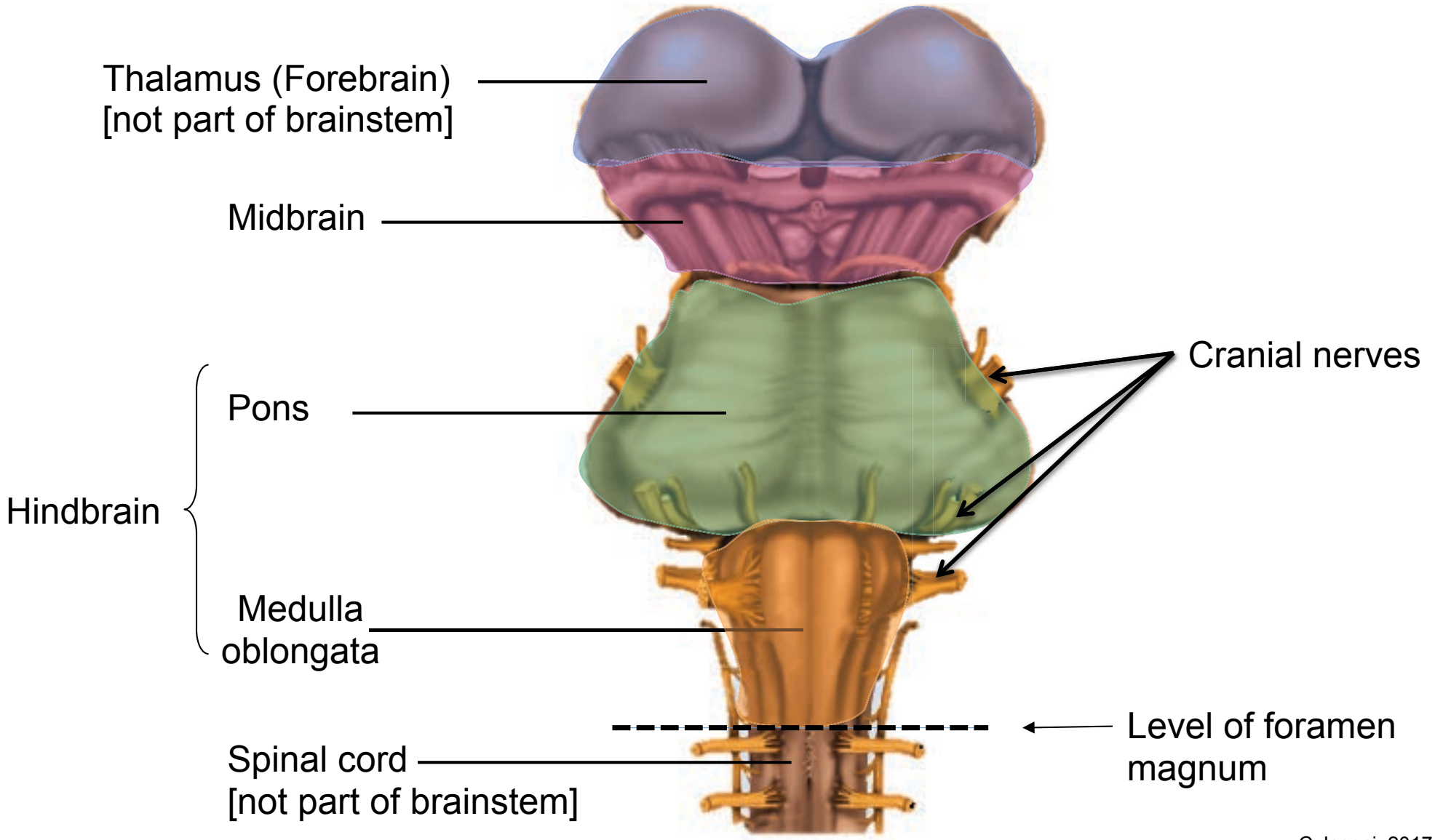
Photo: Anatomy Museum. See also Patton and Thibodeau, 8th ed, Fig 14-19 (7th ed, Fig 13-19)

Major divisions of the brain: Medial view



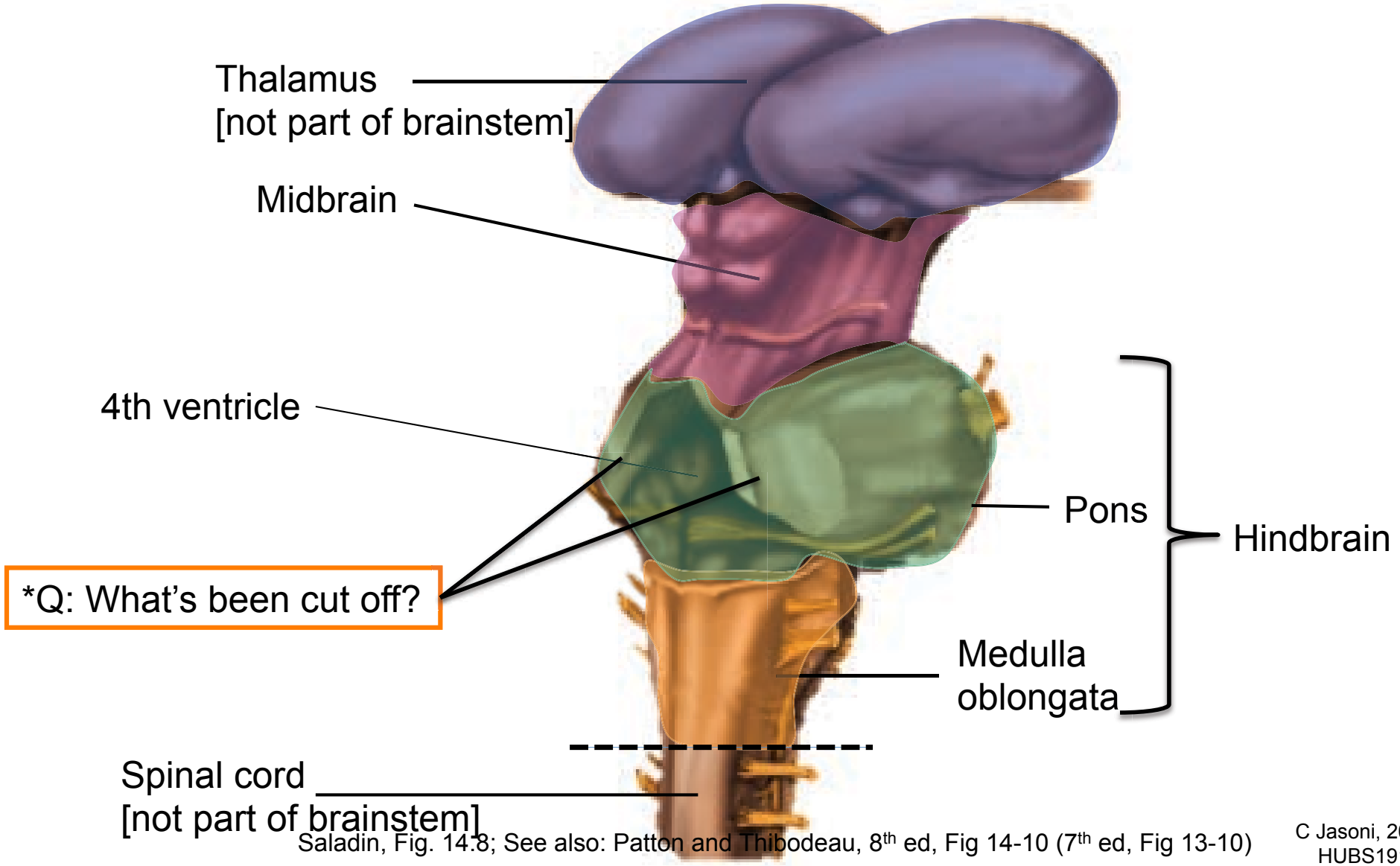
See also: Patton and Thibodeau, 8th ed, Fig 14-9 (7th ed, Fig 13-9)

