

SYSTEM
(information processing)

**PERIPHERAL NERVOUS
SYSTEM**

Afferent neurons

Efferent neurons

**Sensory
receptors**

**Autonomic
nervous system**

**Motor
system**

**Control of
skeletal muscle**

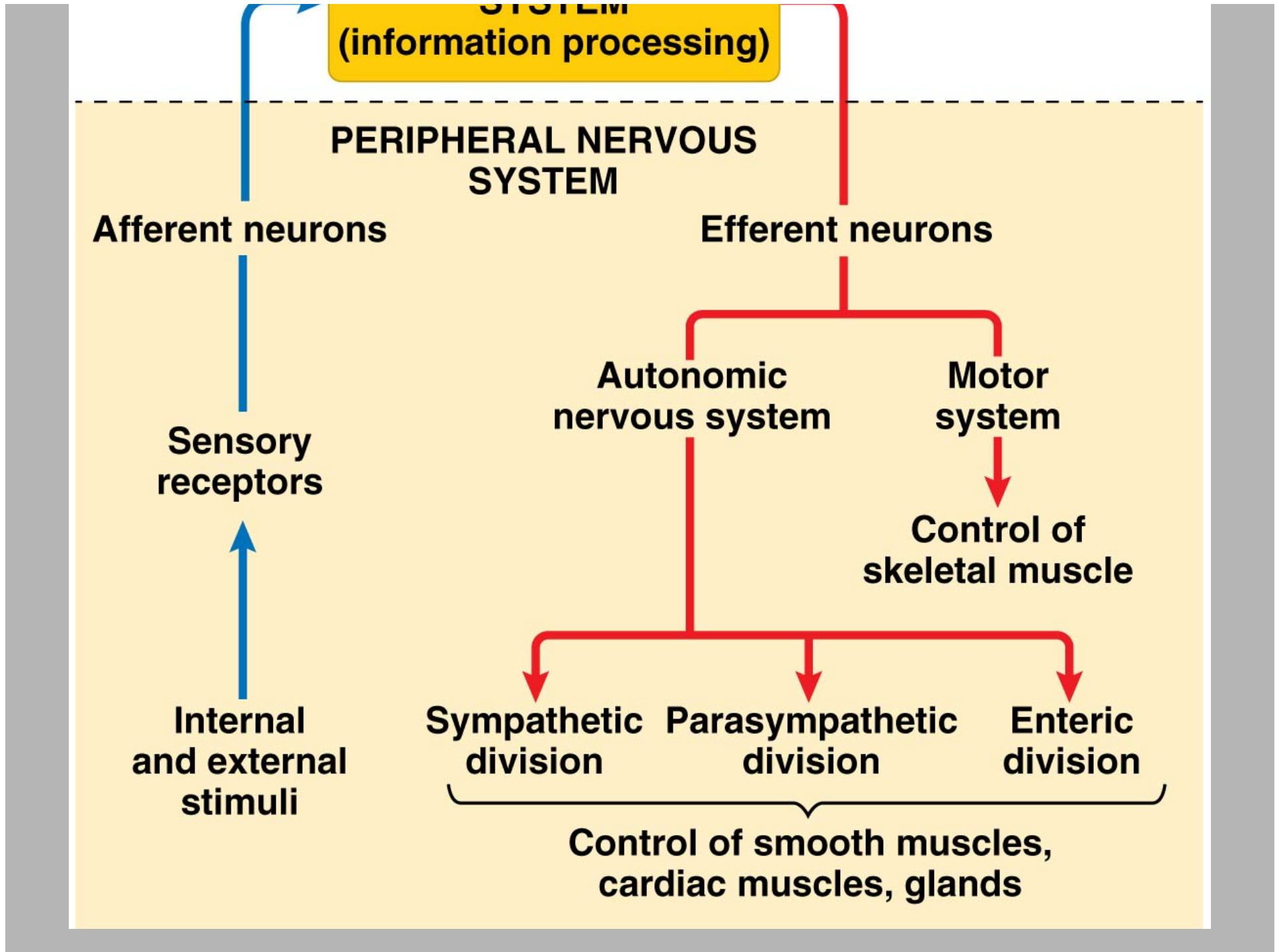
**Internal
and external
stimuli**

**Sympathetic
division**

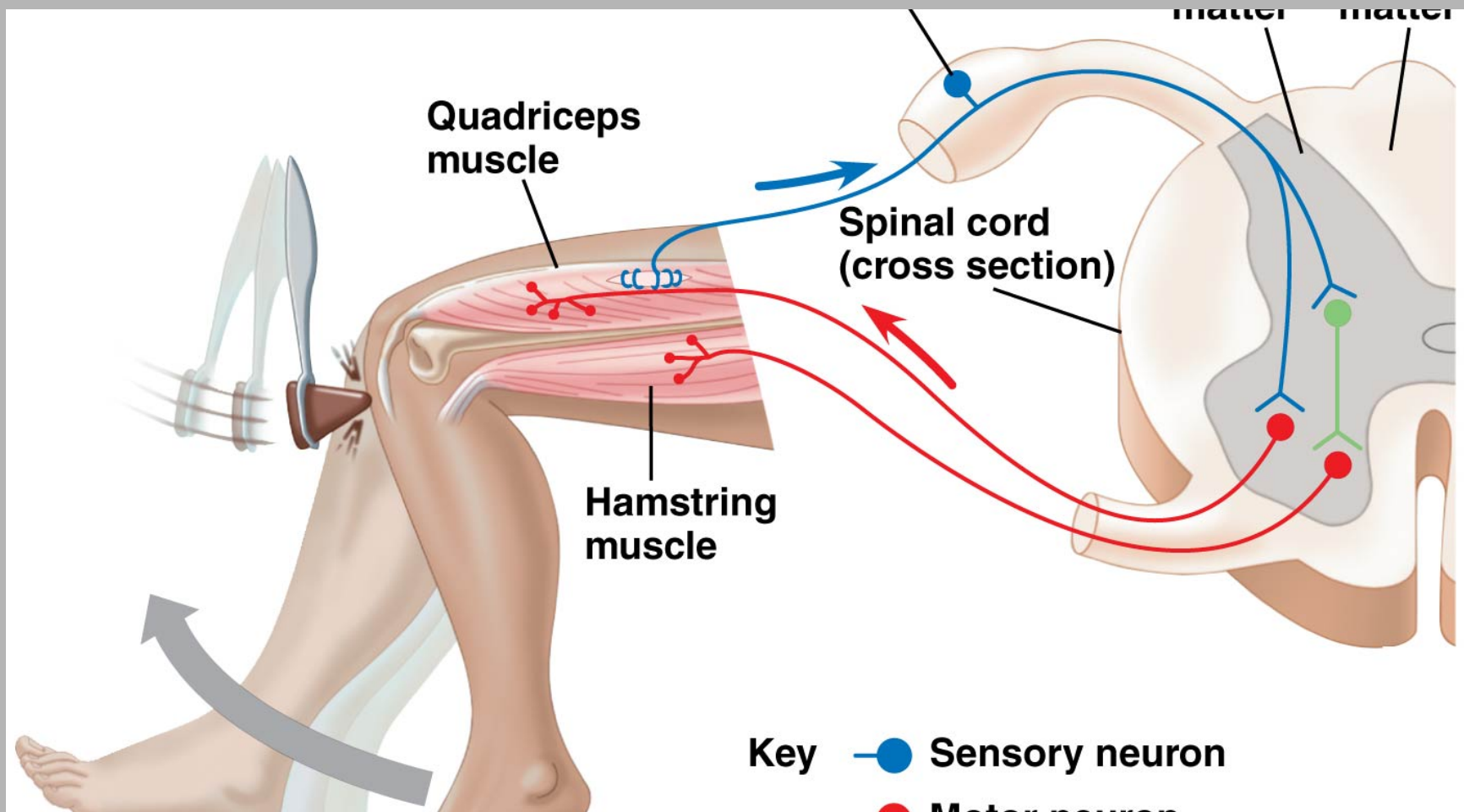
**Parasympathetic
division**

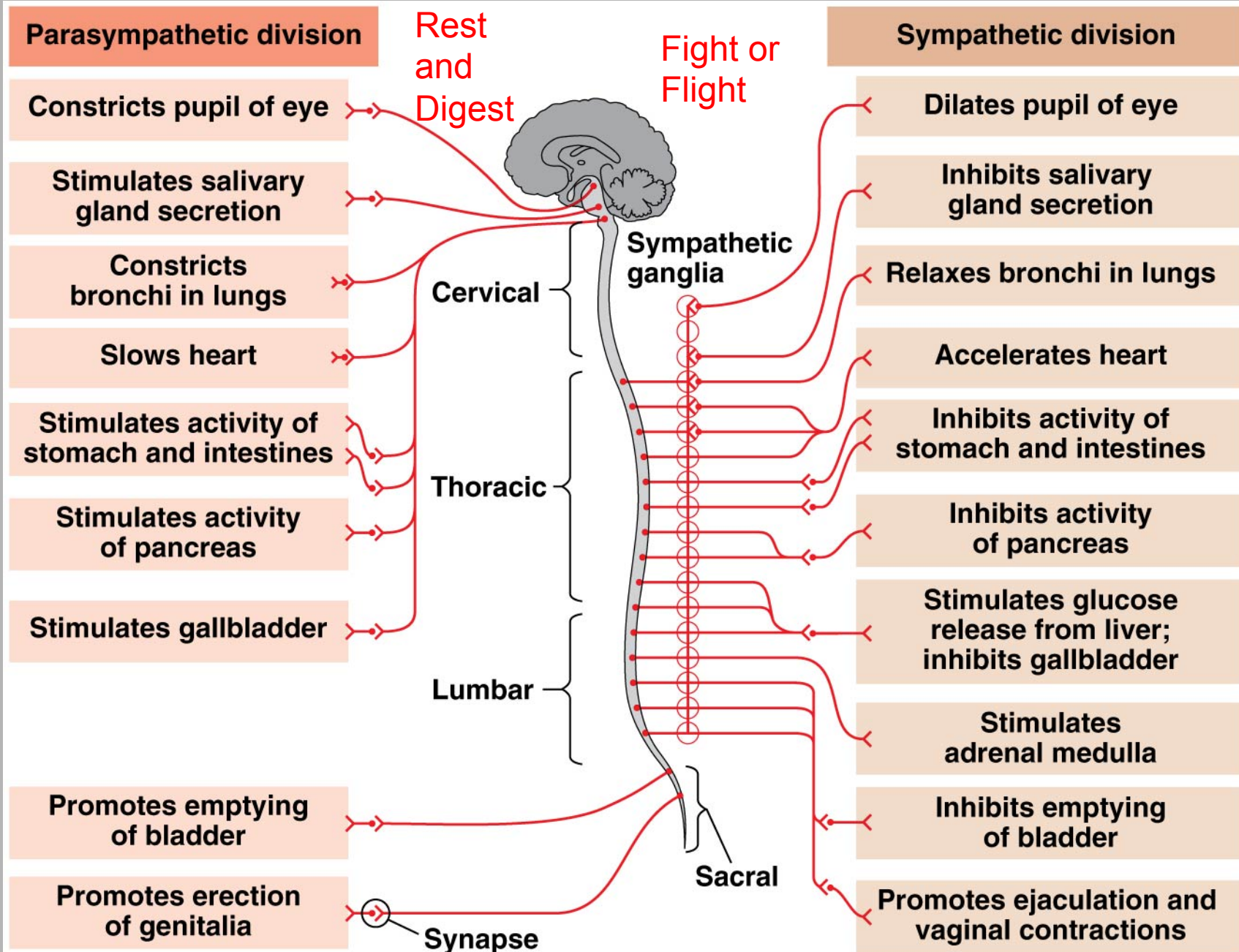
**Enteric
division**

