Neurophysiology- Organization of Central Nervous System- Introduction- L1

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Neurophysiology (*Medical*) spring 2017

Textbook: Textbook of Medical Physiology By : Arthur C. Guyton and John E. Hall, 12th Ed. 2011 or 13th ed. 2016

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Lect. No.	Topic	12th Ed.	13th Ed
1.	Introduction, CNS organization	543-546	577-580
2.	Motor cortex and Brain Stem	667-678	707-719
3.	Cerebellum	681-689	721-730
4.	Cerebellum		
5.	Cerebellum		
6.	Basal ganglia	689-695	730-736
7.	Spinal cord	655-665	695-706
8.	Spinal cord		
9.	Synaptic function	546-558	580-593
10.	Sensory receptors function and neural mechanisms	559-570	595-606
11.	Sensory receptors		
12.	Somatic sensations - tactile and Position	571-582	607-619
13.	Somatic sensations - pain, thermal	583-593	621-632
14.	Vision	597-632	635-670
15.	Vision		
16.	Vision		
17.	Hearing	633-643	673-783
18.	Hearing		
19.	Chemical senses, taste and smell	645-652	685-692
20.	Cerebral cortex: Intellectual Functions	697-709	737-749
21.	Cerebral cortex: Intellectual Functions		
22.	Reticular activating System and sleep	711-714 721-728	751-755 763-772

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Optional Reading:

1. Physiology, by: Robert Berne & Matthew Levy, 6th. ed. 2010
2. Human physiology, by: Lauralee Sherwood, last edition.

Objectives

At the end of the lecture students should be able to:

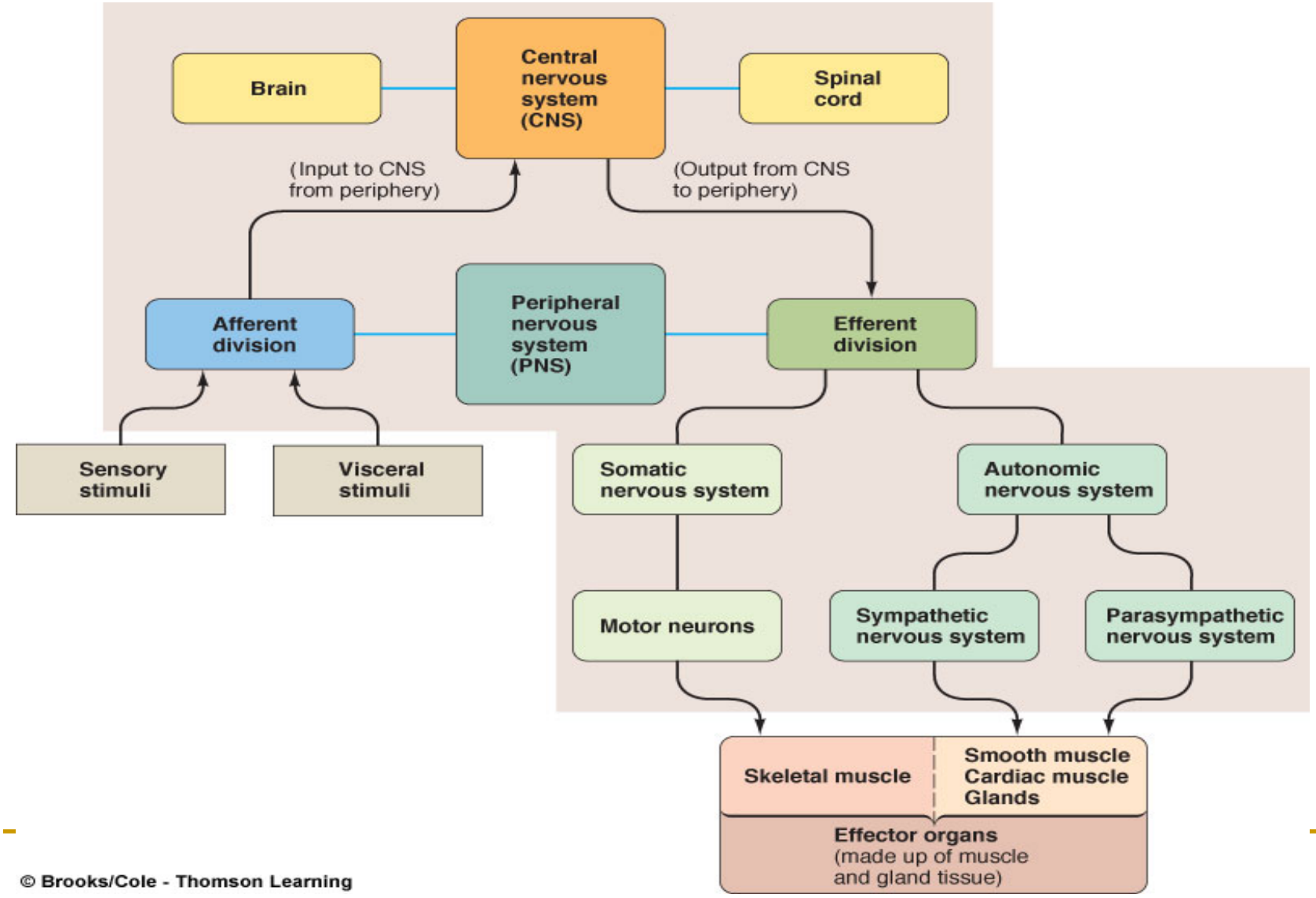
- State the parts of the central nervous system
- Describe the level of organization of the CNS
- List the major functions of the CNS
- Compare the Endocrine system and nervous system
- Describe the anatomy of the functional unit of the nervous system
- Determine the area of communication in the CNS