Brainstem: Anatomy of the ventral aspect



Saladin, Fig. 14.8 (P. 525). See also: Patton and Thibodeau, 8th ed, Fig 14-10 (7th ed, Fig 13-10)

Brainstem: Anatomy of the dorsolateral aspect



Saladin, Fig. 14.8; See also: Patton and Thibodeau, 8th ed, Fig 14-10 (7th ed, Fig 13-10)

Internal structures of the brain: Coronal view

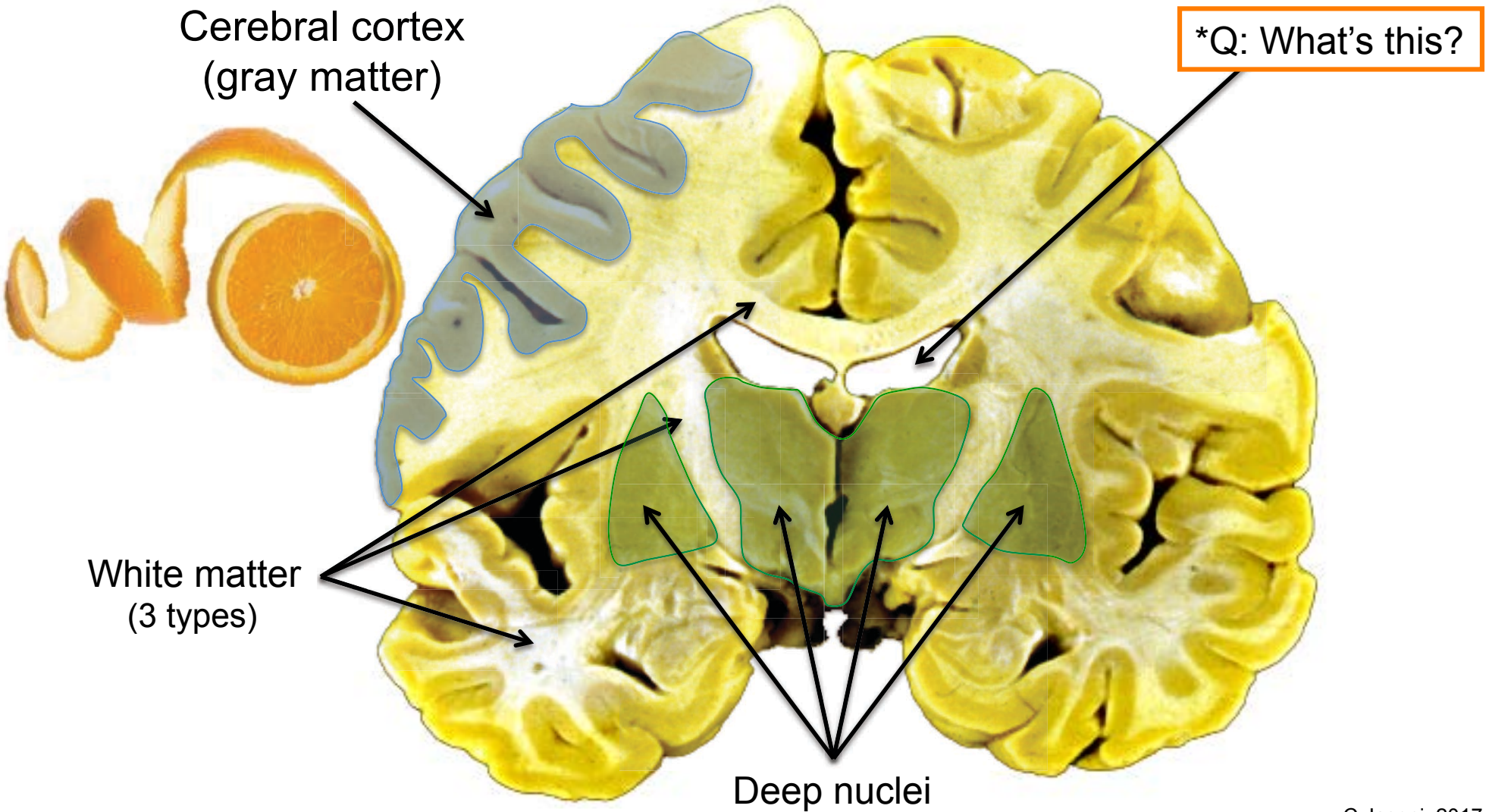


Photo: Anatomy Museum. See also Patton and Thibodeau, 8th ed, Fig 14-18 (7th ed, Fig 13-18)

