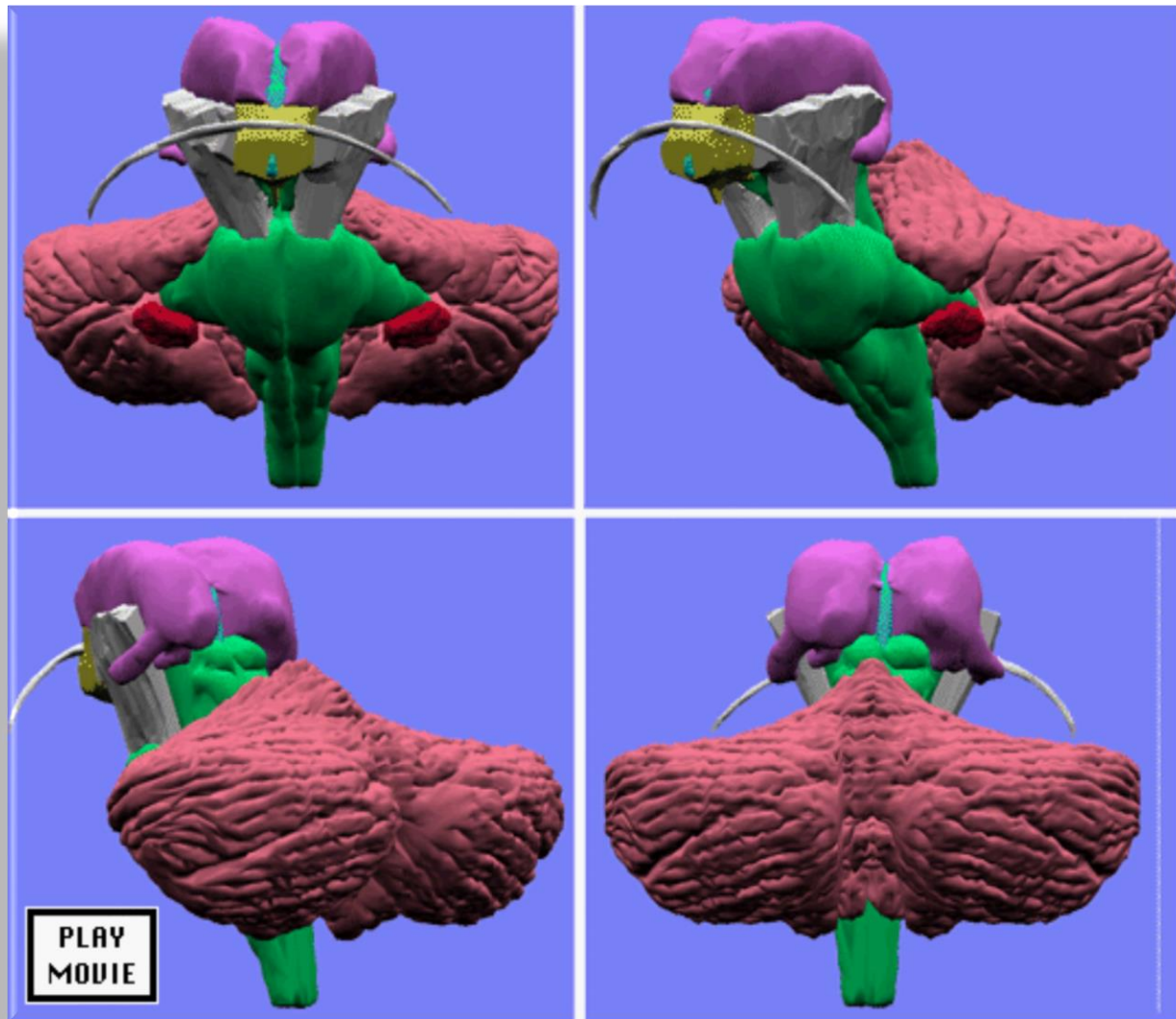


BASICS OF NEUROBIOLOGY

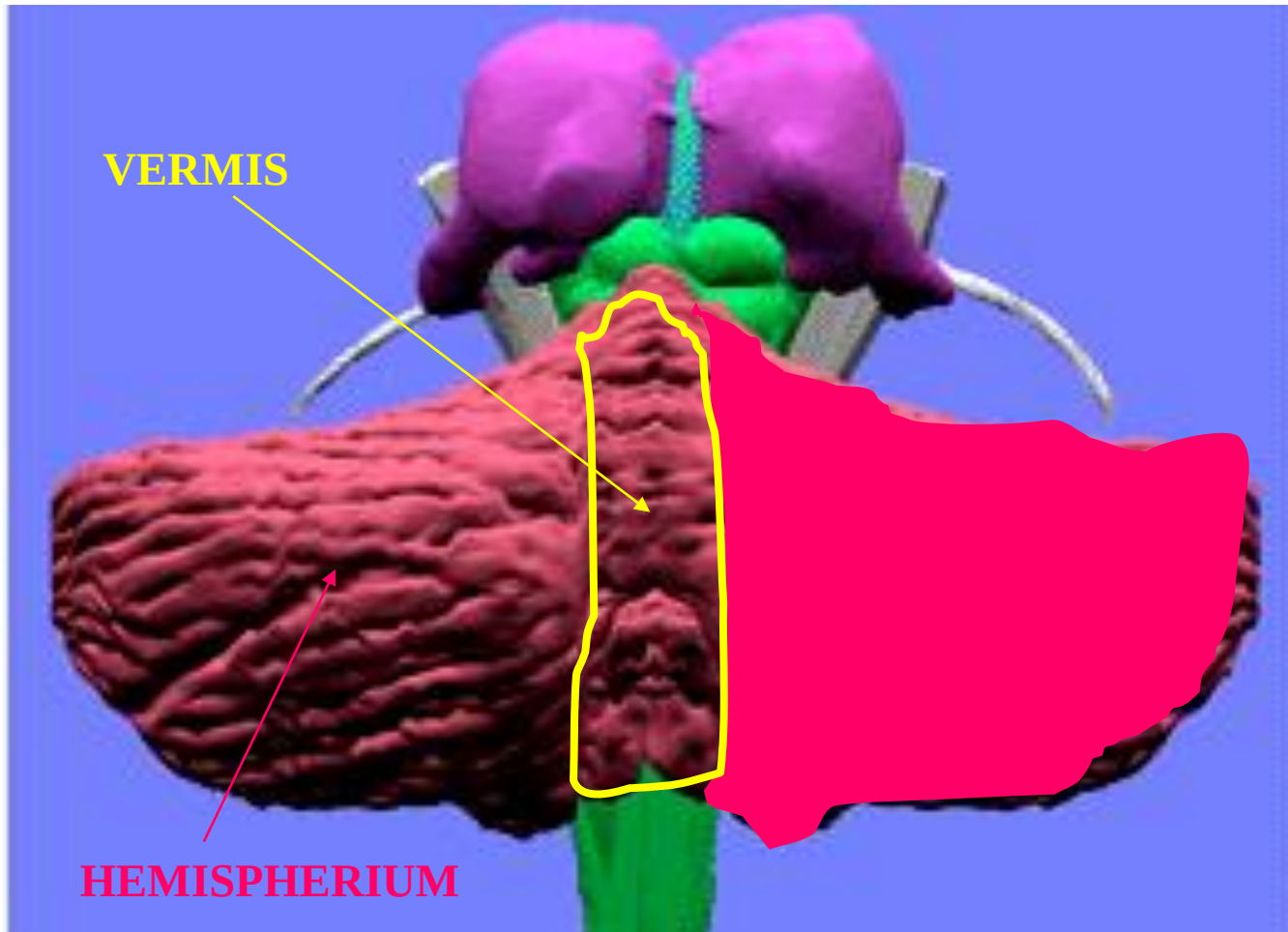
STRUCTURE OF CEREBELLUM

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CHARACTERISTICS OF THE CEREBELLUM