Comparison between Nervous and Endocrine Control System

- Nervous system is fast compared to endocrine
- Nervous system uses Action Potentials compared to chemicals (Hormones) the endocrine system uses
- Nervous system have low gain compared to very high gain for the Endocrine system
- Nervous system affects skeletal muscle and glands, but the endocrine affects growth, metabolism and reproduction

$$Gain = \frac{Correction}{Error}$$

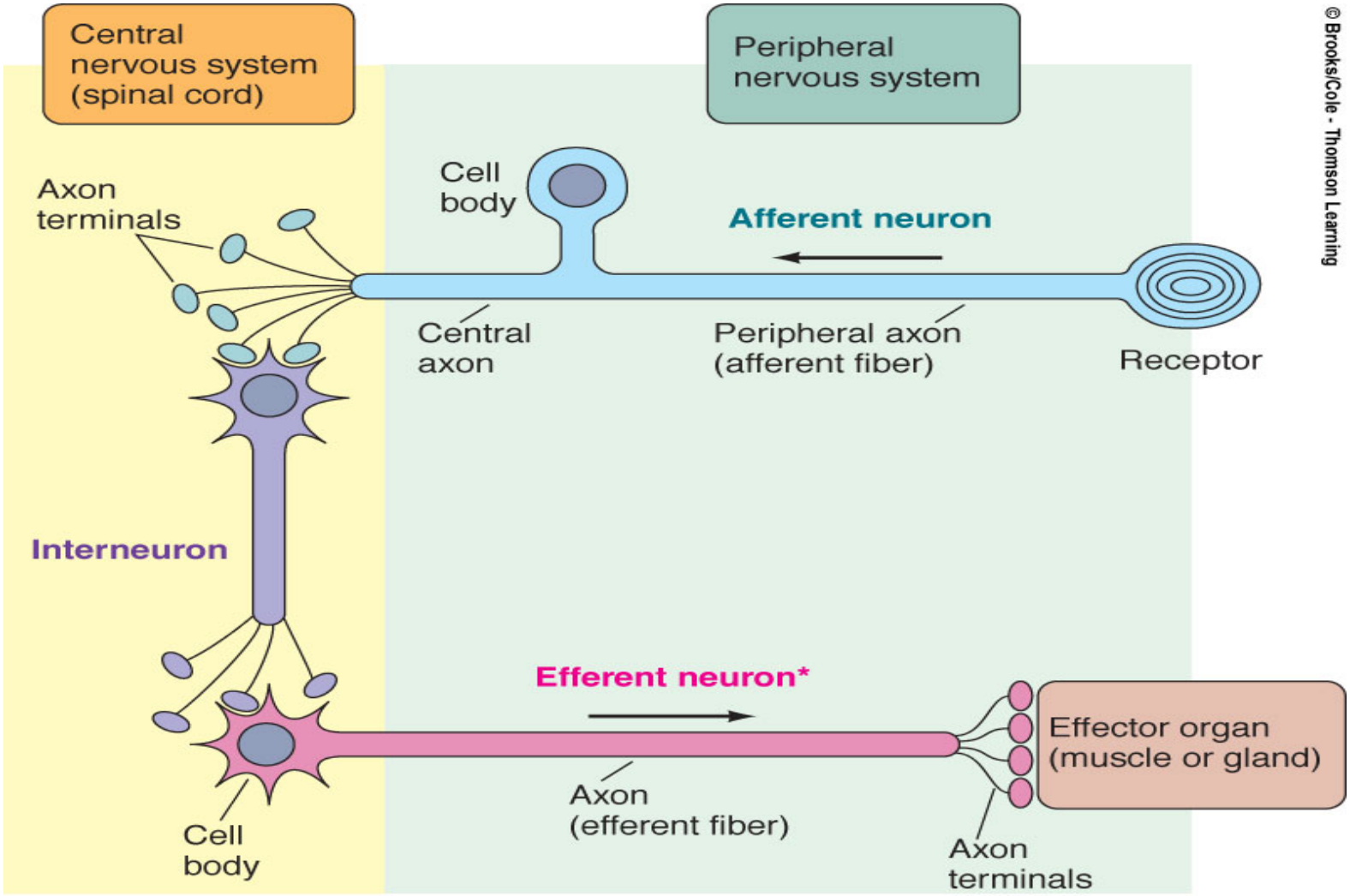
Organization of Nervous System



Organization of the Nervous System

- Sensory Division
  - tactile, visual, auditory, olfactory
- Integrative Division
  - process information, creation of memory
- Motor Division
  - respond to and move about in our environment