Three types of white matter: #1 Commissural tracts

1 **Commissural tracts** –

- Axons cross from side to side; go both ways.
- Example: Corpus callosum

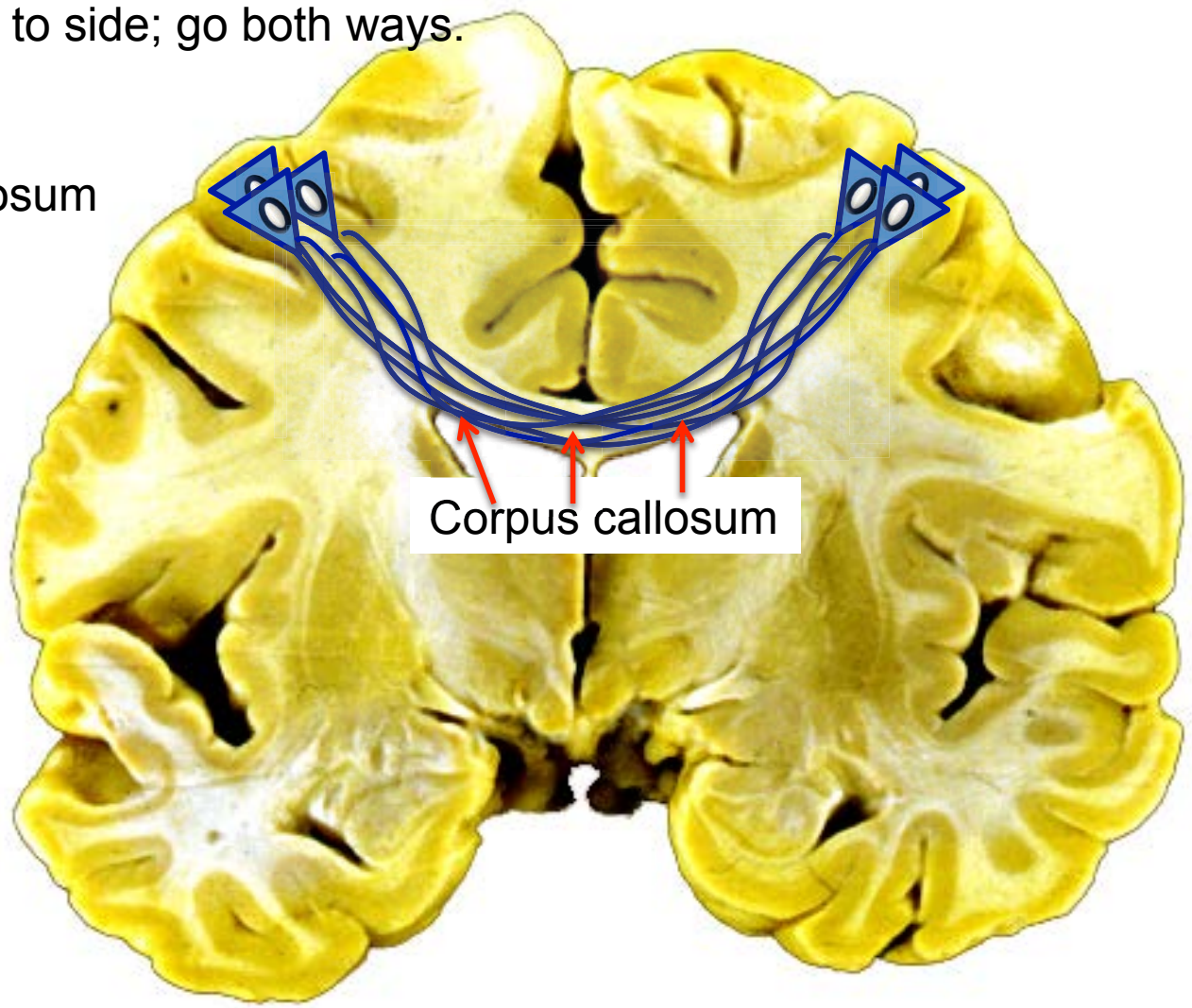


Photo: Anatomy Museum. See also Patton and Thibodeau, 8th ed, Fig 14-17 (7th ed, Fig 13-17)

Three types of white matter: #2 Projection tracts

2 **Projection tracts** –

- Axons extend between cortex and other CNS areas
- Example: Corticospinal tract

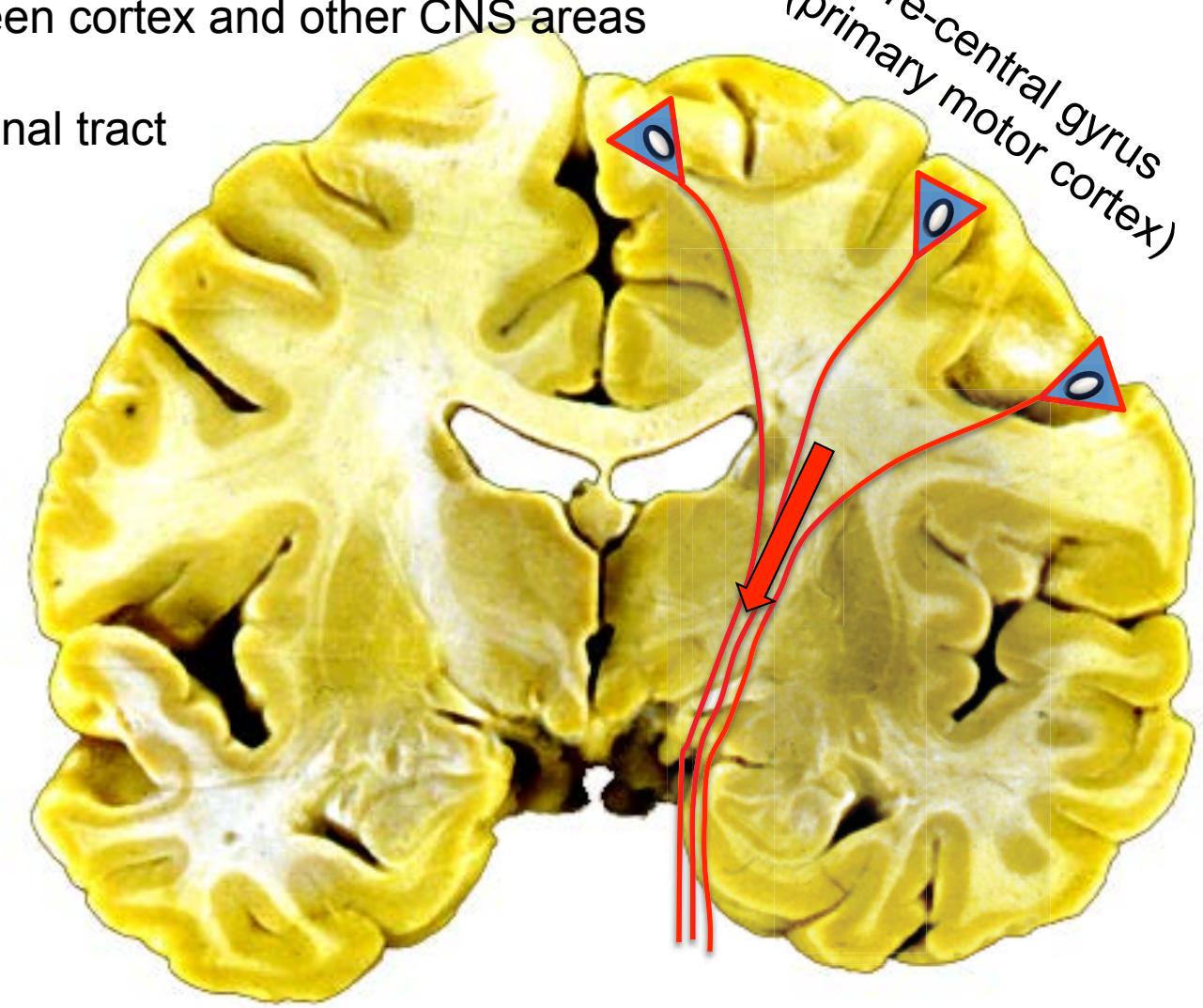
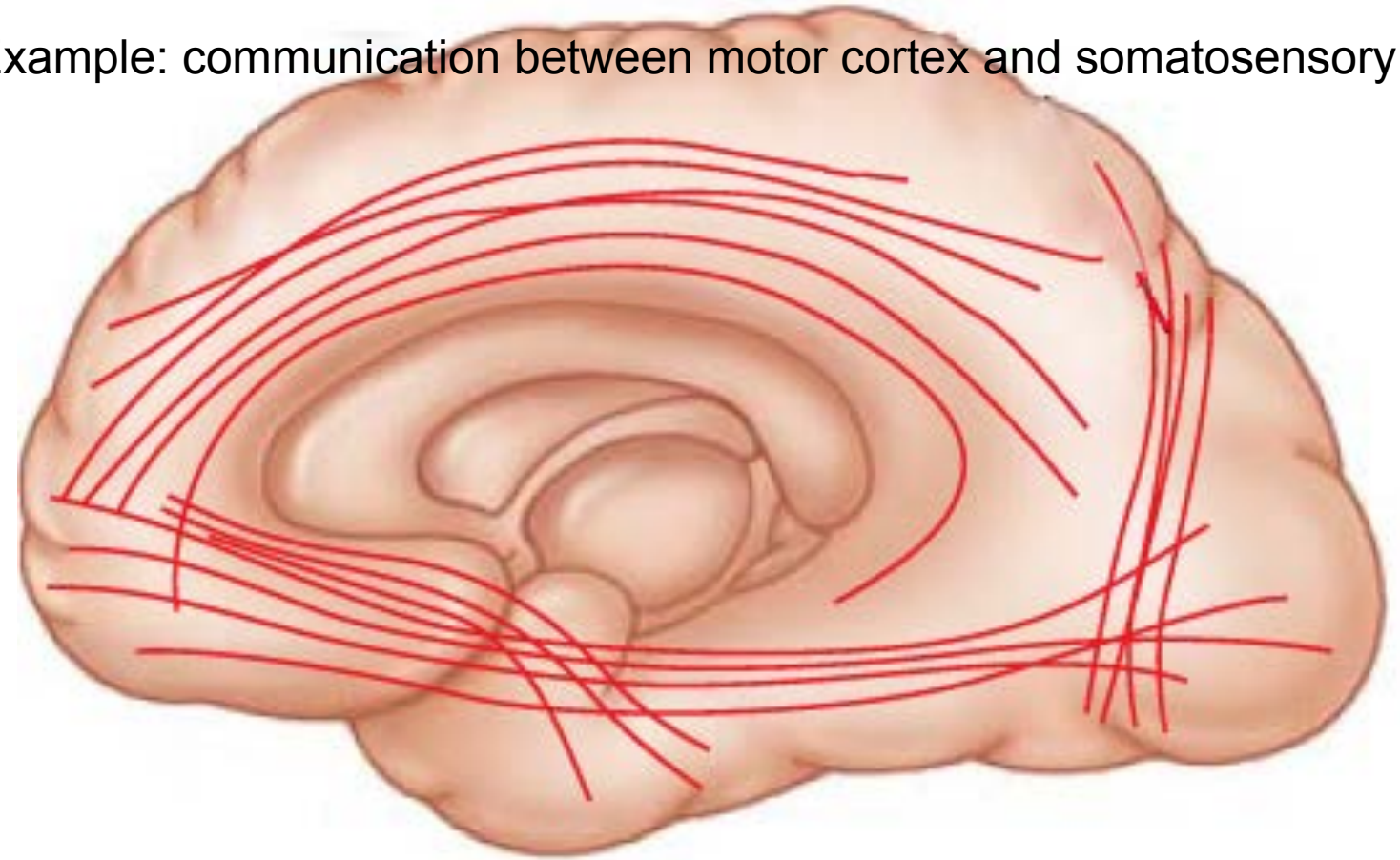