**Control of smooth muscles,
cardiac muscles, glands**

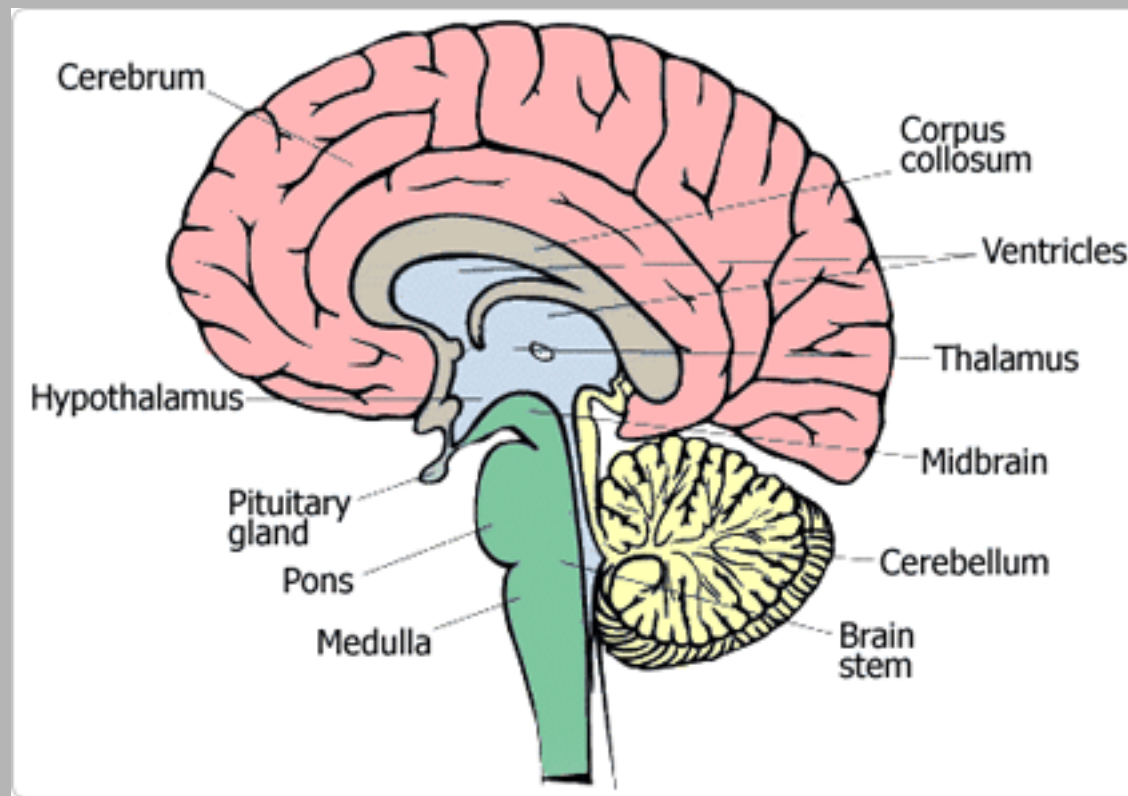


Reflex



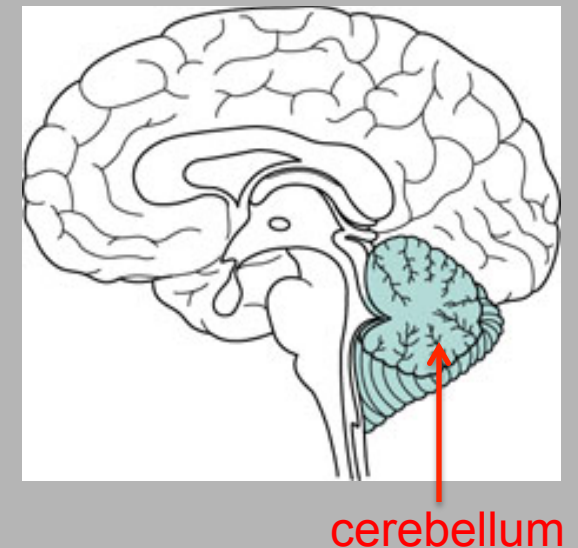
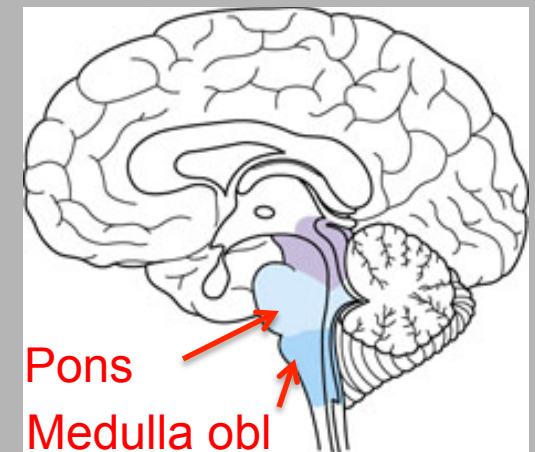


The Brain =
Many Neurons
& Glial Cells = Support Cells



The Brainstem *

- The **Medulla Oblongata** and the **Pons** controls breathing, heart rate, digestion
- The **Cerebellum** controls coordination of movement and balance (Karate; Dance. Separate Section of the brain)



Stairs...

