Anatomy

Sheet

Lec No: 3

Subject: Missed histology section

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00/00/2017

The topics discussed here were not mentioned in the records for the written sheets. And are mainly about histology section.

Table 1. Motor and Sensory Classification of Nerve Fibers

Sensory (Groups)		Sensory and Motor	Greatest Fiber Diameter (μ)	Greatest Conduction Velocity (meters/sec)	General Comments
Ia	=	Aα	22	120	Motor—the large alpha motor neurons of lamina IX Sensory—the primary afferents (annulospiral) of muscle spindles
Ib	=	Aα	22	120	Sensory—Golgi tendon organs, touch, and pressure receptors
II	=	Aβ	13	70	Sensory—the secondary afferents (flower spray) of muscle spindles, touch, and pressure receptors, Pacinian corpuscles (vibratory sensors)
		Aγ	8	40	Motor—the small gamma motor neurons of lamina IX innervate muscle spindles
III	=	Aδ	5	15	Sensory—small lightly myelinated fibers, touch, pressure, pain, and temperature
		B	3	14	Motor—small lightly myelinated preganglionic autonomic fibers
IV	=	C	1	2	Motor—all postganglionic autonomic fibers (all are unmyelinated) Sensory—unmyelinated pain and temperature fibers

Notice → Afferents from muscle spindle are Ia & II

Afferents from Golgi tendon organ is → Ib

Pain fibres run in two types of afferents → Aδ & C

Remember that the greater the diameter of the nerve fibre → the thicker the myelin sheath and the faster the conduction velocity

- **How to classify nerve fibers(axons) ?**
  there are two ways :
  - **Alphabetical (i.e. A {α ,β ,γ, δ} , B ,C)**
  - **Latin numbers (i.e. I{a ,b} ,II ,III, IV)**

The thickest fibers are the first (e.g. Ia is much thicker than IV , and Aα has a much wider diameter than C)

The larger the diameter of a nerve fiber → the thicker the myelin sheath → the faster the conduction

Check the table above and compare (see both diameter and conduction velocity columns) and don't memorize numbers.

The types of nerve fibers that conduct pain are Aδ and C that are relatively slow conductors ,which is good. Because if you are punched , pain is conducted slowly and you won't scream and ask for help. The same with postganglionic autonomic fibers.

According to the muscle spindle (receptor inside the muscle) ; its efferent fibers towards spinal cord are of type Aα which is fast conducting fiber).

☙ Cerebral cortex

Cerebral cortex is divided into three types :

i. Isocortex (neocortex) : contains 6 layers (90% of cerebral cortex)

ii. Allocortex : contains 3 layers and of two types :

   A. paleocortex {in olfactory region}

   B. archicortex {in hippocampus which is part of the limbic system that firstly destroyed in case of Alzheimer disease}.

iii. Mesocortex : contains 3-6 layers. (e.g. parahippocampal gyrus on the outer surface of temporal lobe medially which is also part of the limbic system but of less importance than hippocampus)

☞ Now let's discuss the figure in the next page :
The cortex layers are arranged horizontally from outside to inside, but in reality they are arranged in columns as following:

- Molecular layer
- External granular
- External pyramidal
- Internal granular
- Internal pyramidal
- Multiform

- The main cell types are pyramidal cells of different sizes (small, medium and large).
  As an example of neural cell, pyramidal cell has several dendrites and single axon which may descends as projection (corticofugal) fiber to form pathways as motor pathway , while dendrites interdigitate with other cells (axo-dendritic, axo-somatic and axo-axonic synapse).
- Granule (stellate) cells are also prominent.
  The rest of cells are interneurons : fusiform cells, horizontal cells and cells of martinotti.
- Layers 1, 5 and 6 are present in all types of cortex.
- Layers 2, 3 and 4 are present only in neocortex.
- Layers 1, 2, 3 and 4 are considered receptive (i.e. receive input or afferent)
- Layers 5 and 6 are efferent.
- The largest pyramidal cells are found in layer 5 → called giant pyramidal cells of betz where their axons are involved in 3% of corticospinal tract which is important for both upper and lower limbs muscles.

