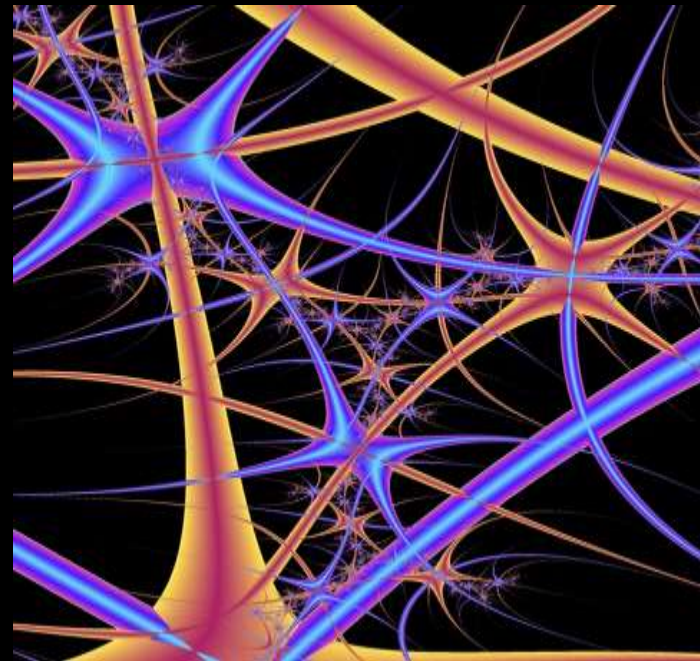
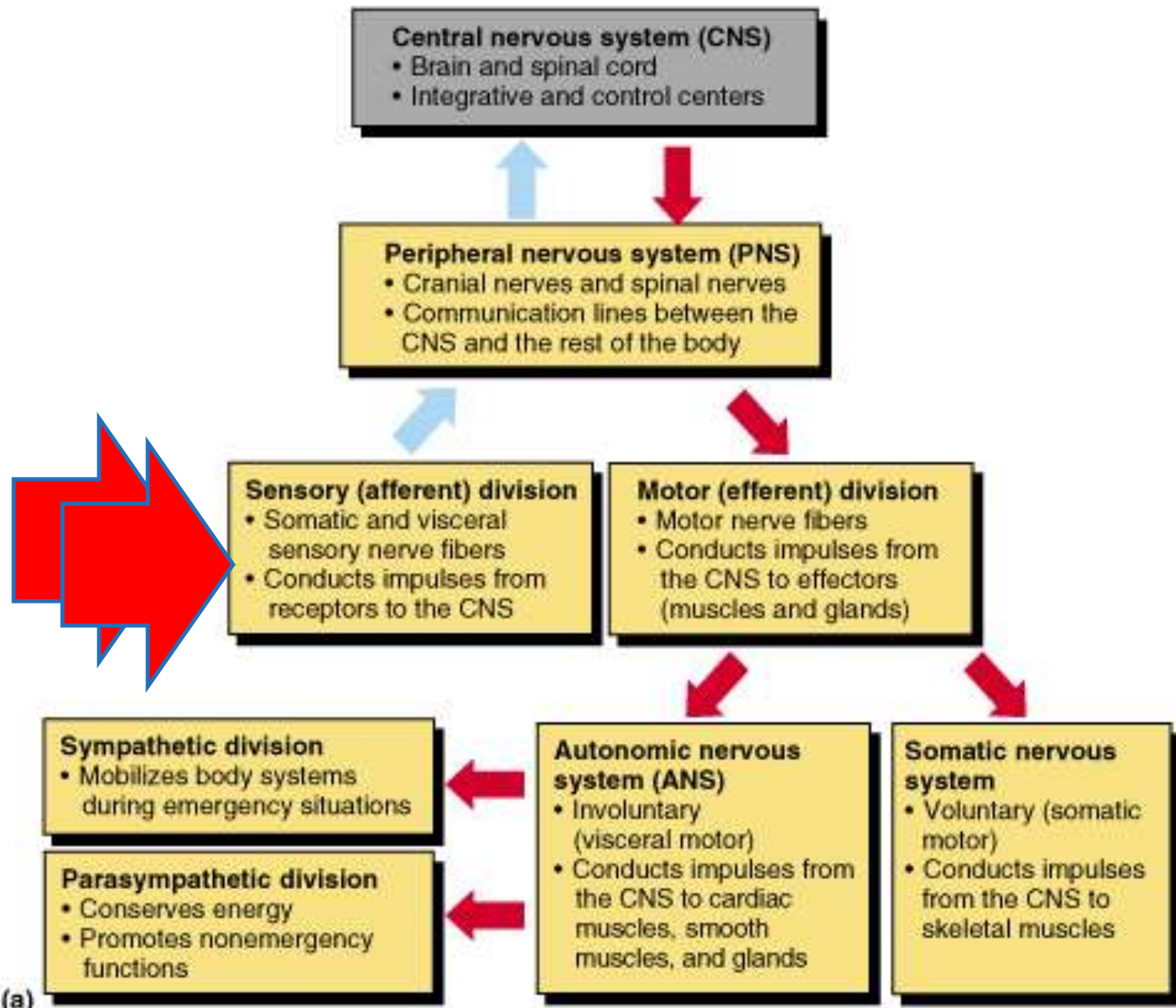