THE CEREBELLUM CONSISTS OF THREE BASIC CONSTITUENTS: CEREBELLAR CORTEX, THE MEDULLARY SUBSTANCE AND THE DEEP, INTRINSIC NUCLEI

STRUCTURALLY THESE COMPONENTS BUILD UP THE TWO SYMMETRICAL HEMISPHERES AND THE VERMIS BEING WEDGED BETWEEN THEM

CEREBELLAR FISSURES DIVIDE THE CEREBELLUM INTO LOBES (ANTERIOR, POSTERIOR AND FLOCCULO-NODULAR) THAT CONTAIN FURTHER SUBUNITS (LOBULES I-X). THE DIVISION PERTAINS TO BOTH THE HEMISPHERES AND THE VERMIS

PHYLOGENETICALLY IT ALSO HAS THREE PARTS:

- 1. ARCHICEREBELLUM.** THIS ANCIENT PART CONTAINS THE FLOCCULO-NODULAR SYSTEM. IT IS RELATED TO THE VESTIBULAR SYSTEM AND CONCERNED WITH EQUILIBRIUM. FUNCTIONALLY, IT IS THE VESTIBULO-CEREBELLUM.
- 2. PALEOCEREBELLUM.** IT CONSISTS OF THE ANTERIOR PORTIONS OF THE HEMISPHERES AND MOST OF THE VERMIS. IT IS LINKED TO SPINAL CORD, ALSO CALLED AS SPINOCEREBELLUM
- 3. NEOCEREBELLUM.** THE REMAINDER OF THE CEREBELLUM LINKED TO THE CEREBRAL CORTEX. ITS SYNONYM IS CEREBRO-CEREBELLUM

Basics of Neurobiology: Structure of cerebellum

CHARACTERISTICS OF THE CEREBELLUM

THE CEREBELLUM IS HIGHLY INTERCONNECTED WITH THE REST OF THE NEURO-AXIS. THE INCOMING AND OUTGOING PROJECTIONS ARE ORGANIZED INTO THREE CEREBELLAR PEDUNCLES CONNECTING THE CEREBELLUM TO THE MEDULLA, THE PONS AND THE MESENCEPHALON

ALTHOUGH THE CEREBELLUM RECEIVES A LARGE QUANTITY OF SENSORY INFORMATION, IT IS NOT CONCERNED WITH CONSCIOUS PERCEPTION. THE STIMULI FROM THE RECEPTORS ARE IMPORTANT REGULATORS OF CEREBELLAR MECHANISMS CONTROLLING THE AUTOMATIC COORDINATION OF SOMATIC MOVEMENT, MUSCLE TONE AND MAINTENANCE OF EQUILIBRIUM

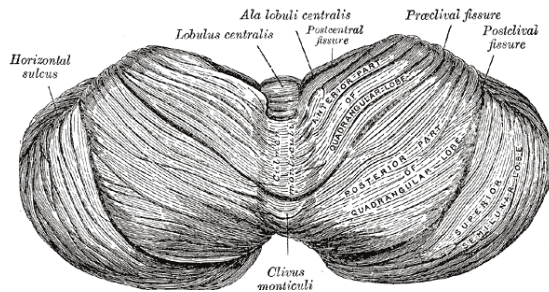
THE PROCESSED INFORMATION FROM THE CEREBELLAR CORTEX IS TRANSMITTED TO THE DEEP CEREBELLAR NUCLEI THE MAIN RELAY STRUCTURES THAT PROJECT TO DISTINCT BRAINSTEM AND DIENCEPHALIC NUCLEI

THE CEREBELLUM DEVELOPS FROM THE RHOMBIC LIP

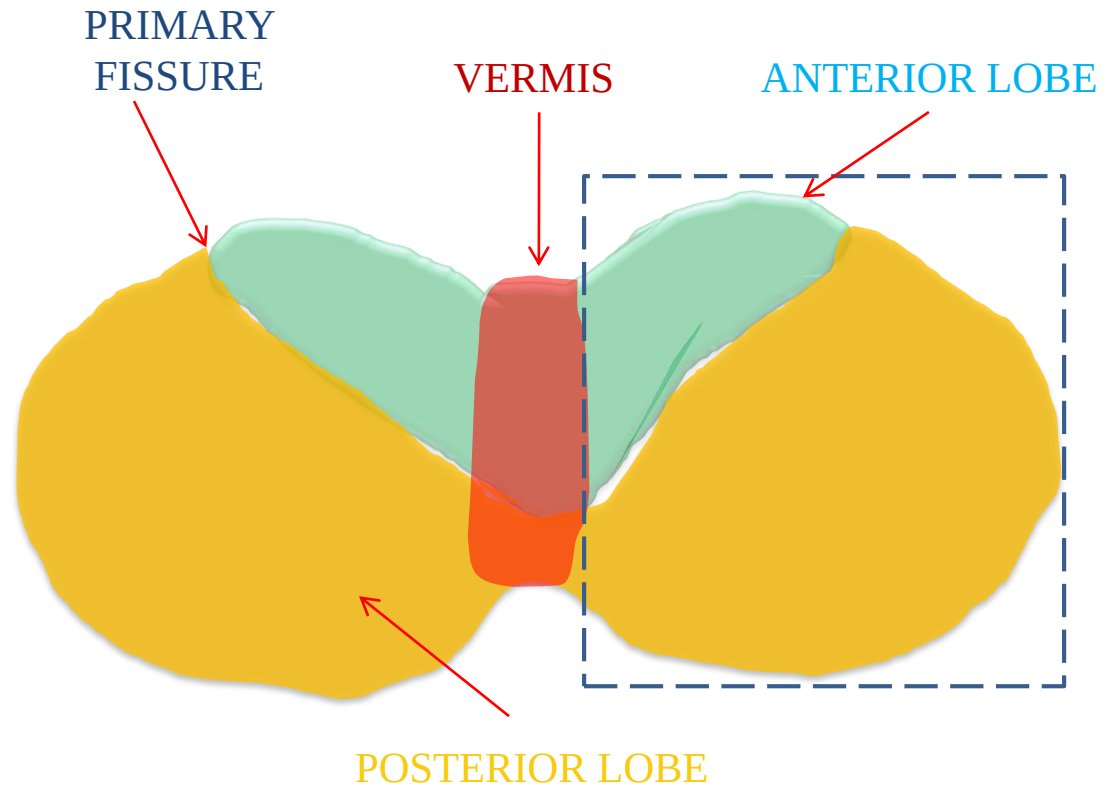
MAIN FUNCTIONS OF THE CEREBELLUM INCLUDE THE COORDINATION OF SKILLED VOLUNTARY MOVEMENTS, THE REGULATION OF THE MUSCLE TONE AND THE CONTROL OF EQUILIBRIUM

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UPPER VIEW OF THE CEREBELLUM



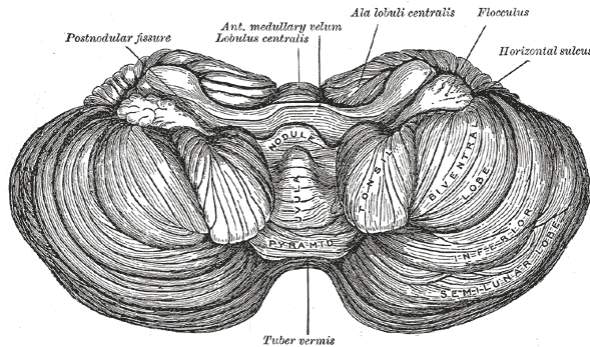
ANATOMICAL DRAWING DEPICTING THE DORSAL SURFACE OF THE HUMAN CEREBELLUM



THE SCHEMATIC DRAWING SHOWS THE ANTERIOR AND POSTERIOR LOBES SEPARATED BY THE PRIMARY FISSURE. THE CEREBELLAR HEMISPHERE IS ENFRAMED.