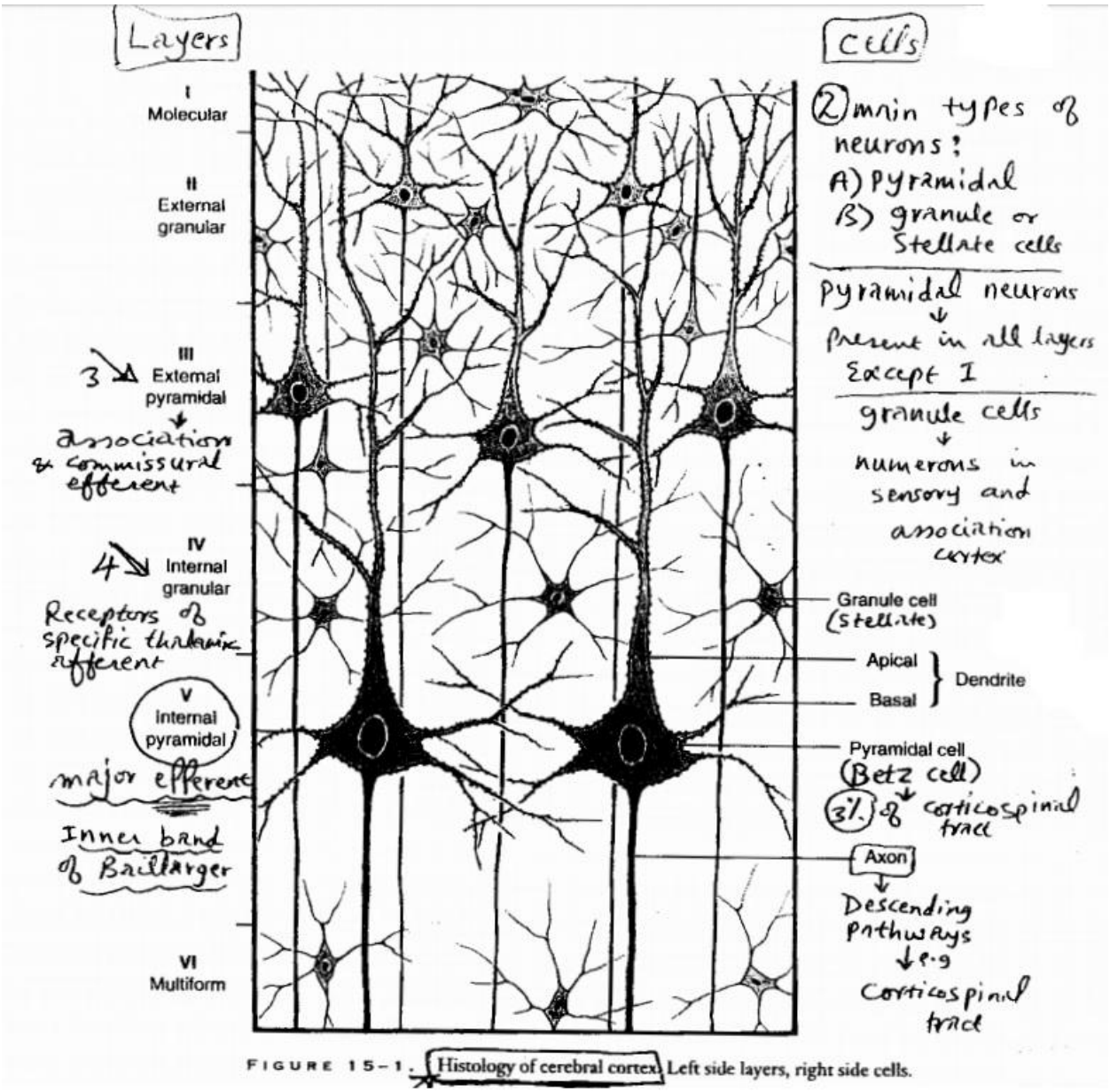
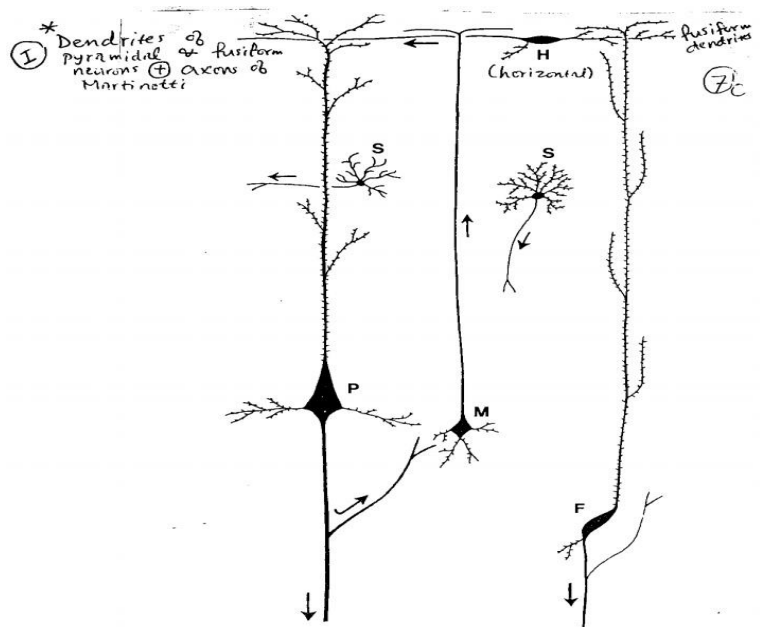


