Nervous Tissue

Lec. 10

Second year
Histology
A.T. Hadeel Kamil

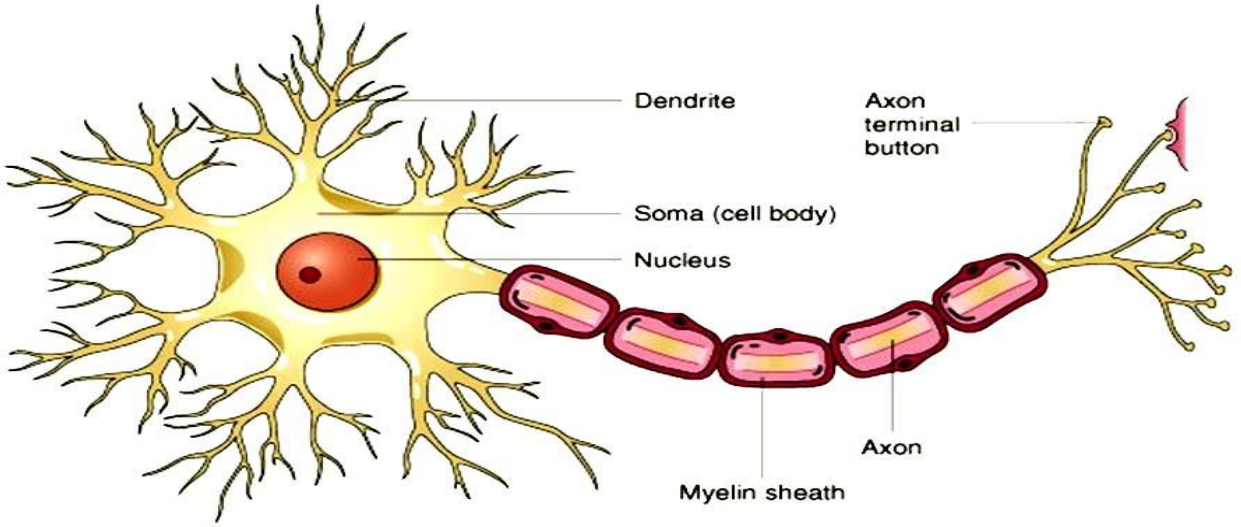
Nervous Tissue consists of 2 types of cells

1 - Neurons – main cells, specialized to

- perception of sensory stimuli,
- processing received information and
- transmission it further to other neurons in form of nerve impulses

2 - Neuroglia

- they support,
- nourish and
- protect neurons



Neuron Structure

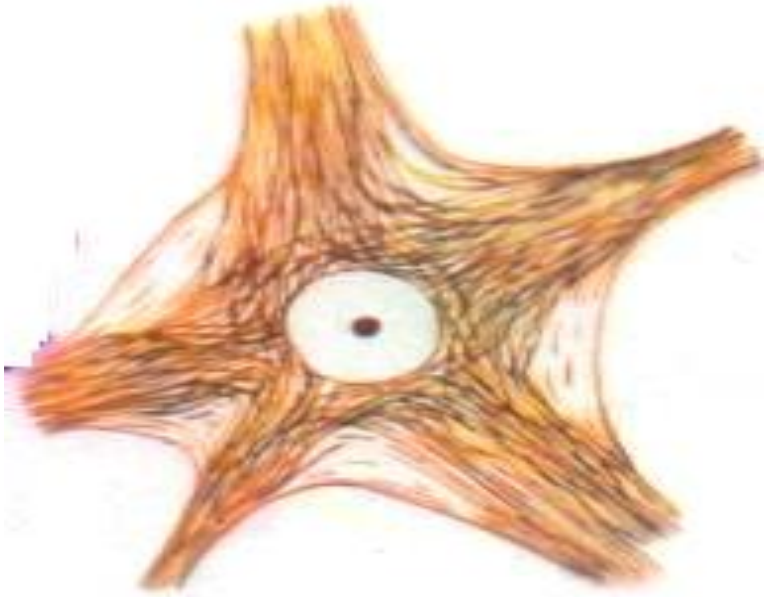
1. Cell body = perikaryon = contains nucleus and is the metabolic center of the cell

2. **Processes** – that extend from the cell body (dendrites and axon)

3. **Nerve endings** (synapses, special receptors)

Cell body has:

1. Nucleus with large nucleolus
2. Neurofibrils
3. "Nissl bodies" (chromophilic substance)



Neurofibrils

are present in the perikaryon, dendrites and axon and are unique to neurons. = "Skeleton" of the neurons

Nissl bodies

- large clumps of basophilic material around the nucleus, an aggregation of many parallel cisternae of the rough endoplasmic reticulum with the rosettes of free polisomal ribosomes

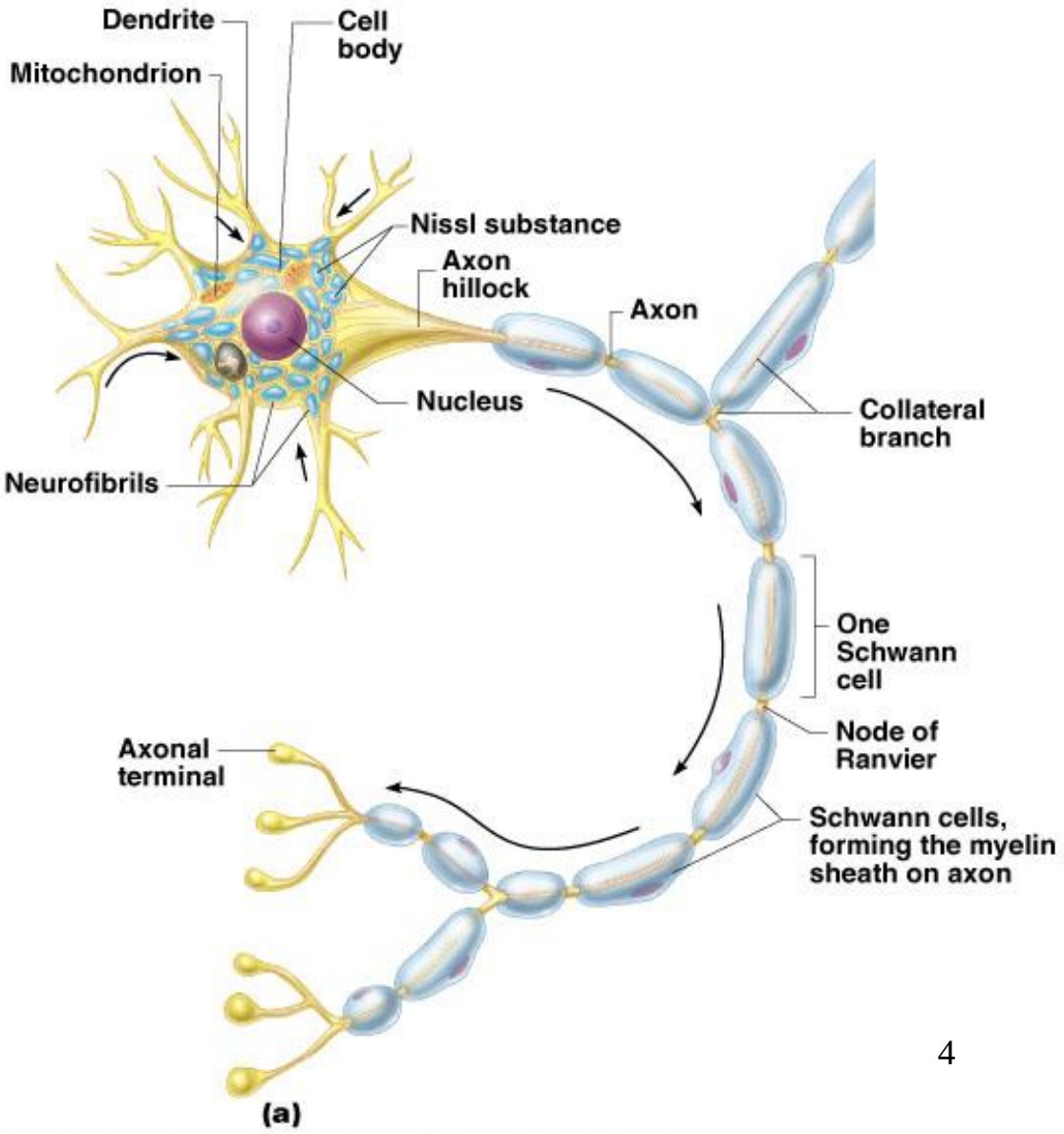
Function – protein synthesis (neurotransmitters)