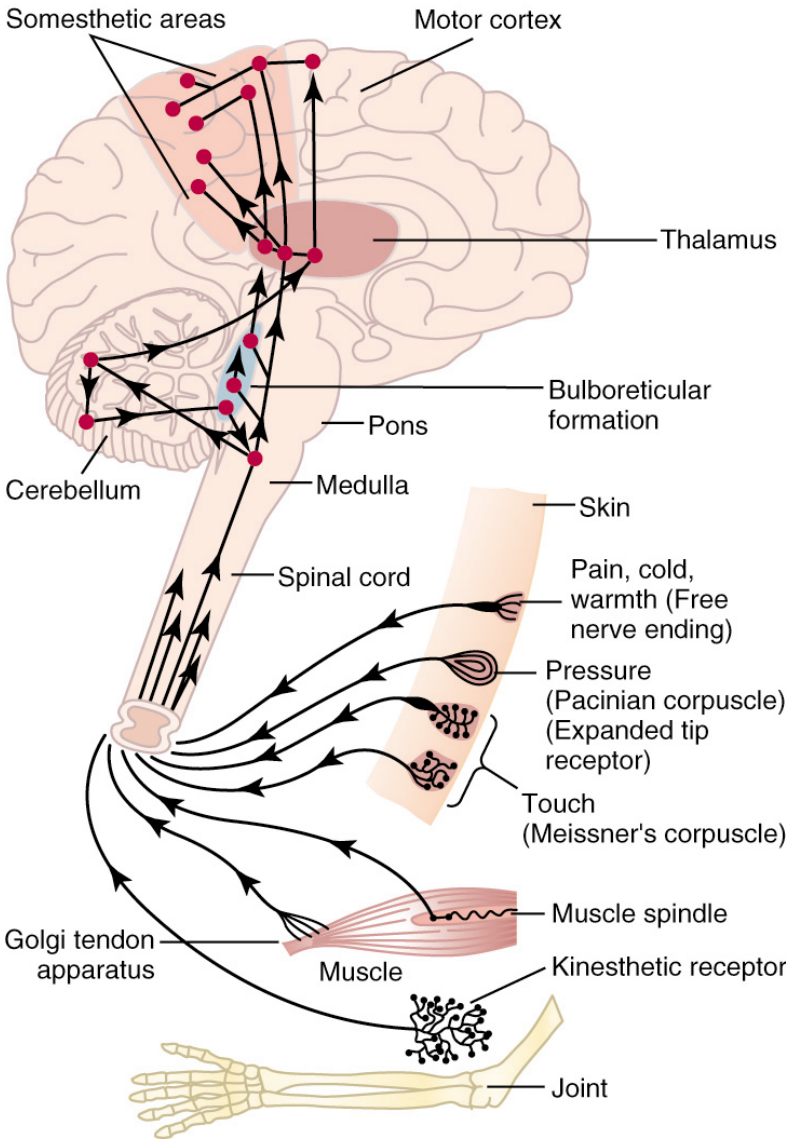
Functional Classes of Neurons



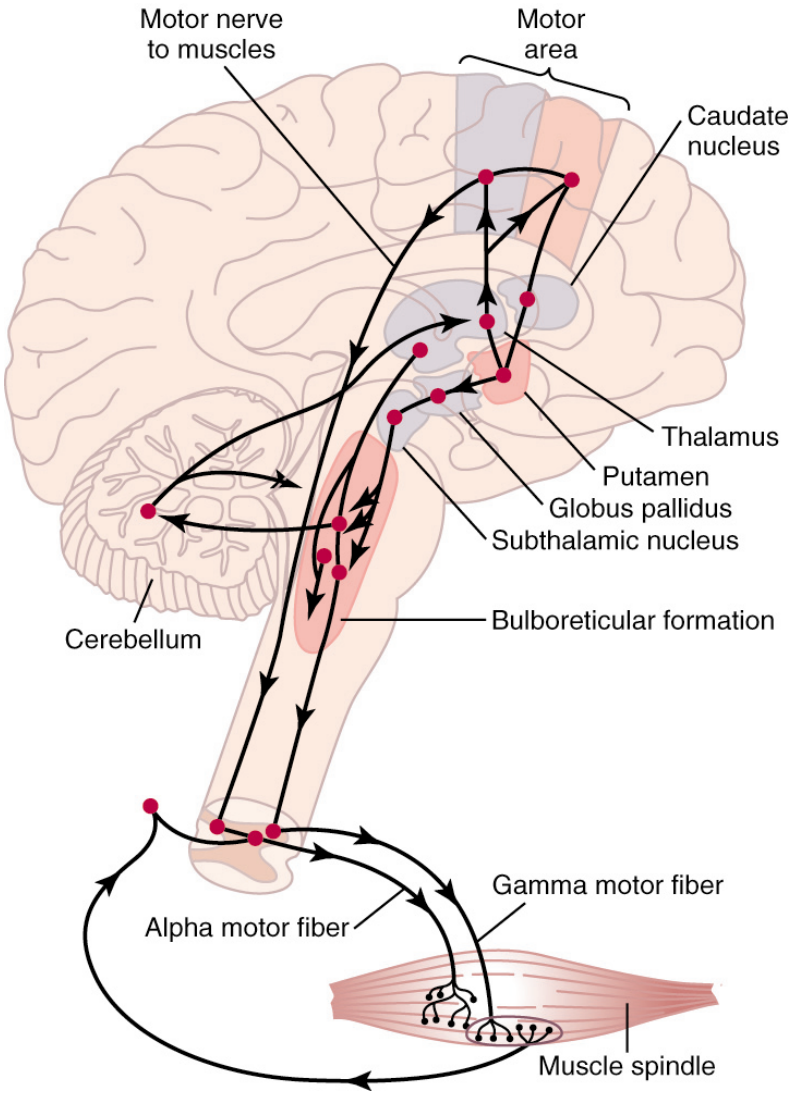
* Efferent autonomic nerve pathways consist of a two-neuron chain between the CNS and the effector organ.