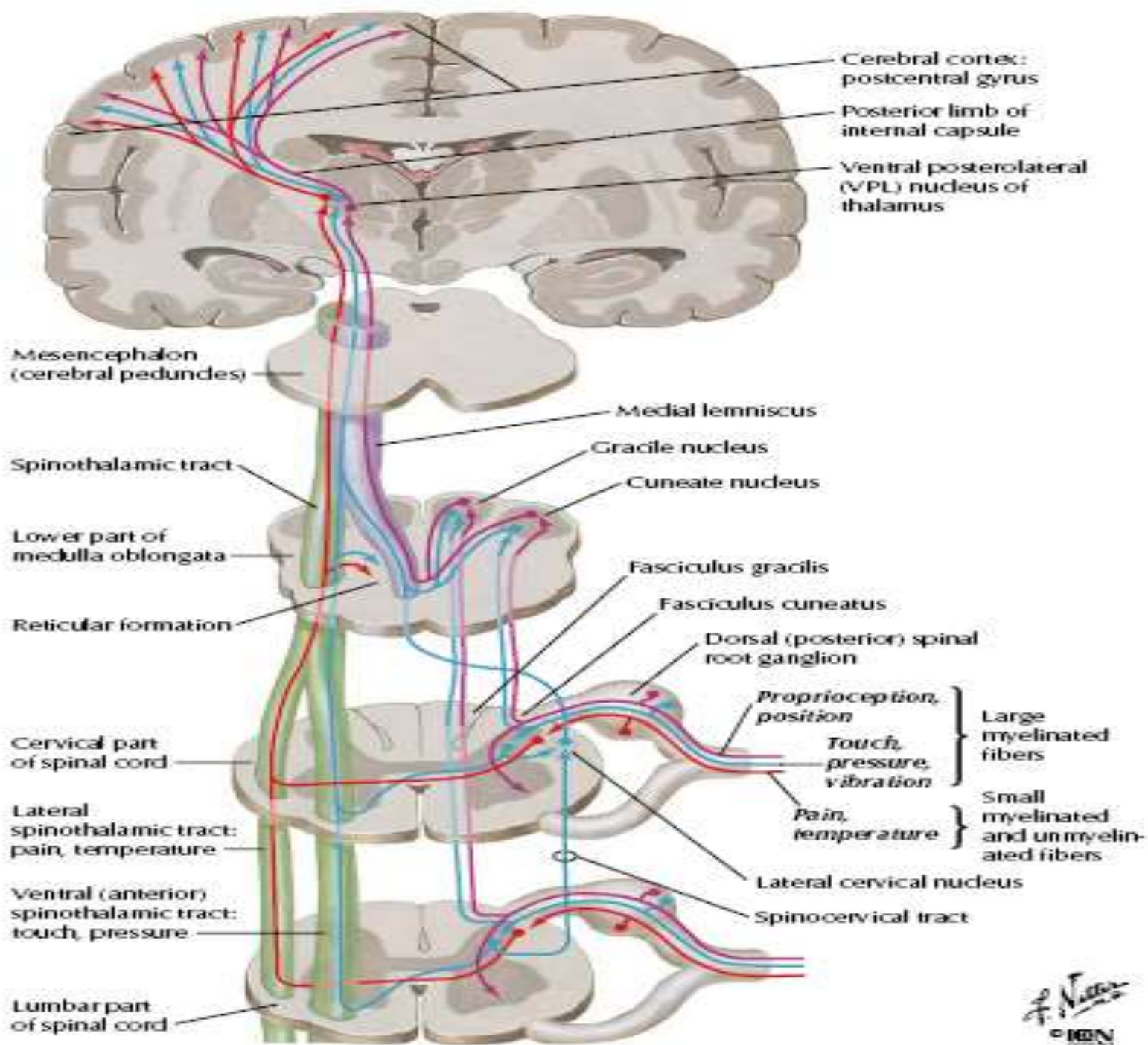
# SISTEM SARAF SENSORIK DAN MOTORIK

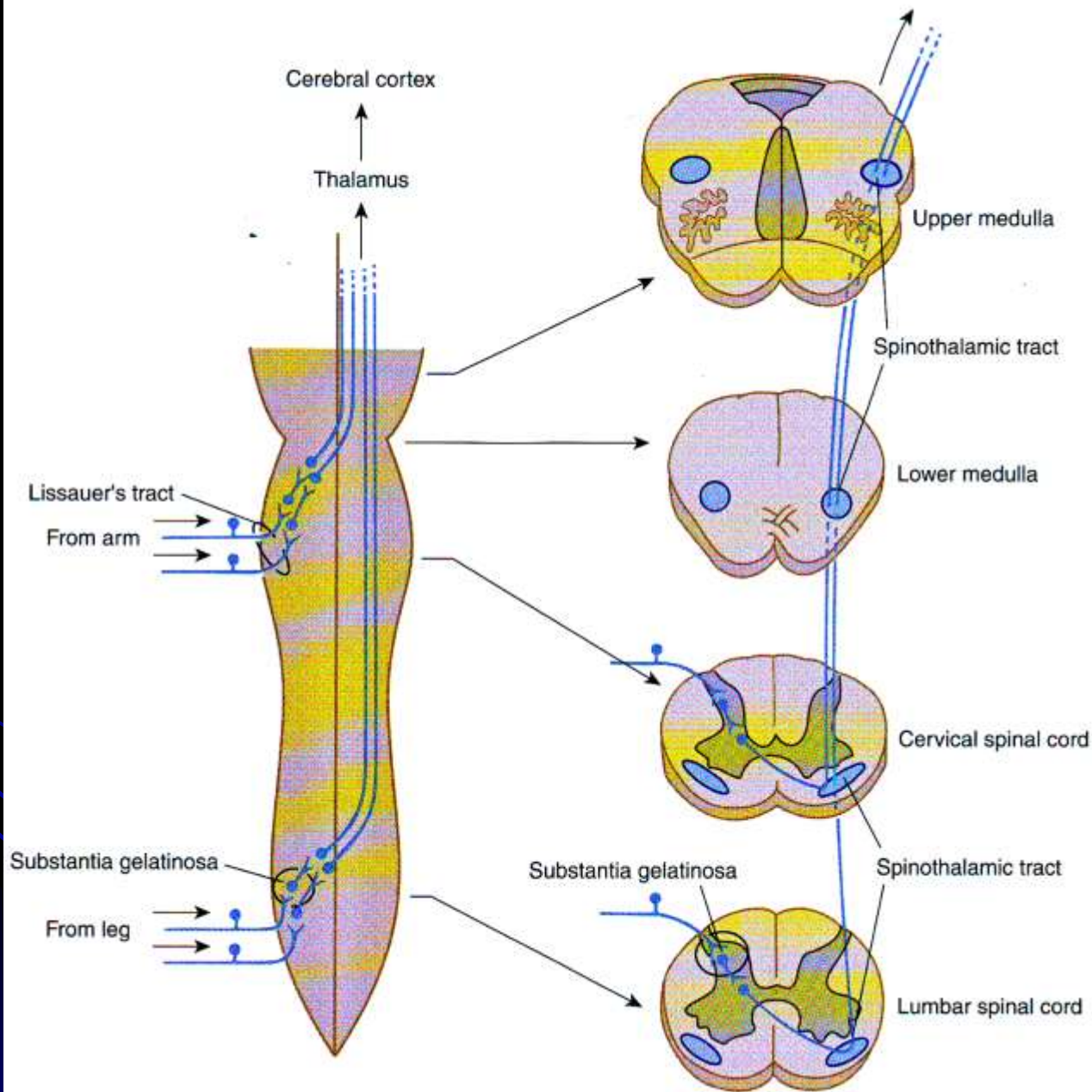


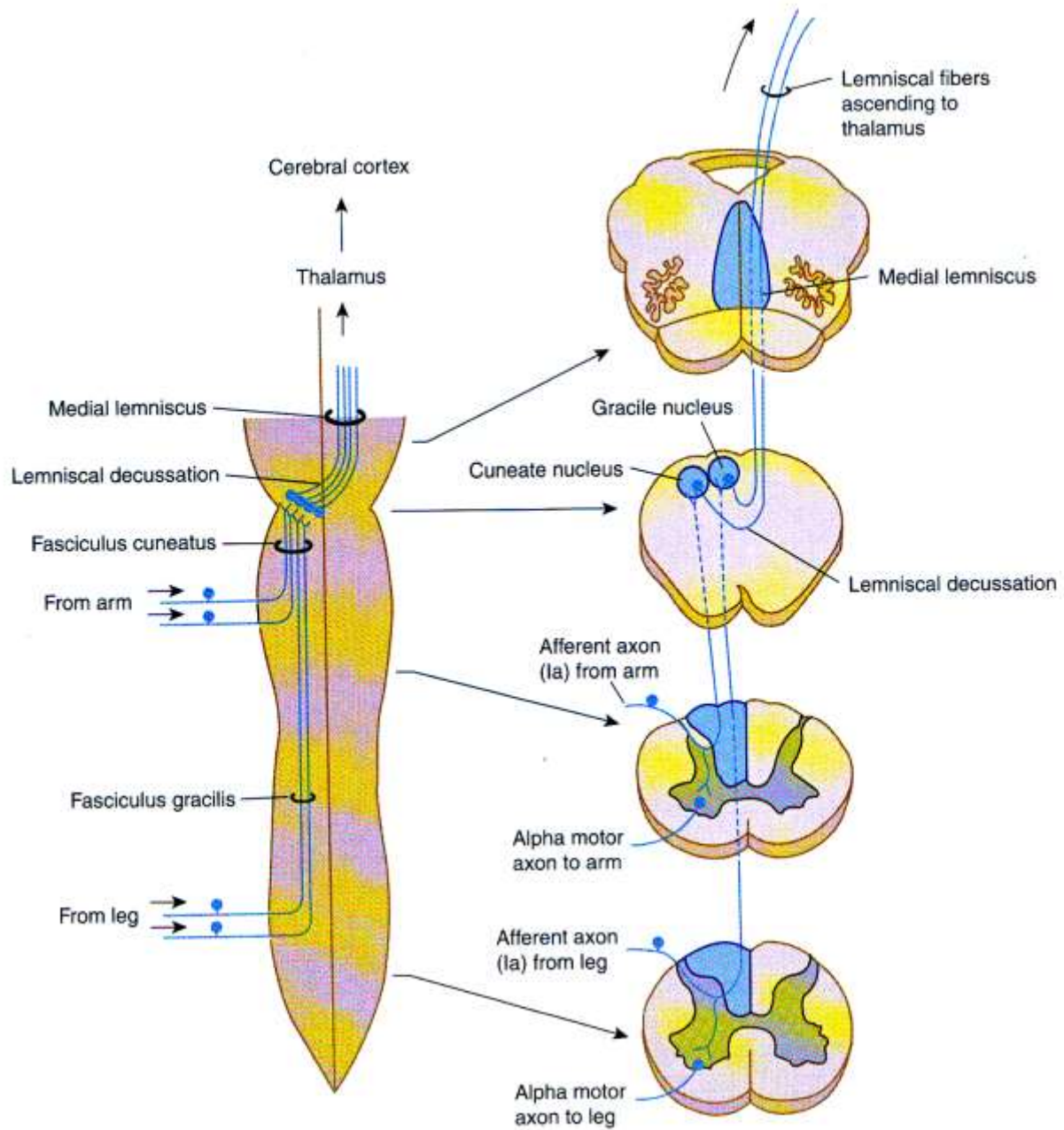
**Dr. Moch. Bahrudin, Sp.S**









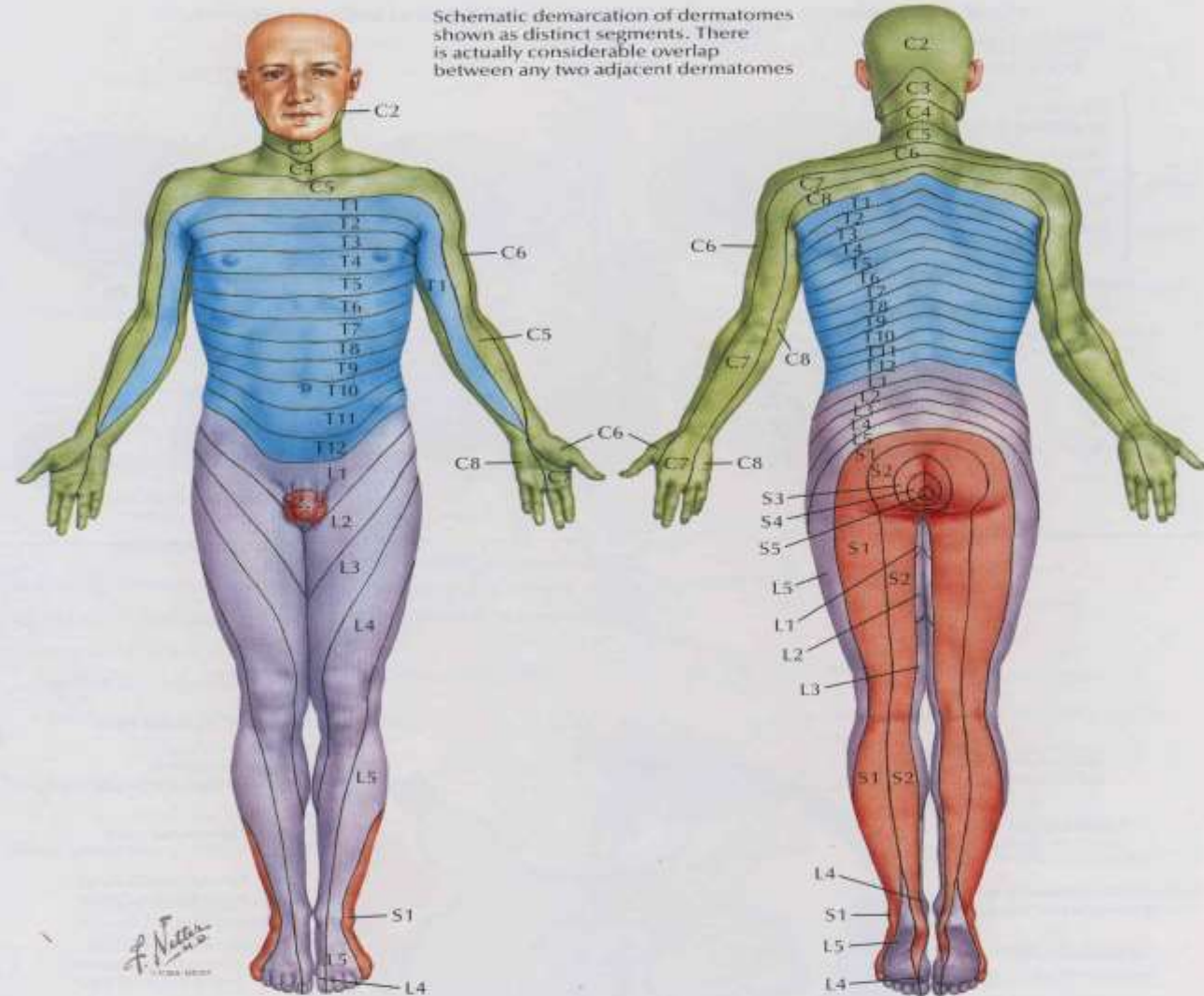




SEE ALSO PLATES 455, 511; FOR MAPS OF CUTANEOUS NERVES SEE PLATES 18, 445, 447, 448, 449, 451, 454, 506-510

## Sensasi superfisial atau eksteroseptif

1. Suhu
2. Raba
3. Nyeri

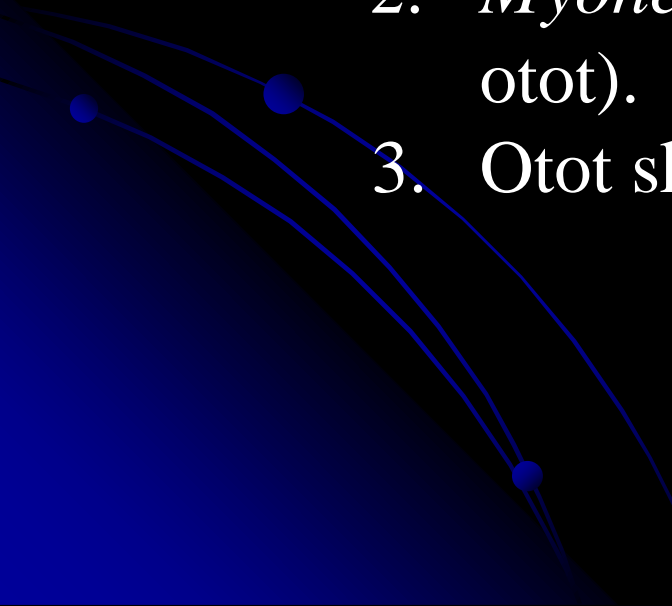


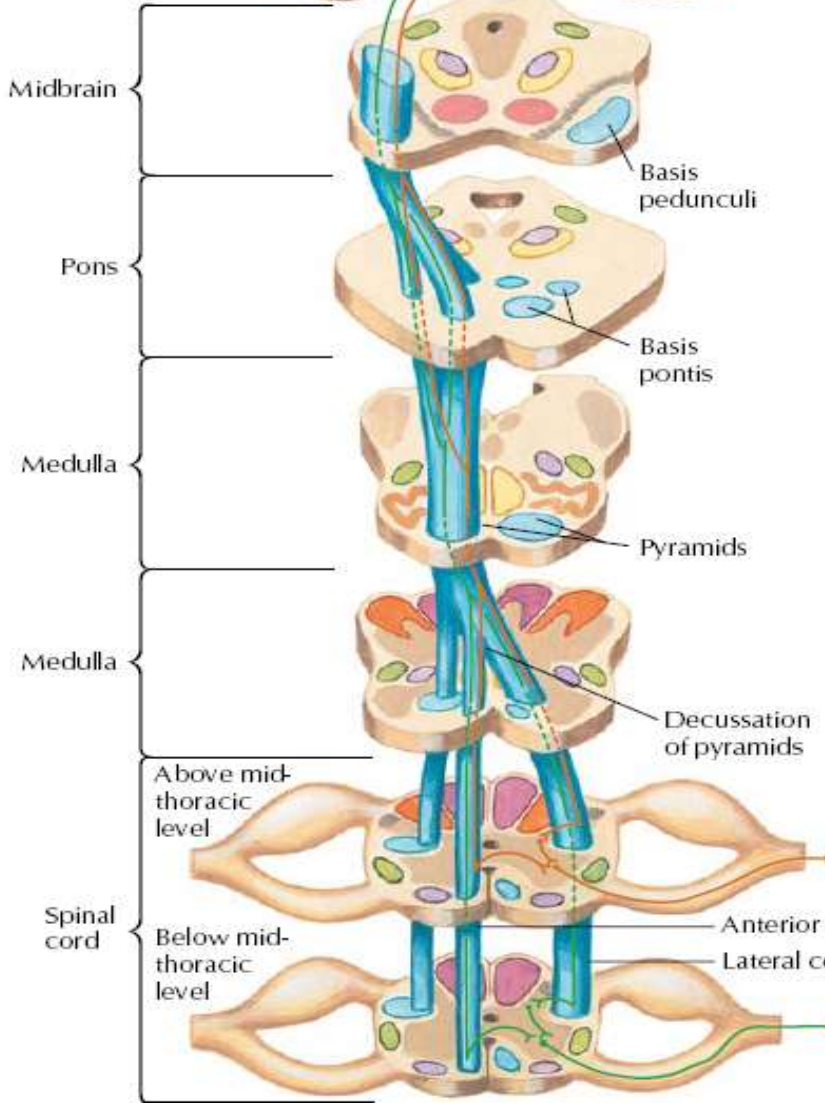
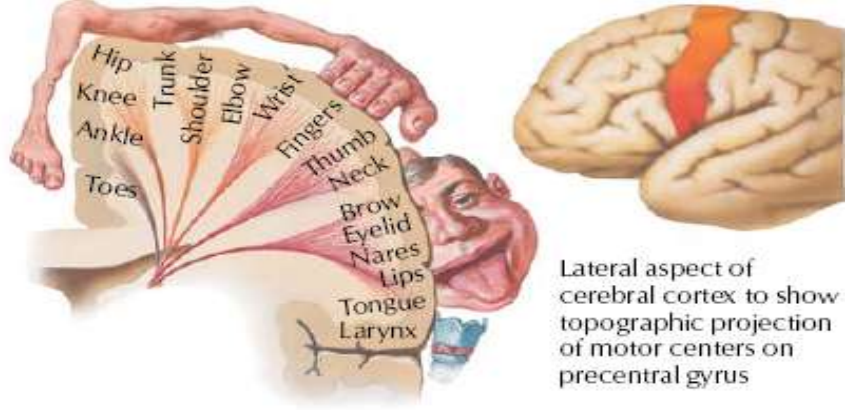
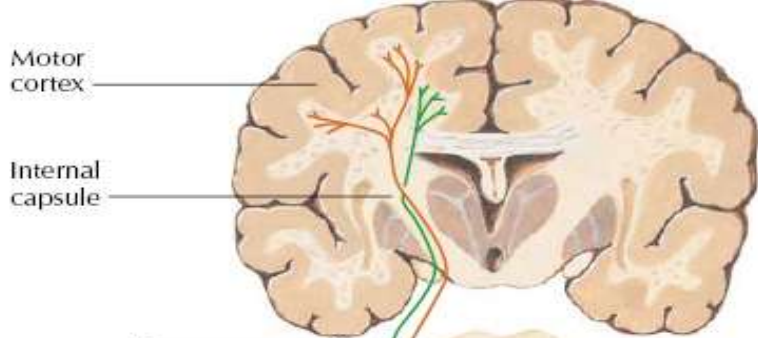
### Levels of principal dermatomes

C5	Clavicles
C5, 6, 7	Lateral parts of upper limbs
C8, T1	Medial sides of upper limbs
C6	Thumb
C6, 7, 8	Hand
C8	Ring and little fingers
T4	Level of nipples

T10	Level of umbilicus
T12	Inguinal or groin regions
L1, 2, 3, 4	Anterior and inner surfaces of lower limbs
L4, 5, S1	Foot
L4	Medial side of great toe
S1, 2, L5	Posterior and outer surfaces of lower limbs
S1	Lateral margin of foot and little toe
S2, 3, 4	Perineum

# Susunan Somatomotorik

1. Traktus Piramidalis (*upper motorik neuron* (UMN) dan *lower motorik neuron* (LMN).)
  2. *Myoneural junction* (hubungan saraf otot).
  3. Otot skeletal
- 



**Motor system**

Fibers originate in motor cortex and descend via posterior limb of internal capsule to basis pedunculi of midbrain

Longitudinal bundles branch upon entering basis pontis and rejoin to enter pyramids of medulla

At lower medulla, bulk of fibers cross median plane to form lateral corticospinal tract; some fibers continue downward in ipsilateral lateral corticospinal tract; others descending ipsilateral anterior corticospinal tract

Synapse occurs at spinal level: Lateral corticospinal fibers synapse on ipsilateral anterior horn cells; anterior corticospinal fibers synapse on contralateral anterior horn cells