Neuron processes - Extensions outside the cell body

- Dendrites – conduct impulses toward the cell body
- Axons –

conduct impulses away from the cell body (usually only 1)

- All processes end with the nerve endings

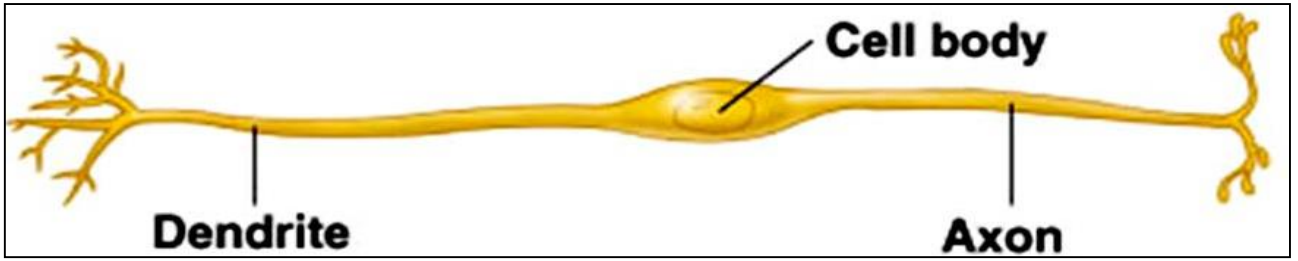


Structural Classification of Neurons

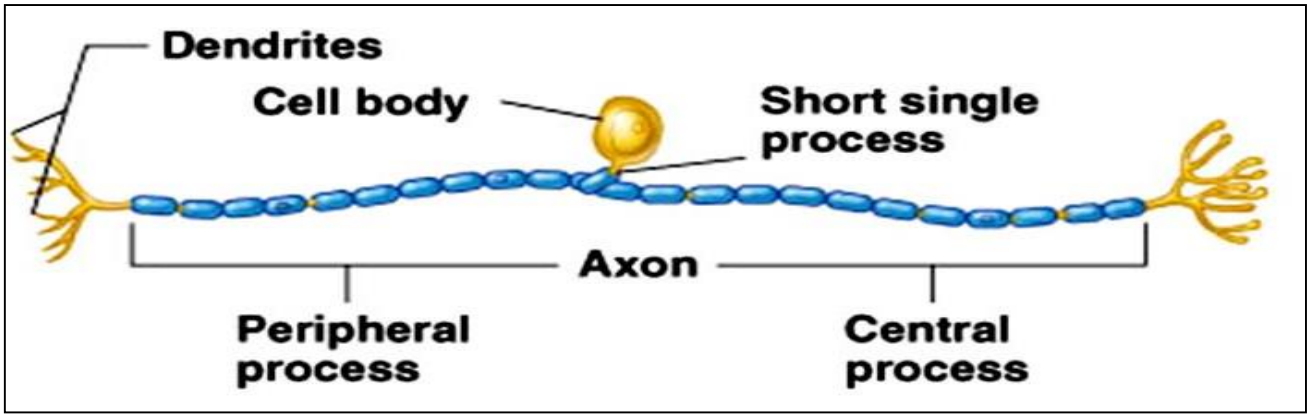
According to amount of processes

1. **Unipolar** neurons – are found during early embryogenesis. They have one axon

2. **Bipolar** neurons – one axon and one dendrite

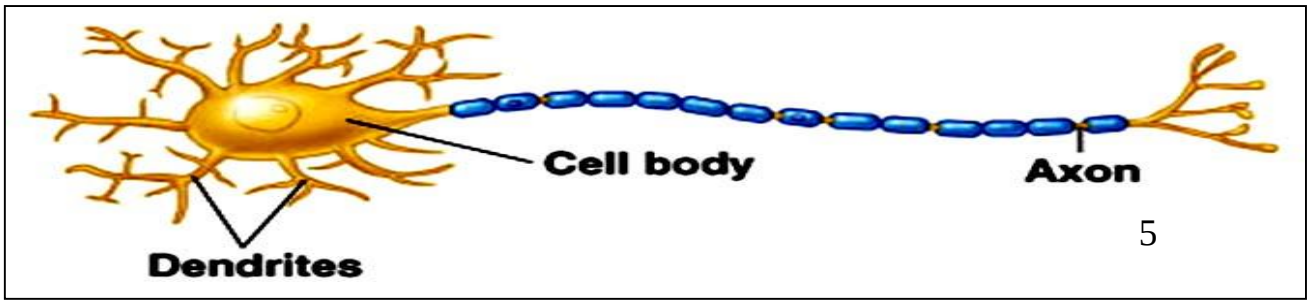


3. **Pseudounipolar** neurons – have a short single process leaving the cell body



4. **Multipolar**

neurons – many extensions from the cell body



Functional Classification of Neurons

1. Sensory (afferent) neurons

   Carry impulses from the sensory receptors to the cell body

2. Motor (efferent) neurons

   Carry impulses from cell body which lie in the central nervous system to effector cells

3. Interneurons (= association neurons)

   99,9% in the central nervous system

   Connect sensory and motor neurons

Supporting Cells (Neuroglia or Glia) = Macroglia + Microglia

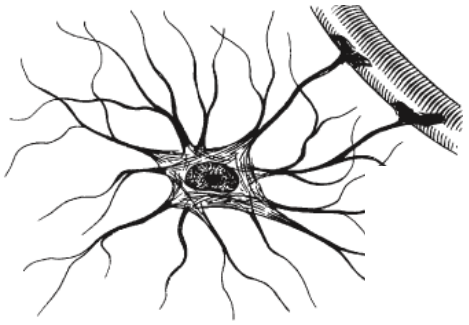
Macroglia in the **CNS**

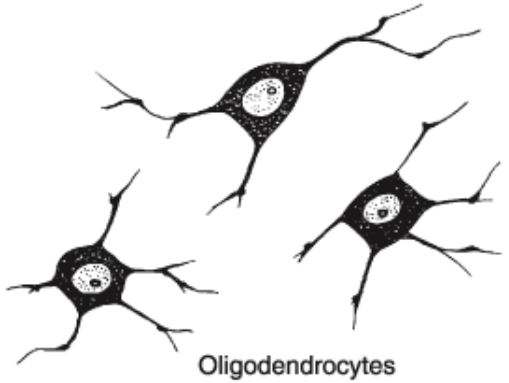
1. **Ependymal** cells Line cavities of the brain and spinal cord Synthesize cerebrospinal fluid.

2. **Astrocytes**

- Star-shaped cells
- Support neurons
- Form barrier between capillaries and neurons
- Control the chemical environment of the brain (CNS)

types: **Protoplasmic** and **Fibrous**


Fibrous astrocyte

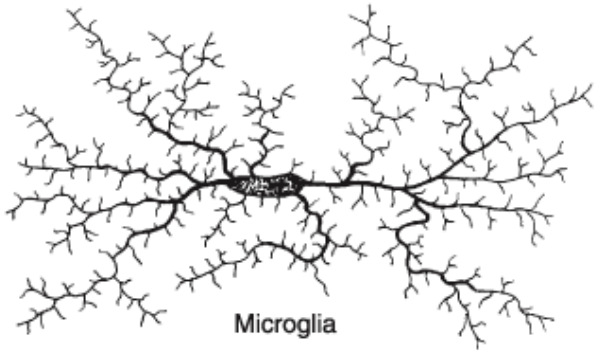

Oligodendrocytes

3. **Oligodendrocytes**

Produce myelin sheath around nerve fibers in the central nervous system - Nourish neurons