Functional Classes of Neurons

- Afferent neurons
  - Inform CNS about conditions in both the external and internal environment
- Efferent neurons
  - Carry instructions from CNS to effector organs – muscles and glands
- Interneurons
  - Found entirely within CNS
  - Responsible for
    - Integrating afferent information and formulating an efferent response
    - Higher mental functions associated with the “mind”

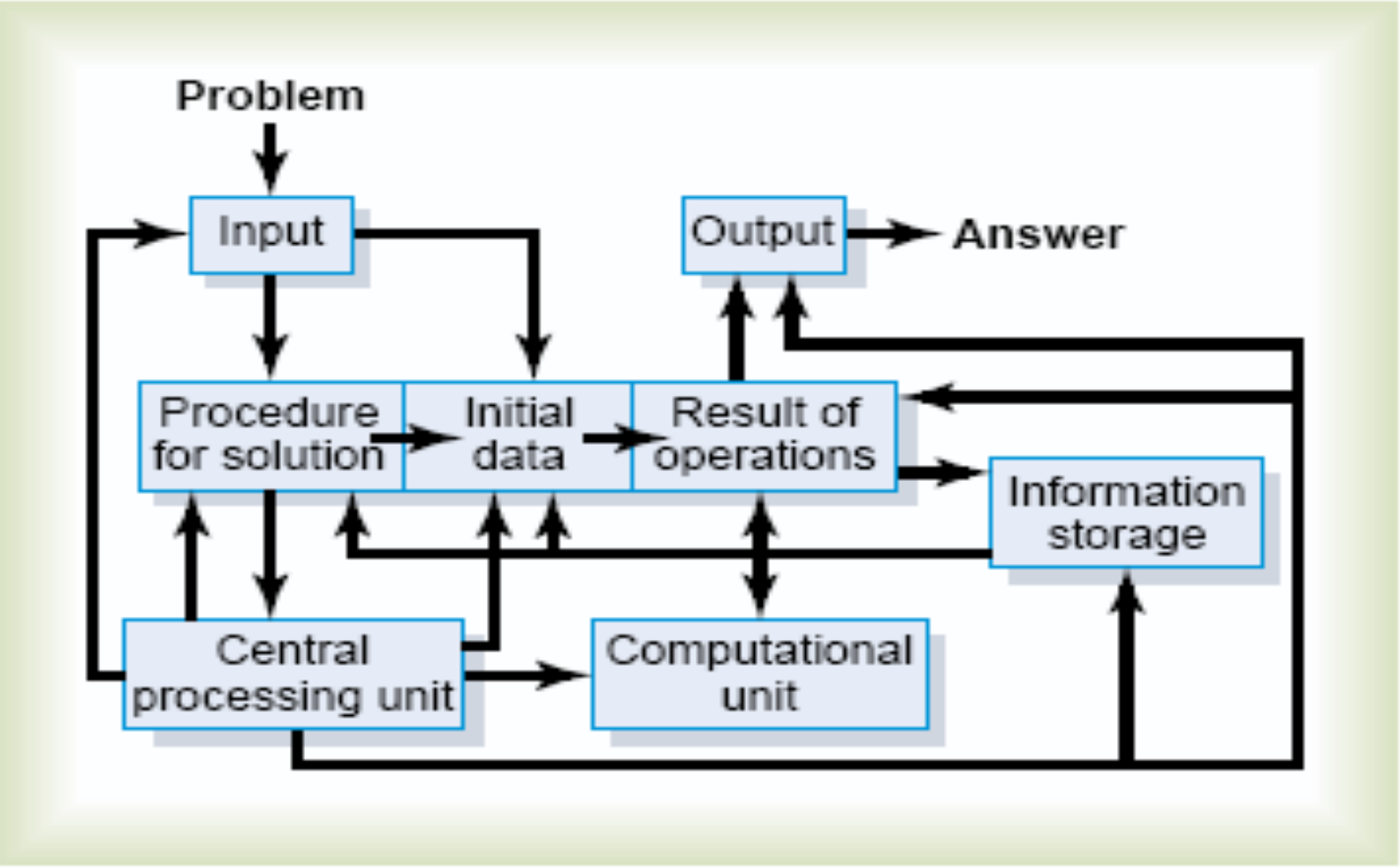


Somatosensory Axis of the Nervous System



Skeletal Motor Nerve Axis of the Nervous System

Central Nervous System compared to Computer system



Levels of CNS Function- 3 major levels

1. The spinal cord level

more than just a conduit for signals from periphery of body to brain and vice versa

- cord contains:
  - walking circuits
  - withdrawal circuits
  - support against gravity circuits
  - circuits for reflex control of organ function

2. The Lower Brain Level

- Contains:

  medulla, pons, mesencephalon, hypothalamus, thalamus, cerebellum and basal ganglia

- Controls subconscious body activities:

  arterial pressure, respiration, equilibrium, feeding reflexes, emotional patterns

3. The Higher Brain or Cortical Level

- Cortex never functions alone, always in association with lower centers
- Large memory storehouse
- Essential for thought processes
- Each portion of the nervous system performs specific functions, but it is the cortex that opens the world up for one's mind.