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THE VENTRAL ASPECT OF THE CEREBELLUM



ANATOMICAL DRAWING DEPICTING THE VENTRAL SURFACE OF THE HUMAN CEREBELLUM

POSTERIOR LOBE

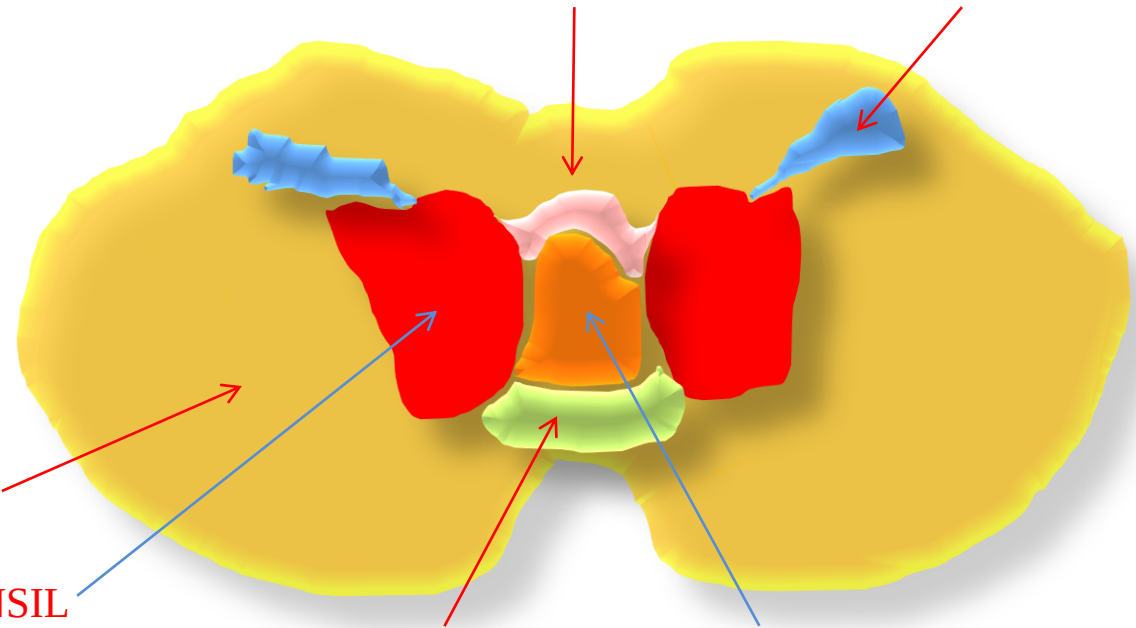
TONSIL

PYRAMID

UVULA

NODULE

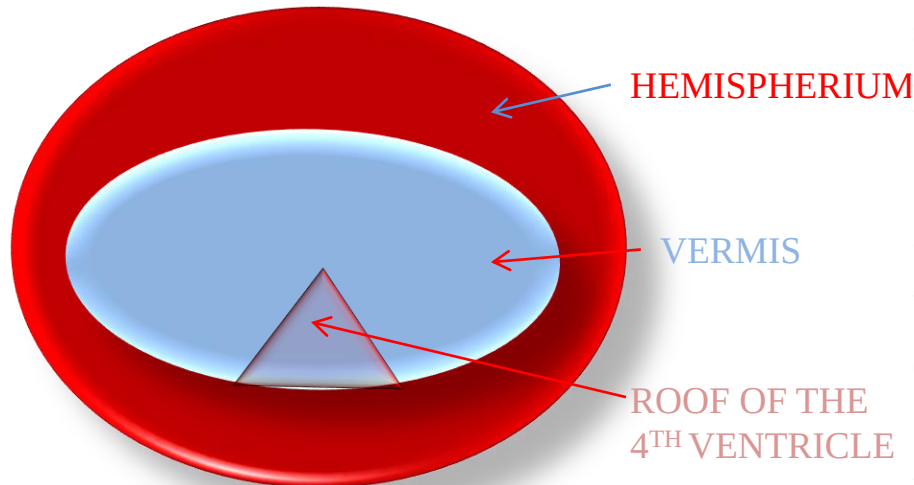
FLOCCULUS



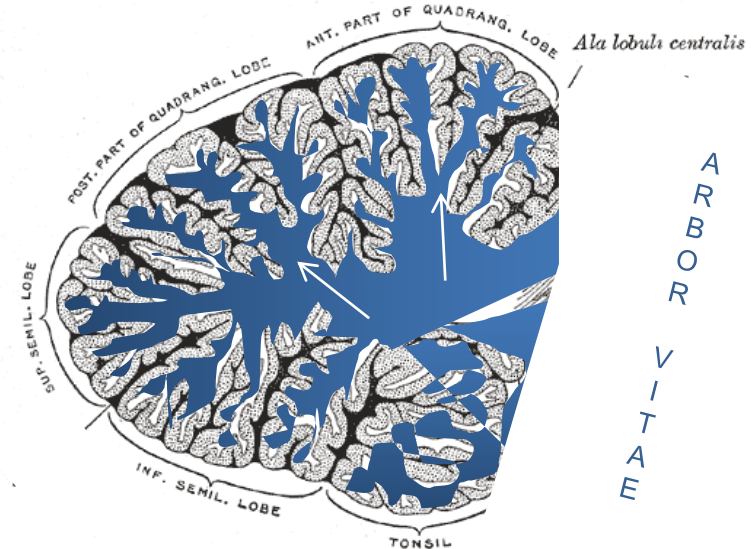
THE SCHEMATIC ILLUSTRATION OF THE VENTRAL SURFACE OF THE CEREBELLUM. THE POSTERIOR LOBE AND THE COMPONENTS OF THE NODULO-FLOCCULAR LOBE ARE DEPICTED. SOME CLINICALLY RELEVANT PARTS OF THE HEMISPHERIUM (TONSIL) AND THE VERMIS (NODULE, UVULA, PYRAMID) ARE HIGHLIGHTED.