Microglia

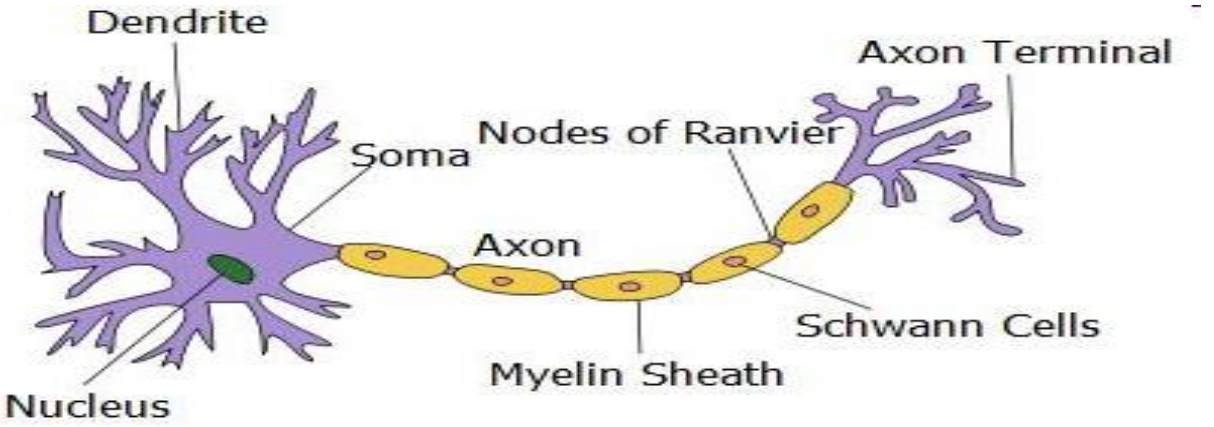
- A rise from monoblast of the blood
  - Spider-like
  - phagocytes
  - Dispose of debris


Microglia

Supporting Cells of the peripheral nervous system PNS

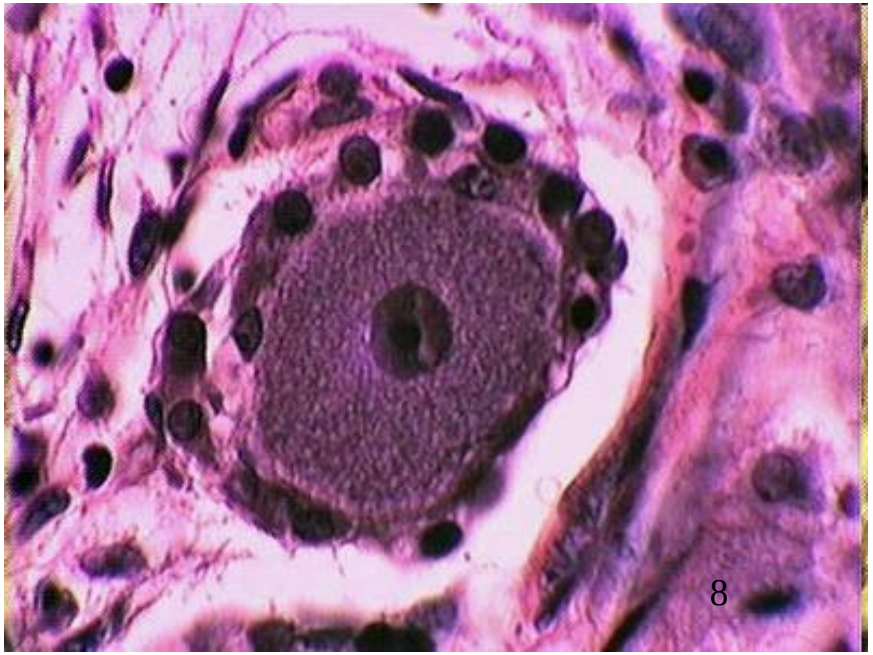
1. Schwann cells

form myelin sheath in the peripheral nervous system



2. Satellite cells

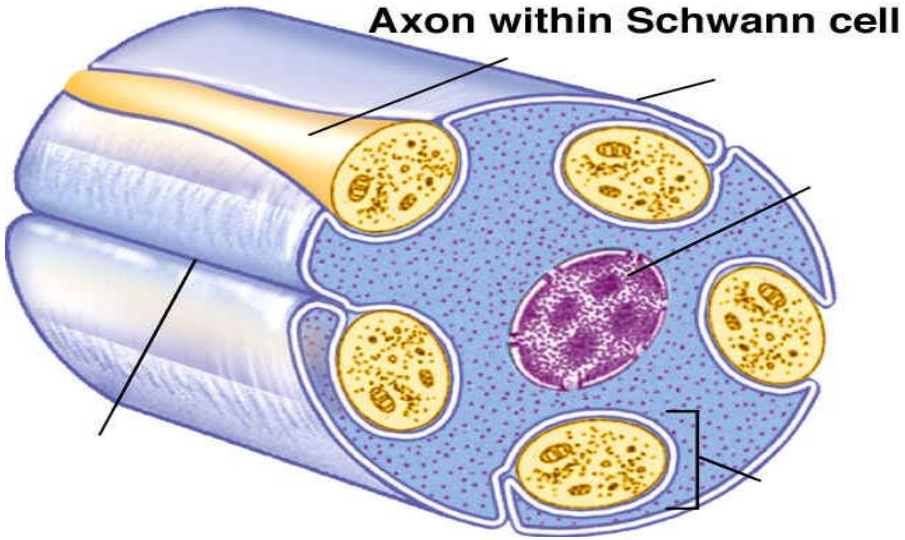
surround cell bodies of neurons in sensory ganglia



Nerve fibers : 1. Unmyelinated 2. Myelinated

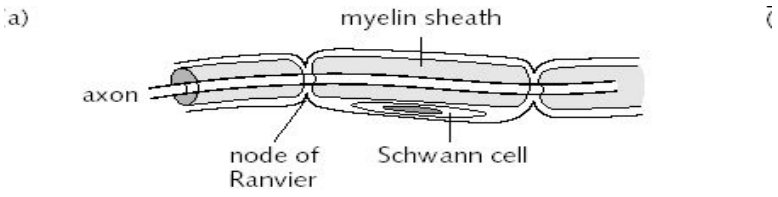
Unmyelinated nerve fiber:

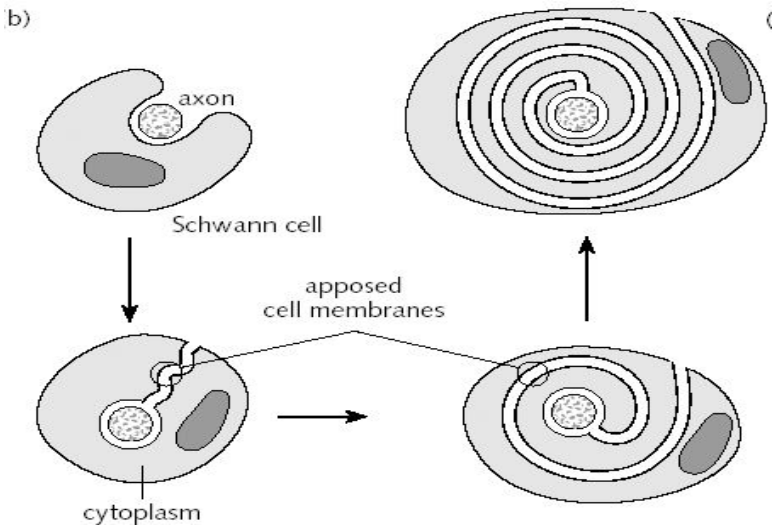
Axones and dendrites are invaginated in Schwann cell cytoplasm