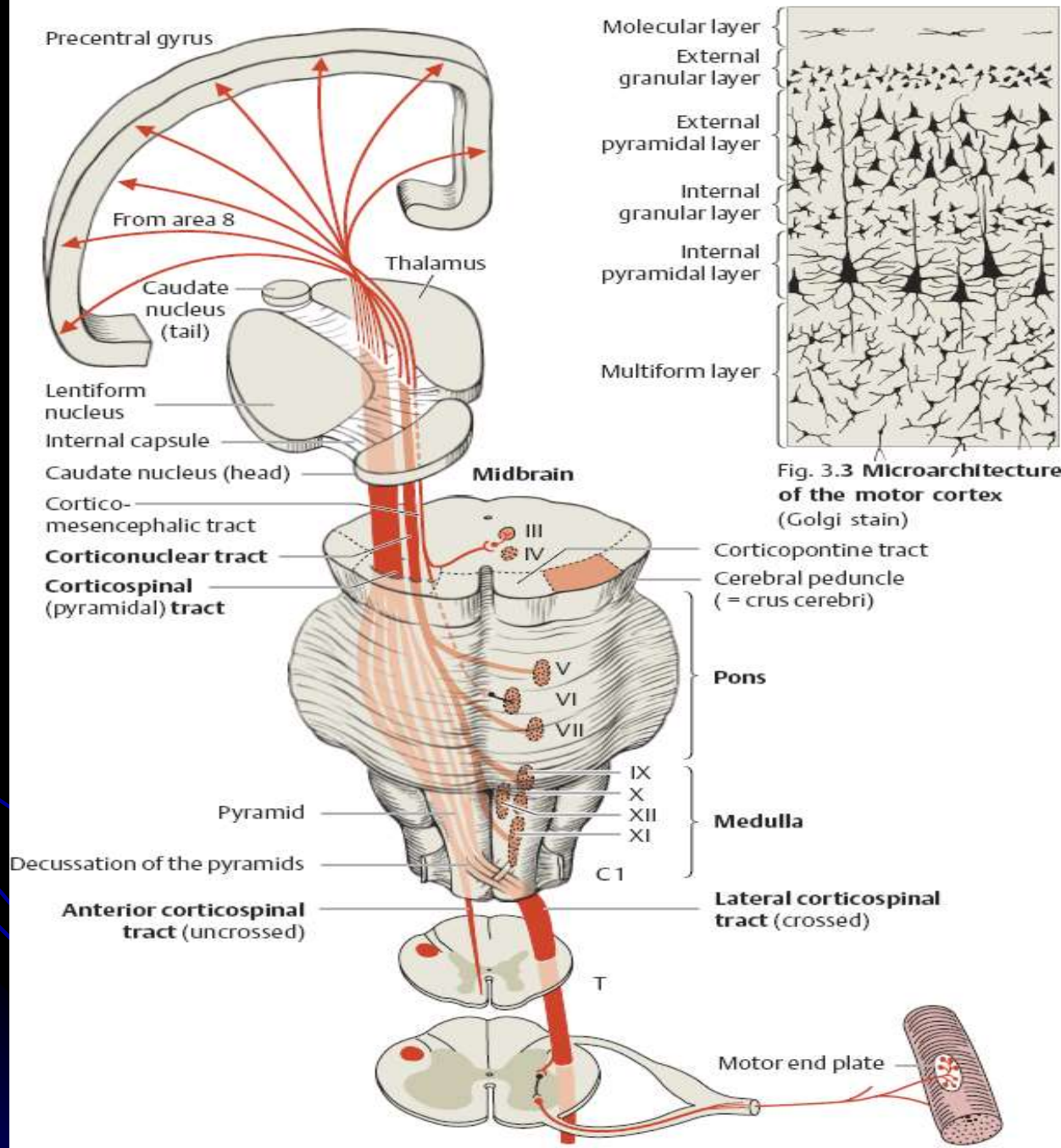
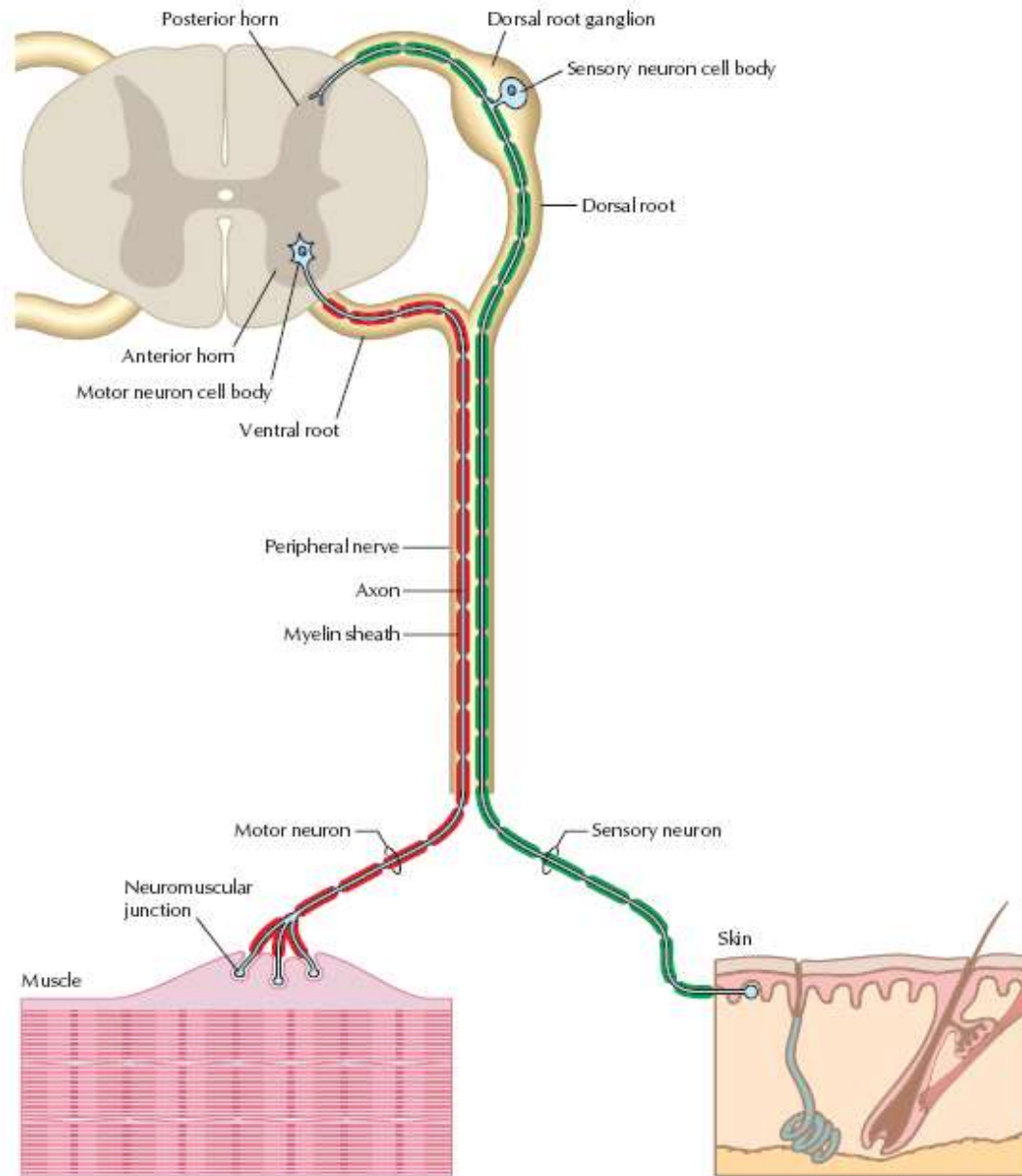


Fig. 3.3 Microarchitecture of the motor cortex (Golgi stain)

Gangguan **Traktus Piramidalis** memberikan kelumpuhan tipe **UMN** yang ditandai :

- **parese/paralisis**
- **spastis**
- **Hipertoni**
- **hiperrefleksi**
- **klonus**
- **refleks patologis positif**
- **tak ada atrofi**



F. Netter  
M.D.  
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Gangguan pada **LMN** ditandai :

- **Lumpuh / Parese**
- **Arefleksi**
- **Tak ada refleks patologis**
- **Atrofi**

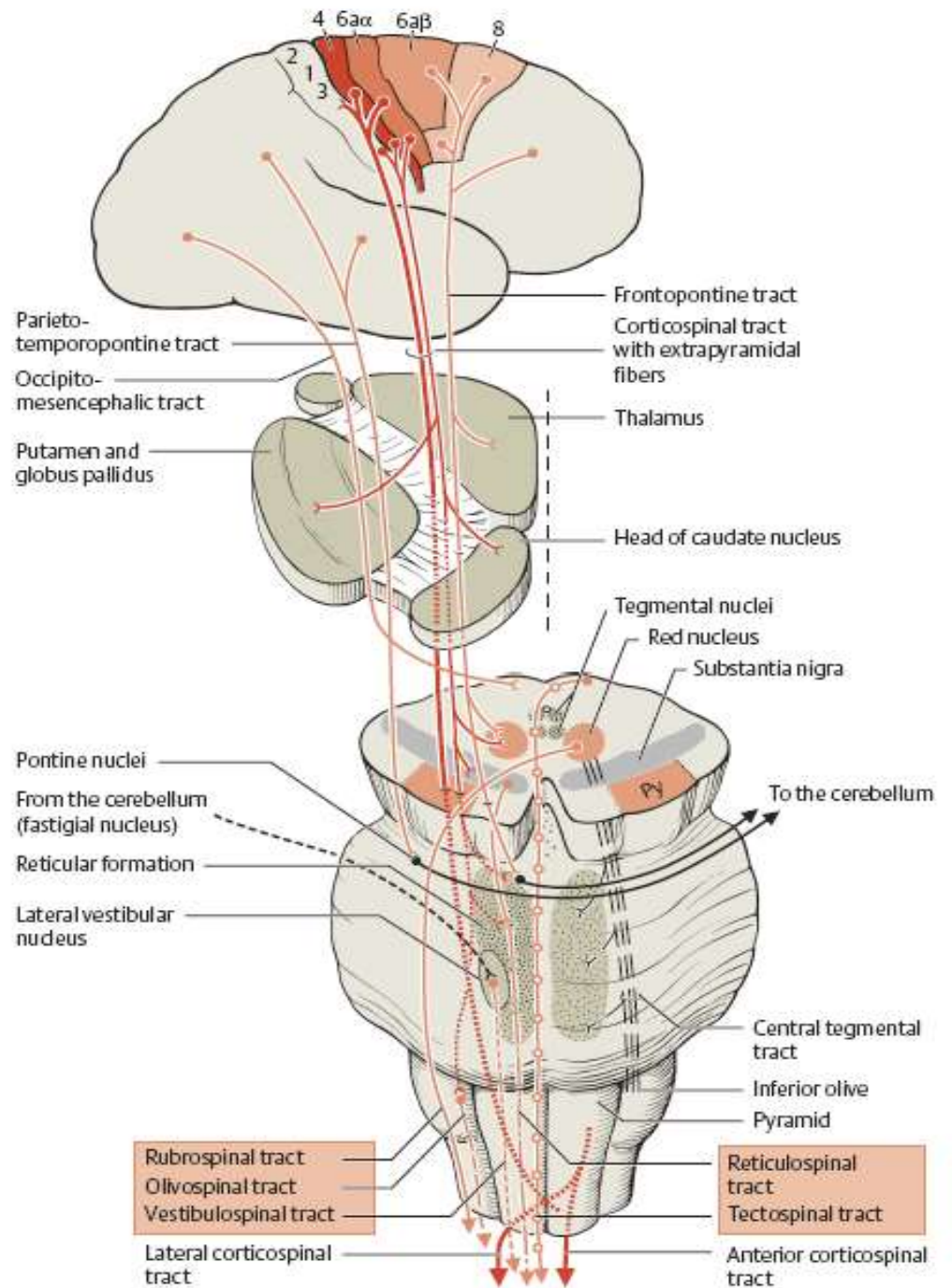
# Kelainan **Traktus Piramidalis** setinggi :

- Hemisfer : **hemiparesis tipika**
- Setinggi batang otak : **hemiparesis alternans.**
- Setinggi medulla spinalis cervicalis : **tetraparesis**
- Setinggi medulla spinalis thorakalis : **paraparesis**

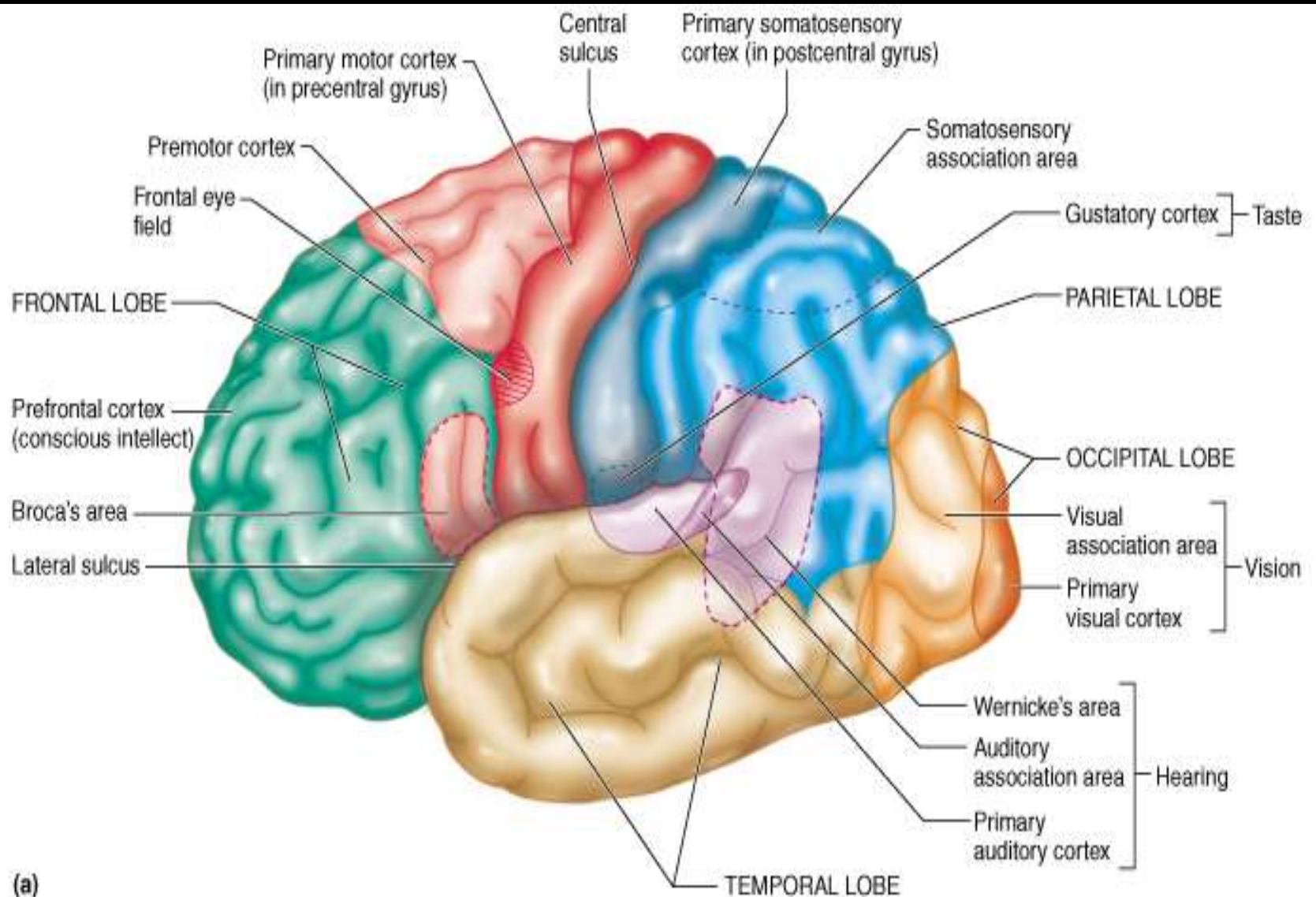
## Traktus ekstrapiramidal :

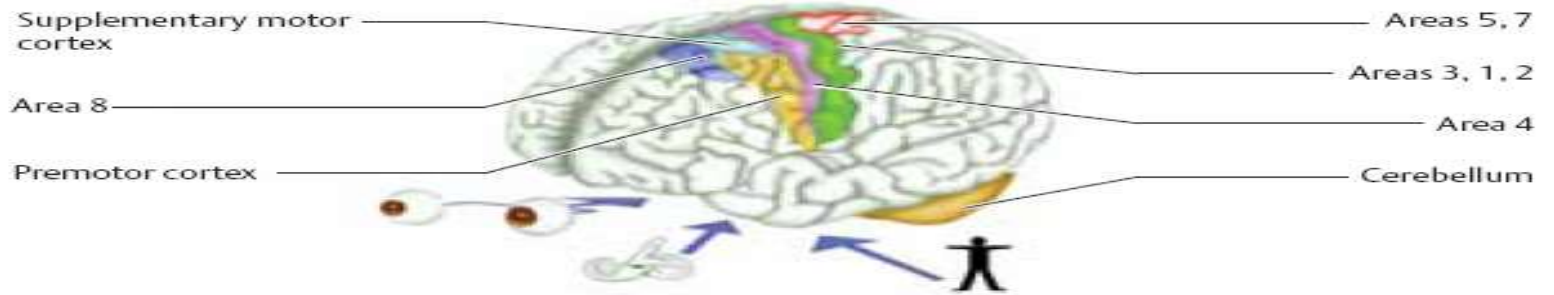
semua traktus, inti dan sirkuit yang mempengaruhi aktifitas somatomotorik, selain lintasan piramidal.

**Terdiri dari :** Korteks motorik, Basal ganglia, Inti-inti talamus dan subtalamus, Nukleus ruber dan substansia nigra (mesensefalon), Inti-inti di formasio retikularis (pons dan Medula oblongata), Sirkuit *feedback*, traktus dan lintasannya (tektospinalis, Kortikoretikulo-spinalis dan vestibulospinalis).