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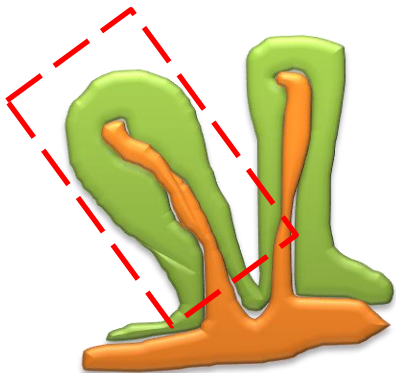
SAGITTAL VIEW OF THE CEREBELLUM



A MEDIO-LATERAL PERSPECTIVE OF THE CEREBELLUM IN SCHEME

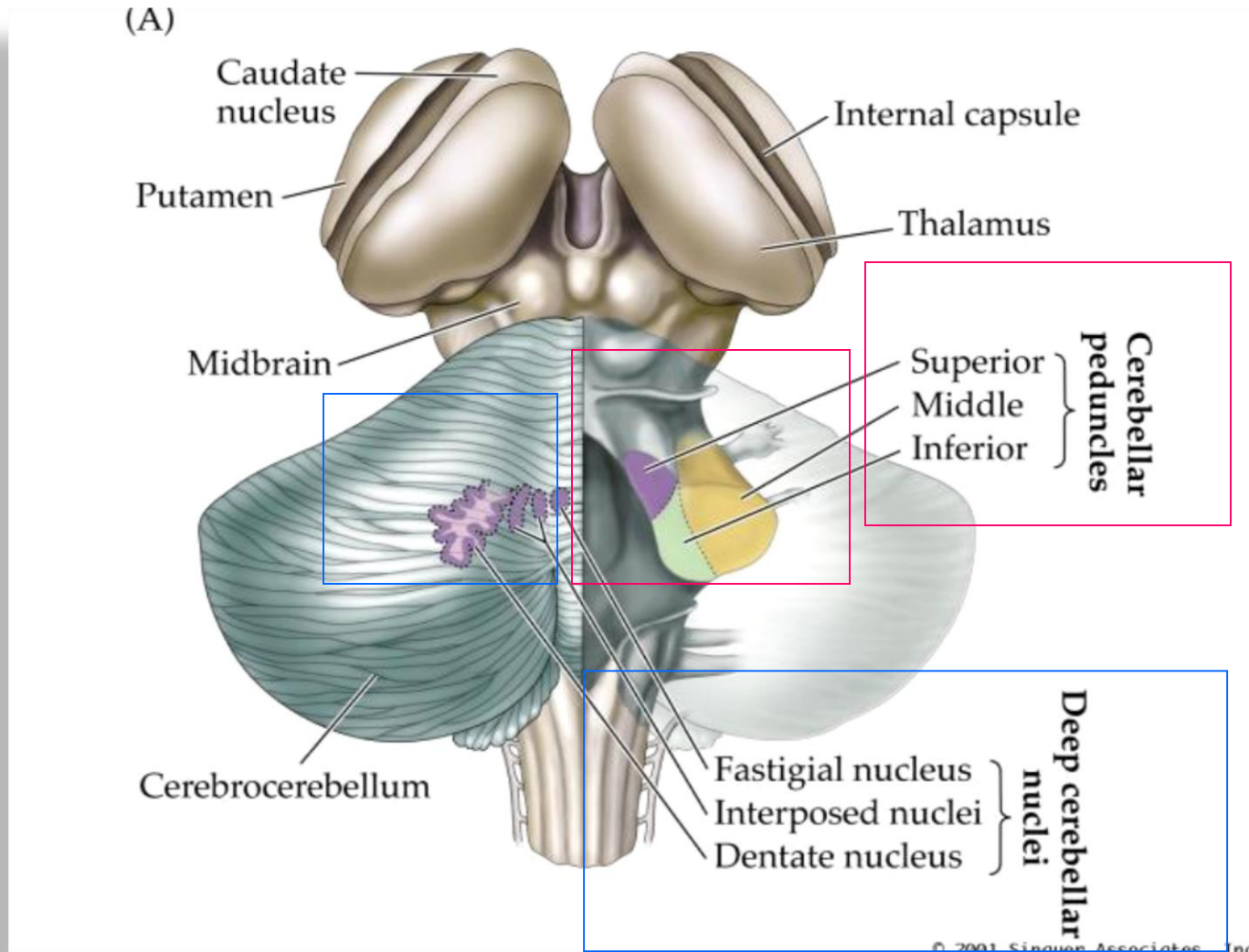


MEDIAN-SAGITTAL SECTION THROUGH THE VERMIS SHOWS THE ARBOR VITAE, THE CHARACTERISTIC IMAGE OF THE STRUCTURE IN THIS PARTICULAR PLANE. THE BRANCHING WHITE MATTER SENDS THIN PROJECTIONS INTO THE GREY MATTER ESTABLISHING THE CEREBELLAR FOLIA.



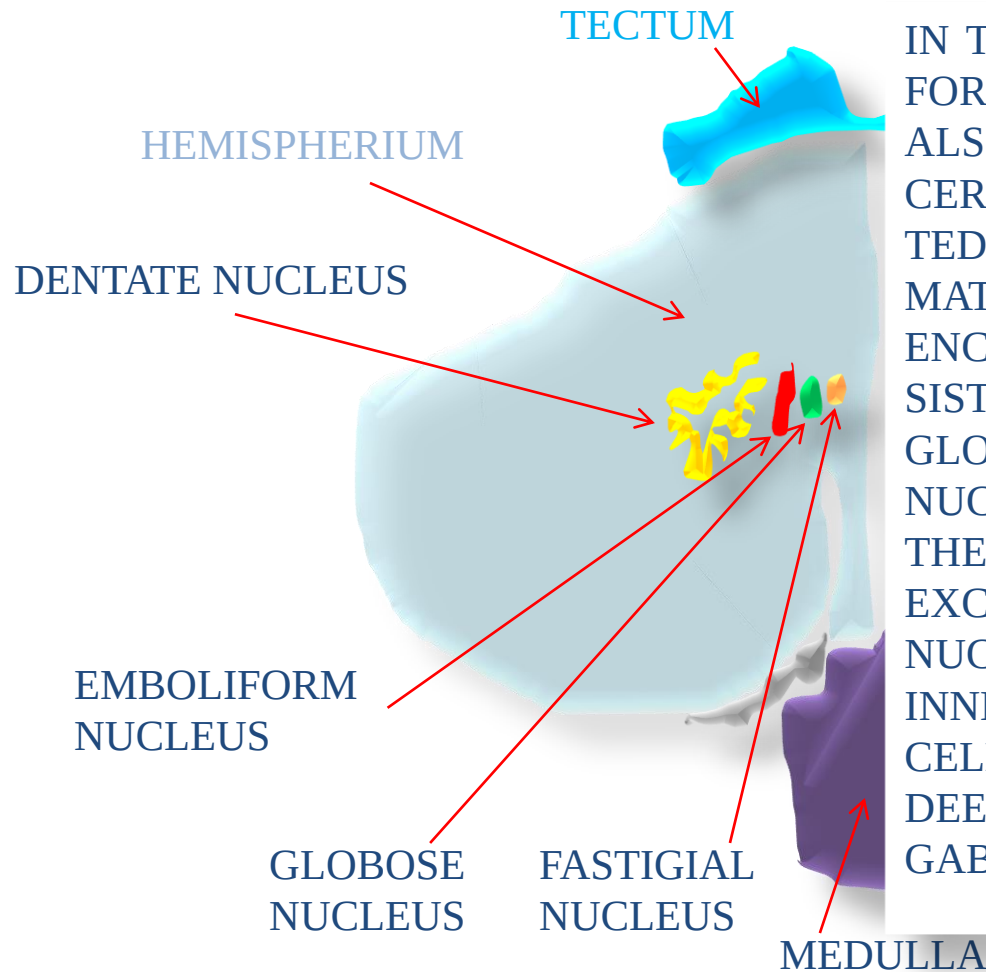
THE LAMINA ALBA OF THE WHITE MATTER AND THE SURROUNDING GREY MATTER CREATE THE FOLIUM (ENFRAMED)

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DEEP NUCLEI OF THE CEREBELLUM