FIGURE 15–1. Histology of cerebral cortex. Left side layers, right side cells.



Cortical neurons .

H, horizontal neuron;

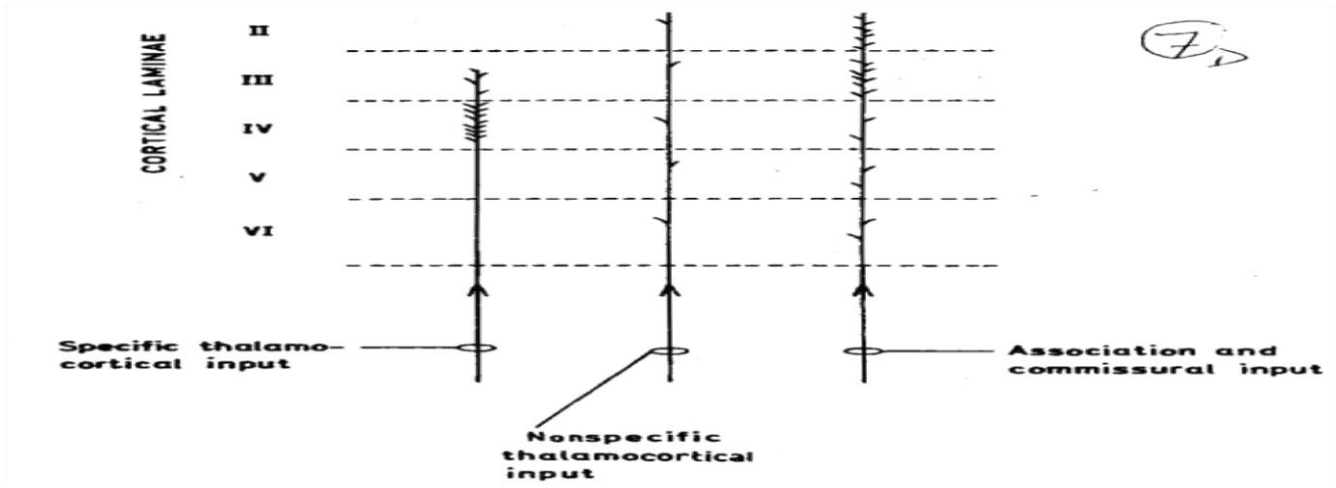
S, stellate neuron;

P, pyramidal neuron;

M, martinotti neuron;

F, fusiform neuron.

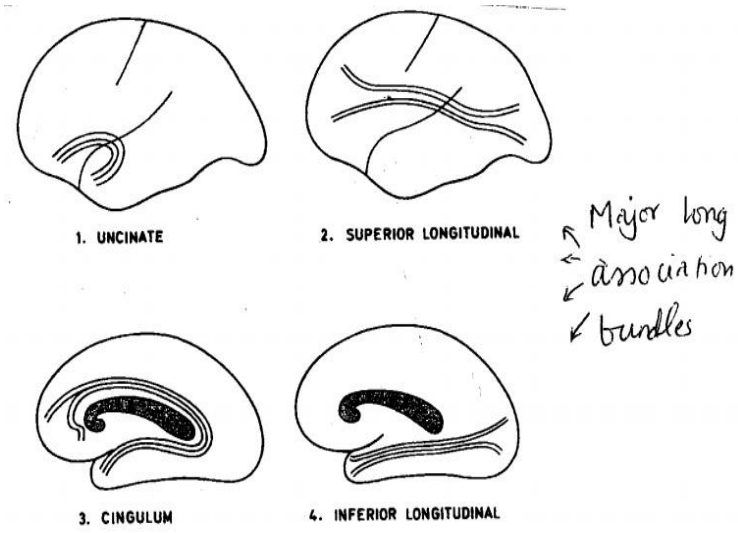
Termination pattern of the various inputs to cortical laminae :