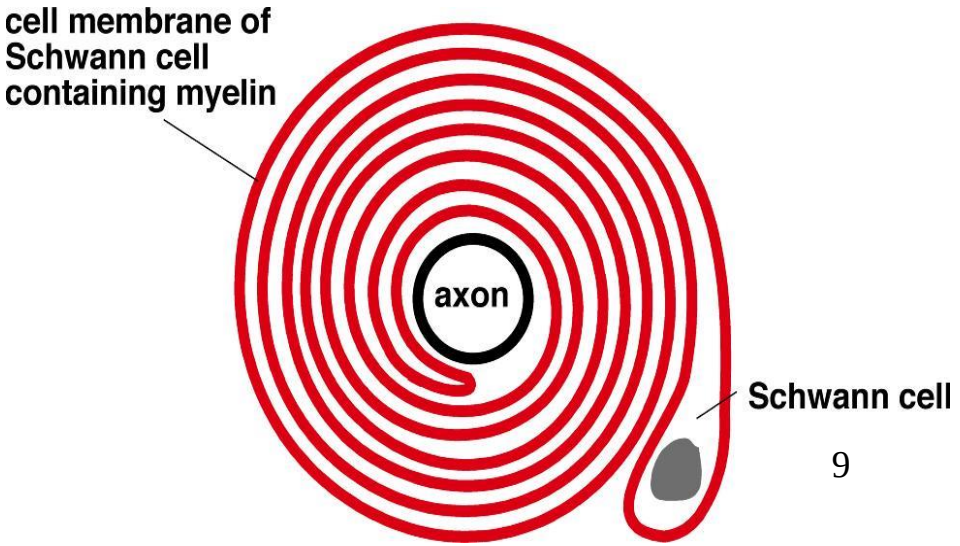


Myelinated nerve fibers

Schwann cells produce myelin sheath







Sensory nerve endings
(afferent neuron receptors)

Classification:

By type of the structure:

1. **A. Free nerve endings**

   B. Hair follicle nerve ending

   C. Merkel nerve endings (Merkel's disk)

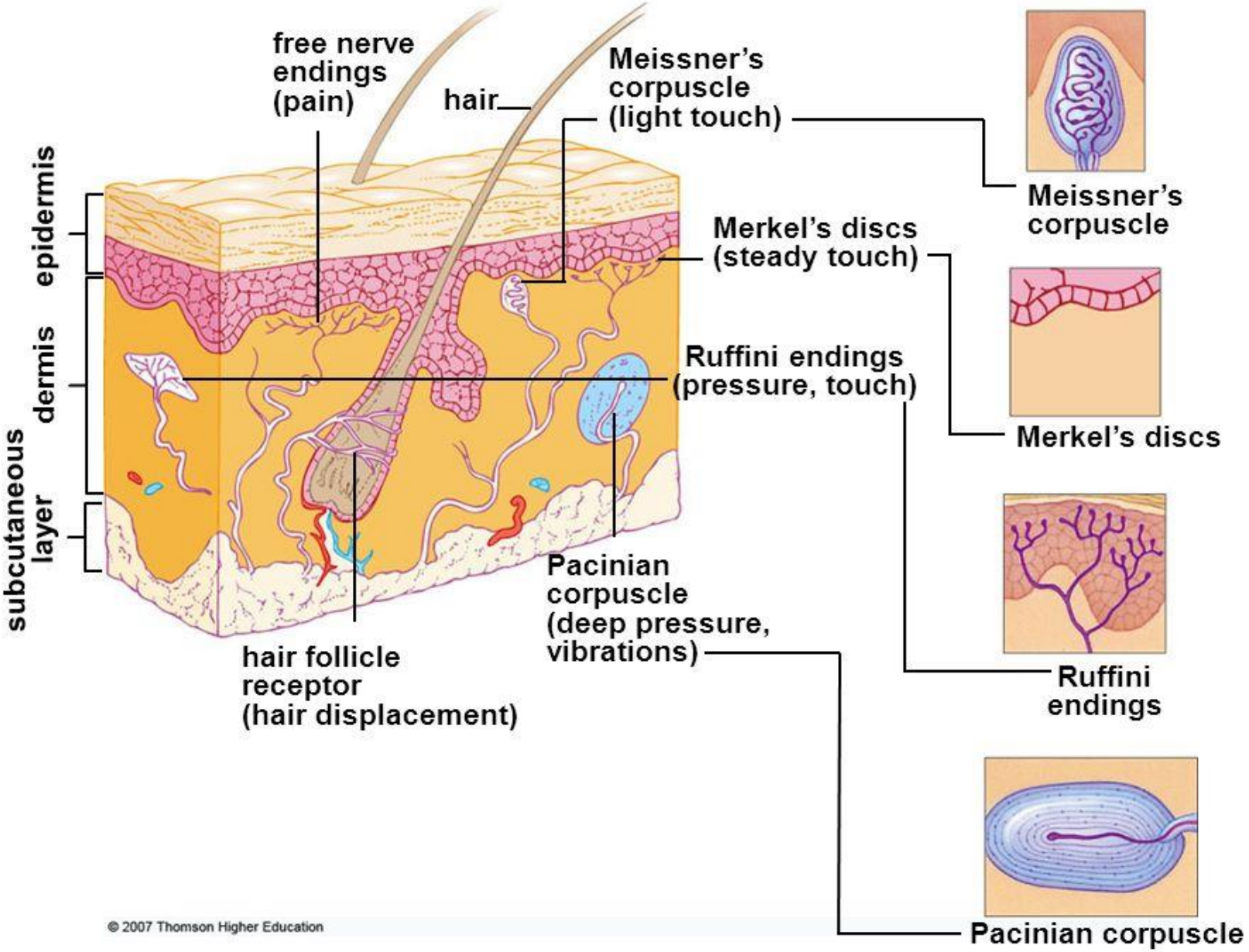
2. **Encapculated:**

   Tactile corpuscle of Meissner

   Corpuscle of Pacini

   Ruffini endings

3. **Muscle spindle**


free nerve endings (pain)
hair
Meissner's corpuscle (light touch)
epidermis
dermis
subcutaneous layer
Merkel's discs (steady touch)
Ruffini endings (pressure, touch)
Pacinian corpuscle (deep pressure, vibrations)
hair follicle receptor (hair displacement)
Meissner's corpuscle
Merkel's discs
Ruffini endings
Pacinian corpuscle
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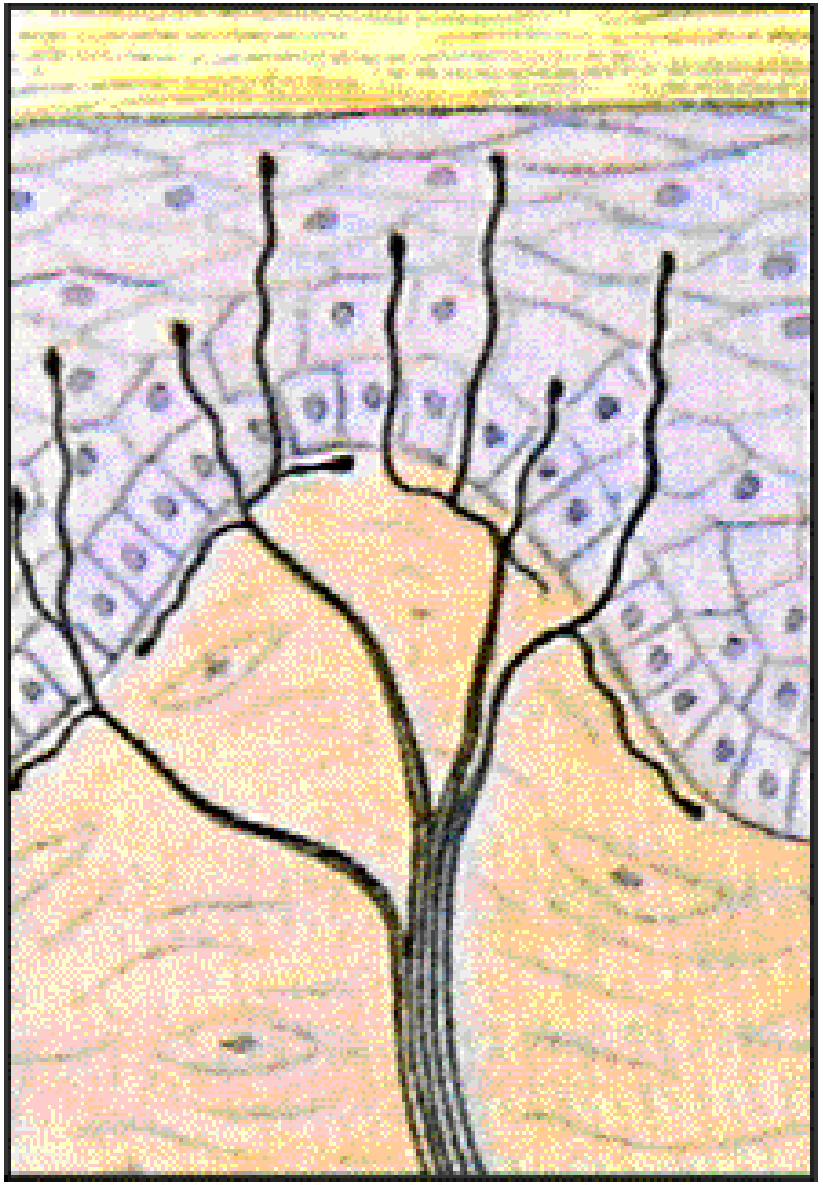
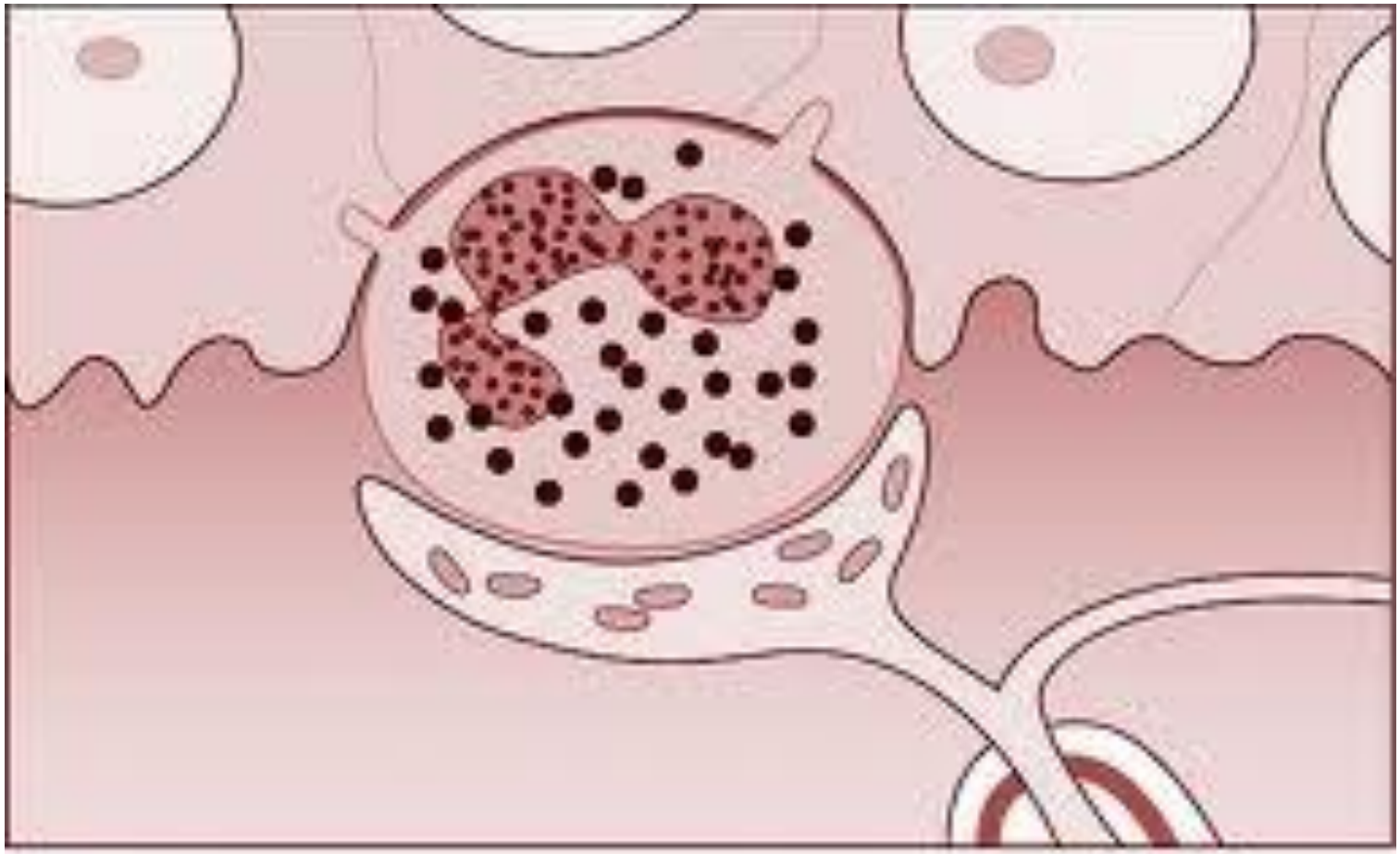
1. A. **Free nerve endings** – pain, thermal receptors



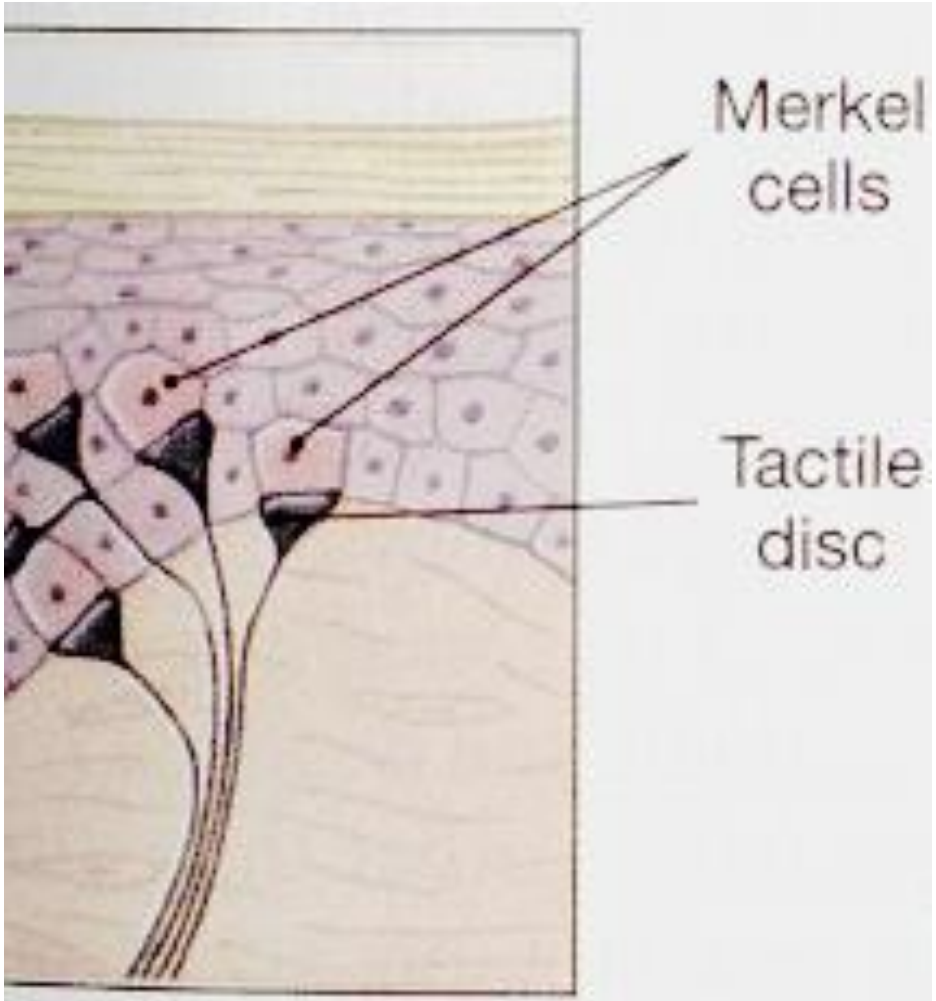
1. B. Hair follicle nerve endings – respond to very light touch