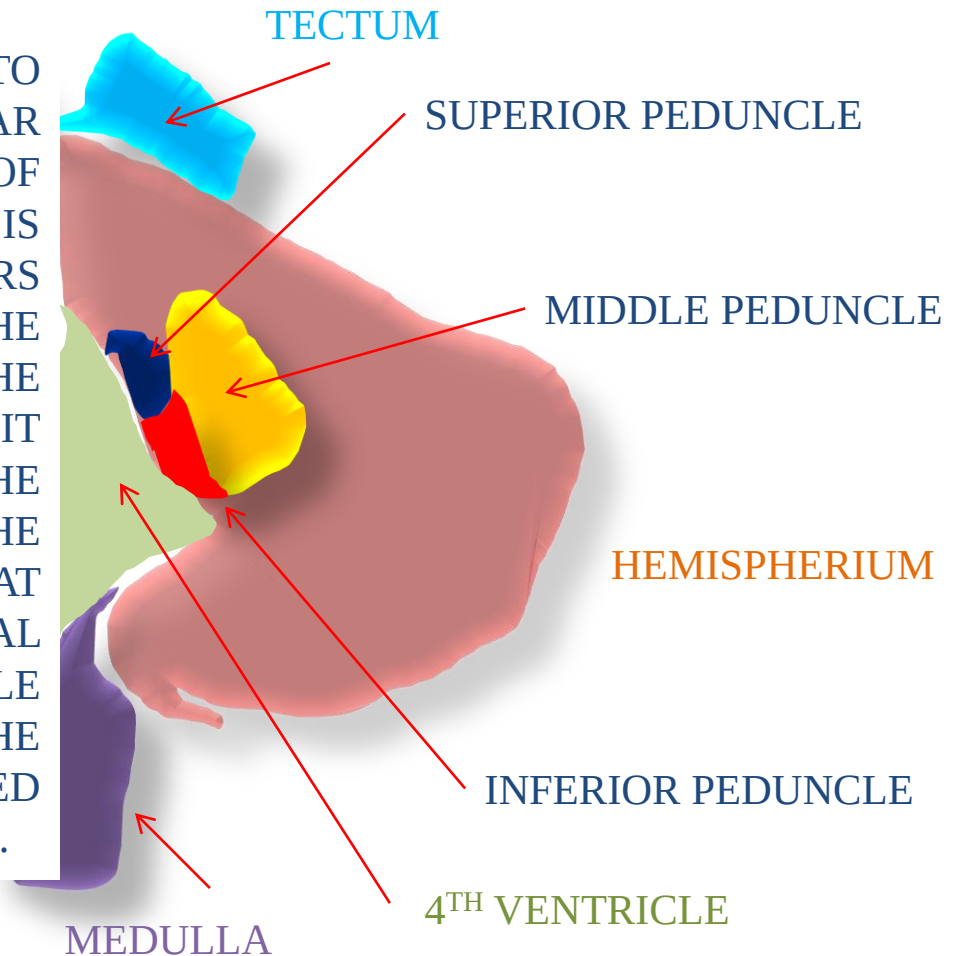


IN THE CEREBELLUM THE GRAY MATTER FORMS THE CEREBELLAR CORTEX AND ALSO THE INTRINSIC NUCLEI OF THE CEREBELLUM THAT ARE DEEPLY LOCATED AND EMBEDDED IN THE WHITE MATTER. IN A MEDIO-LATERAL SEQUENCE, THE COMPLEX OF NUCLEI CONSISTS OF THE FASTIGIAL NUCLEUS, THE GLOBOSE NUCLEUS, THE EMBOLIFORM NUCLEUS AND THE DENTATE NUCLEUS. THE INCOMING AFFERENT AXONS GIVE EXCITATORY COLLATERALS TO THE DEEP NUCLEI. THEY RECEIVE THE HEAVIEST INNERVATION FROM THE PURKINJE CELLS. THE CORTICAL INPUT TO THE DEEP NUCLEI IS INHIBITORY, UTILIZING GABA FOR NEUROTRANSMISSION.

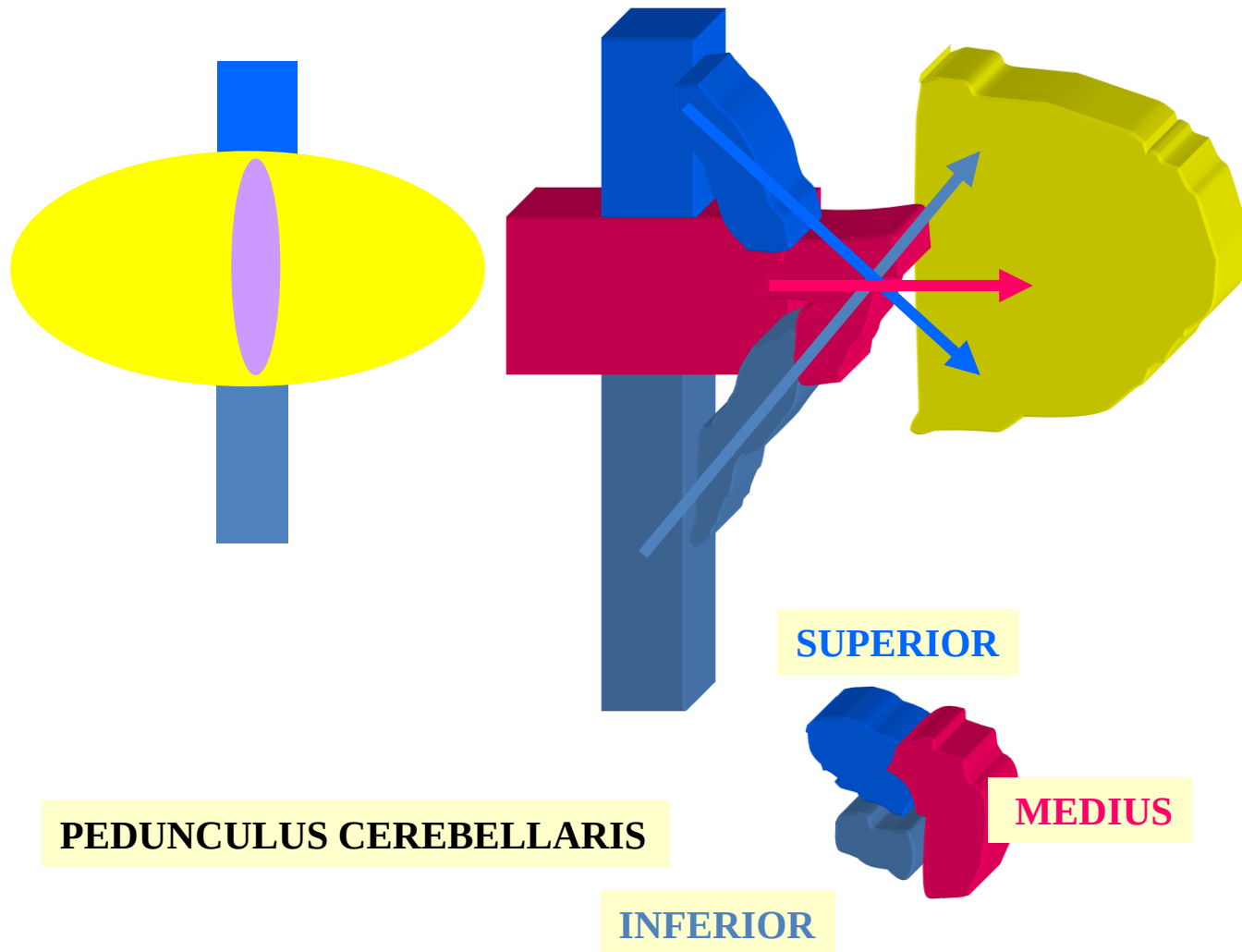
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PEDUNCLES OF THE CEREBELLUM