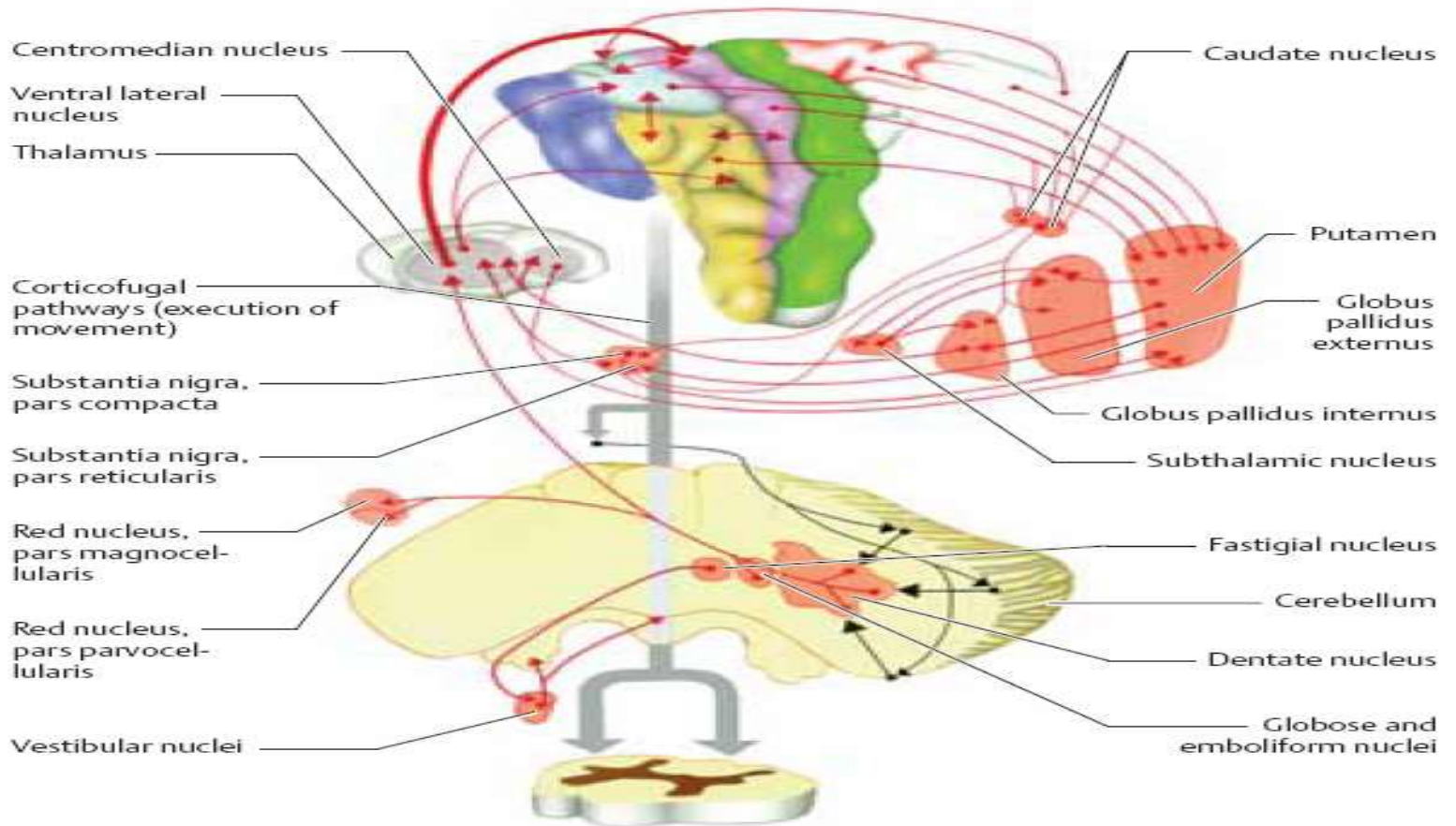




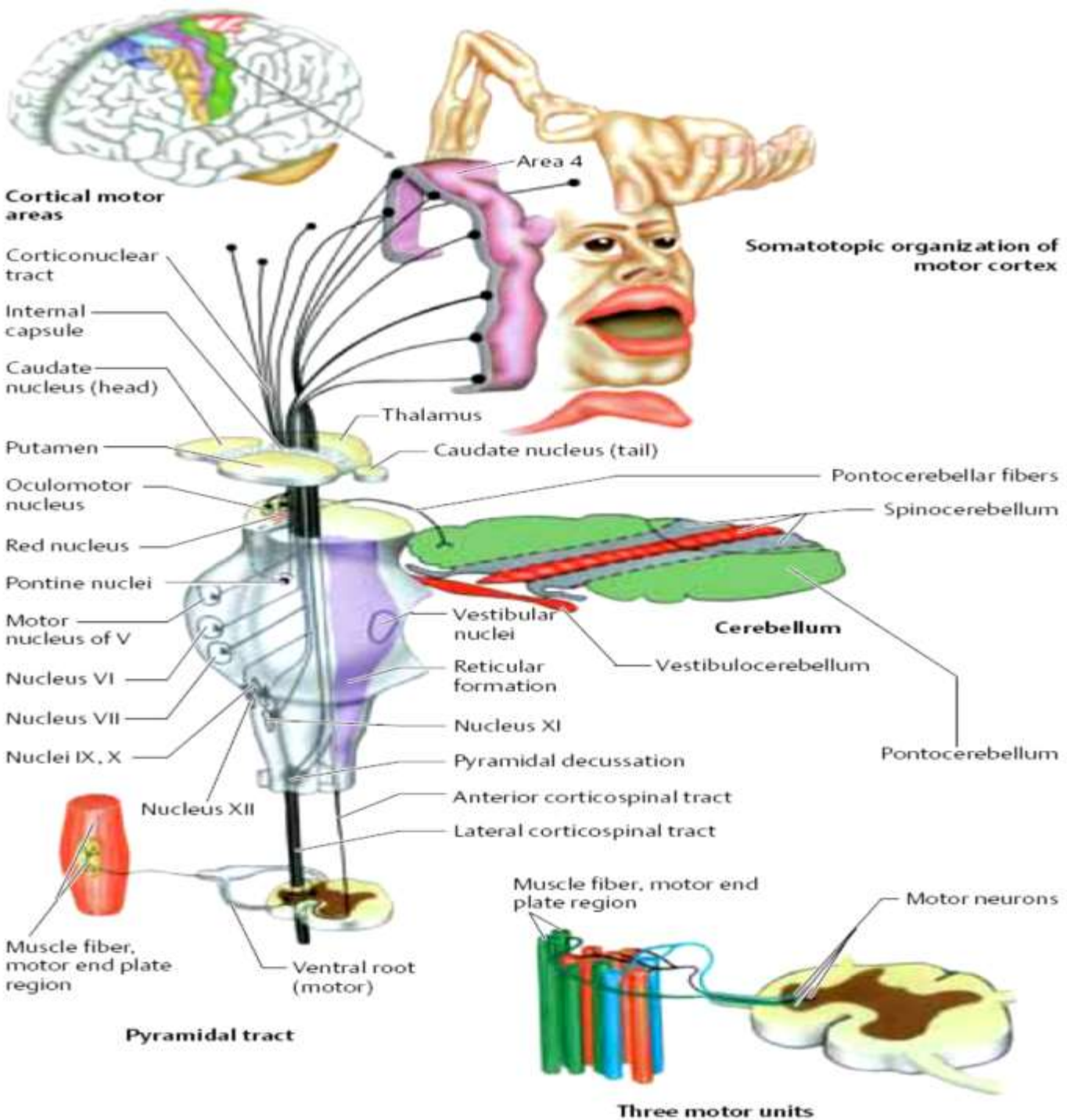




**Cortical motor areas, afferent connections** (visual, vestibular, somatosensory)



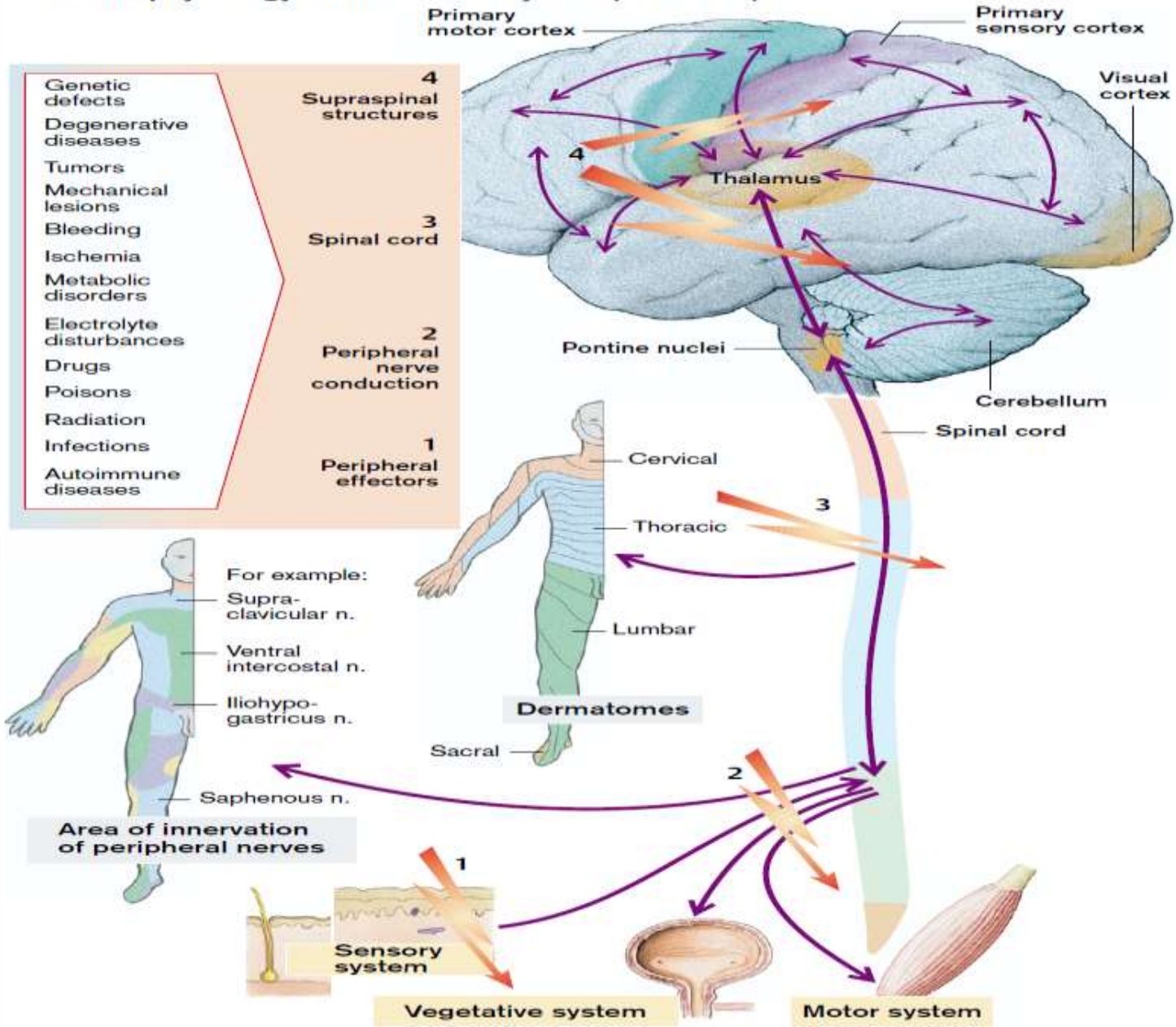
**Motor pathways**  
(cortex, basal ganglia, thalamus, brain stem, cerebellum, spinal cord)