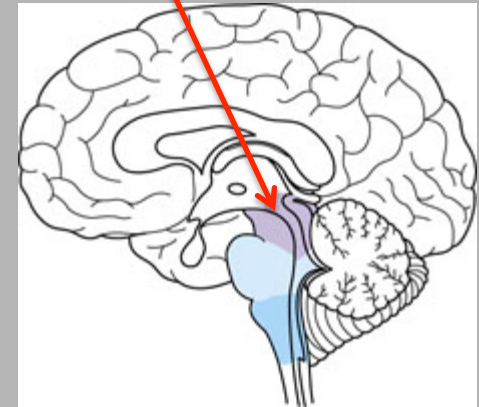


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The Midbrain

- The Midbrain receives, integrates, and projects sensory information to the forebrain

midbrain

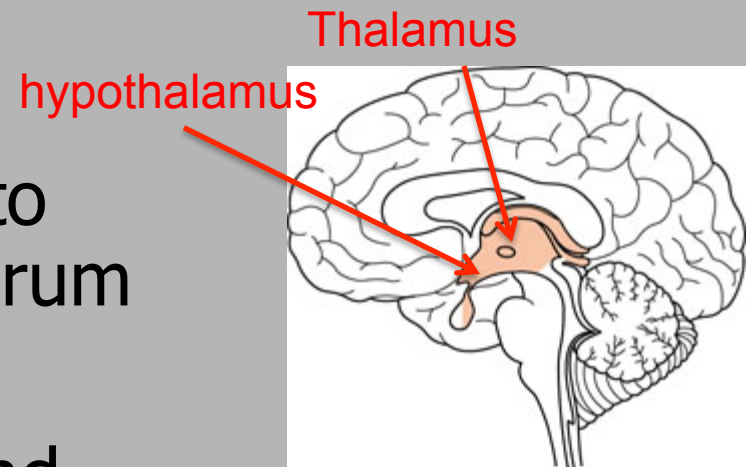


– Thalamus

- conducts information to specific areas of cerebrum

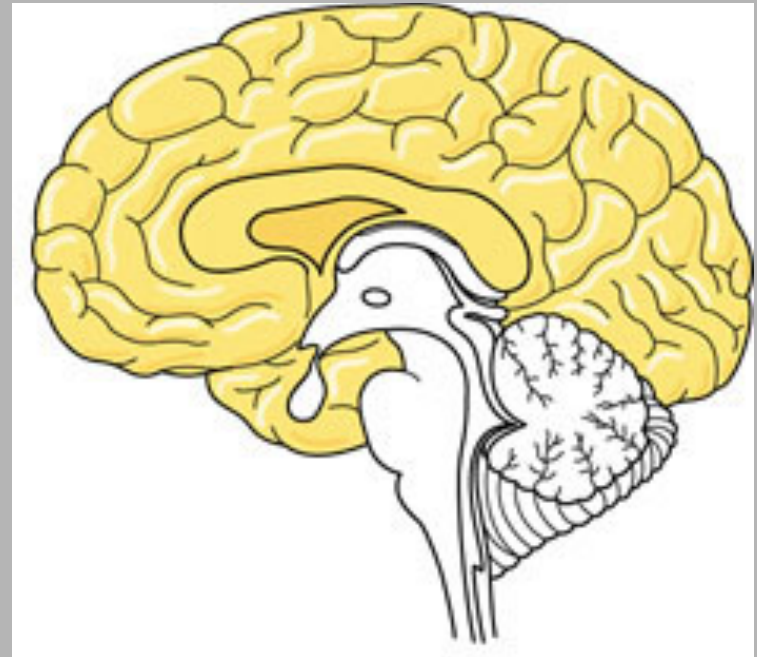
– Hypothalamus

- produces hormones and regulates body temperature, hunger, thirst, sexual response, circadian rhythms