Photo: Anatomy Museum. See also Patton and Thibodeau, 8th ed, Fig 14-17 (7th ed, Fig 13-17)

Three types of white matter: #3 Association tracts

3 **Association tracts** –

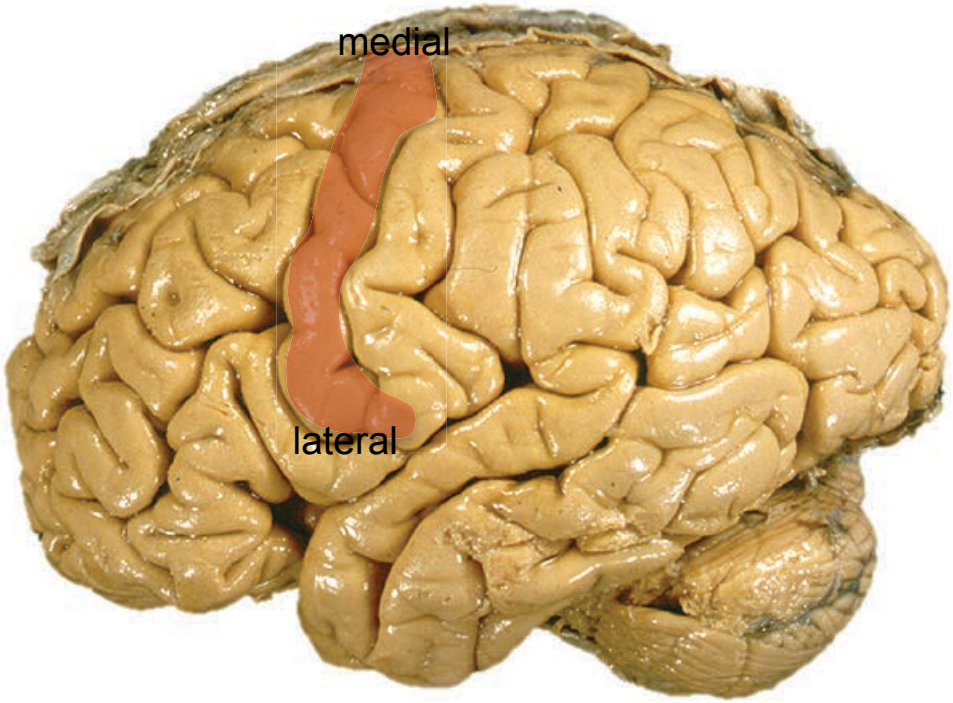
- Axons on <u>same</u> side within cerebral cortex
- Communication between brain areas
- Example: communication between motor cortex and somatosensory cortex

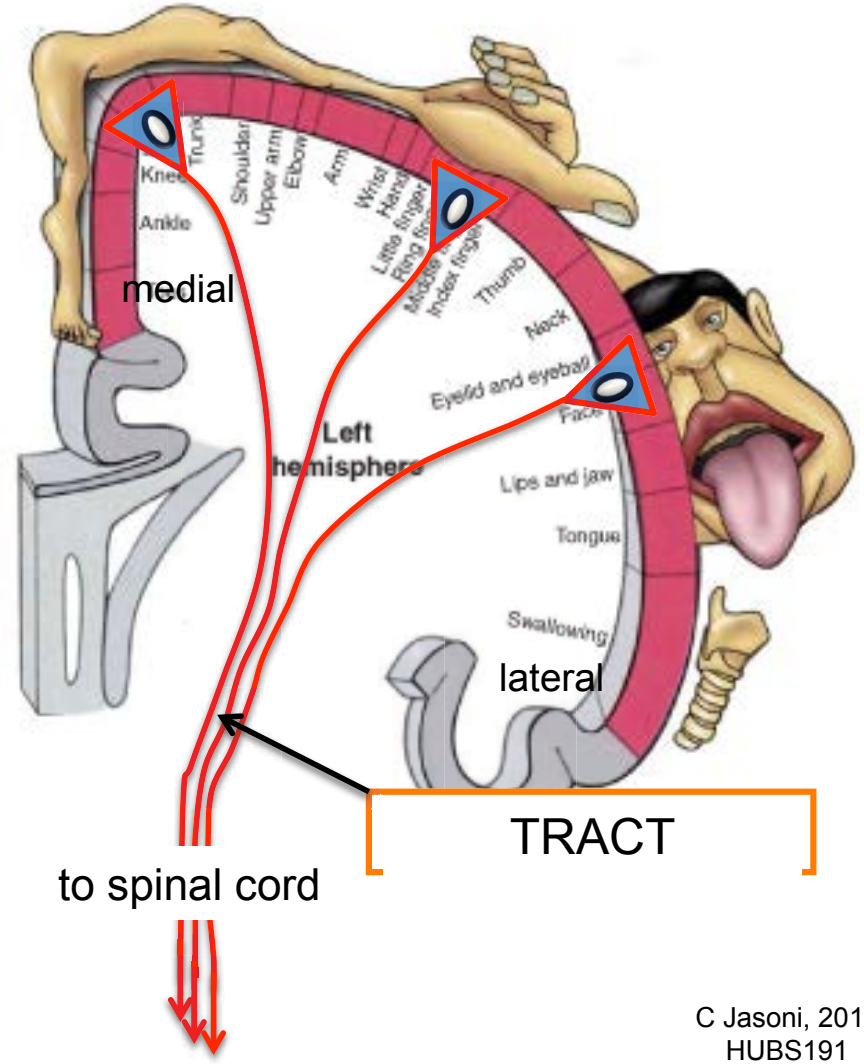


Patton and Thibodeau, 8th ed, Fig 14-17 (7th ed, Fig 13-17)