Anatomy of a Neuron

- 3 major components:
  1. Soma - main body of the neuron
  2. Axon - extends from soma to the terminal
     the effector part of the neuron
  3. Dendrite - projections from the soma
     the sensory portion of the neuron

Functional Unit (Neuron)

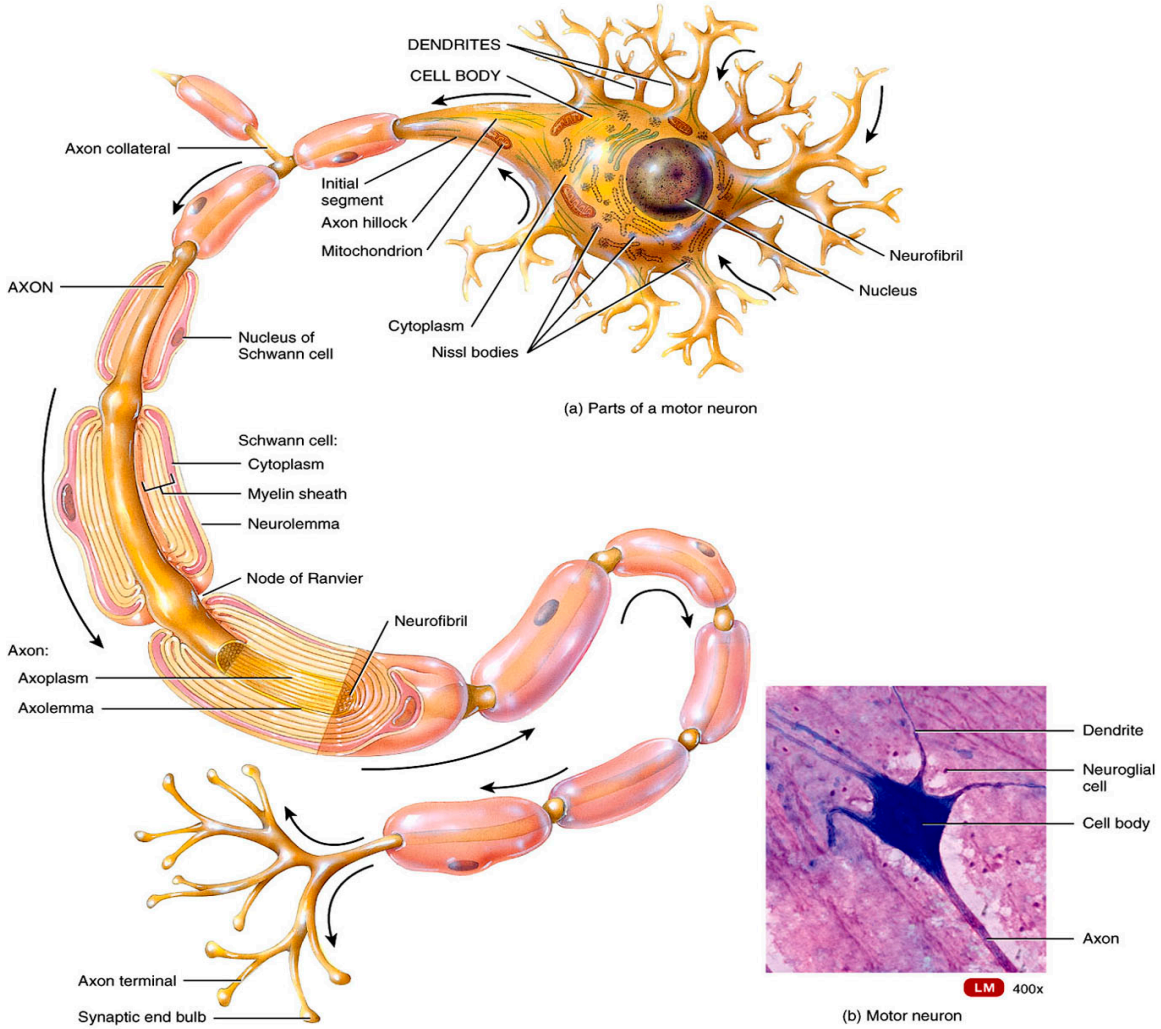
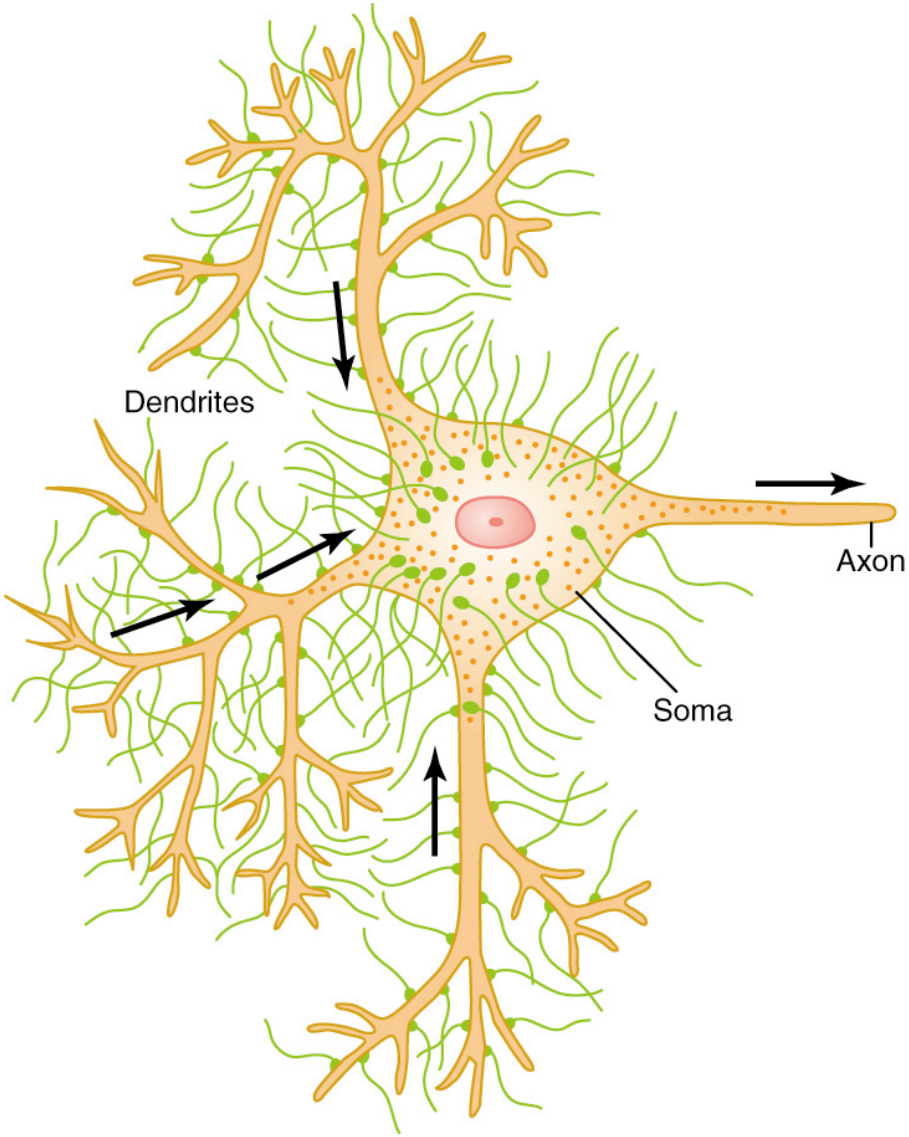
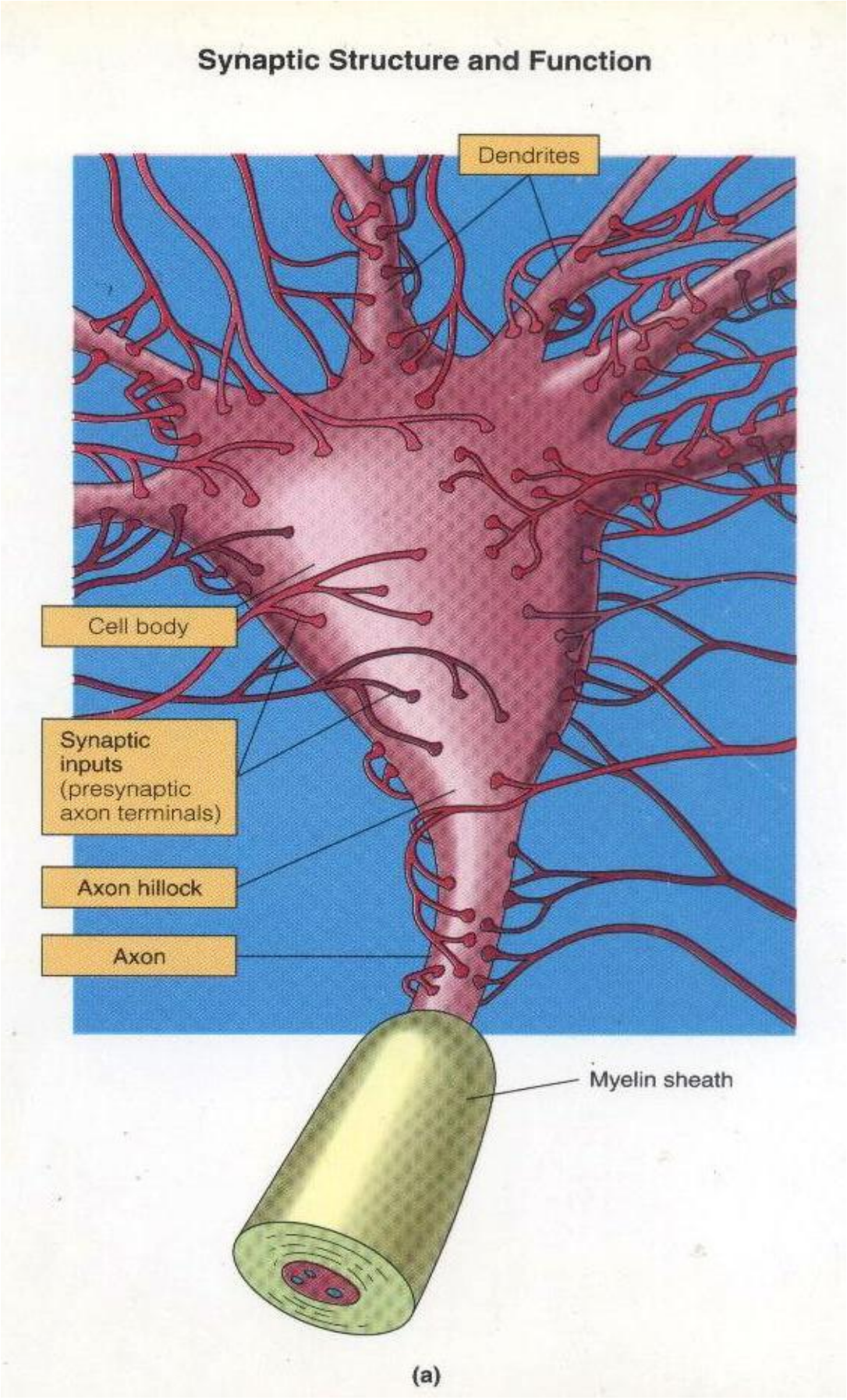