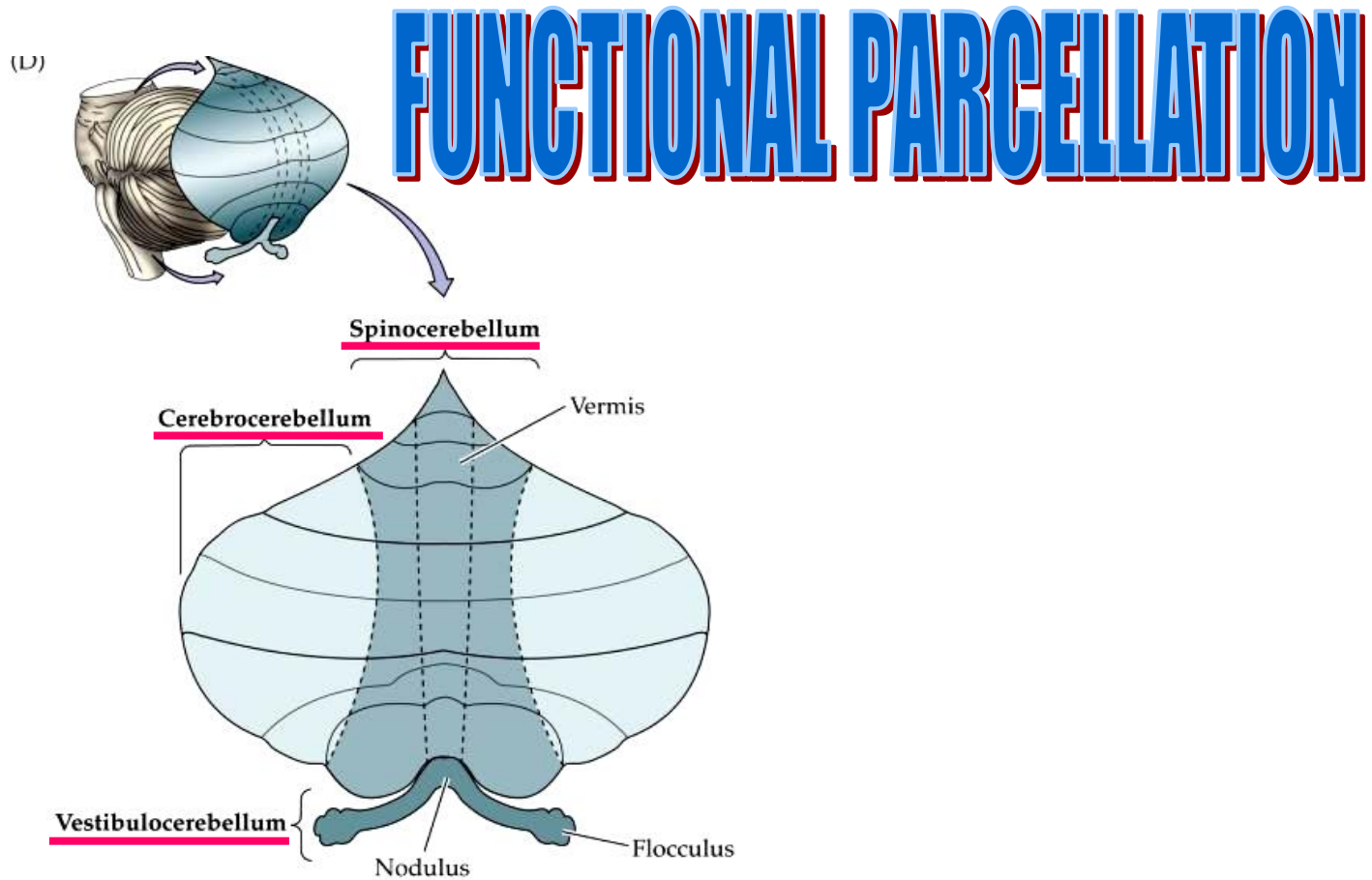
THE CEREBELLUM IS TIGHTLY BOUND TO THE BRAIN STEM VIA THE CEREBELLAR PEDUNCLES. THERE ARE THREE PAIRS OF THEM. THE SUPERIOR PEDUNCLE IS MAINLY COMPOSED OF EFFERENT FIBERS PROJECTING TO THE THALAMUS AND THE RED NUCLEUS OF THE MIDBRAIN. THE MIDDLE PEDUNCLE IS THE THICKEST. IT CONNECTS THE CEREBELLUM TO THE PONS. IT CARRIES AXONS FROM THE CONTRALATERAL PONTINE NUCLEI THAT MAINLY RECEIVE CEREBRAL CORTICAL AFFERENTS. THE INFERIOR PEDUNCLE ESTABLISHES COMMUNICATION WITH THE SPINAL CORD AND STRUCTURES LOCATED IN THE CAUDAL PART OF THE BRAINSTEM.



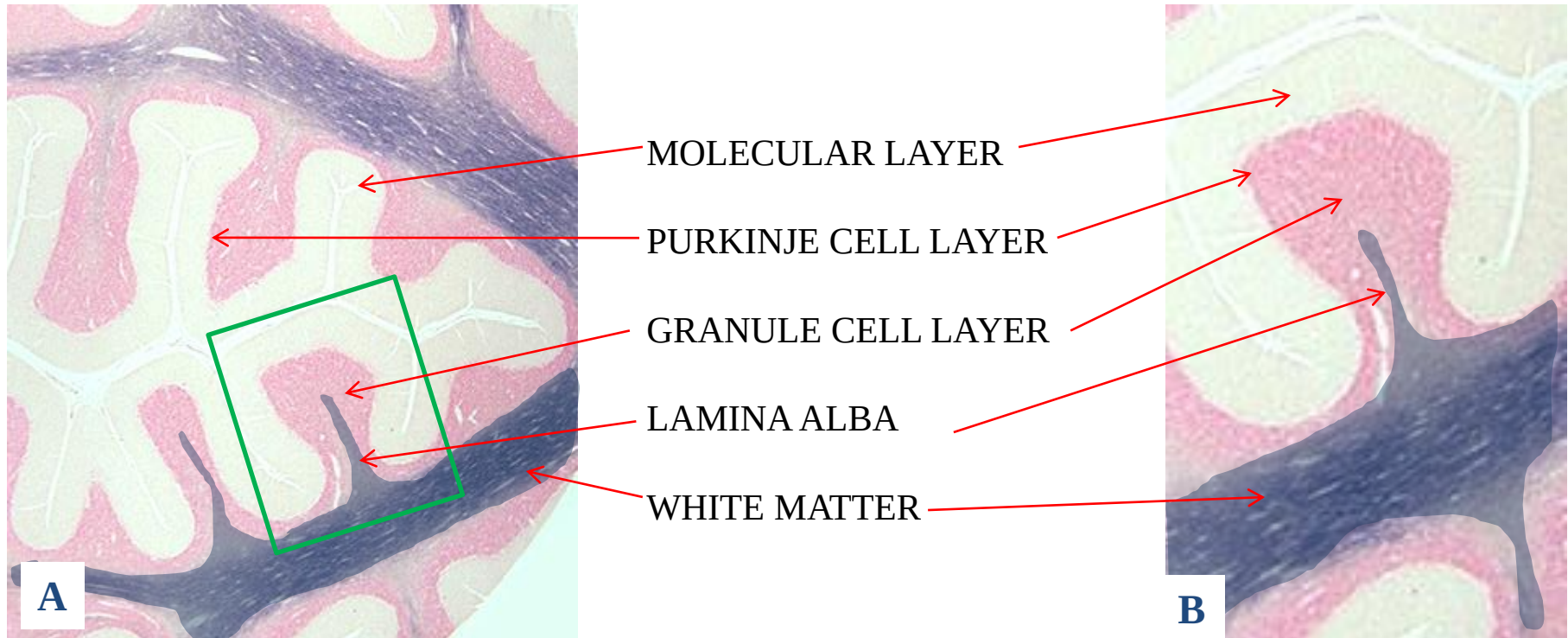
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HISTOLOGY OF THE CEREBELLUM



THE LOW POWER VIEW (**A**) SHOWS THE CHARACTERISTIC THREE LAYERS OF THE CEREBELLAR CORTEX: THE MOLECULAR, PURKINJE AND GRANULE CELL LAYERS. THE LAMINA ALBA PROJECTION OF THE WHITE MATTER IS IN THE CENTER OF THE CEREBELLAR FOLIUM WHICH IS ENFRAMED IN **A** AND SHOWN AT HIGHER POWER IN **B**.