Primary motor cortex organisation

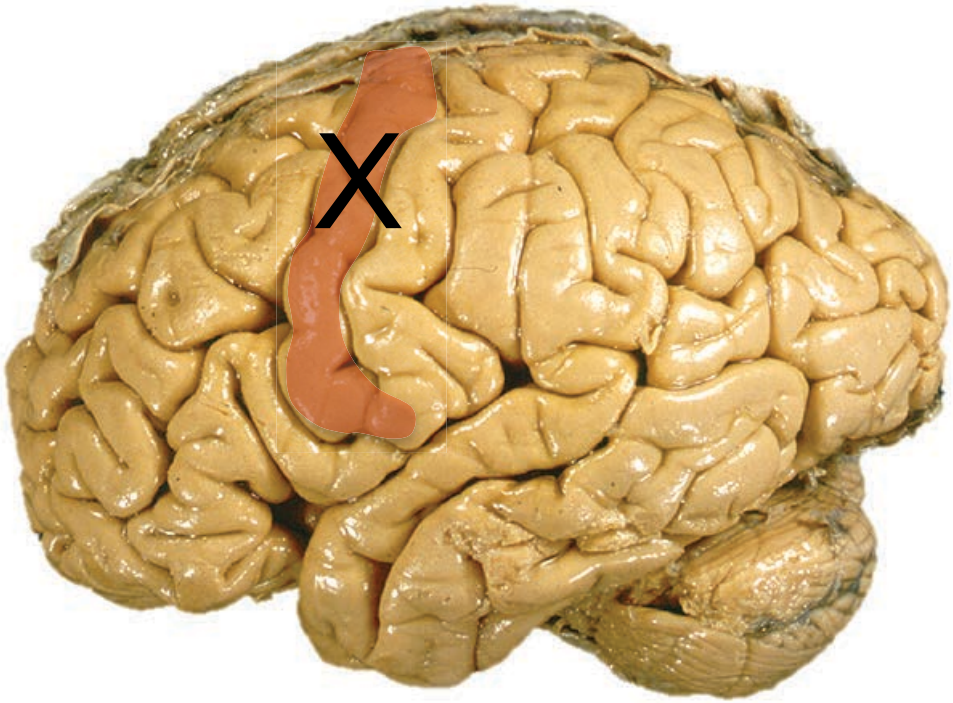
- Specific regions of the motor cortex control specific regions of the body

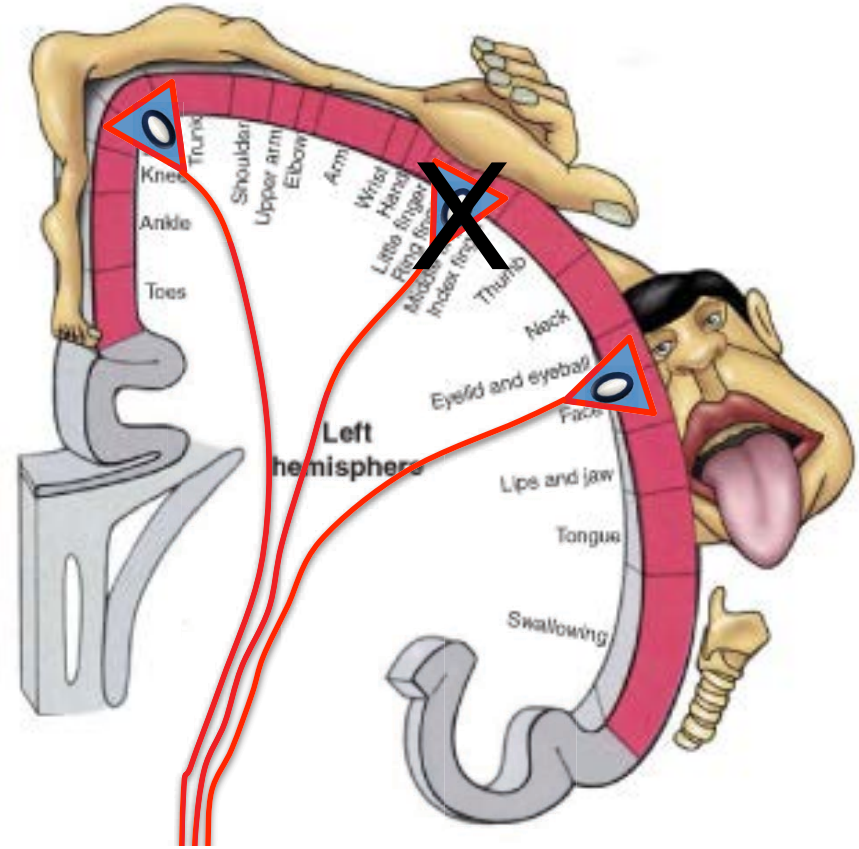




When it goes wrong: Primary motor cortex stroke

- Specific regions of the motor cortex control specific regions of the body





to spinal cord

Patton and Thibodeau, 8th ed, Fig 14-20 (7th ed, Fig 13-20)

The corticospinal tract: A descending somatic motor tract

- Controls activity of somatic (efferent) motor neuron

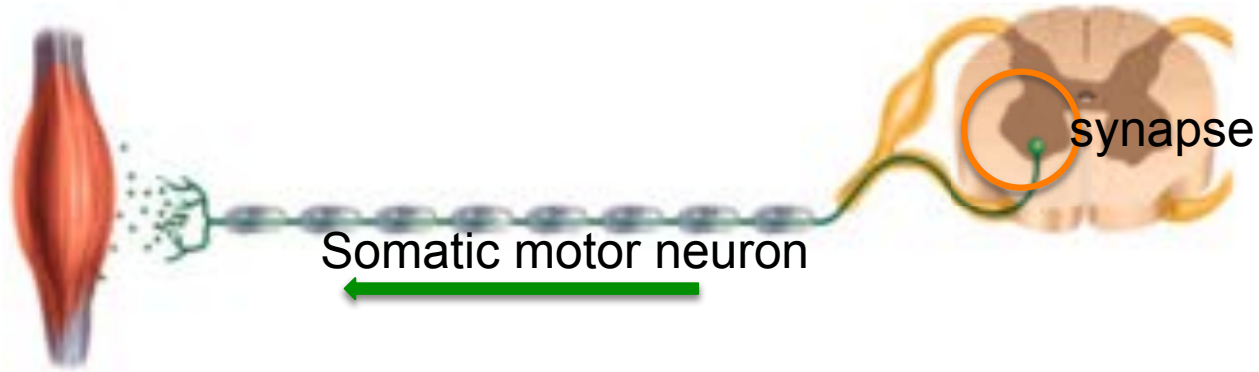


Photo: Anatomy museum. See also: Patton and Thibodeau, 8th ed, Fig 14-24 (7th ed, Fig. 13-24)

The corticospinal tract: A descending somatic motor tract

- Cell bodies (EFFERENT) in primary motor cortex
- Most fibres cross to opposite side in medulla oblongata
- Axons *descend* until spinal cord
- Synapse in spinal cord (ventral horn)