1. C. **Merkel nerve endings** – light touch receptors



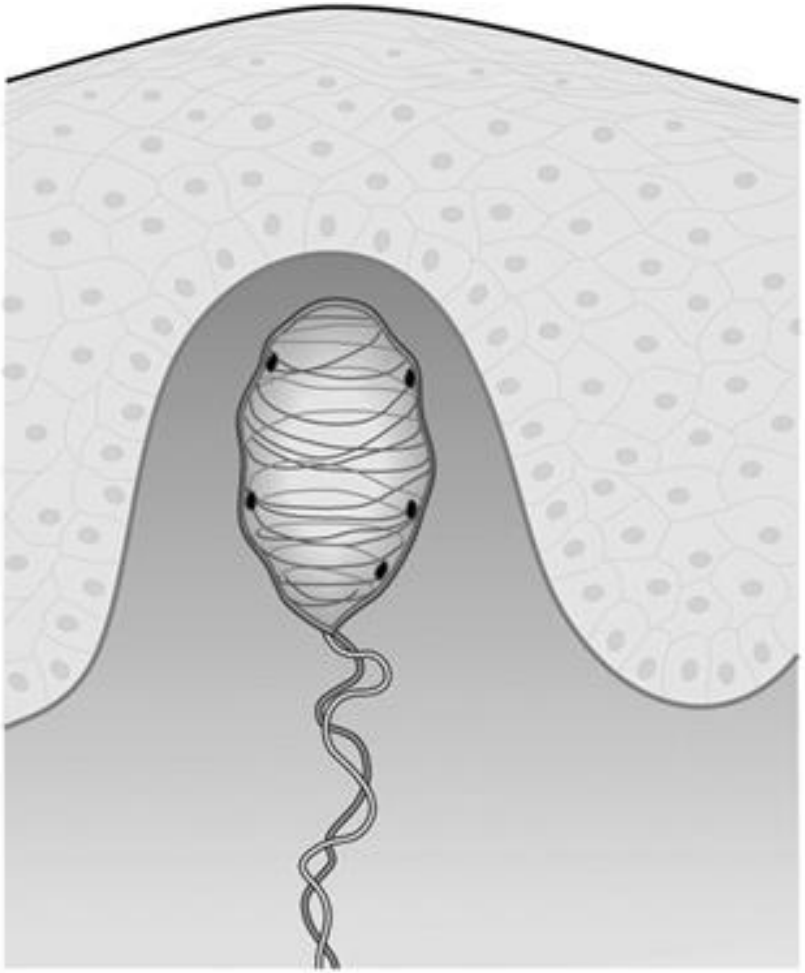
The nucleus of the cell is lobulated and the cytoplasm contains granules of unknown function similar to secretory granules. The axon terminal is filled with mitochondia and covered by a Schwann cell until it enters the Merkel cells.

1. C. **Merkel nerve endings** – light touch receptors

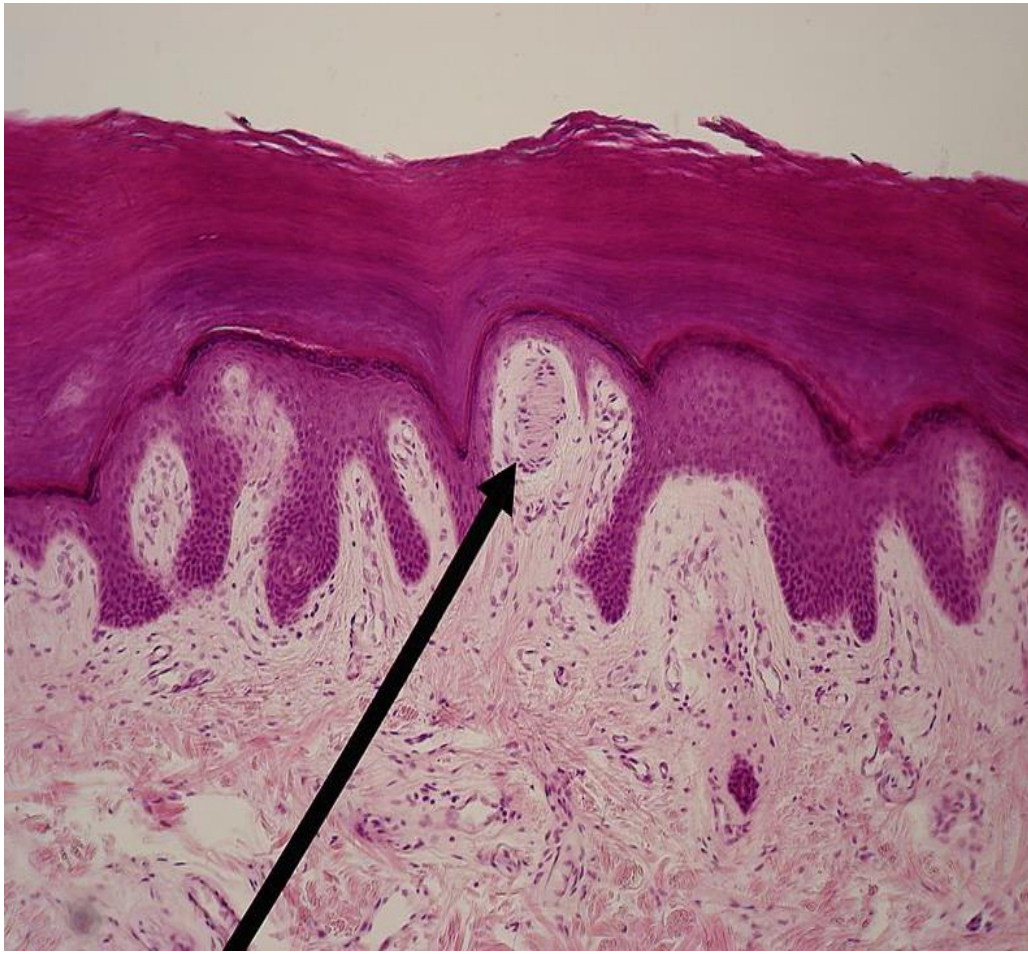


Merkel cells and tactile discs

2. Encapsulated = Tactile corpuscle of Meissner

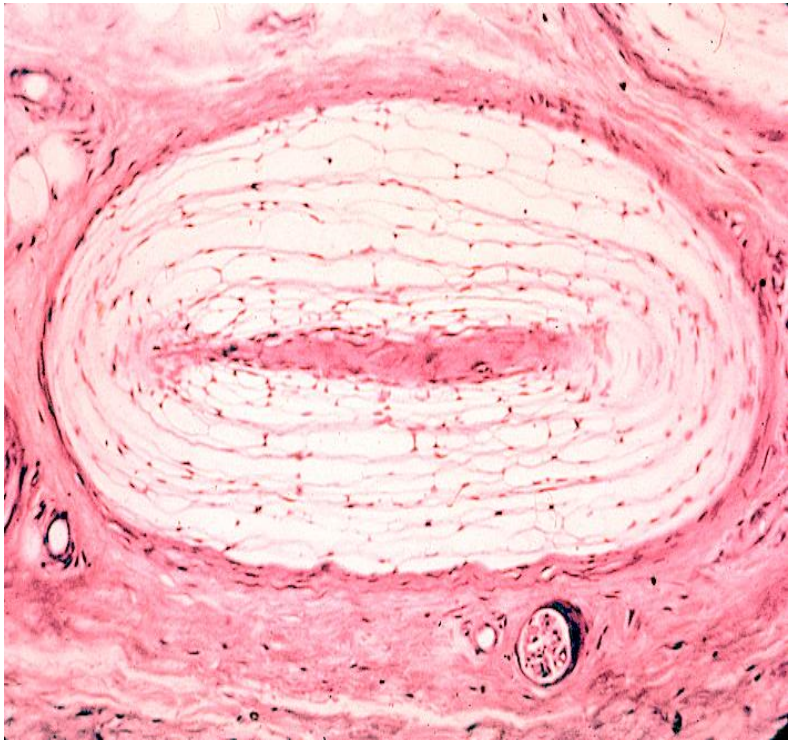


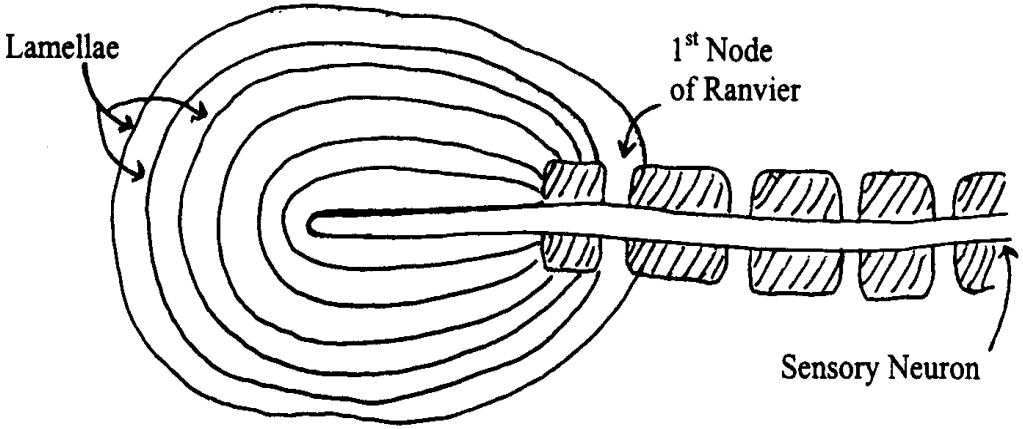
Non-neural corpuscular cells are wrapped around one or more branching nerve terminals. The structure is most sensitive to low-frequency vibrations.
Source: Dykes 1977.