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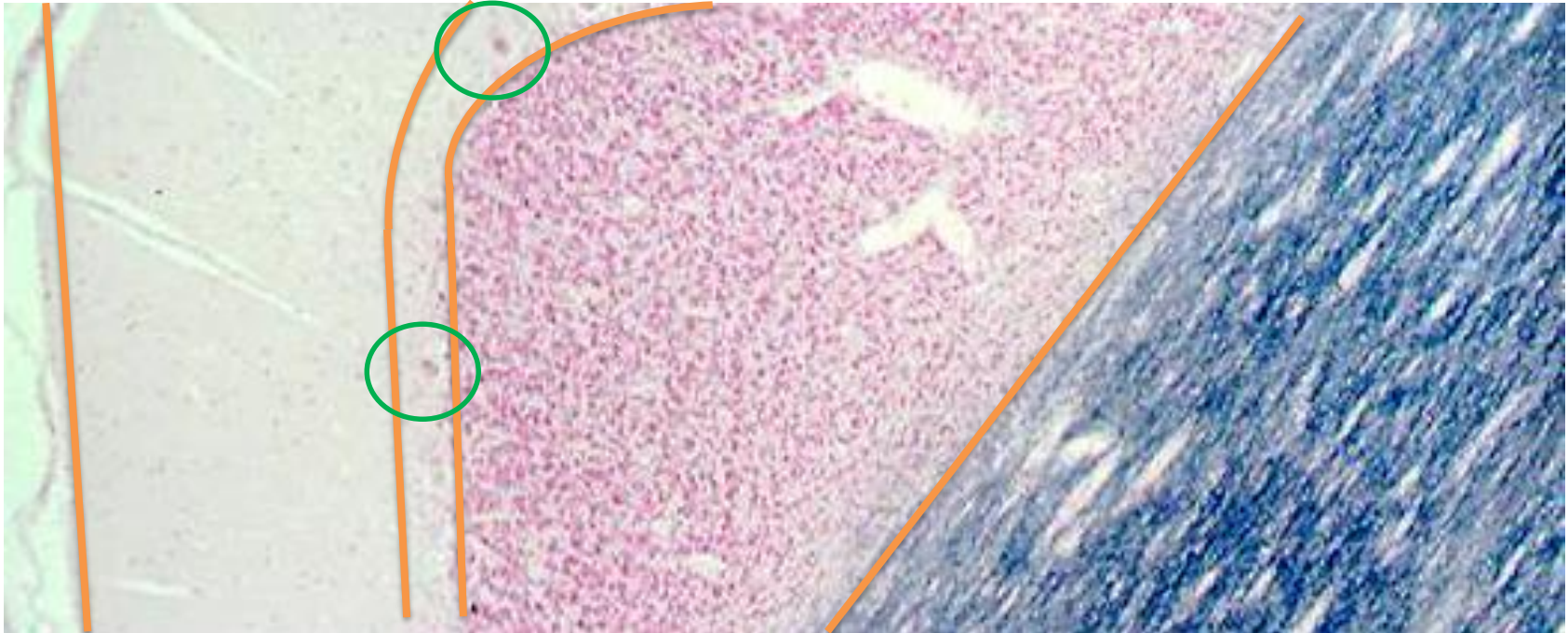
DETAIL FROM A FOLIUM AT HIGHER POWER

MOLECULAR

PURKINJE

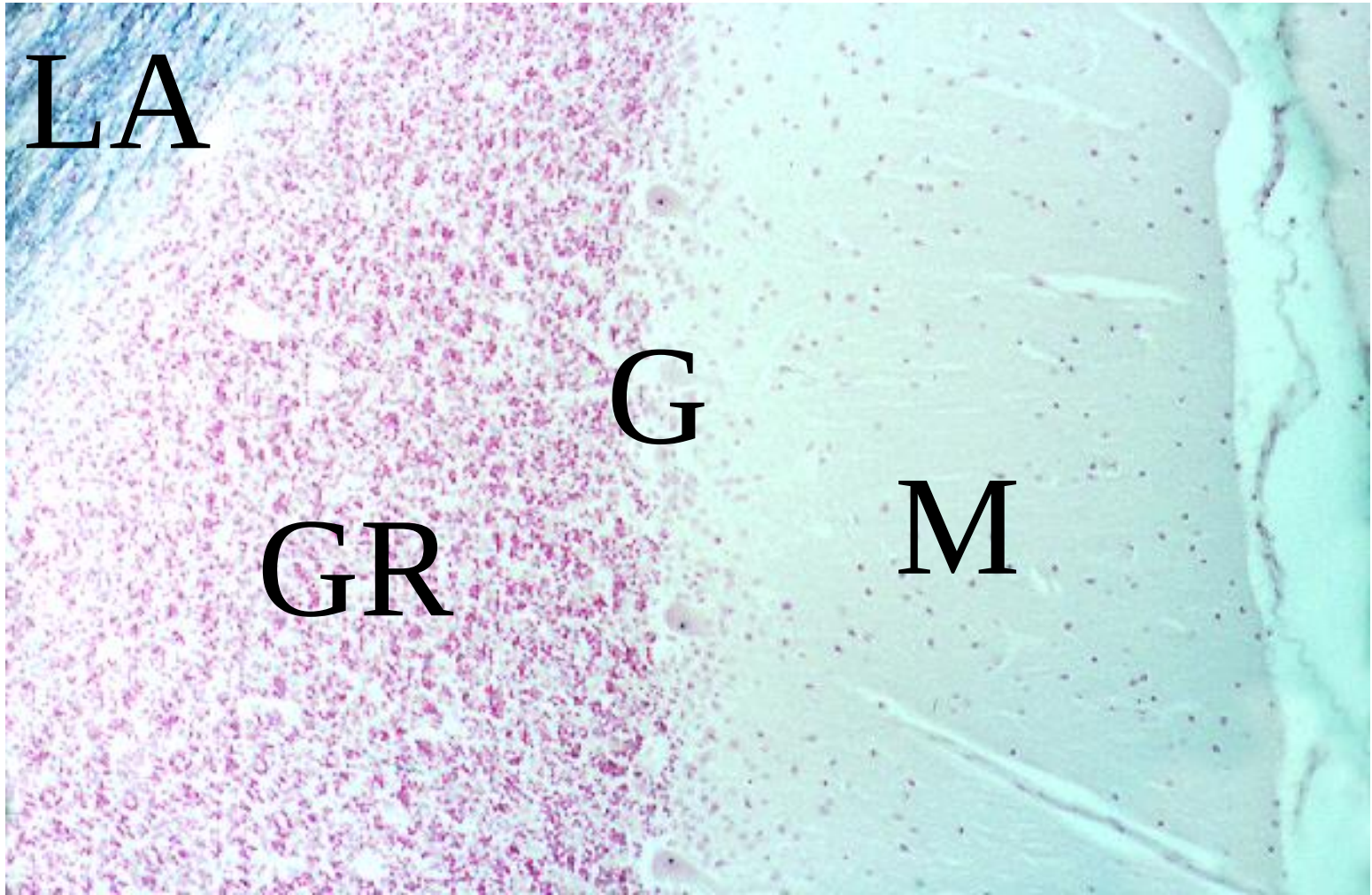
GRANULAR

WHITE M.