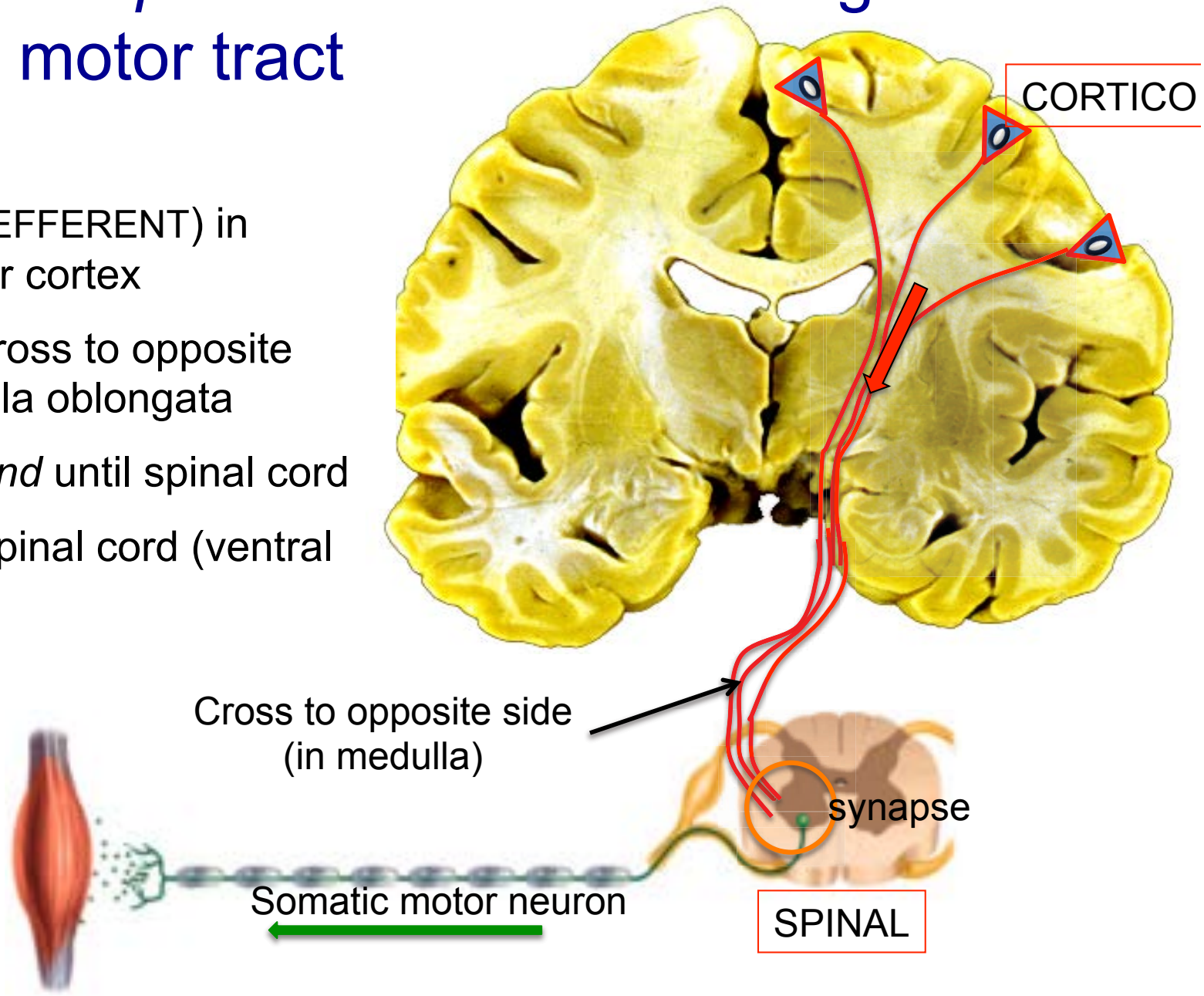


Photo: Anatomy museum. See also: Patton and Thibodeau, 8th ed, Fig 14-24 (7th ed, Fig. 13-24)

Functional anatomy: Parietal lobe

- Somatosensory
- Integration of multiple types of sensory information
- Association

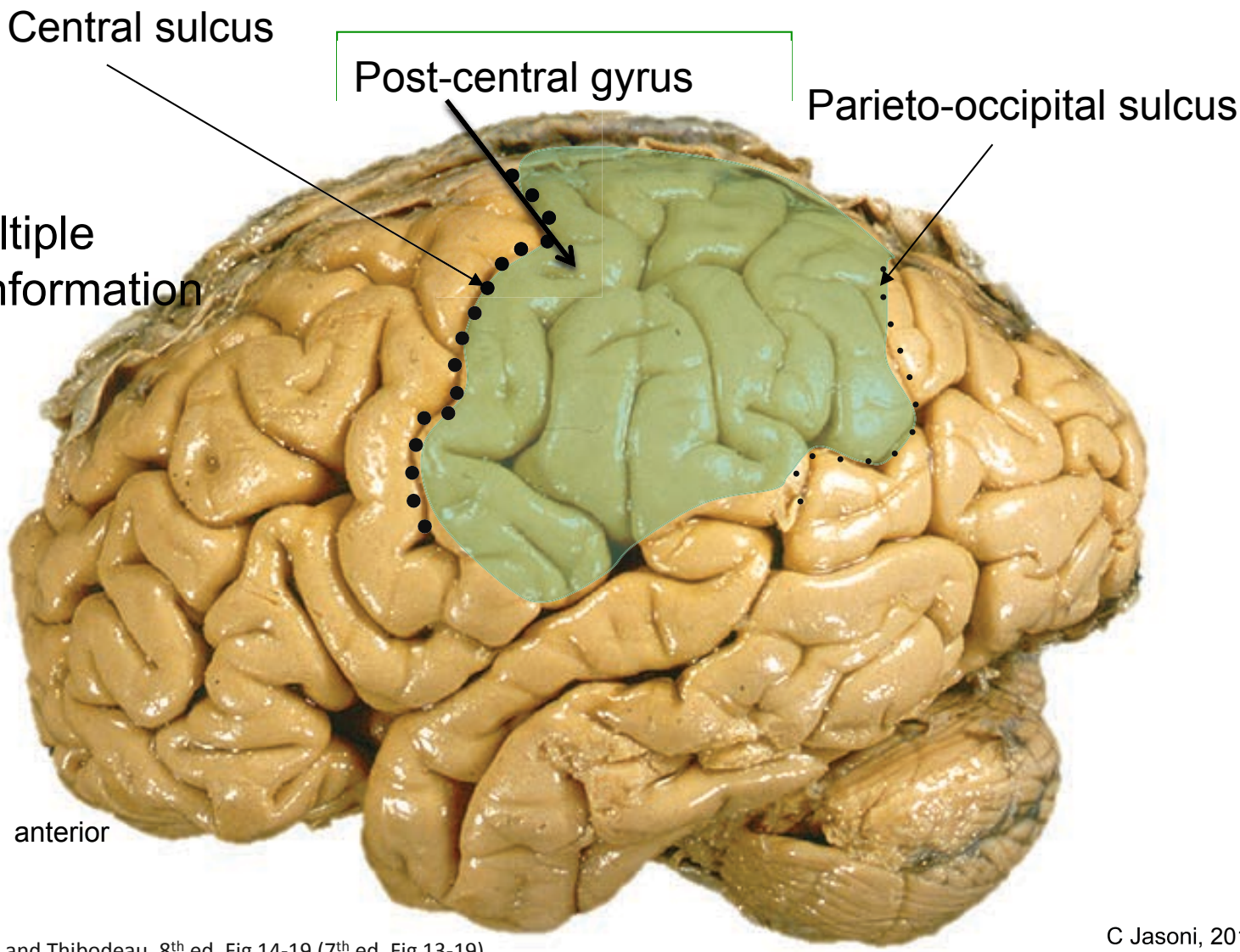


Photo: Anatomy Museum. See also Patton and Thibodeau, 8th ed, Fig 14-19 (7th ed, Fig 13-19)