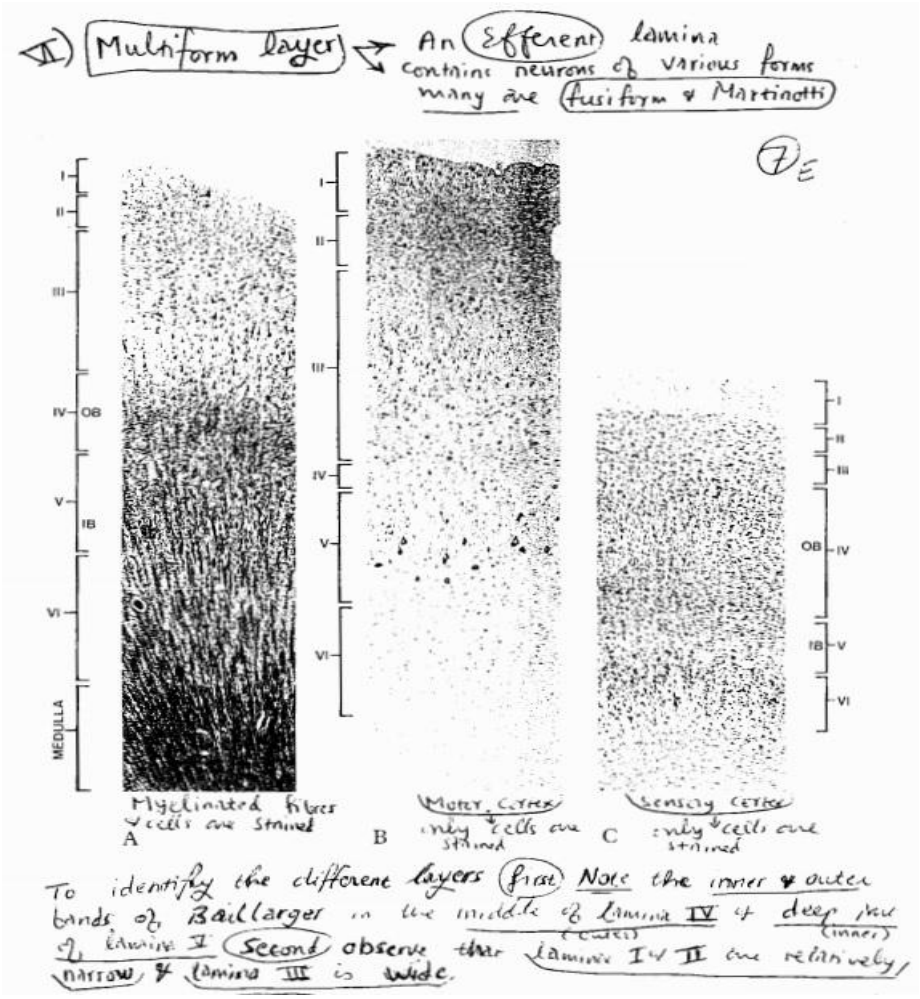


- **T**he input to cerebral cortex (ascending / sensory) must go through thalamus as a last station before the cortex.
- Thalamus has two types of nuclei : specific (VA, VL and VP) and nonspecific
- Specific thalamic nuclei fibers end mainly at the 4th layer and to less extent at layer 3.
  (also called specific thalamocortical), while nonspecific nuclei fibers end at all layers .
- Recall: Mother cells are present in cortex , where their axons forms association , commissural or corticofugal fibers. Here , association and commissural end mainly at the first three layers especially layers 1 and 2.

Types of association (intrahemispheric):

- ☞ Uncinate: gyrus to gyrus
- ☞ Superior longitudinal : frontal to occipital
- ☞ Inferior longitudinal : temporal to occipital
- ☞ Cingulum: (white matter) frontal to parietal to temporal





How can I differentiate between layers in a myelin stained section?

- 1st & 2nd layers are thin
- 3 is wide relatively
- 4th layer has an obvious line called outer-band (OB) of Baillarger (represents the association in layer 4)
- (OB) line is most obvious in the visual cortex of occipital lobe so we call it striated cortex.
- (IB) inner-band is present in layer 5 , where as we said the largest cells are found.
- Layer 6 has few cells.
- All are gray matter till reaching the white matter. (medulla)