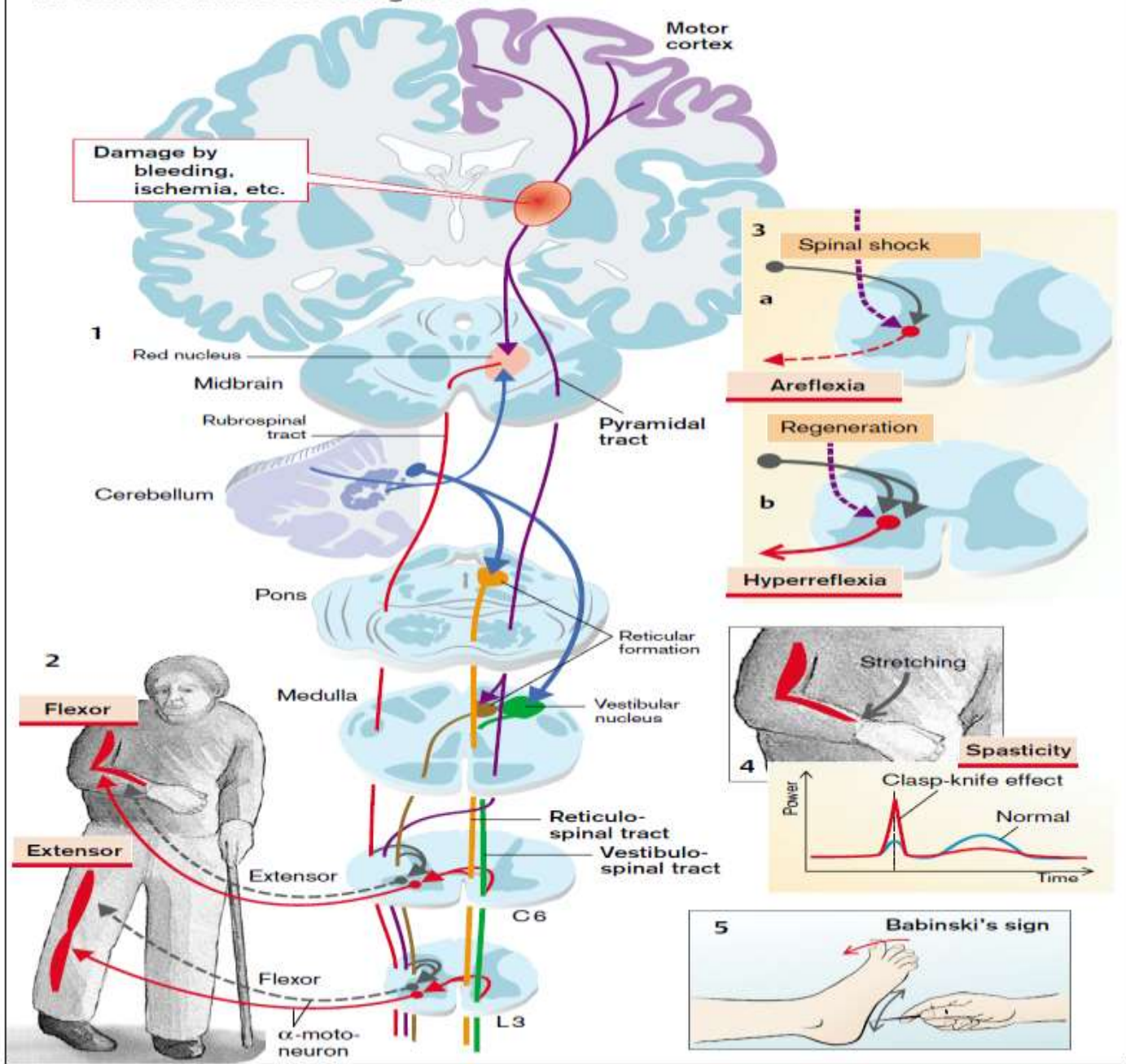


# TAKE HOME MESSAGE

## A. Pathophysiology of the Nervous System (Overview)



**A. Lesions of the Descending Tracts**







# Terima Kasih

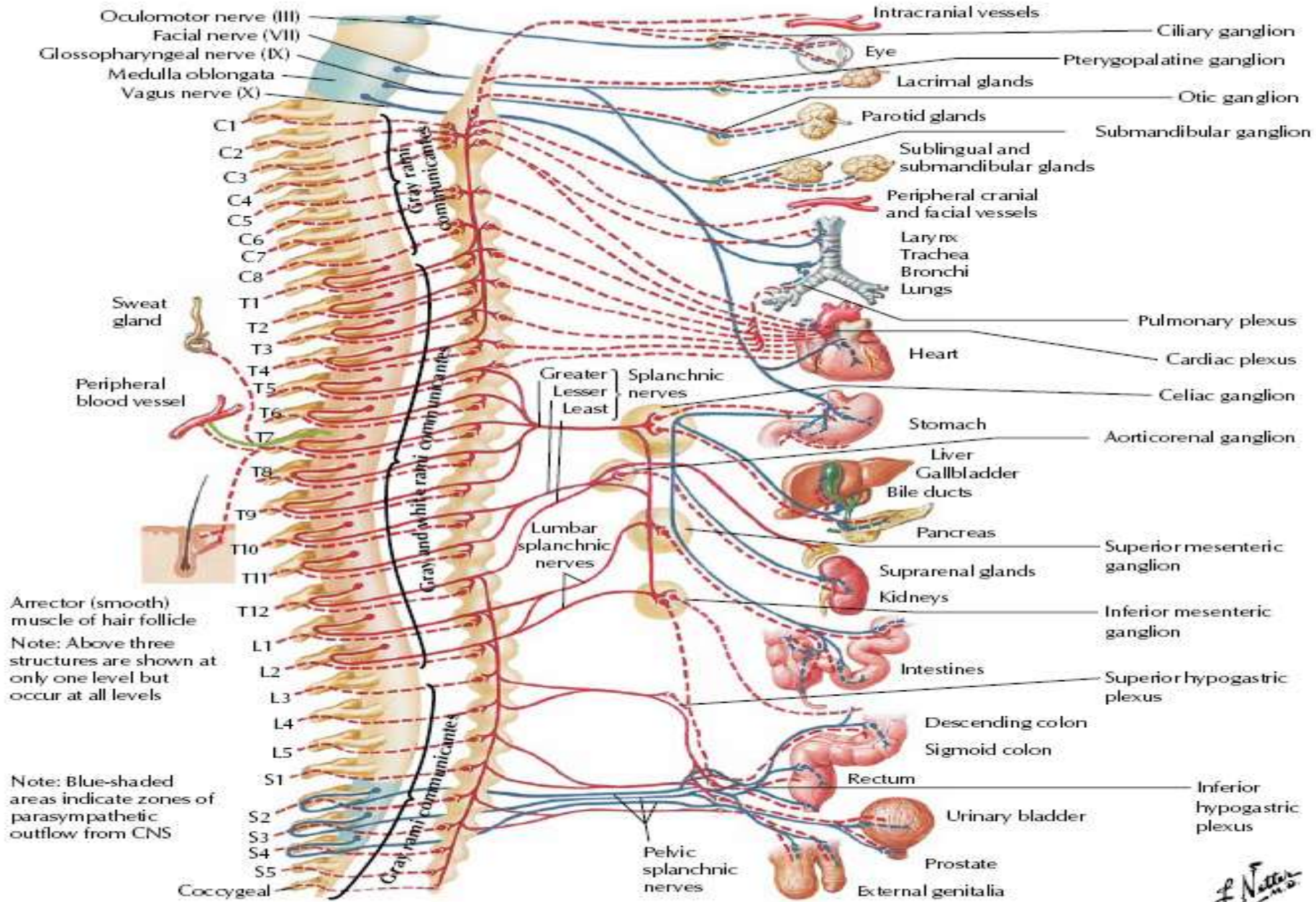
## SEMOGA BERMANFAAT



## AUTONOMIC NERVOUS SYSTEM

The autonomic nervous system is composed of two divisions: the parasympathetic division derived from four of the cranial nerves (CN III, VII, IX, and X) and the S2-S4 sacral spinal cord levels, and the sympathetic division associated with the thoracic and upper lumbar spinal cord levels (T1-L2). The autonomic nervous system is a two-neuron chain, with the preganglionic neuron arising from the central nervous system and synapsing on a postganglionic neuron located in

a peripheral autonomic ganglion. Postganglionic axons of the autonomic nervous system innervate smooth muscle, cardiac muscle, and glands. Basically, the sympathetic division mobilizes our body ("fight or flight") while the parasympathetic division regulates digestive and homeostatic functions. Normally, both divisions work in concert to regulate visceral activity (respiration, cardiovascular function, digestion, and associated glandular activity).



Sympathetic fibers { Presynaptic ———  
 Postsynaptic - - - - -

Parasympathetic fibers { Presynaptic ———  
 Postsynaptic - - - - -

Antidromic conduction ———



## CHOLINERGIC AND ADRENERGIC SYNAPSES

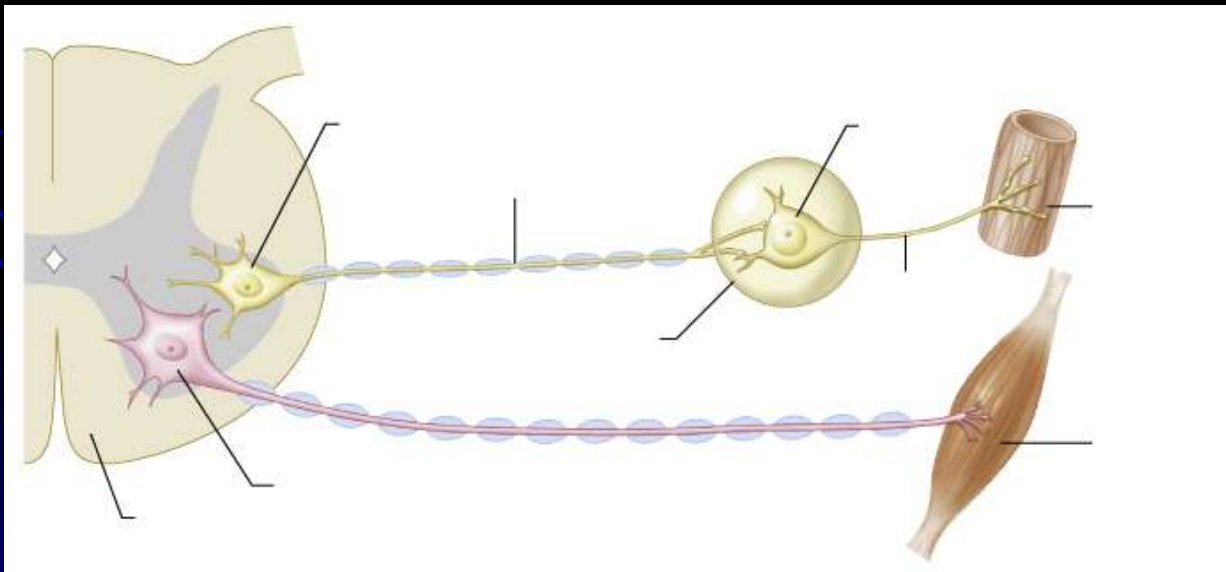
The autonomic nervous system (ANS) is a two-neuron chain, with the preganglionic neuron arising from the central nervous system and synapsing on a postganglionic neuron located in a peripheral autonomic ganglion. Acetylcholine is the neurotransmitter in both the sympathetic and parasympathetic ganglia. The parasympathetic division of the ANS releases acetylcholine at its postganglionic synapses and is characterized as having cholinergic (C) effects, whereas the sympathetic division releases predominantly noradren-

aline (norepinephrine) at its postganglionic synapses, causing adrenergic (A) effects (except on sweat glands, where acetylcholine is released). Although acetylcholine and noradrenaline are the chief transmitter substances, other neuroactive peptides often are colocalized with them and include such substances as gamma-aminobutyric acid (GABA), substance P, enkephalins, histamine, glutamic acid, neuropeptide Y, and others.



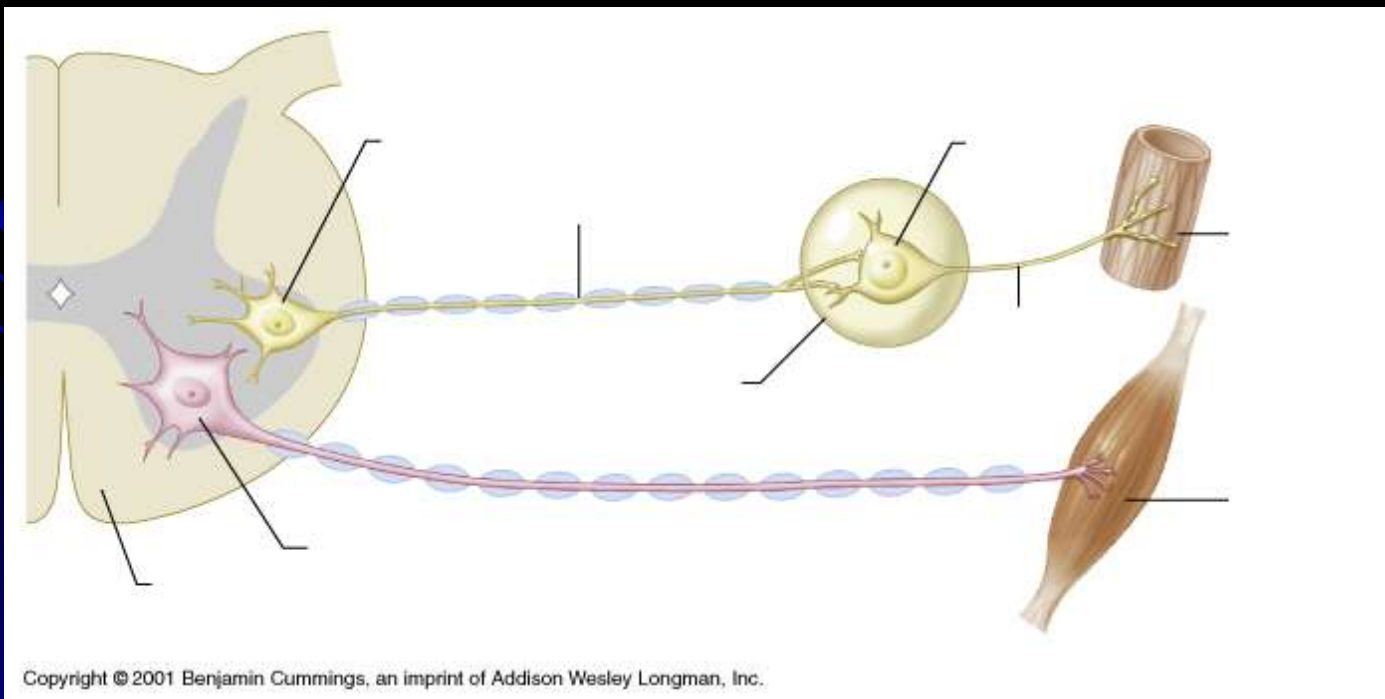
# ANS vs. somatic motor system

- ANS has 2 neuron pathway
  - Preganglionic neurons
    - In spinal cord and brainstem
    - Myelinated axon
  - Postganglionic neurons
    - In ANS ganglion
    - Unmyelinated axon
    - Axon terminal to smooth & cardiac muscle, and glands



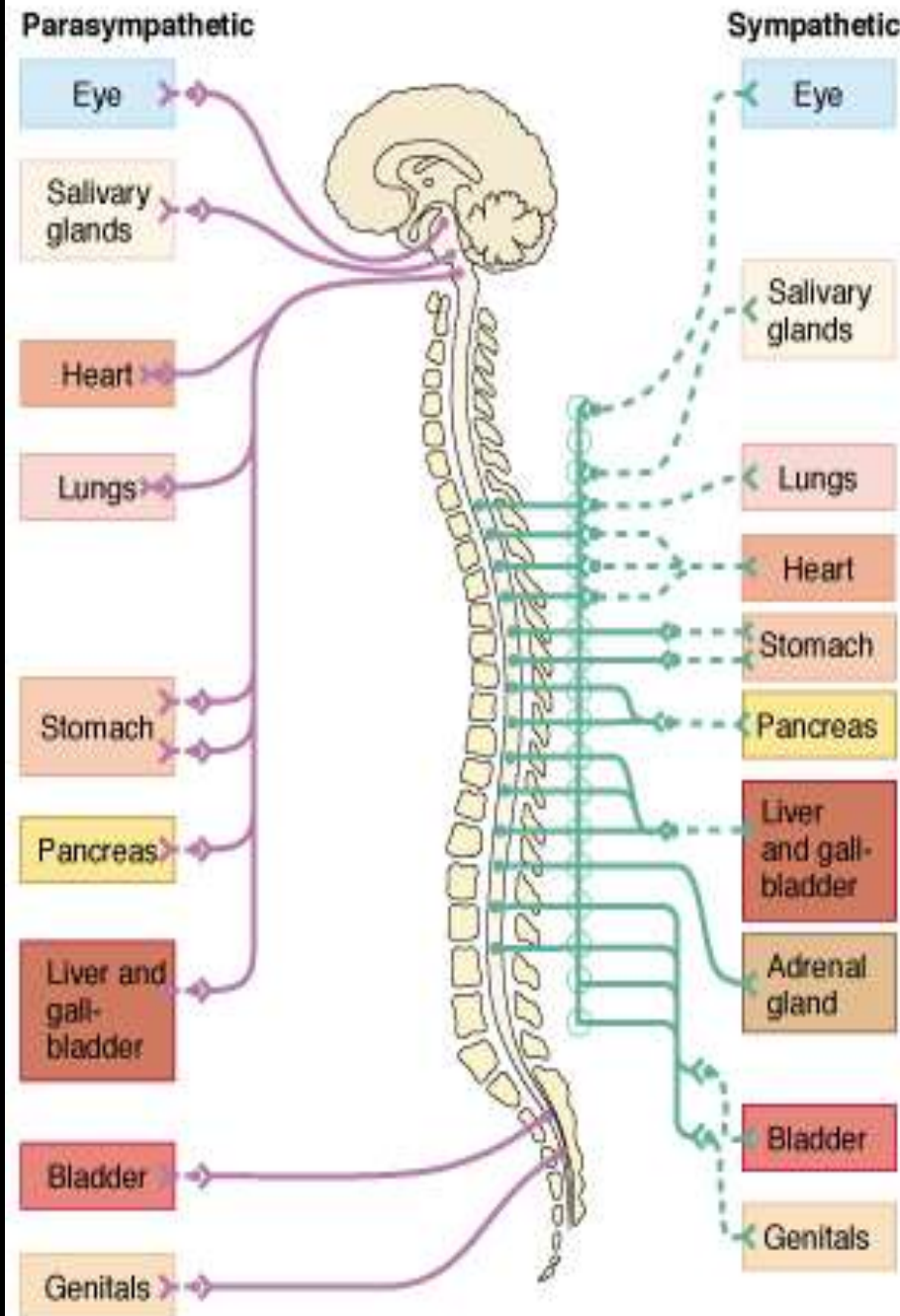
# ANS vs. somatic motor system

- Somatic system has one neuron pathway
  - LMN (lower motor neuron)
  - Cell body in ventral horn
  - Myelinated axon to skeletal muscle
  - Axon forms NMJ



# ANS divisions

- Sympathetic division
- Parasympathetic division
- Dual innervation – many organs receive opposing inputs from both divisions
- Only sympathetic innervation to blood vessels, arrector pili, and sweat glands