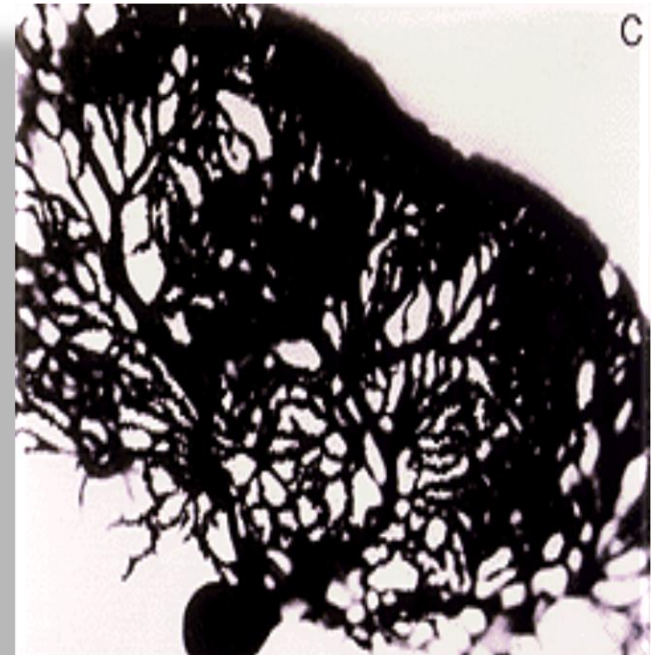
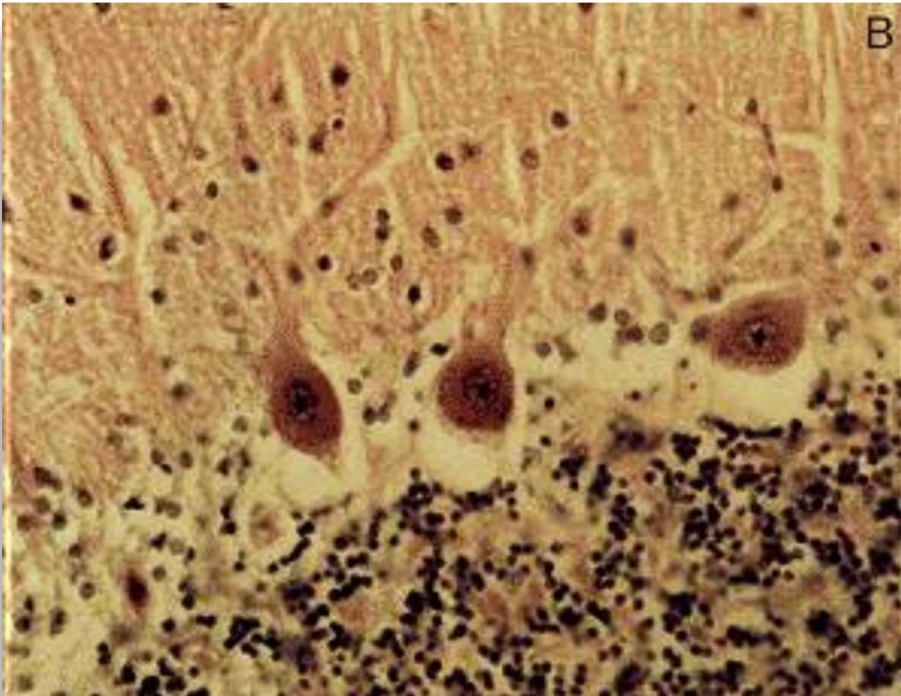


THE MOLECULAR LAYER IS POOR IN CELLS, BUT DENSELY INNERVATED BY AXON BUNDLES. THE PRUKINJE LAYER CONTAINS THE CELL BODIES OF PURKINJE CELLS. TWO OF THEM ARE ENCIRCLED. THE THICK, GRANULAR LAYER IS PACKED BY SMALL SIZED NEURONS. THE INDIVIDUAL LAYERS ARE SEPARATED BY YELLOW LINES.

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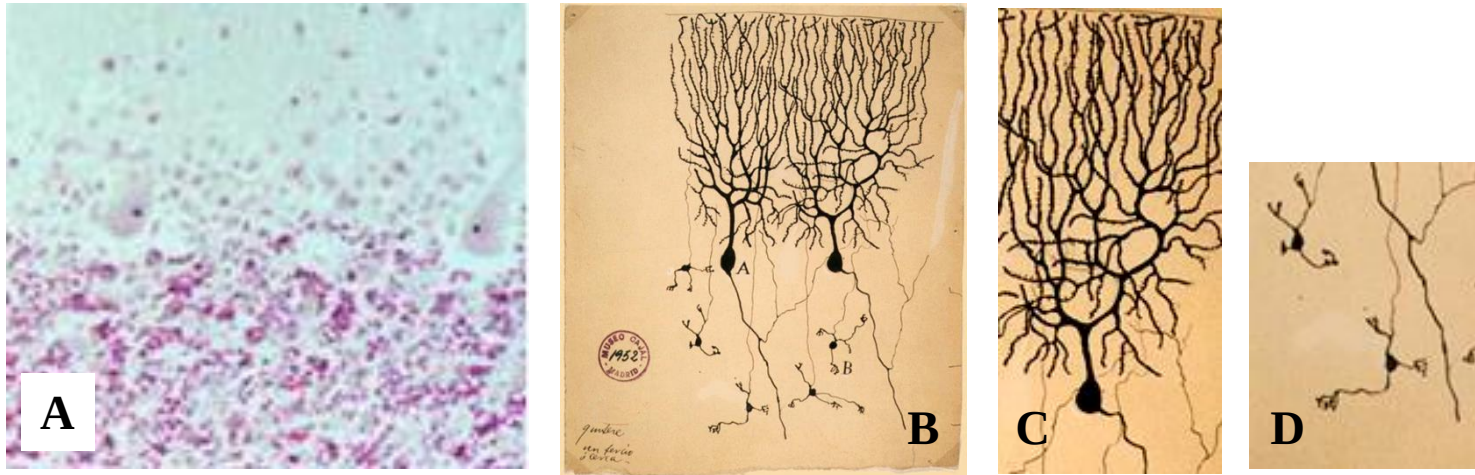


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FEATURES OF PURKINJE AND GRANULES CELLS



A. HEMATOXYLIN-EOSIN STAINED SPECIMEN. **B, C AND D** ARE SILVER IMPREGNATED CELLS

B AND C. PURKINJE CELLS HAVE EXTENSIVELY ARBORIZING DENDRITIC TREES. THE DENDRITES CARRY SPINES. THE WHOLE DENDRITIC DOMAIN IS ORGANIZED IN ONE PLANE. THE AXONS OF PURKINJE CELLS LEAVE THE CELL BODIES OPPOSITE TO THE ORIGIN OF THE MAIN DENDRITIC TRUNK. **D.** GRANULE CELLS ARE SMALL IN SIZE. THEY POSSES 3-4 SHORT DENDRITES. THEIR AXONS ARE SENT TO THE MOLECULAR LAYER WHERE THEY COMMUNICATE WITH DENDRITES OF PURKINJE CELLS, BASKET CELLS AND GOLGI NEURONS. THEY FORM GLOMERULAR SYNAPSES WITH INCOMING AFFERENTS (MOSSY FIBERS).