2. Encapsulated. Corpuscle of Pacini

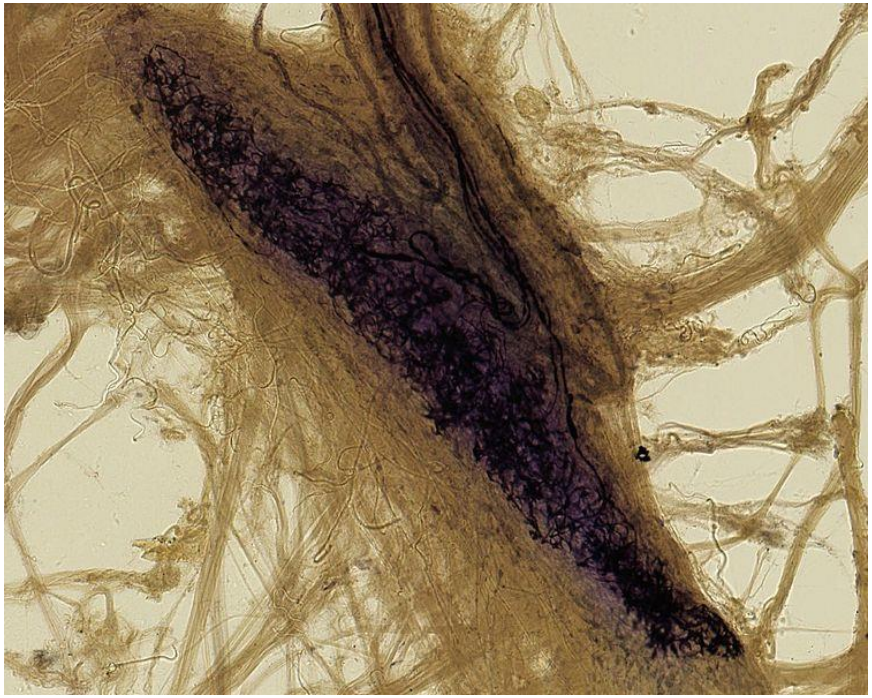
(lamellar body) is specialized to detect gross pressure changes and vibration