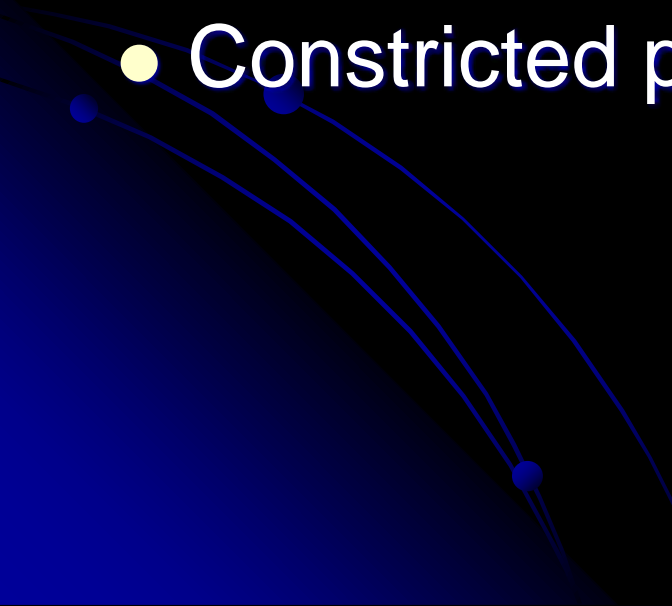




# Sympathetic activation

- “flight, fight, or fright” response
- ↑ heart rate
- ↑ blood pressure
- ↑ increased respiration
- Dilated pupil
- Clammy skin
- ↓ digestion
- ↓ urinary motility

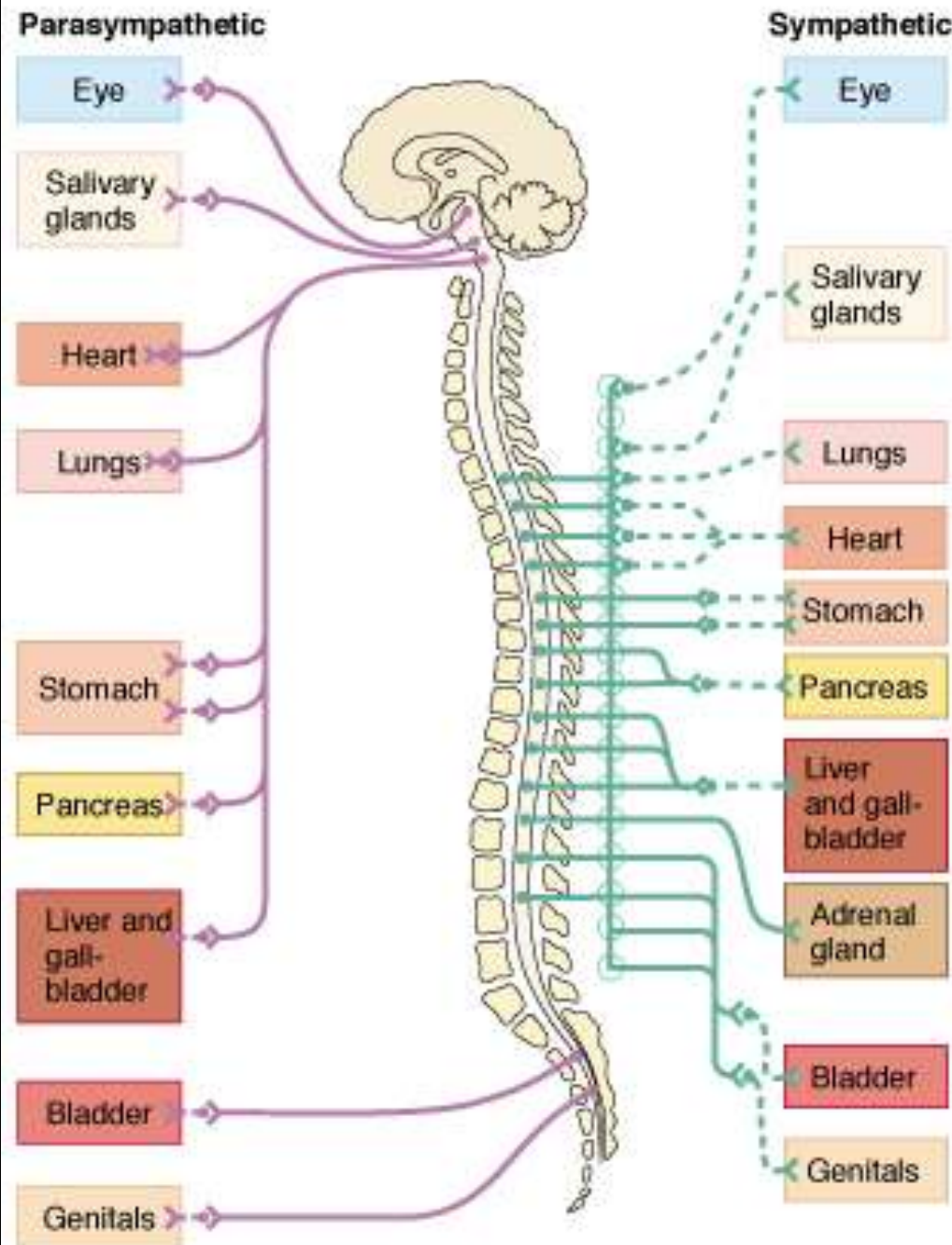
# Parasympathetic activation

- “resting and digesting,” conserves energy
  - ↓ heart rate
  - ↓ respiration
  - ↑ digestive activity
  - Constricted pupil
- 

# Sympathetic location

- Thoracolumbar division
- Preganglionic cell bodies at T1-L2

(15.3)

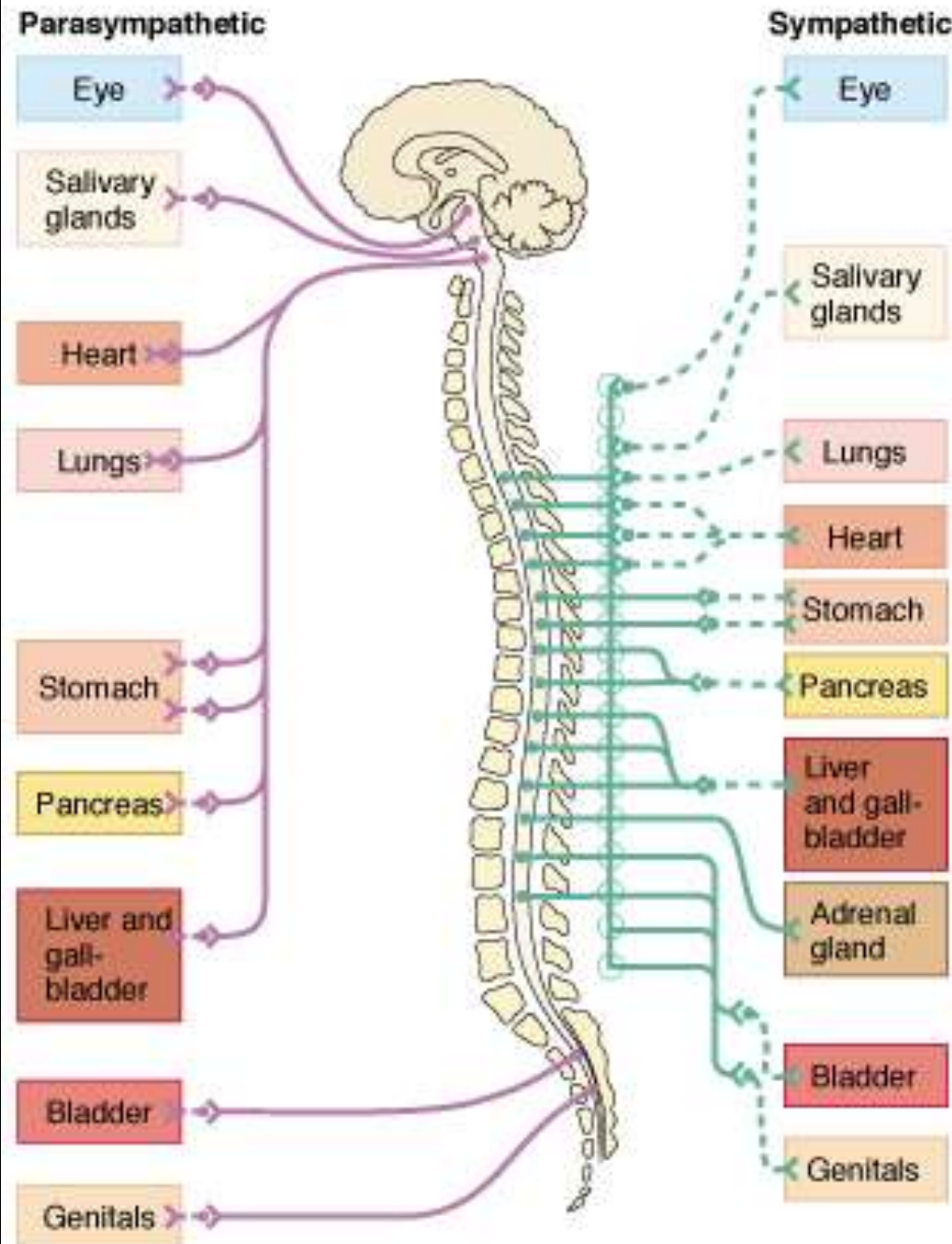




# Parasympath. location

- Craniosacral division
- Preganglionic cell bodies
  - Brainstem
  - Sacral spinal cord

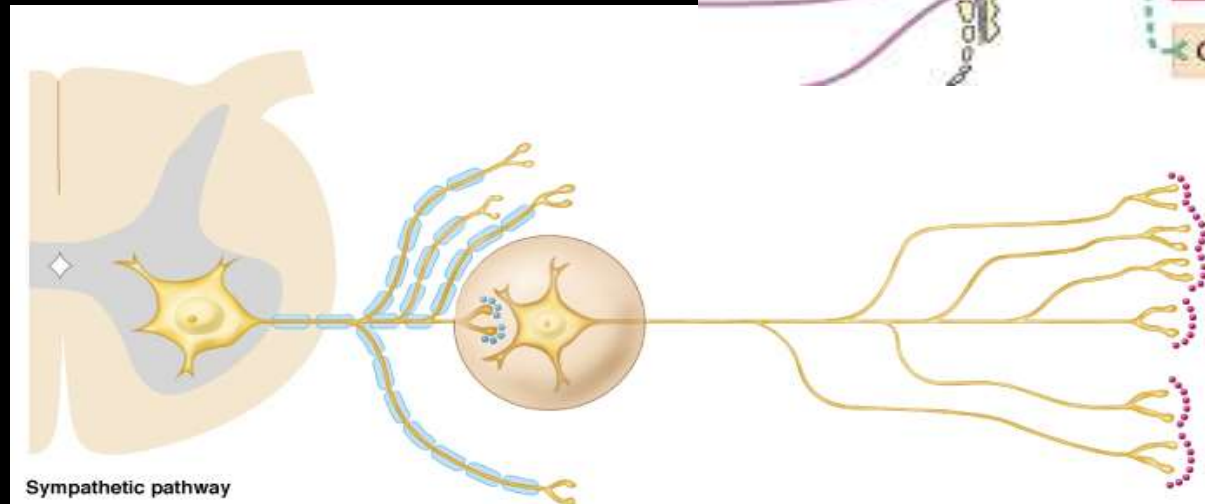
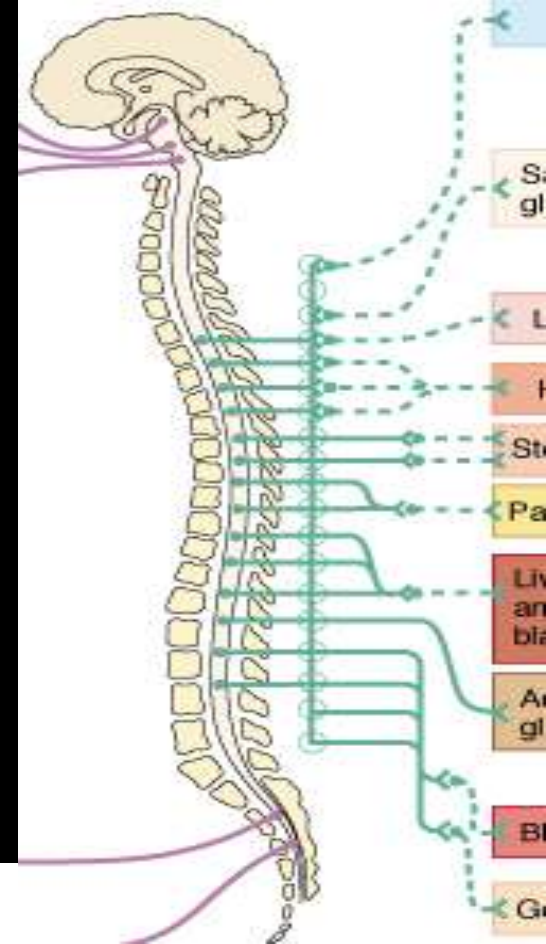
(15.3)



# Sympathetic pathways

- Short preganglionic axon
  - Myelinated
  - Many branches
- Postganglionic nerve cell body in prevertebral and sympathetic chain ganglia
- Long postganglionic axon
  - Unmyelinated

(15.3, 15.4a)

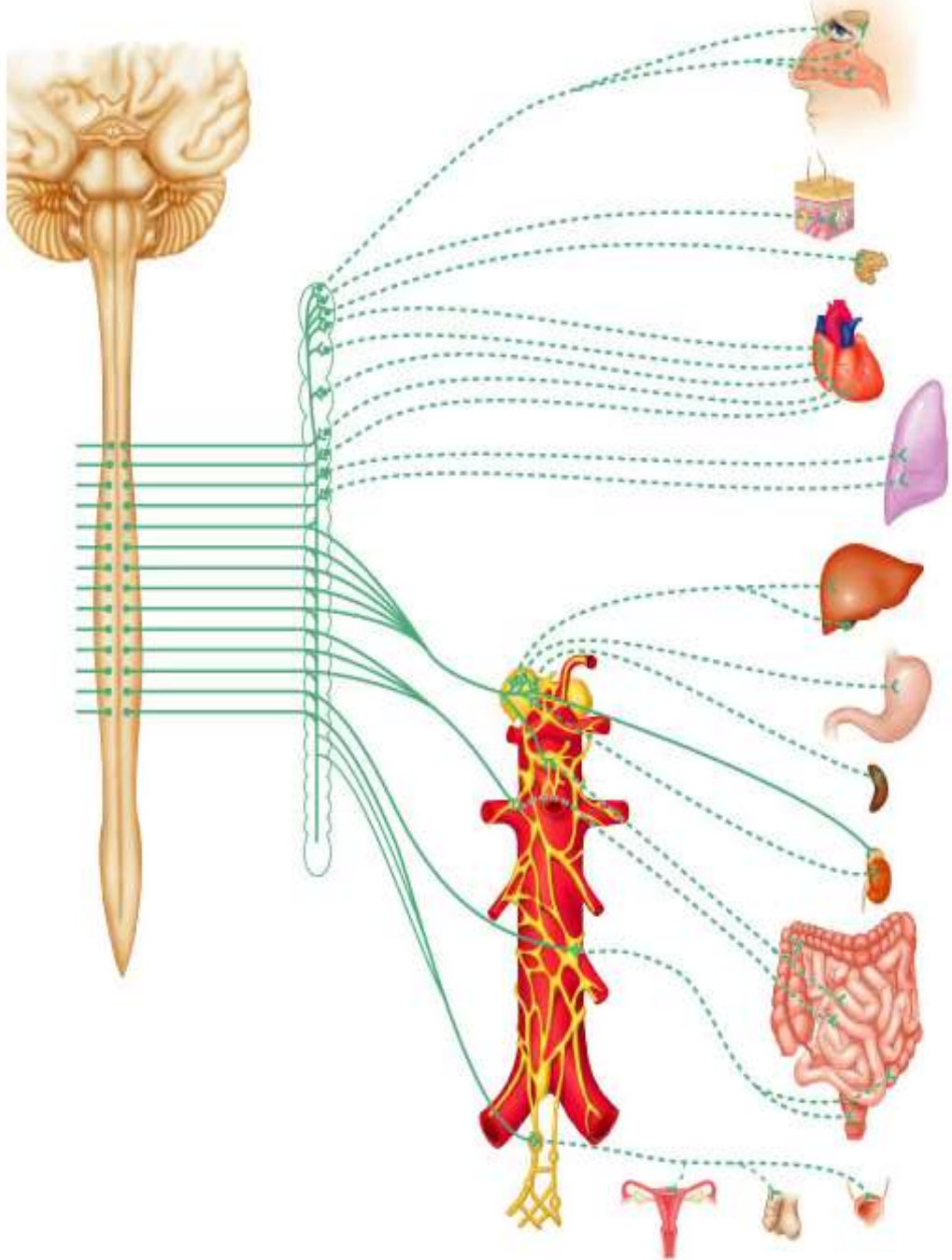


Sympathetic pathway

(a)

