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1

External Anatomy of the Brain

This atlas emphasizes views of the interior of the human **central nervous system (CNS)**, sectioned in various planes. Here in the first chapter we lay some of the groundwork for understanding the arrangements of these interior structures by presenting the surface features with which they are continuous, and by giving a broad overview of the components of the CNS.

The CNS is composed of the **spinal cord** and the **brain**, the major components of which are indicated in Fig. 1.1. The human brain is dominated by two very large **cerebral hemispheres**, separated from each other by a deep **longitudinal fissure**. Each hemisphere is convoluted externally in a fairly consistent pattern into a series of **gyri**, separated from each other by a series of **sulci** (an adaptation that makes more area available for the cortex that covers each cerebral hemisphere). Several prominent sulci are used as major landmarks to divide each hemisphere into five **lobes**[a]—**frontal**, **parietal**, **occipital**, **temporal**, and **limbic**—each of which contains a characteristic set of gyri (Figs. 1.3 to 1.8). The two hemispheres are interconnected by a massive bundle of nerve fibers, the **corpus callosum,** and two smaller bundles of fibers called the **anterior** and **posterior commissures**. Finally, certain areas of gray matter are embedded in the interior of each cerebral hemisphere. These include major components of the **basal ganglia** (or, more properly, basal nuclei) and **limbic system** (primarily the **amygdala** and **hippocampus**). They are apparent in the brain sections shown in Chapters 5 through 7.

The cerebral hemispheres of humans are so massive that they overshadow or almost conceal the remaining major subdivisions of the brain—the **diencephalon** (made up of the thalamus, hypothalamus, epithalamus), **brainstem**, and **cerebellum**. Hemisecting a brain in the midsagittal plane, as in Fig. 1.1B, reveals these components.

The diencephalon (literally the "in-between brain") is interposed between each cerebral hemisphere and the brainstem. The diencephalon contains the left and right **thalamus**, major waystations for information seeking access to the cerebral cortex; the **hypothalamus**, a major control center for visceral and drive-related functions; and the epithalamus, which includes the pineal gland and a set of nuclei called the habenula.

The brainstem, continuous caudally with the spinal cord, serves as a conduit for pathways traveling between the cerebellum or spinal cord and more rostral levels of the CNS. It also contains the neurons that receive or give rise to most of the **cranial nerves**.

The cerebellum (literally the "little brain") is even more intricately convoluted than the cerebral hemispheres, to make room for an extensive covering of its own cortex. It plays a major role in the planning and coordination of movement. A deep **transverse fissure** (normally occupied over most of its extent by the **tentorium cerebelli**) separates the cerebellum from the overlying occipital and parietal lobes and then continues deeper into the brain, partially separating the diencephalon from the cerebral hemispheres.

[a]In addition, the **insula**, an area of cerebral cortex buried deep in the **lateral sulcus** (see Fig. 5.7A), is usually considered as a separate lobe.

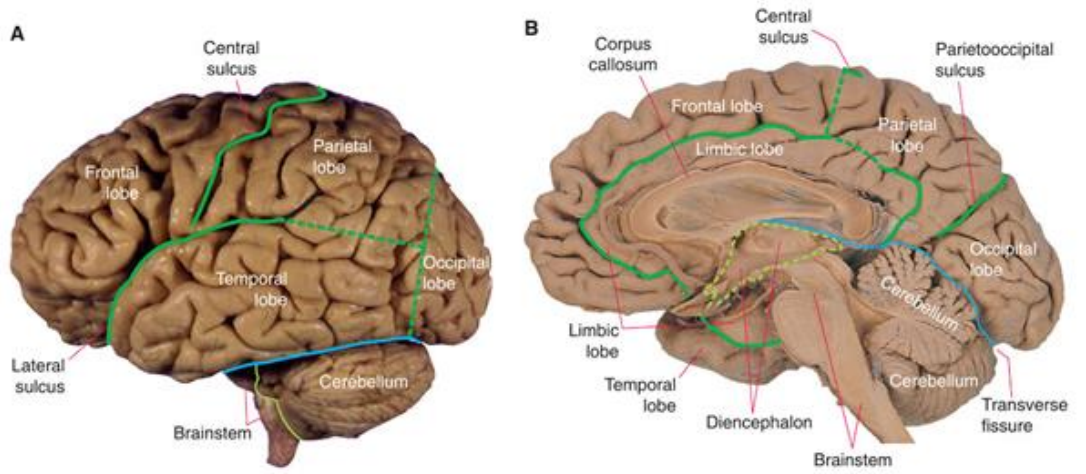

Figure 1.1 Lateral and medial surfaces of the brain. **(A)** The left lateral surface of the brain; anterior is to the left. **(B)** The medial surface of the right half of the sagittally hemisected brain; anterior is to the left. (Dissections by Grant Dahmer, Department of Cell Biology and Anatomy, The University of Arizona College of Medicine.)