Figure 12.02 Tortora - PAP 12/e



Anterior Motor Neuron


Synaptic Structure and Function
Dendrites
Cell body
Synaptic inputs (presynaptic axon terminals)
Axon hillock
Axon
Myelin sheath
(a)

Communication Between Neurons

- Through release of chemical transmitters

  more than 50 compounds have been identified as transmitter substances

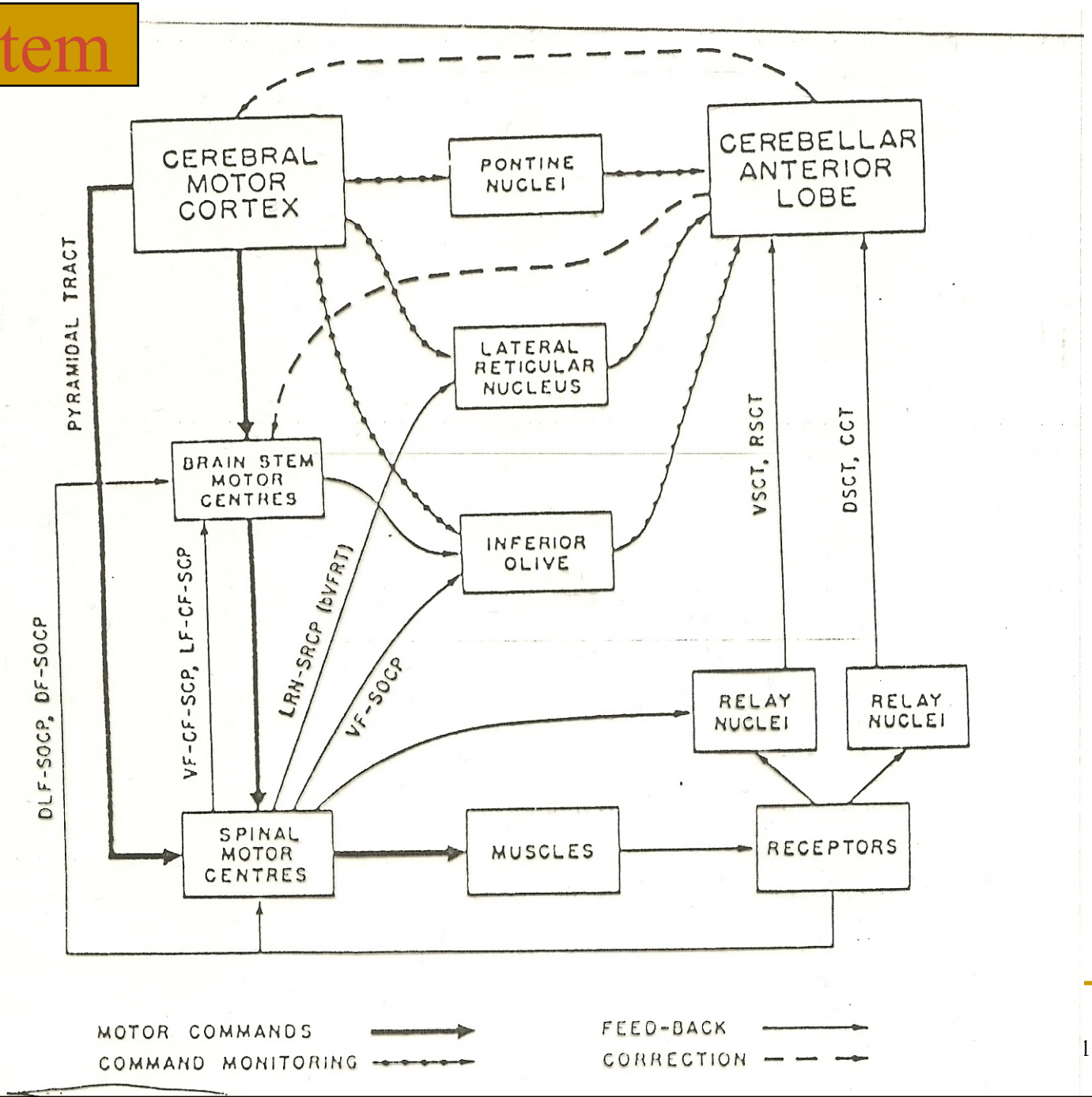
- General characteristics of neuronal communication:

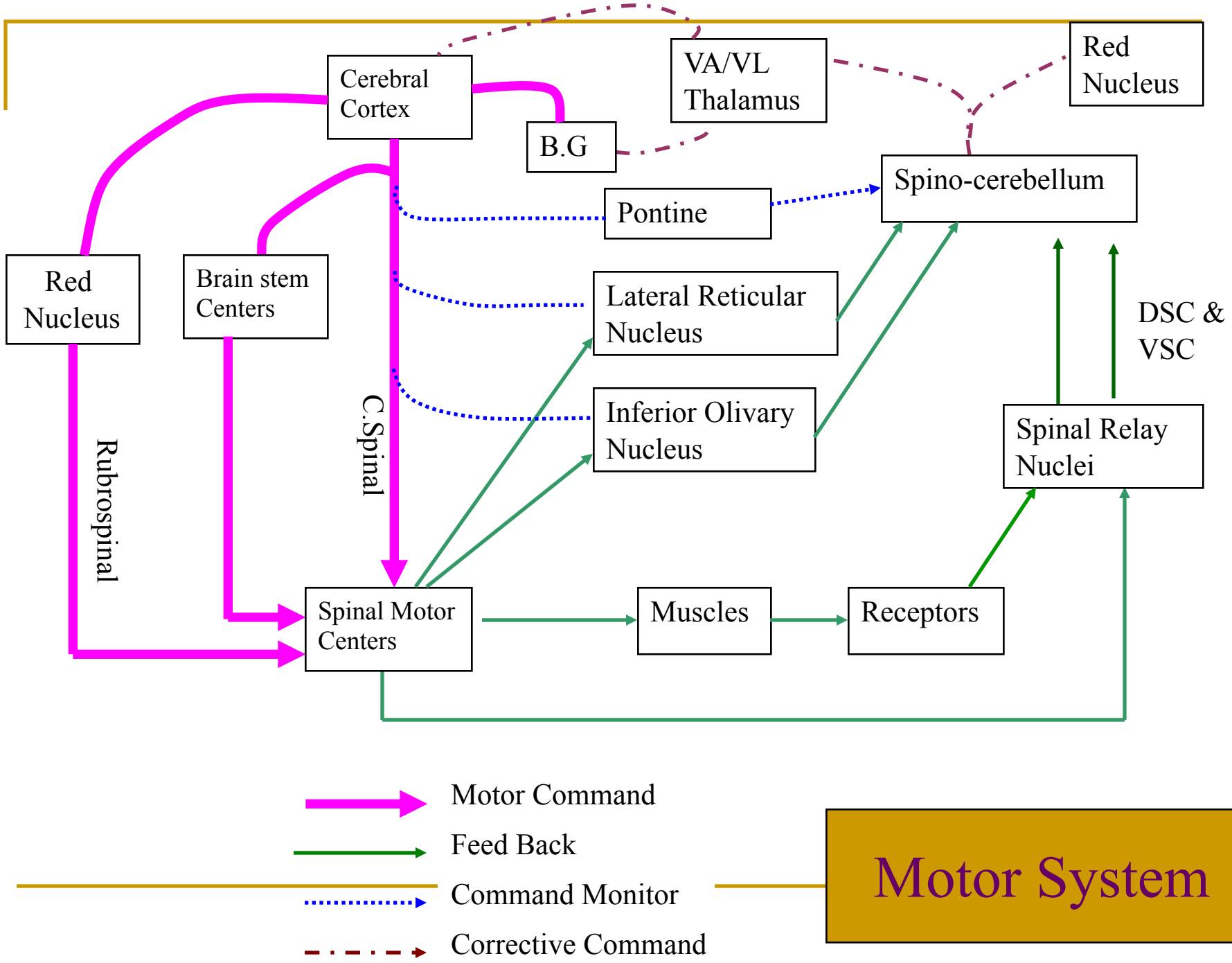
  one-way conduction, always transmits signals in one direction

  this allows signals to be directed toward specific goals

Motor system-Motor Functions

Motor System




Cerebral Cortex
VA/VL Thalamus
Red Nucleus
B.G
Spino-cerebellum
Pontine
Red Nucleus
Brain stem Centers
Lateral Reticular Nucleus
DSC & VSC
Inferior Olivary Nucleus
Spinal Relay Nuclei
C.Spinal
Rubrospinal
Spinal Motor Centers
Muscles
Receptors
Motor Command
Feed Back
Command Monitor
Corrective Command
Motor System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JDRF 2005
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