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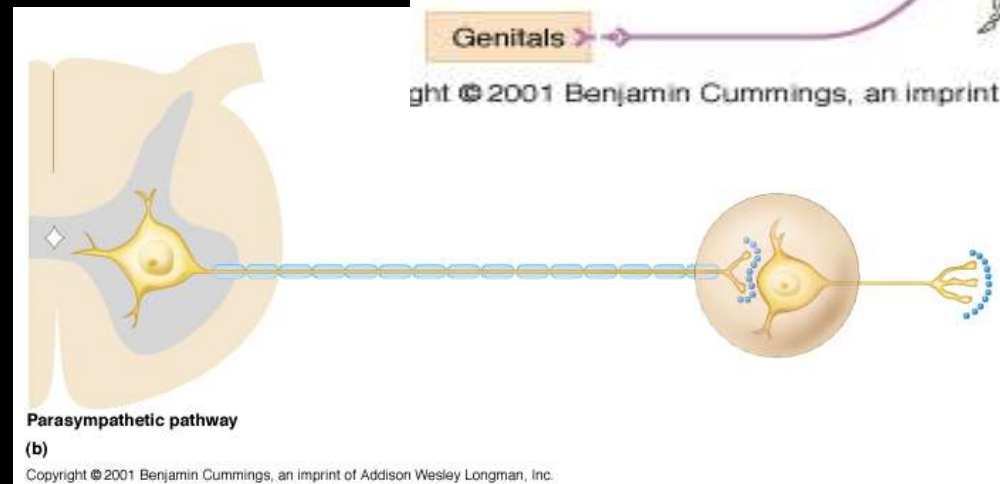
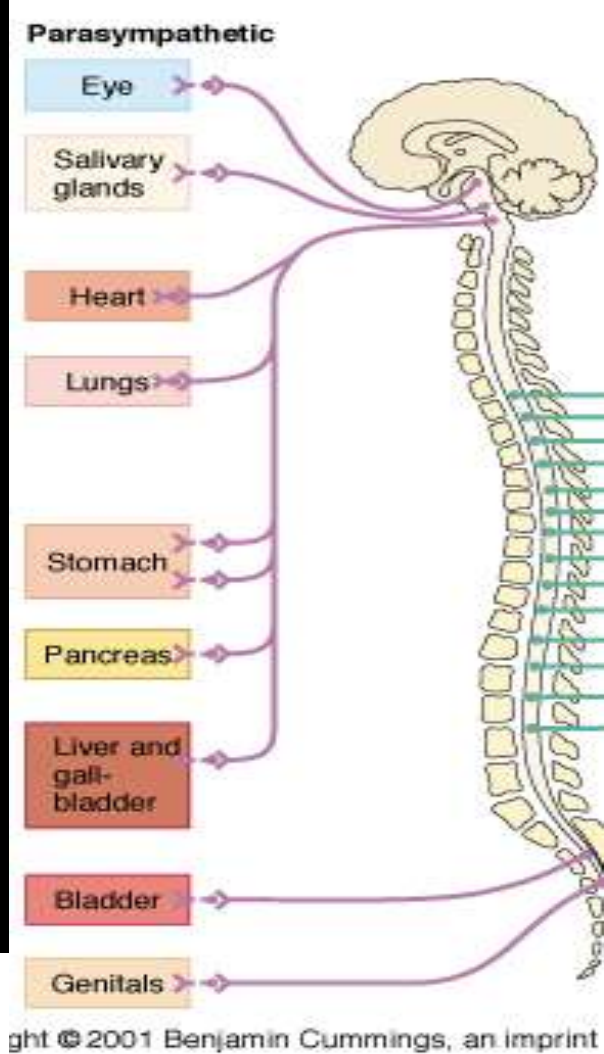
# Sympathetic pathways





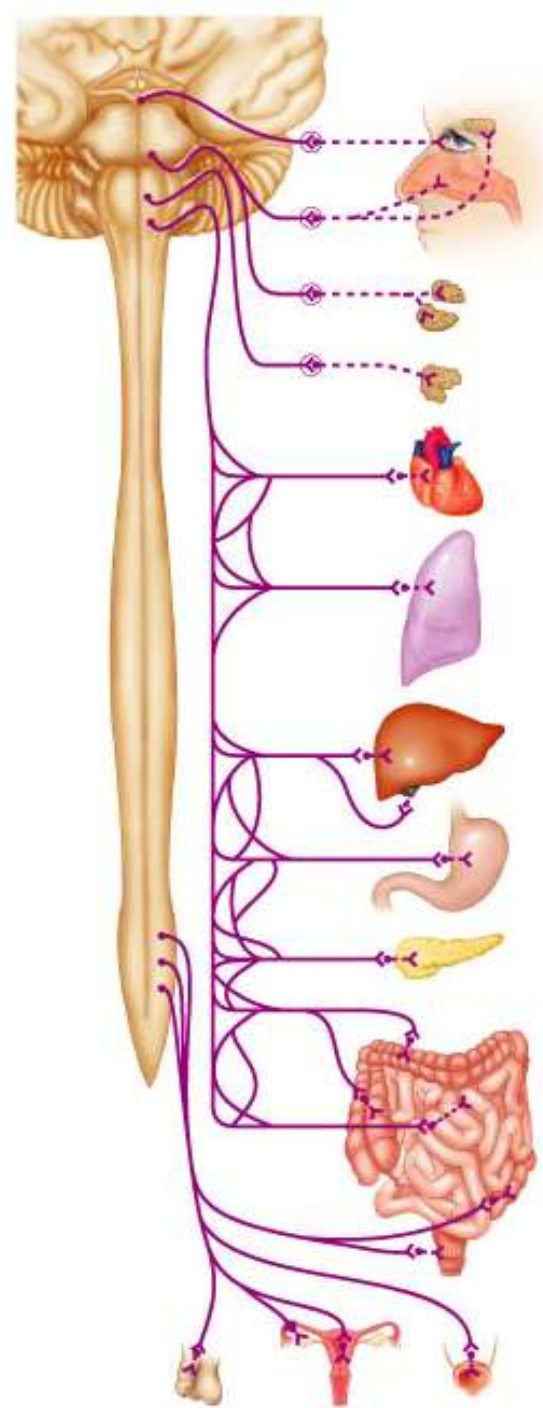
# Parasympathetic pathway

- Long preganglionic axon
  - Myelinated
  - Few branches
- Postganglionic nerve cell body close to target organ
- Short postganglionic axon
  - Unmyelinated



(15.3,15.4b)

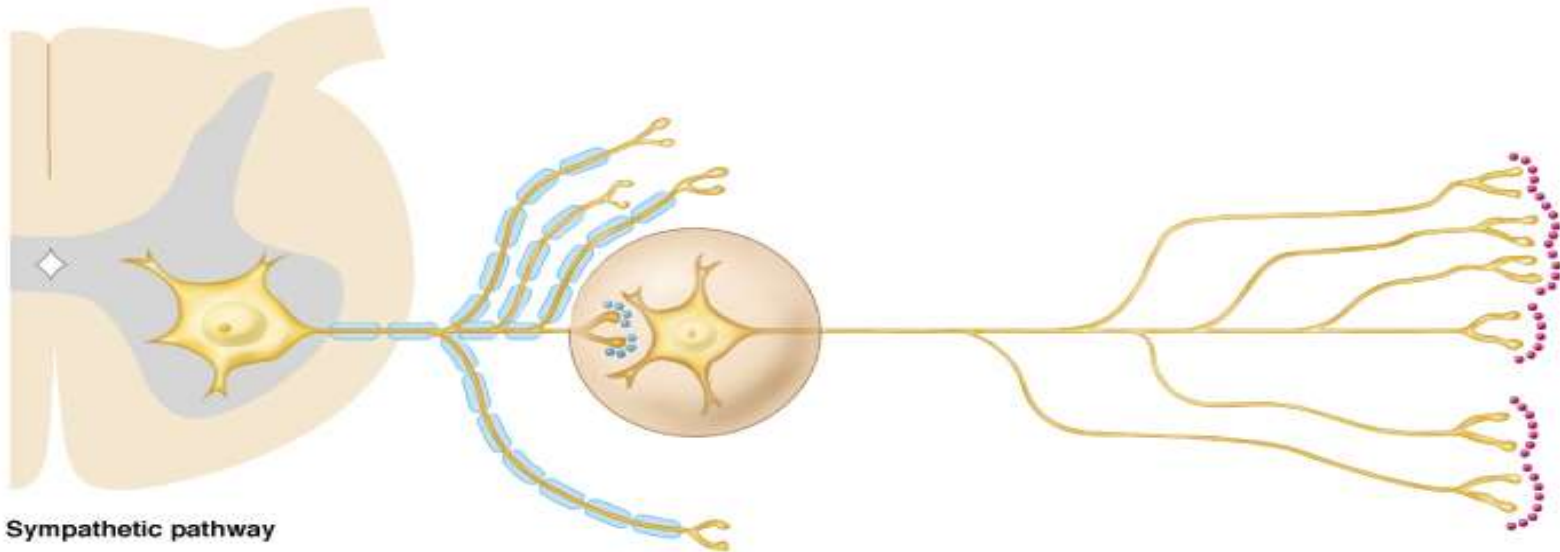
# Parasympathetic pathways



15.5

# Sympathetic neurotransmitters

- ACh at pre-postganglionic synapse
  - Cholinergic fiber
- NE at postganglionic axon terminal on effector organ
  - Adrenergic fiber



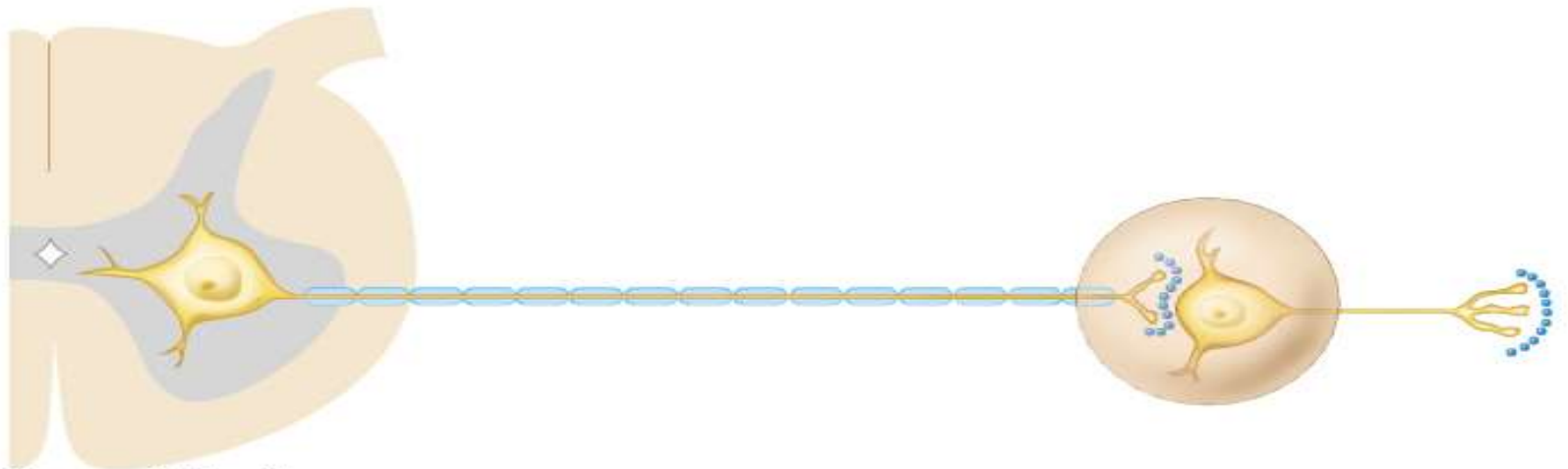
Sympathetic pathway

(a)



# Parasympathetic neurotransmitters

- ACh at pre-postganglionic synapse
  - Cholinergic fiber
- ACh at postganglionic axon terminal on effector organ
  - Cholinergic fiber

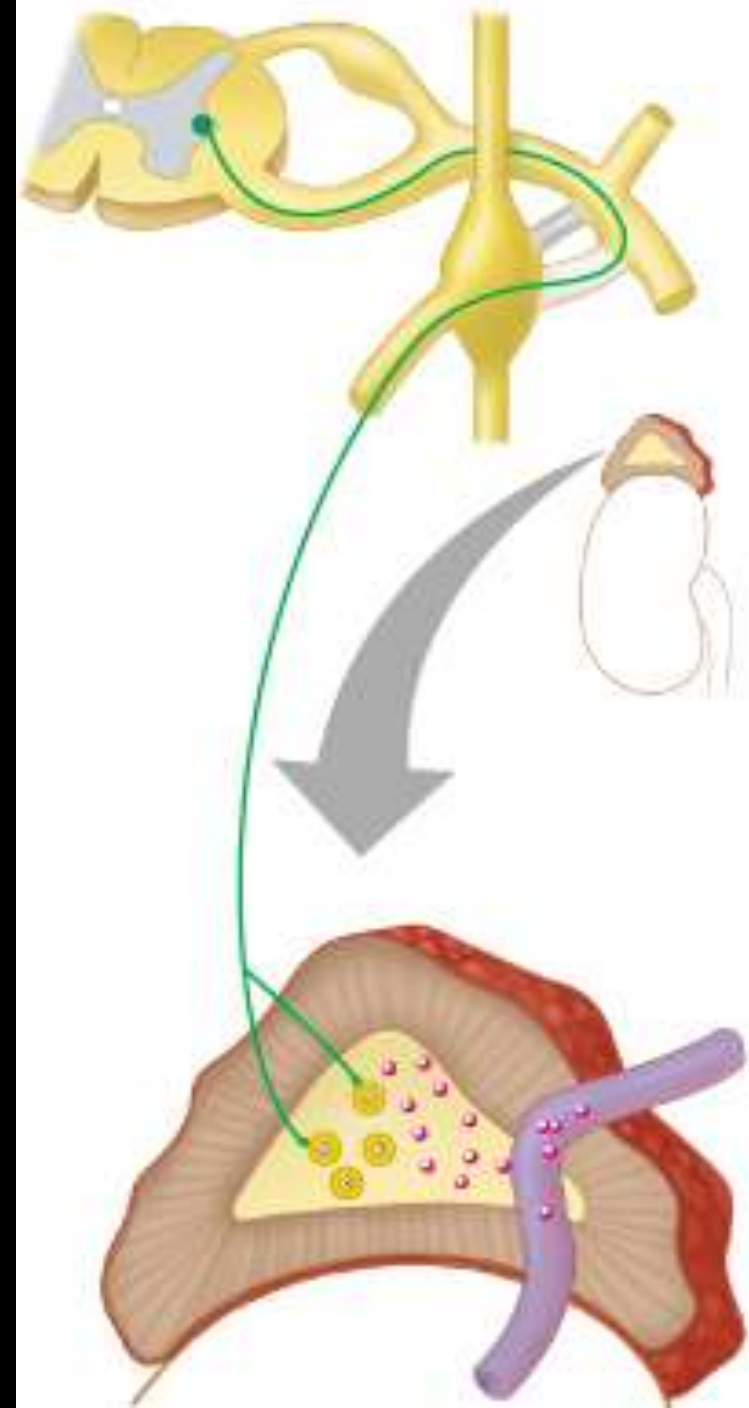


Parasympathetic pathway

(b)