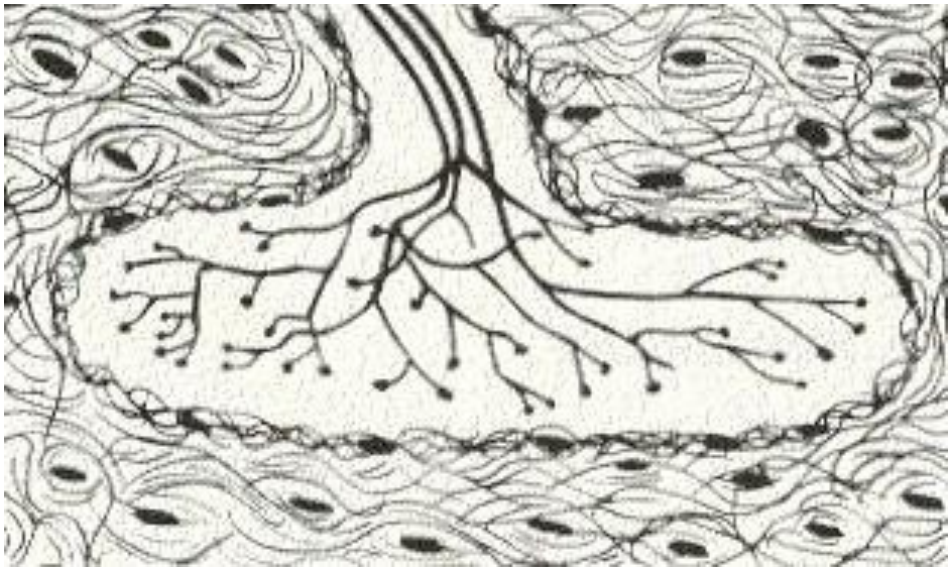


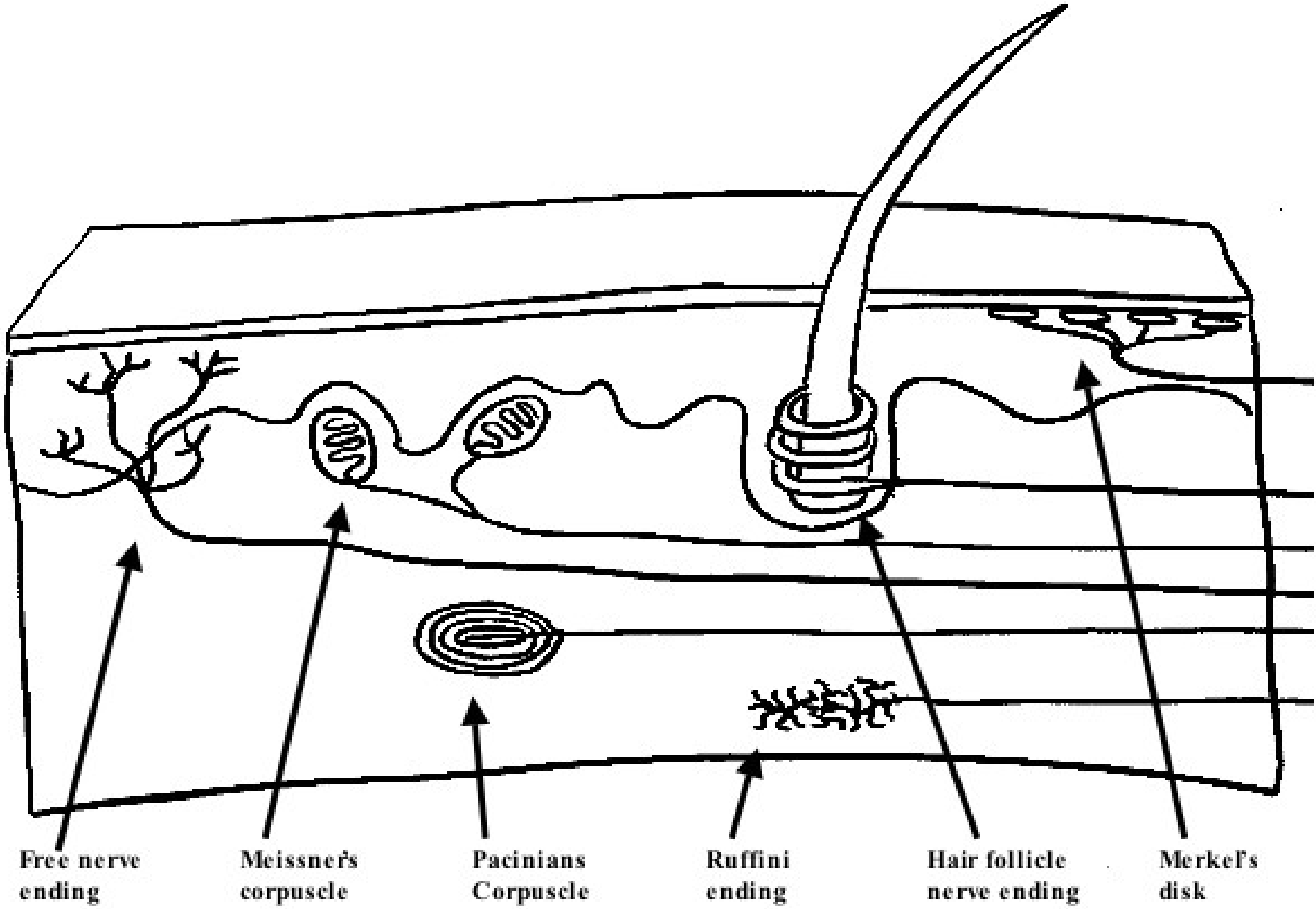


2. Encapsulated. Ruffini ending

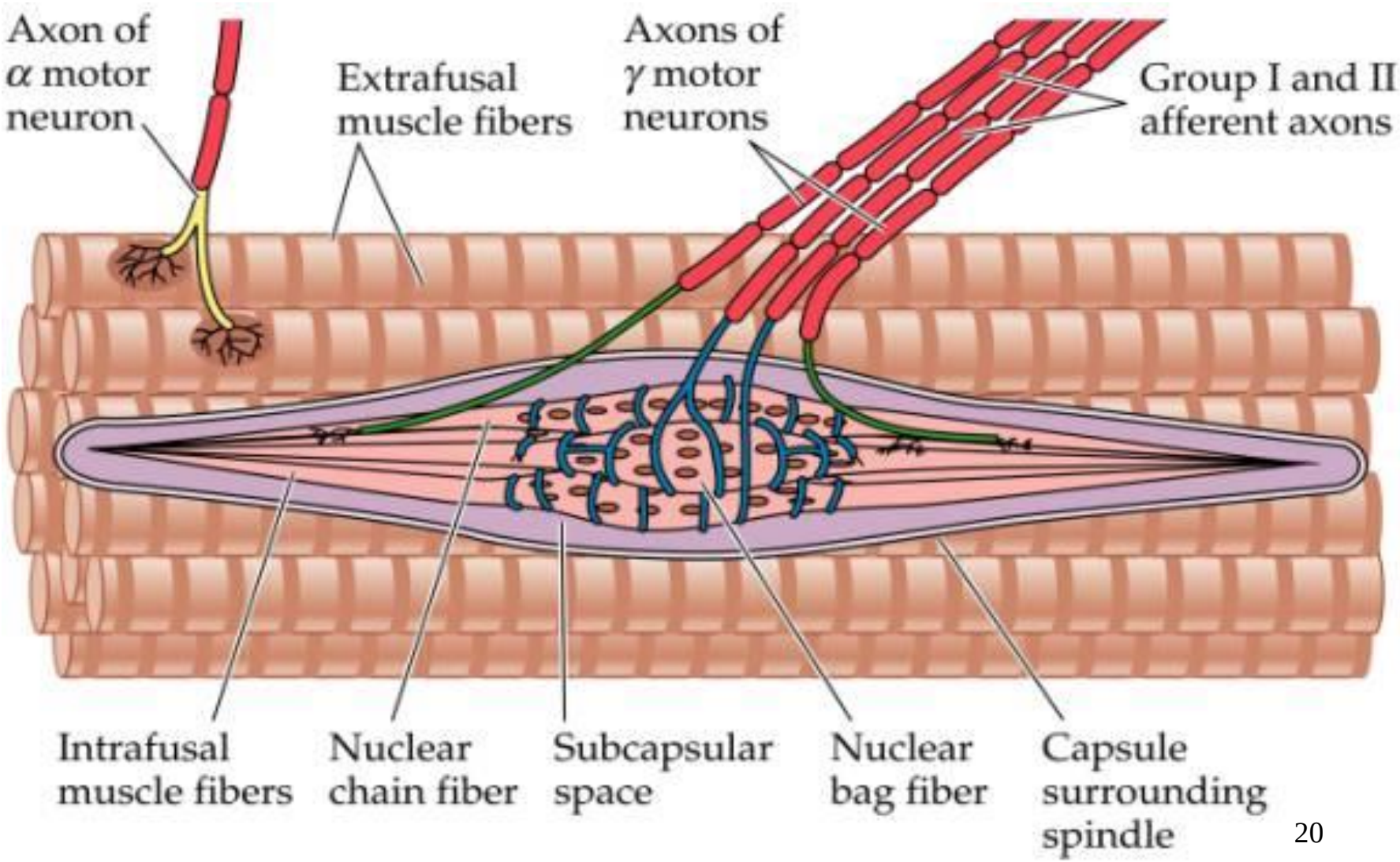
Dense branches of nerve-endings encapsulated in connective tissue. Is sensitive to skin stretch






Free nerve ending
Meissner's corpuscle
Pacinians Corpuscle
Ruffini ending
Hair follicle nerve ending
Merkel's disk

3. Muscle spindle (detects muscle stretch)



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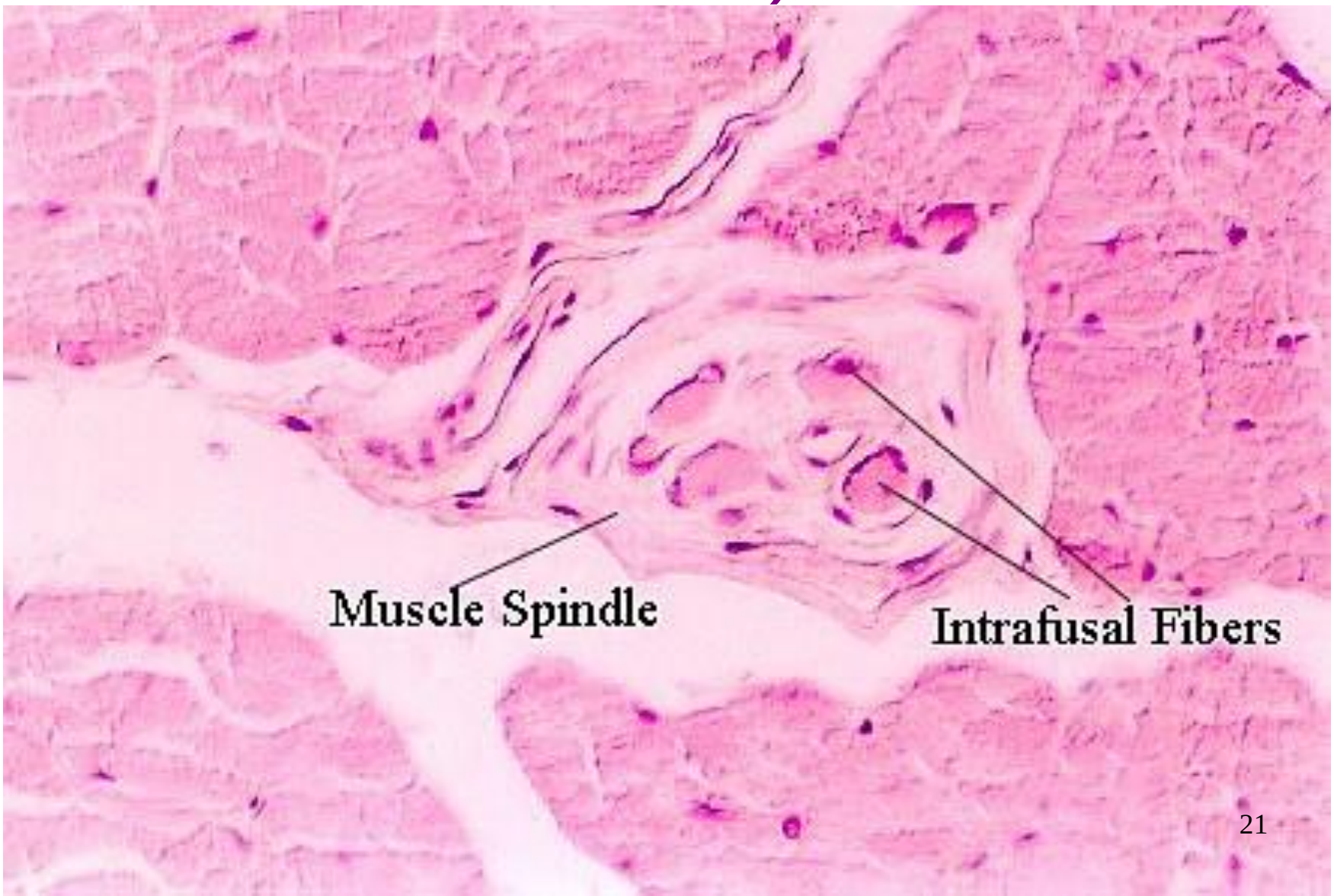

3. Golgi tendon organ (detects muscle tension)