Simple somatic sensory (afferent) pathway

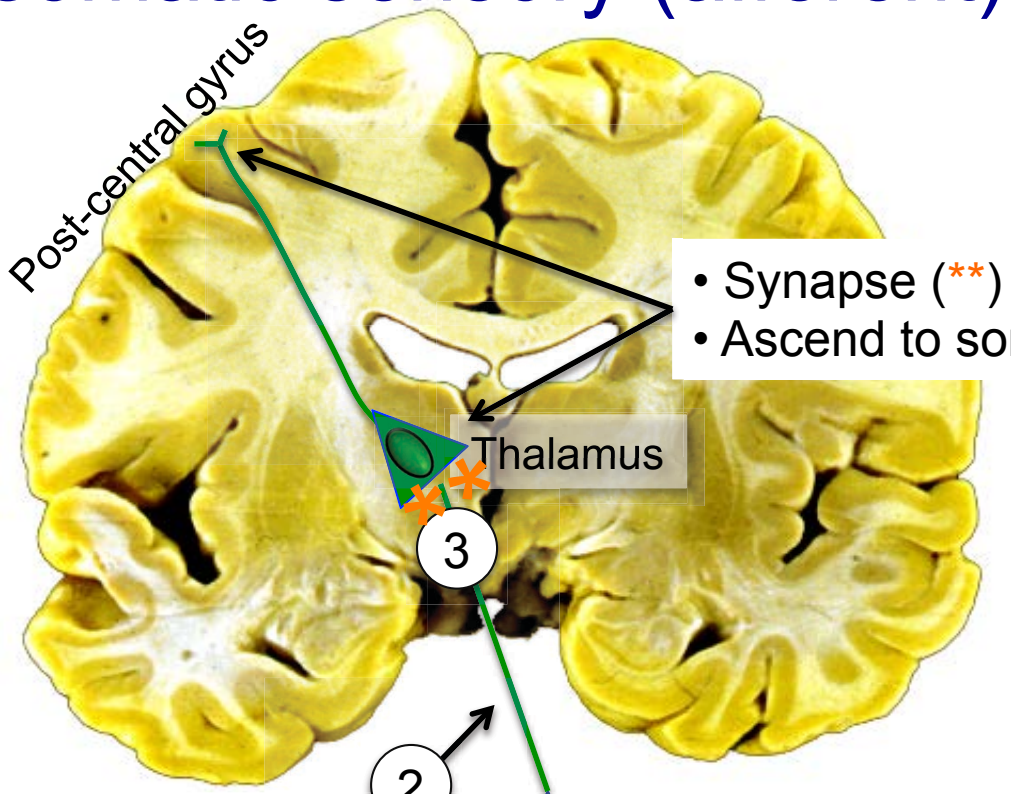
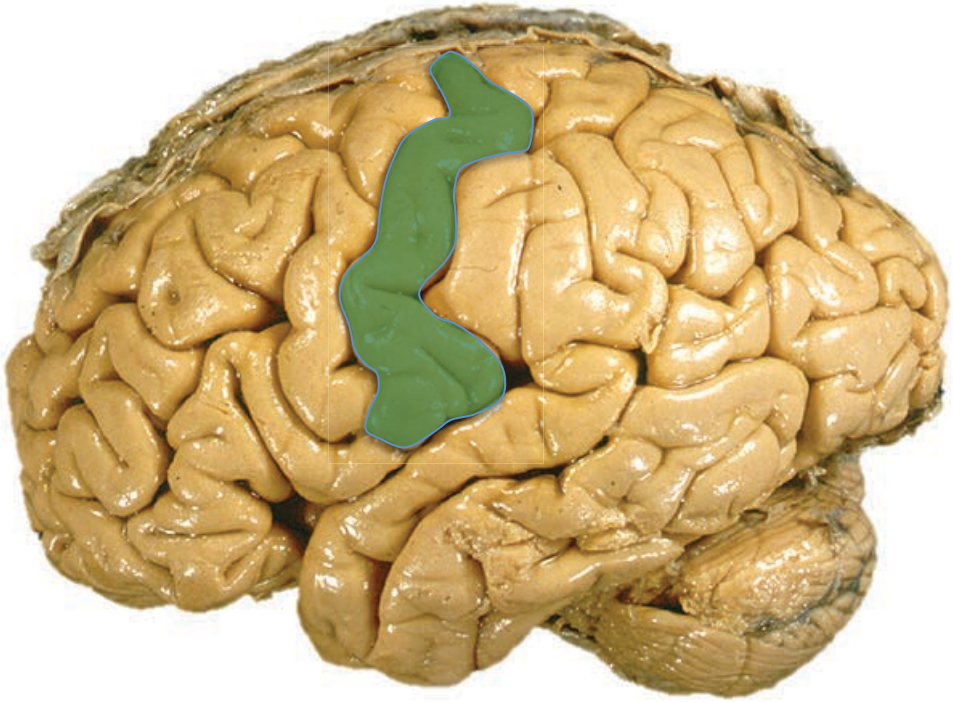
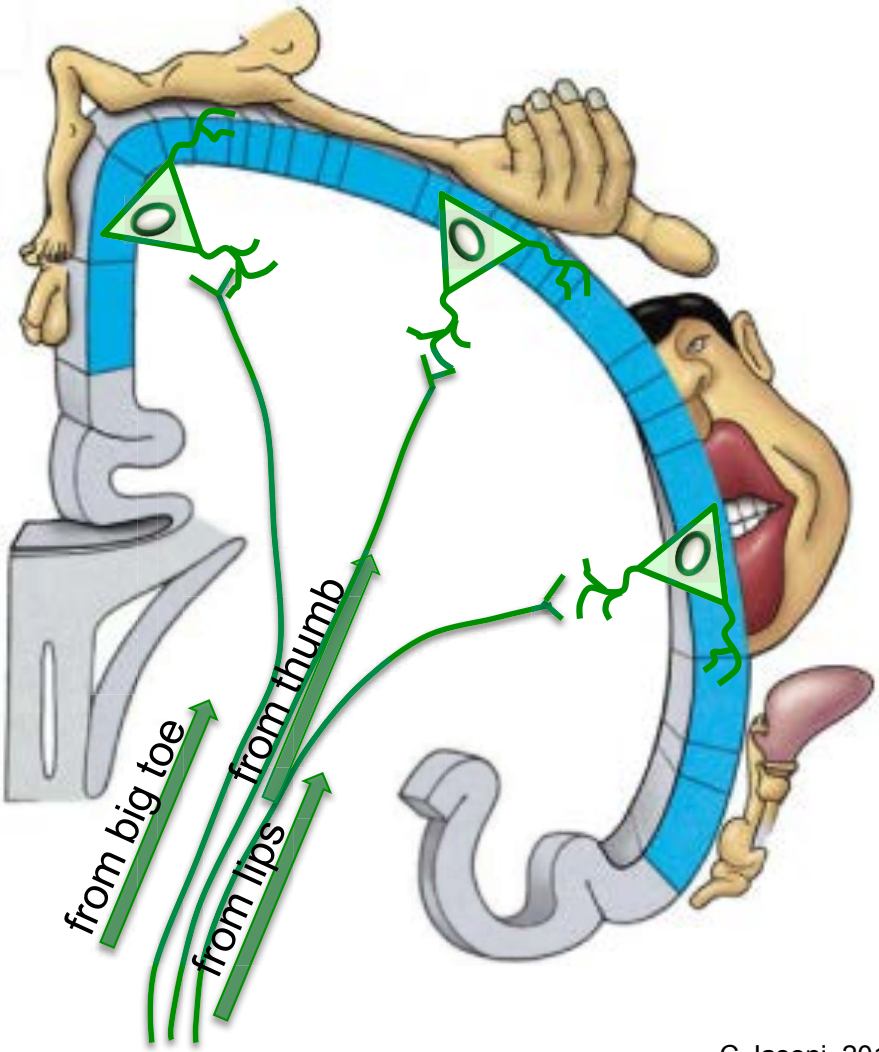


Photo: Anatomy Museum. See also Patton and Thibodeau 8th ed, Fig 14-23 (7th ed, Fig 13-23)

Primary somatosensory cortex

• Specific regions of the somatosensory cortex receive sensory information from specific regions of the body





Anatomy museum and Patton and Thibodeau 8th ed, Fig 14-20 (7th ed, Fig 13-20)

Integration between motor and sensory systems: Role for cerebellum

1.) Motor cortex initiates movement

2.) Copy of instructions sent to cerebellum

3.) Some sensory information goes to the cerebellum = information about actual movement

4.) Cerebellum compares this info with copy of motor output

5.) “Adjusts” motor output for COORDINATION

➔ The cerebellum coordinates movement, guided by sensory feedback.