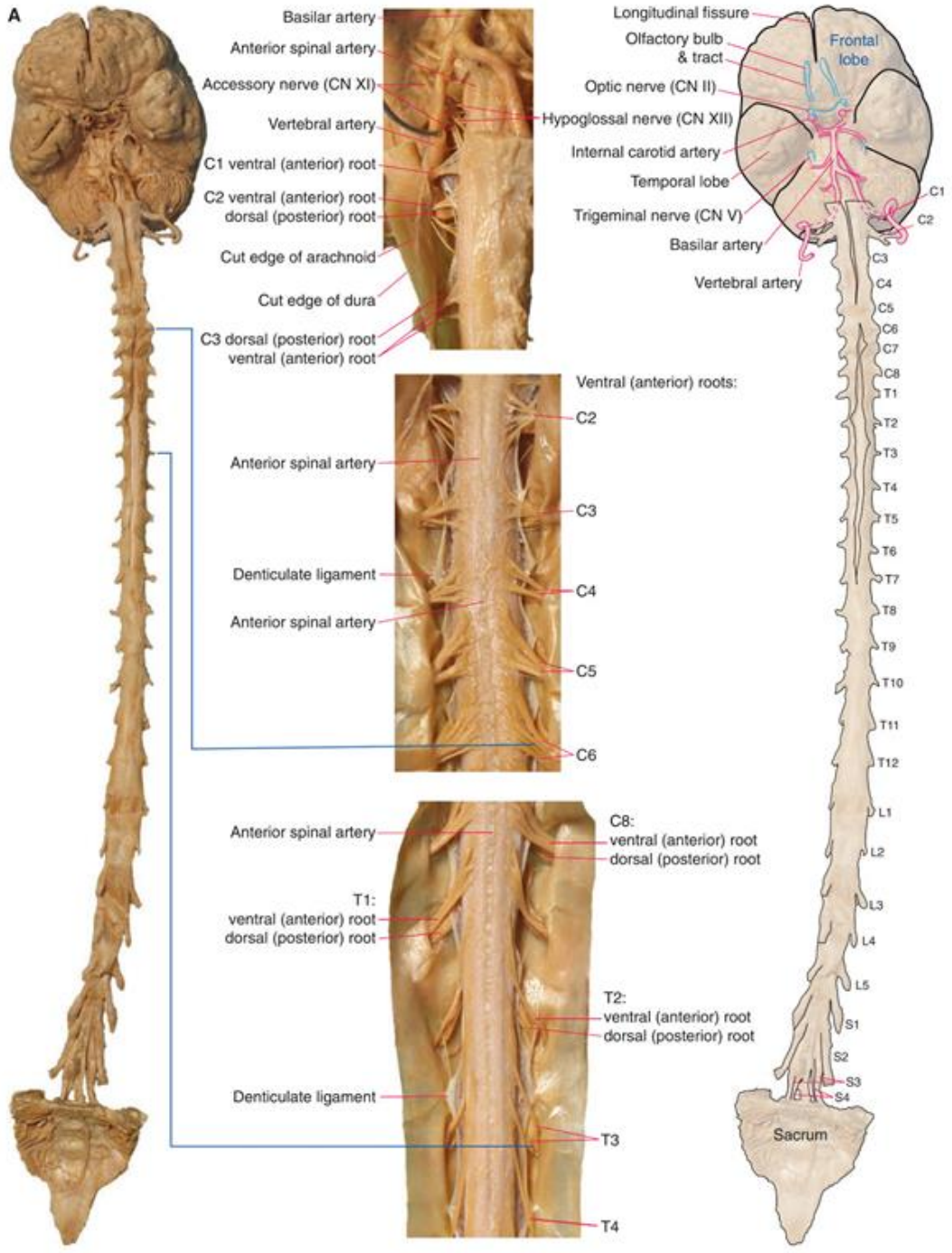

Figure 1.2 A masterful dissection of the entire CNS, with the spinal cord still encased in dura mater and arachnoid. **(A)** The anterior/inferior surface. Regions enlarged in the *insets*, after the dura mater and arachnoid were spread apart.