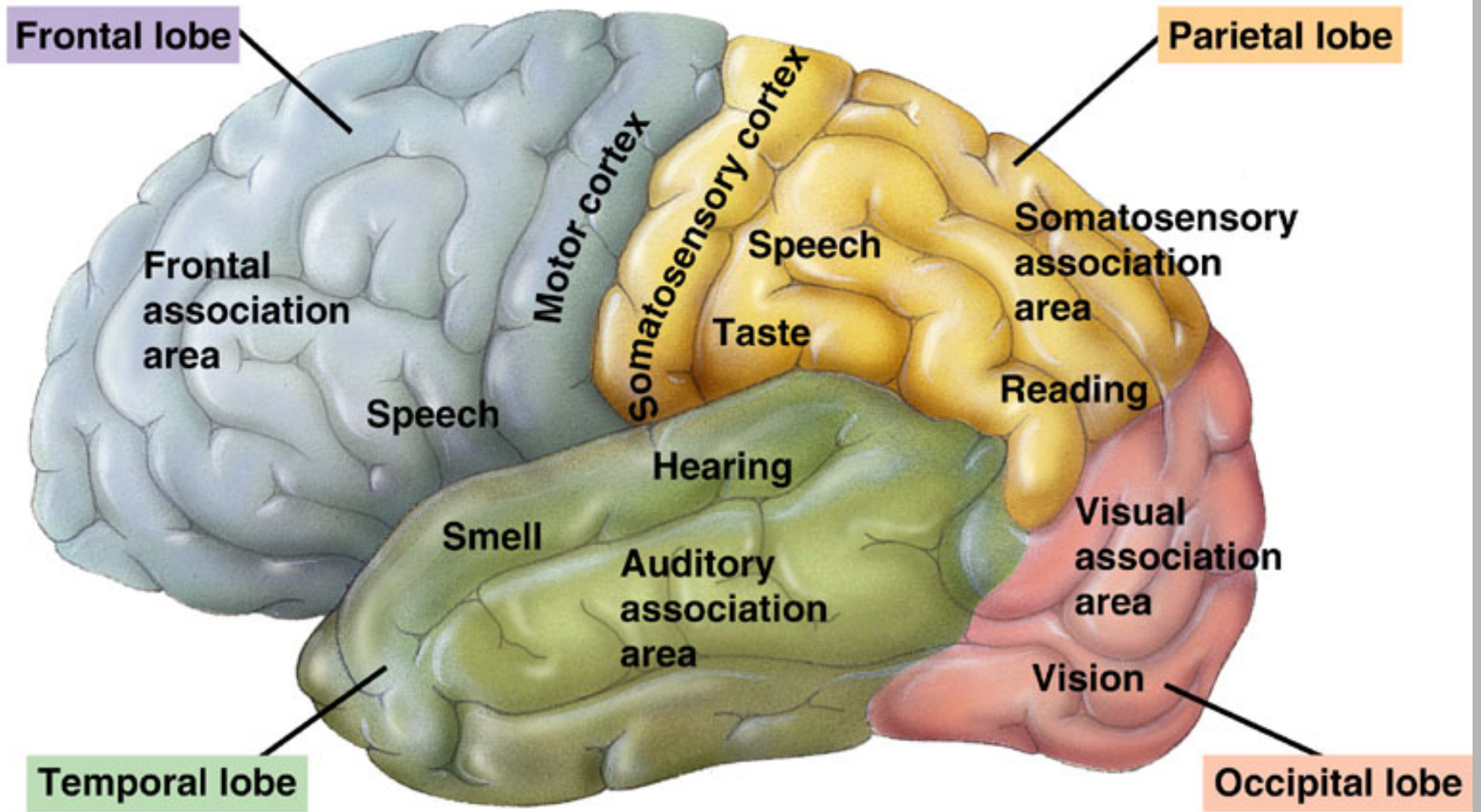


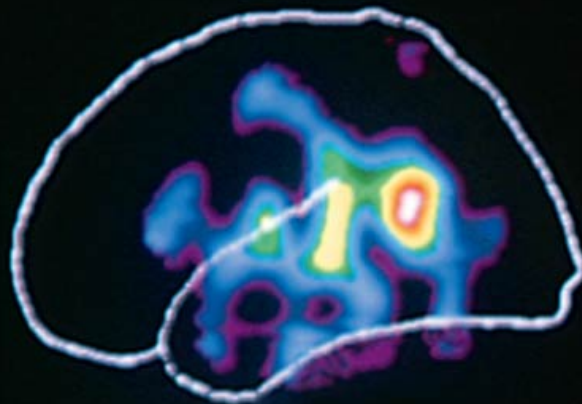
*

- Cerebrum
 - with cortex and corpus callosum
 - higher thinking

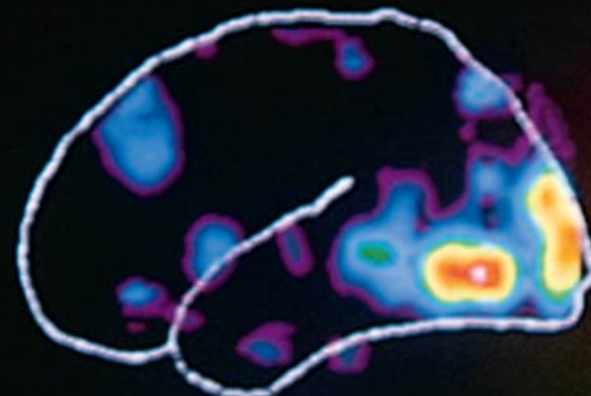


Cerebrum

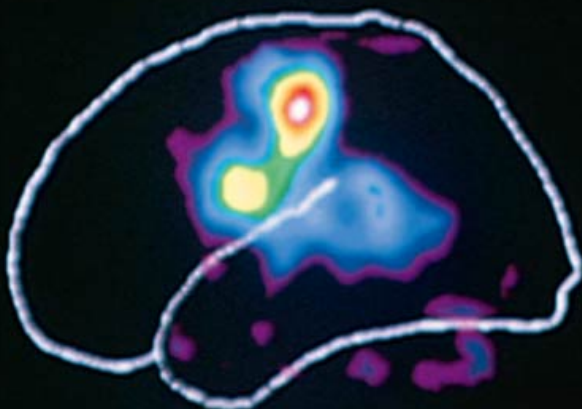




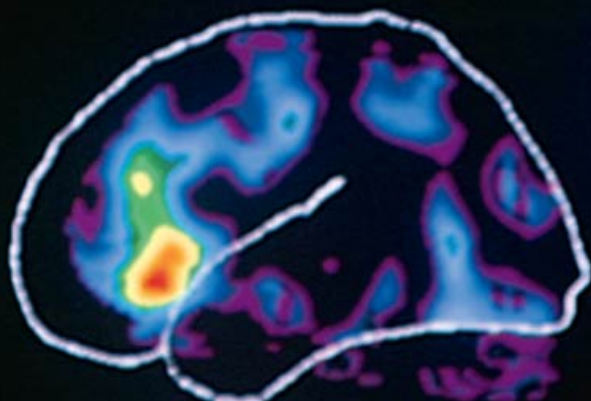
**Hearing
words**



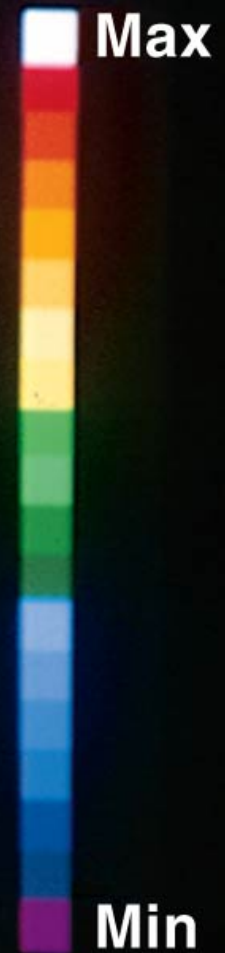
**Seeing
words**



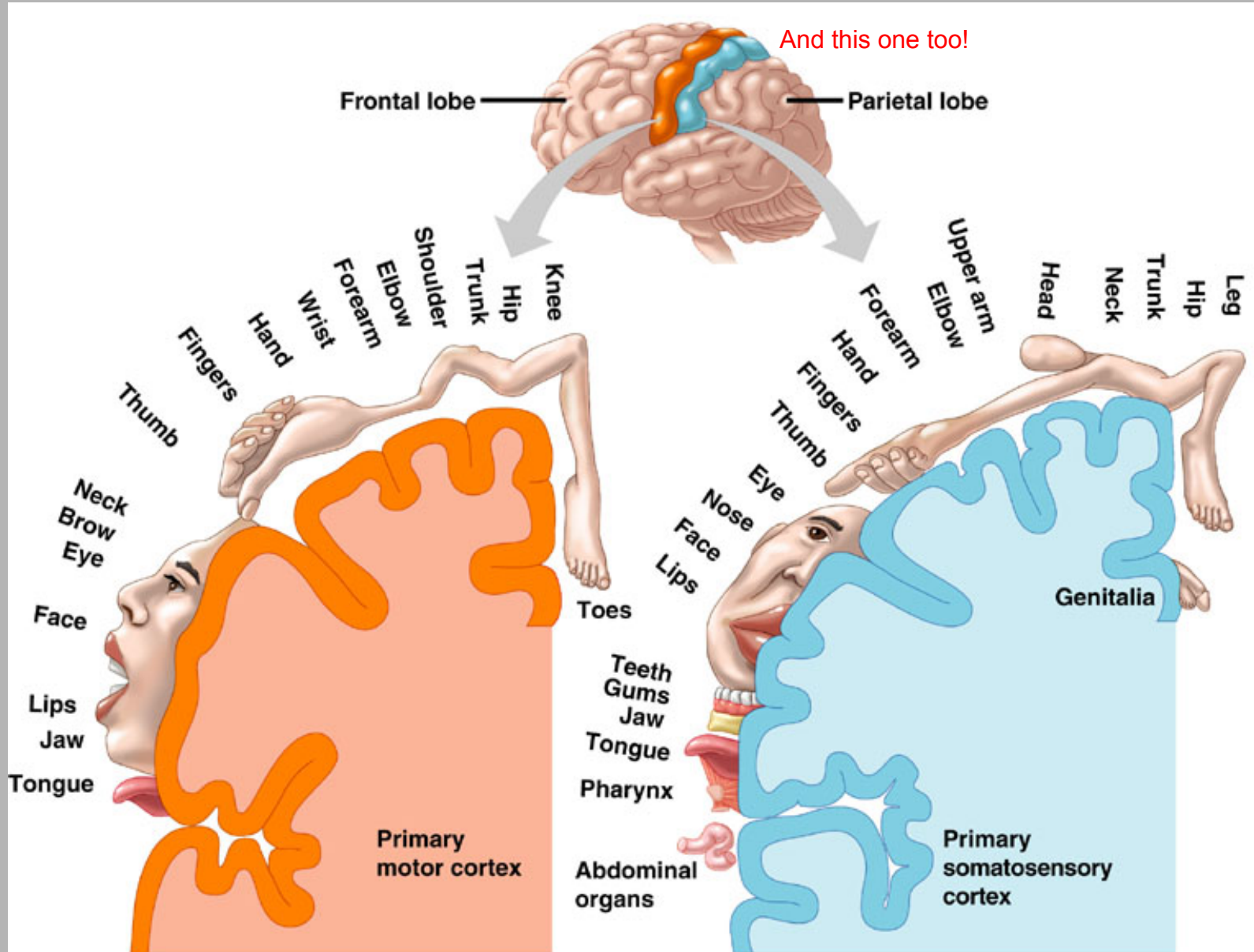
**Speaking
words**

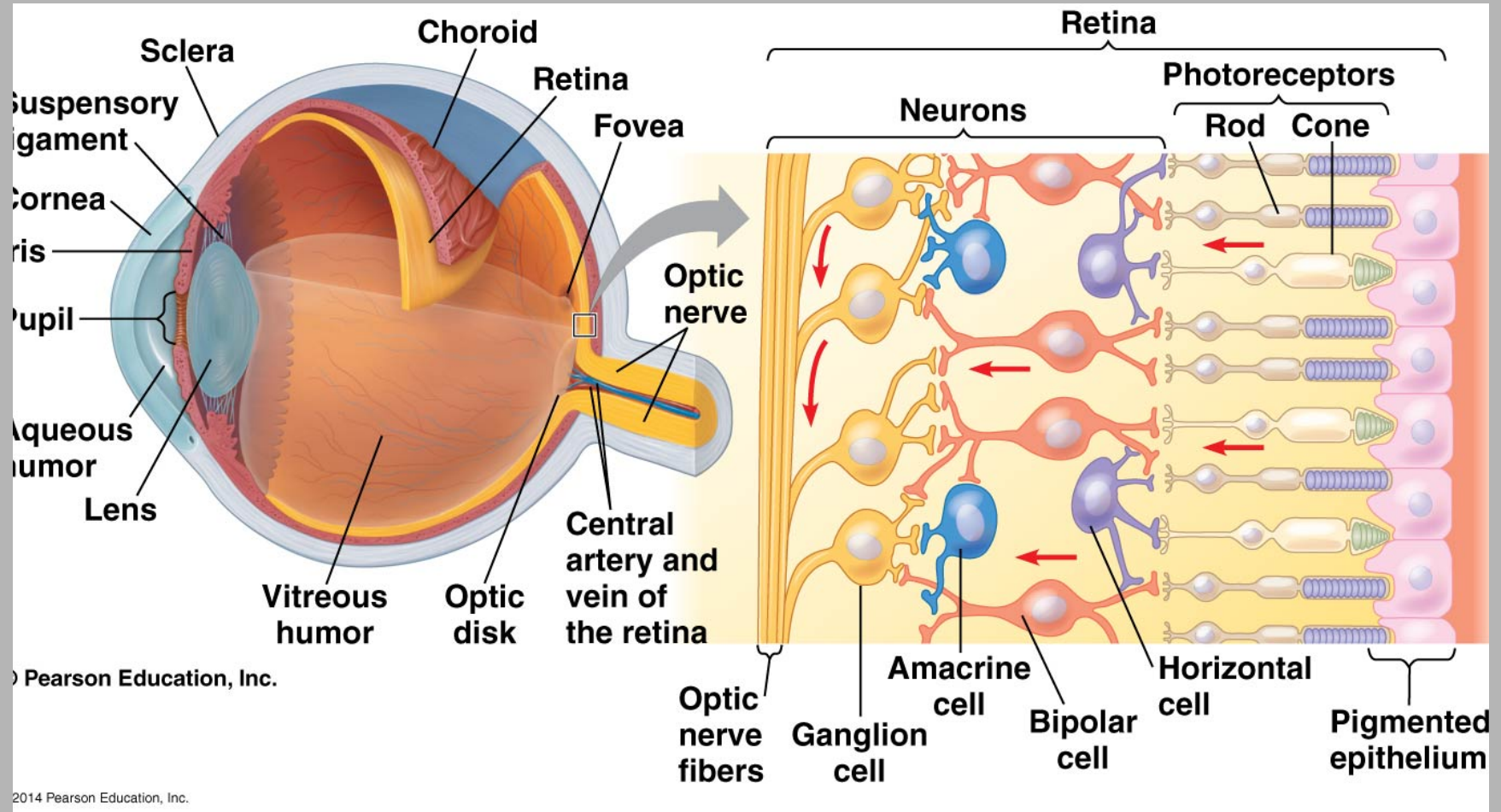


**Generating
words**



Cerebrum





**Right
visual
field**



**Left
visual
field**

**Right
eye**

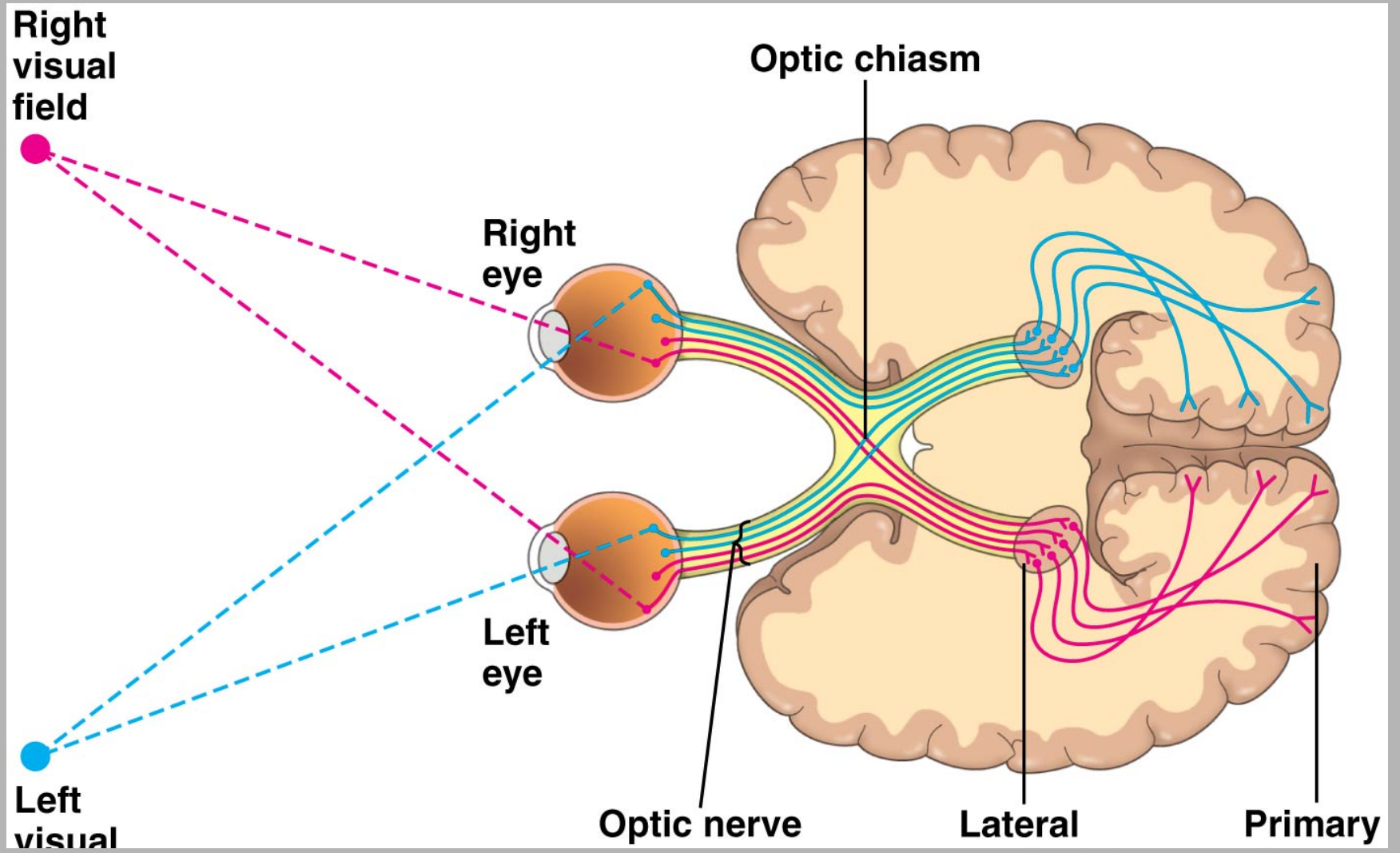
**Left
eye**

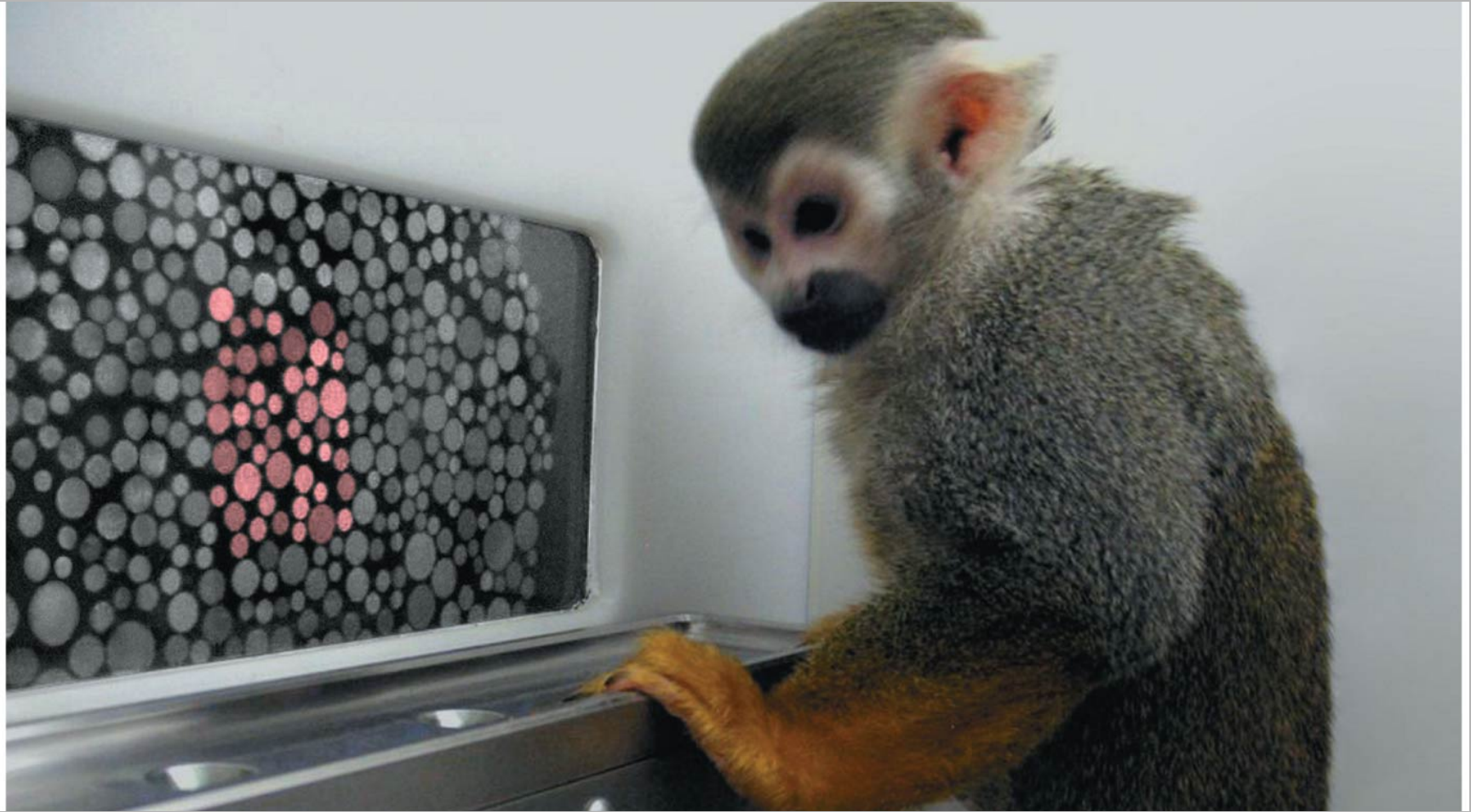
Optic chiasm

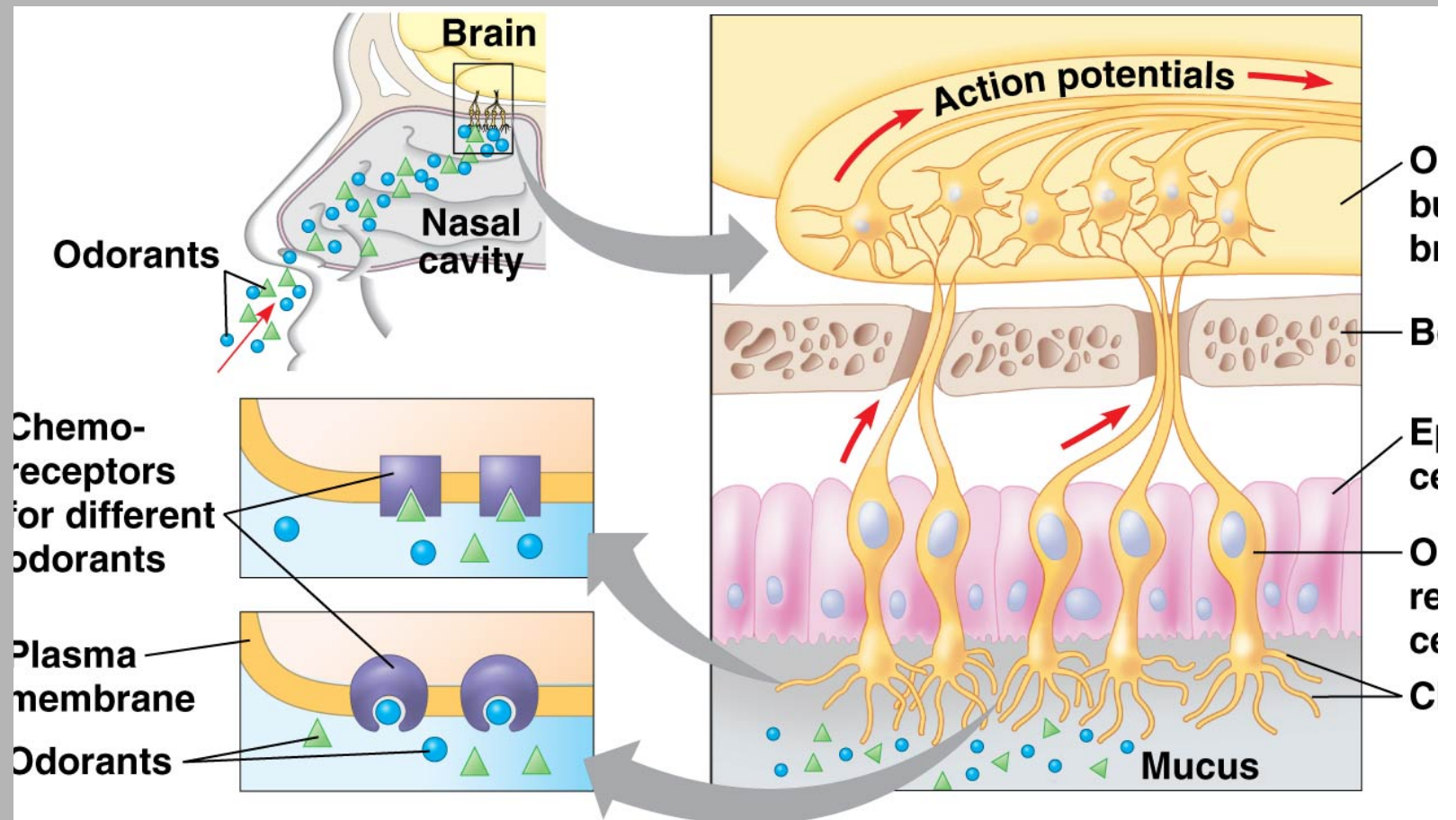
Optic nerve

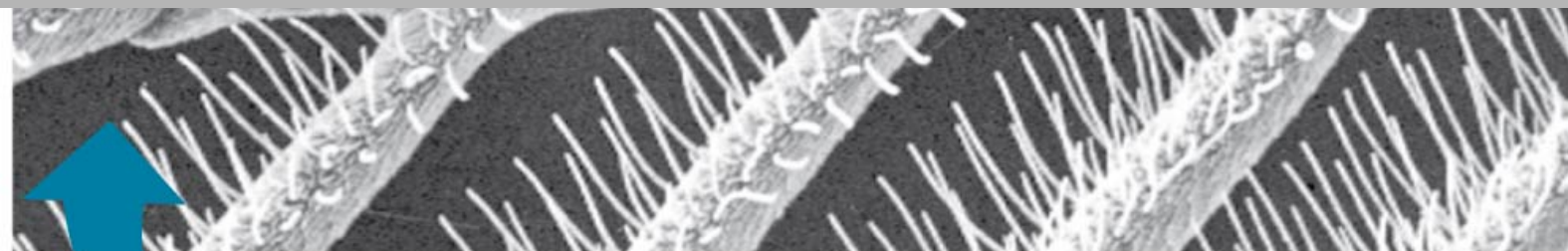
Lateral

Primary

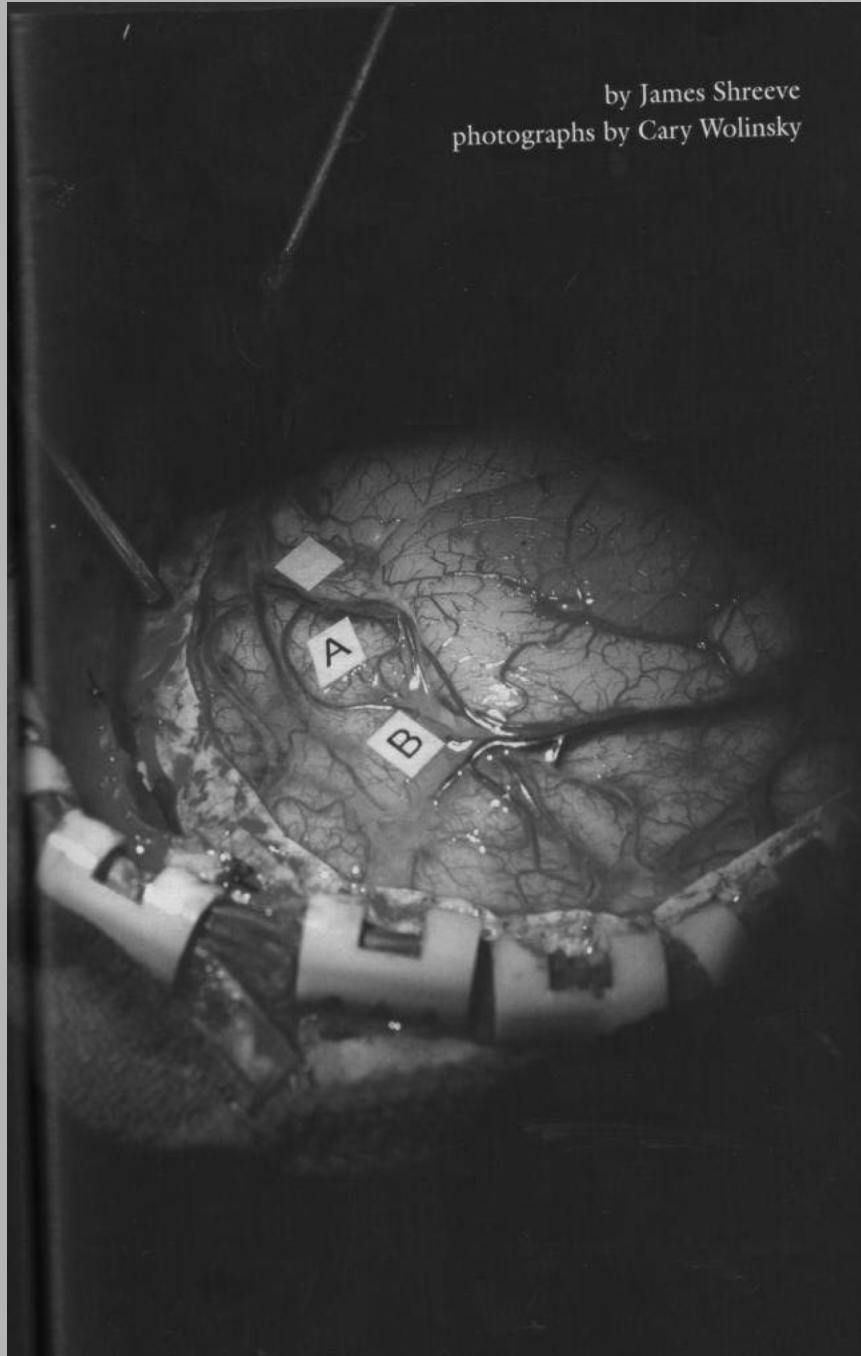