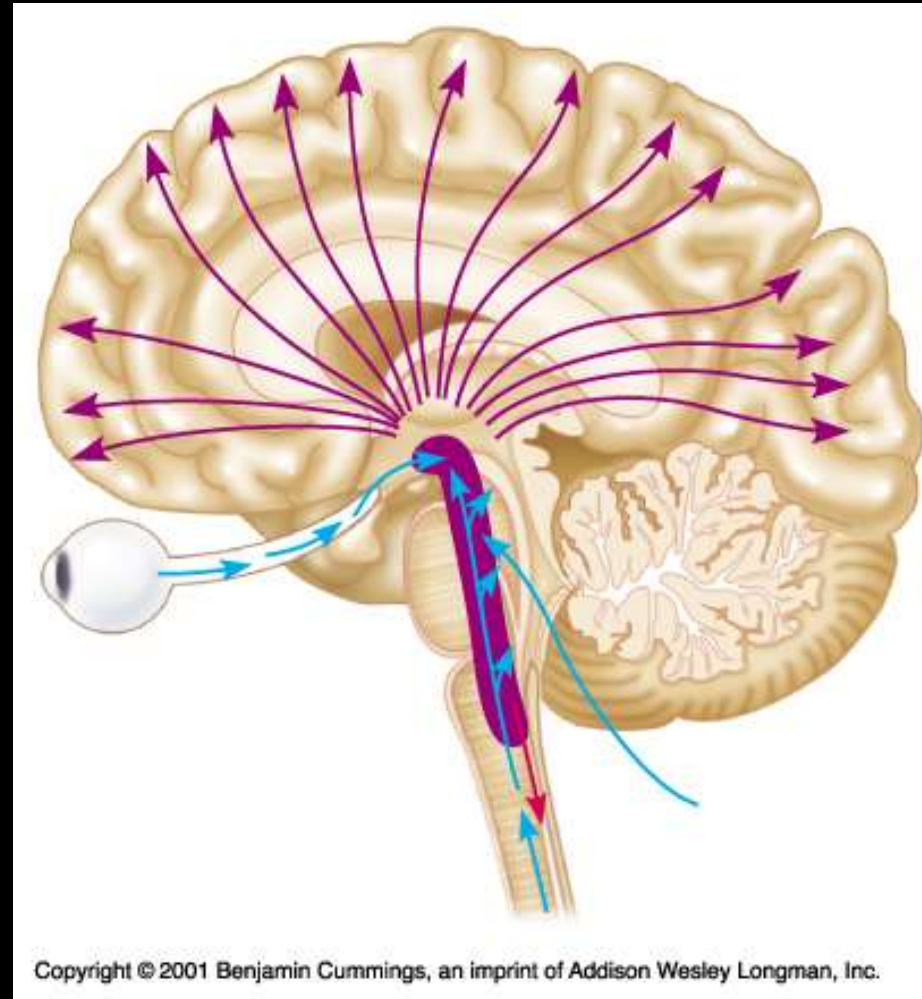
# Adrenal medulla

- Develops from neural crest
- Sympathetic preganglionic innervation
- Adrenal medulla cells secrete
  - Norepinephrine (same as postganglionic sympathetics)
  - Epinephrine (adrenaline)
    - Sympathomimetic – activates sympathetic target organs



# CNS input to ANS

- Inputs to preganglionic neurons from:
- Reticular formation of brainstem
  - Cardiac center
  - Respiratory center
  - Vasomotor center

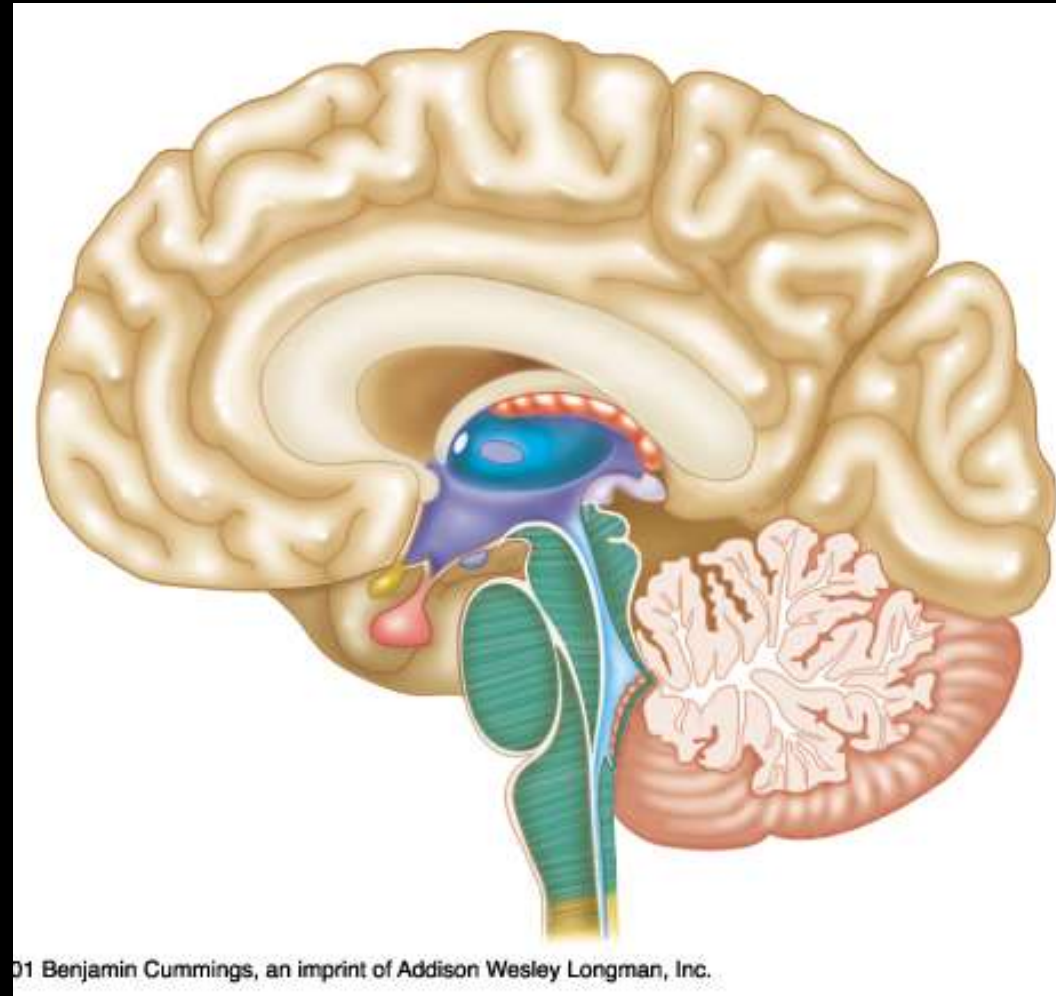


(13.24)



# CNS input to ANS

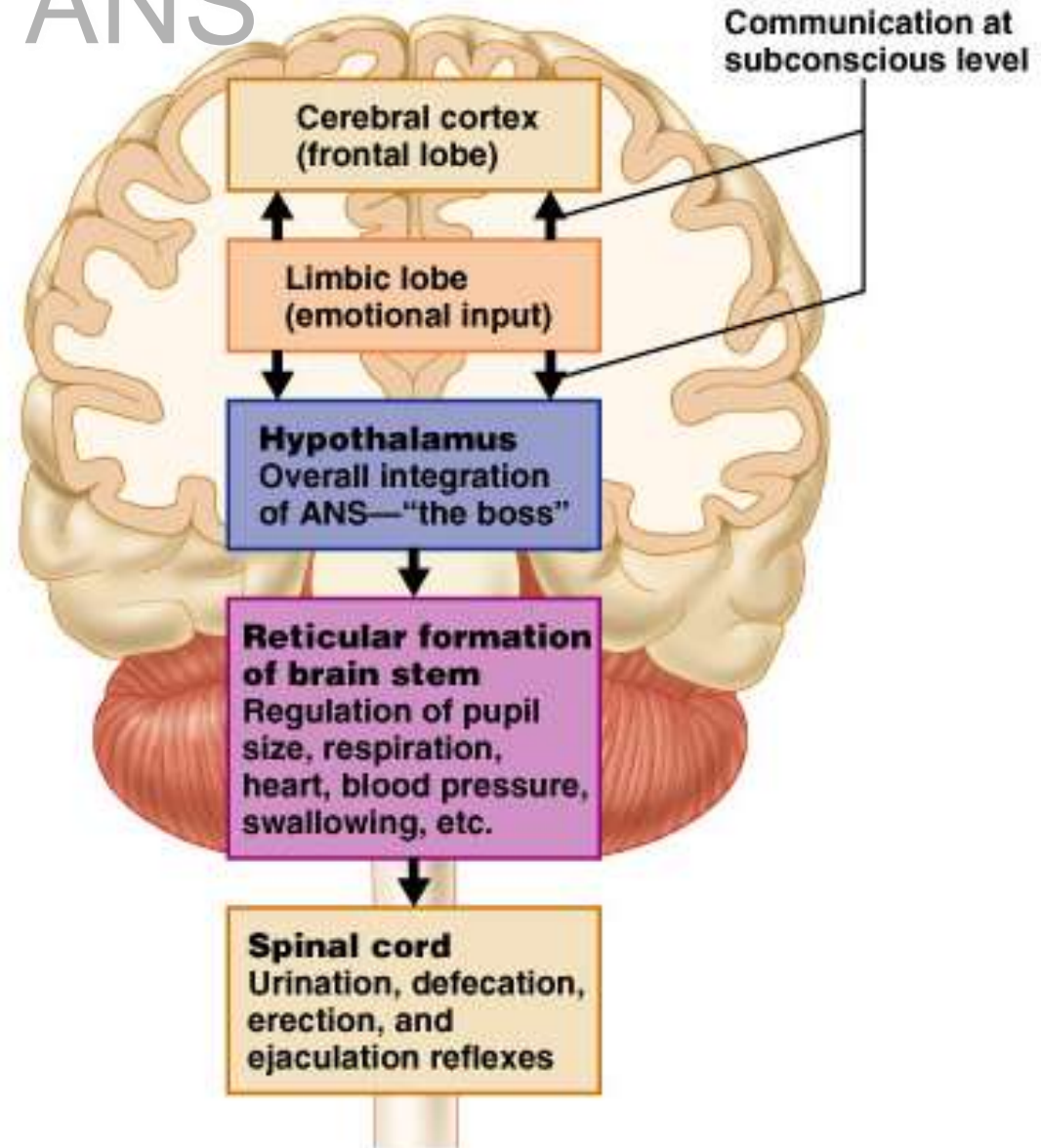
- Inputs to preganglionic neurons
- Hypothalamus
  - Controls heart rate, blood pressure, body temperature, digestion



(13.15)

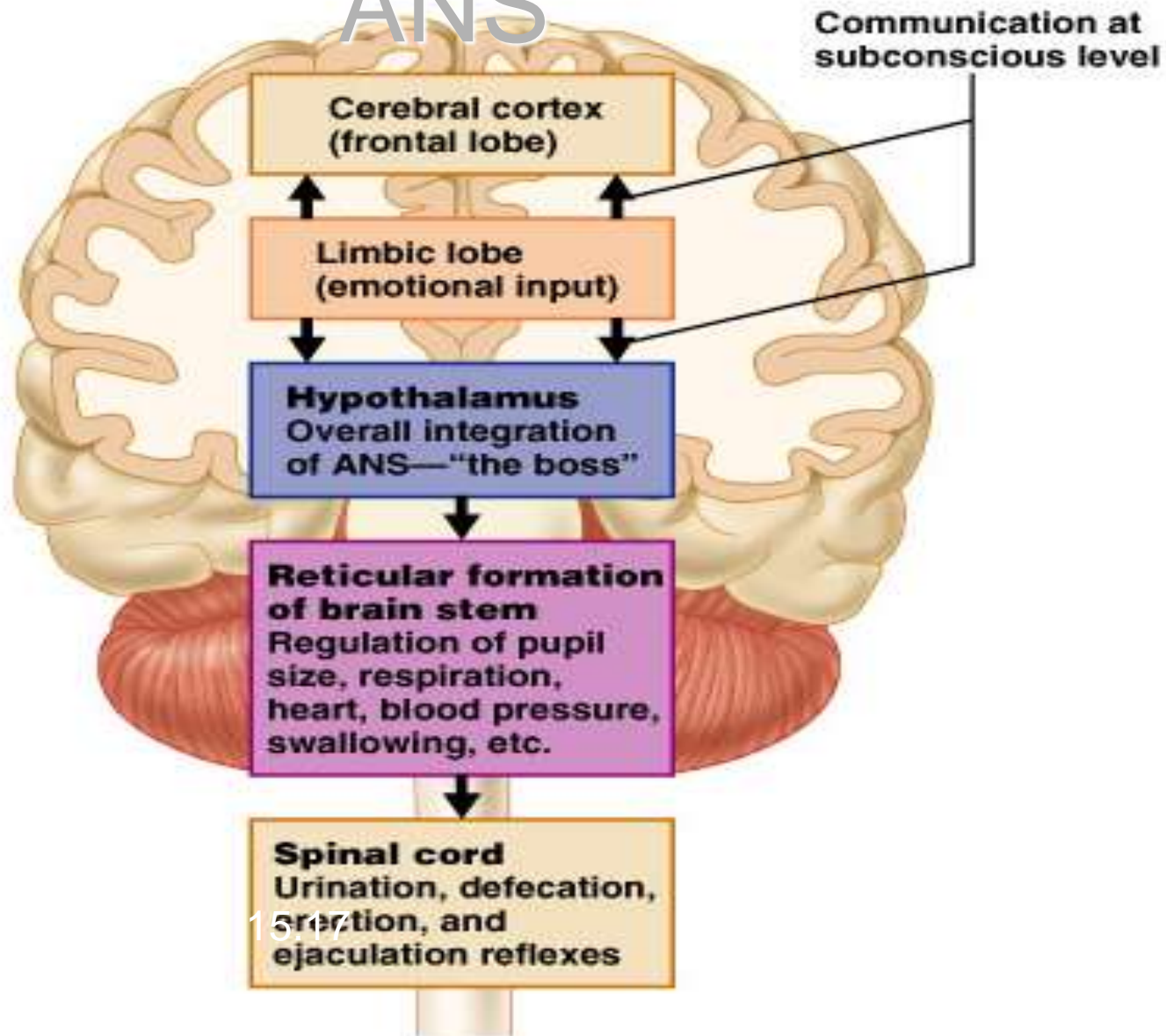
# CNS control of the

## ANS



# CNS control of the

## ANS







# Terima Kasih

## SEMOGA BERMANFAAT