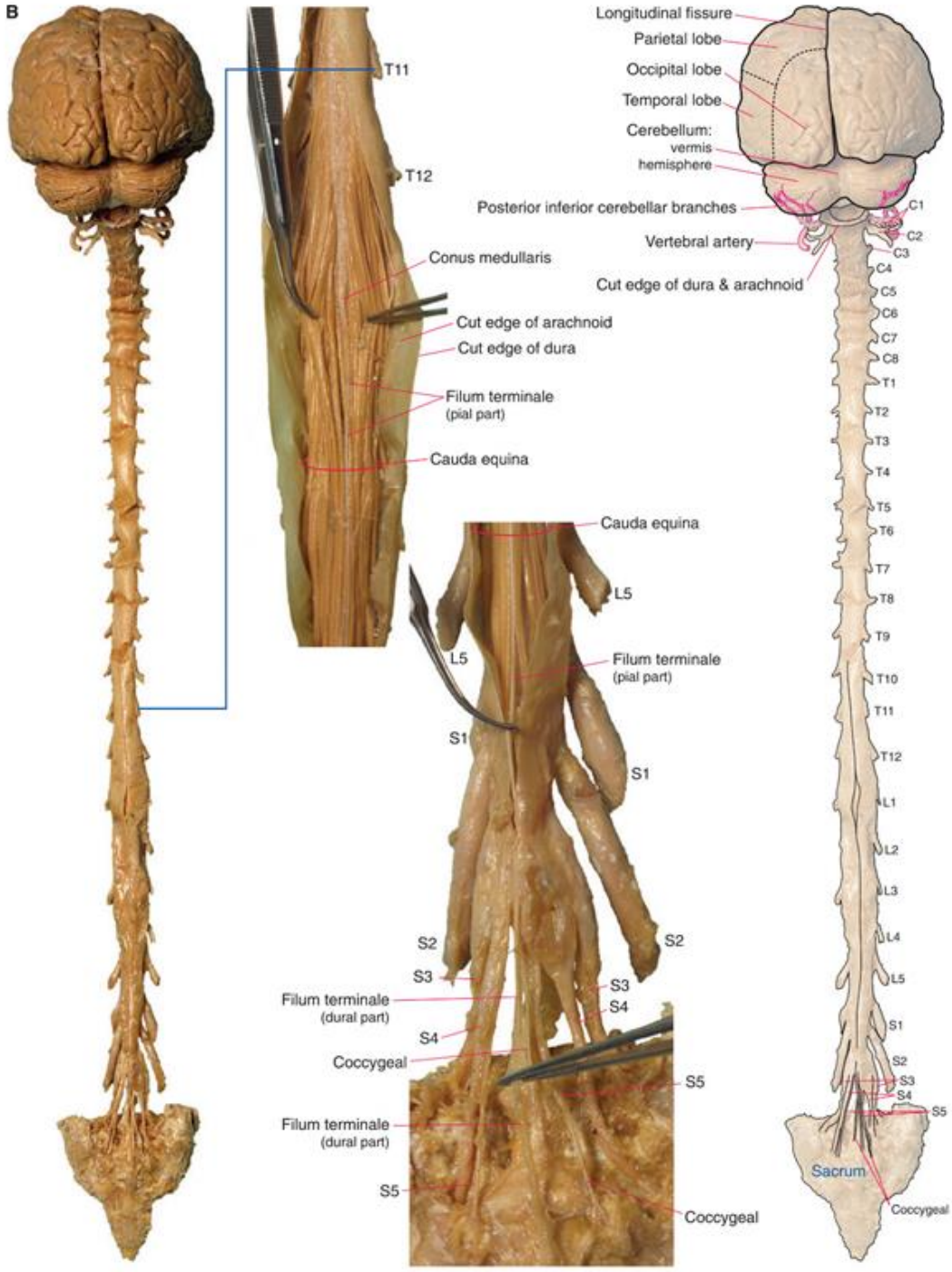

Figure 1.2 (Continued) **(B)** The posterior surface of the entire CNS. The cauda equina and the caudal end of the spinal cord, enlarged in the insets after the dura mater and arachnoid were spread apart. (Dissection by Dr. Norman Koelling, Department of Cell Biology and Anatomy, The University of Arizona College of Medicine.)