by James Shreeve
photographs by Cary Wolinsky



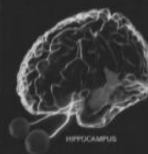


matter in two areas involved in visual and motor activity. When the newly trained jugglers stopped practicing, however, these regions shrank back. Furthermore, neither the driver study nor the juggler study could discern whether the growth in brain volume was due to the reorganization of existing circuits, an increased number of neural connections, or most intriguingly, the birth of actual new brain cells—an idea thought preposterous until recently. In 1998 Fred H. Gage of the Salk Institute in La Jolla, California, showed that new cells can indeed grow in the adult human hippocampus. Gage believes that stem cells, capable of developing into functioning new neurons, may exist elsewhere in

the brain. Better understanding of such nerve regeneration could provide hope for the treatment of Alzheimer's disease, Parkinson's disease, and a host of other degenerative brain disorders.

Meanwhile, Glen McNeill has more work to do with his hippocampus. He has to pass three sets of examinations testing his knowledge of London streets—and then prove familiarity with the surrounding towns.

"The suburbs is the last 'urdle," he says in his thick Cockney accent. "After that you get your lit'l green badge."



...natural setting show no more alarm at the
...t of one than the young primate in the
...ure below, blithely nestled in the coils of
...1-foot python. So is fear of snakes in our
...are or a product of our nurture?

...predisposition to learn to fear something that
...will not. But the predisposition requires social