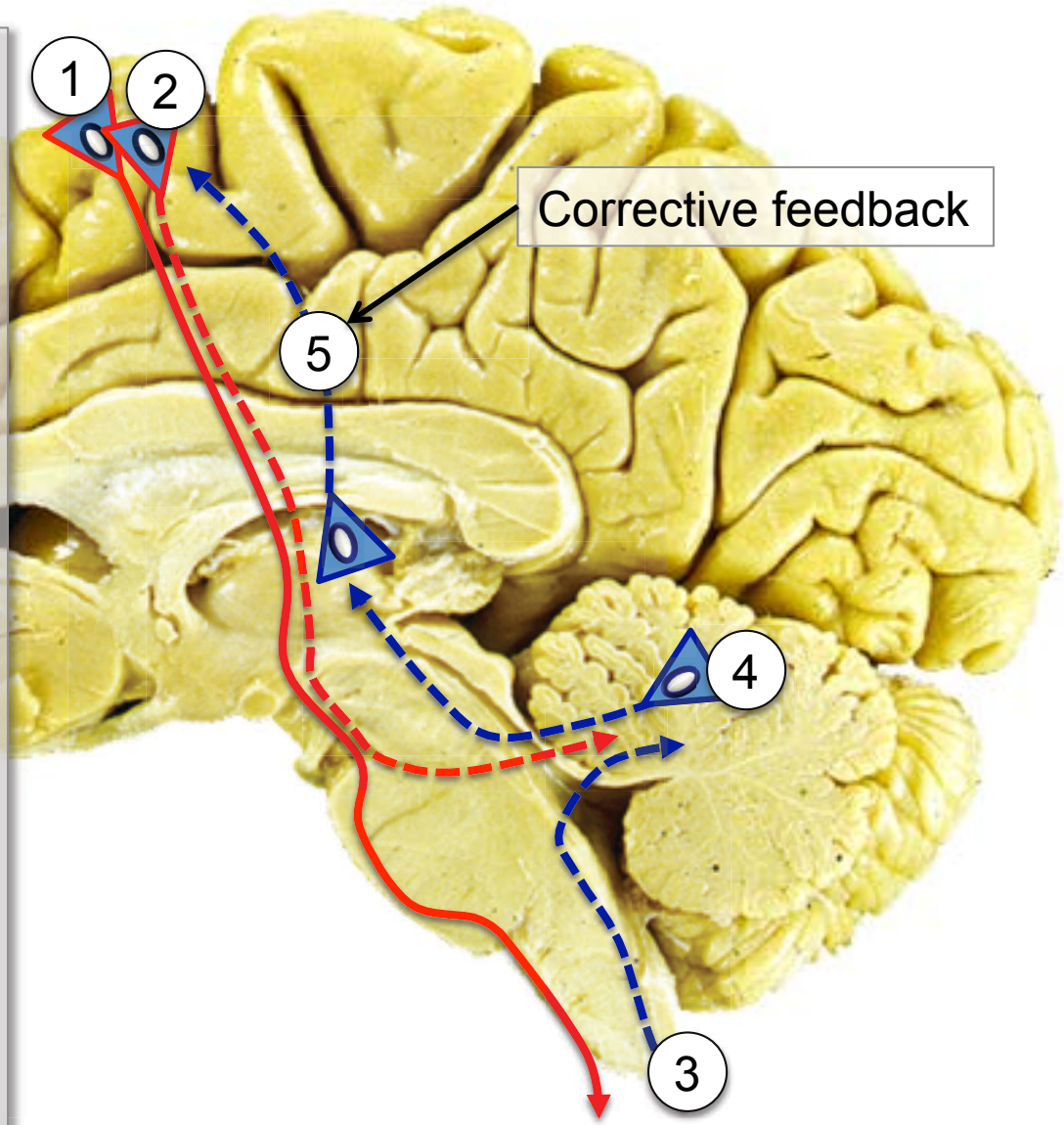
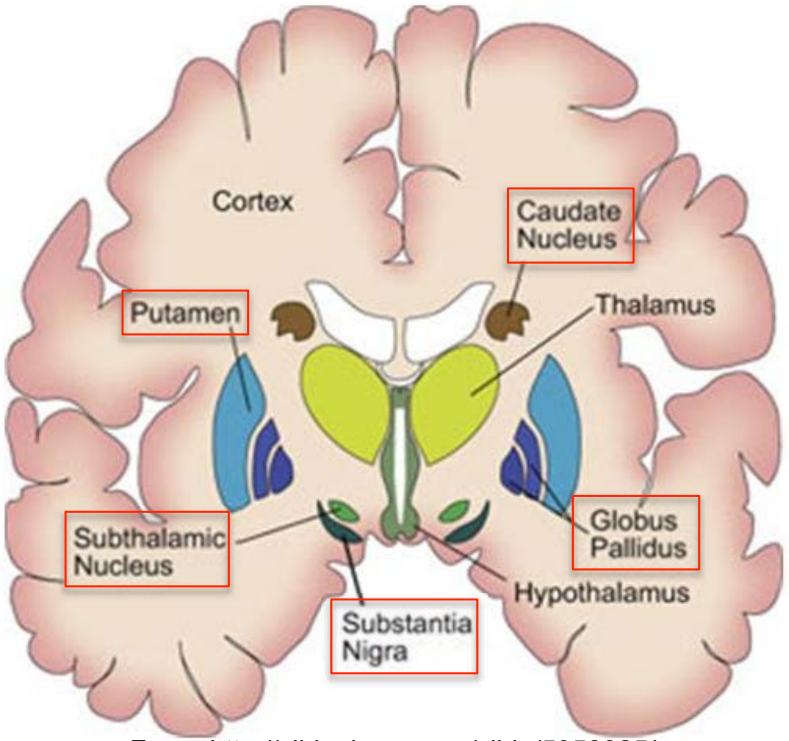


Photo: Anatomy museum.
See also: Patton and Thibodeau, 8th ed, Fig 14-12 (7th ed Fig 13-12)

Integration between motor and sensory systems: Role for Basal Ganglia

The ***Basal Ganglia*** consists of a collection of 5 nuclei (groups of cell bodies):

- Caudate
- Putamen
- Globus pallidus
- Subthalamic nucleus
- Substantia nigra



From: http://slideplayer.com/slide/5958325/

Basal Ganglia function:

- In a brain circuit that also involves other structures
- Select an appropriate movement for a given situation
- Initiate movement
- Terminate movement

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