new evidence for the brain's plasticity, western neuroscientists have taken a keen interest. Can meditation literally change the mind?

For the past several years Richard Davidson and his colleagues at the University of Wisconsin-Madison have been studying brain activity in Tibetan monks, both in meditative and non-meditative states. Davidson's group had shown earlier that people who are inclined to fall prey to negative emotions displayed a pattern of persistent activity in regions of their right prefrontal cortex. In those with more positive temperaments the activity occurred in the left prefrontal cortex instead. When Davidson ran the experiment on a senior Tibetan lama skilled in meditation, the lama's baseline of activity proved to be much farther to the left of anyone previously tested. Judging from this one study, at least, he was quantifiably the happiest man in the world.

Davidson recently tested the prefrontal activity in some volunteers from a high-tech company in Wisconsin. One group of volunteers then received eight weeks of training in meditation, while a control group did not. All the participants also received flu shots.

By the end of the study, those who had meditated showed a pronounced shift in brain activity toward the left, "happier," frontal cortex. The meditators also showed a healthier immune response to the flu shot, suggesting that the training affected the body's health as well as the mind's.

"You don't have to become a Buddhist," says the Dalai Lama himself, who is closely following the work of Western cognitive scientists like Davidson. "Everybody has the potential to lead a peaceful, meaningful life." □