

Glossary

Accumbens: Part of the **ventral striatum** that receives a large concentration of dopamine-carrying axons from the midbrain; also called the *nucleus accumbens*.

Action potential: An electrical signal that propagates along the neuron's extension (see **axon**), much like current flowing along a wire.

Amygdala: Subcortical structure extensively studied in the context of aversive conditioning but involved in a very large array of functions. The “amygdala complex” contains at least a dozen subnuclei. In very broad terms, it is useful to consider a “basolateral amygdala” and a “central amygdala.”

Area: A unit that is thought to be anatomically and functionally meaningful by many neuroscientists. In the book, an area is viewed as functionally meaningful when it participates in large-scale, distributed circuits. In the cortex, an area is typically defined based on cytoarchitectonic differences of lamination pattern, including cell type and density (example: primary visual cortex in occipital lobe). In the subcortex, an area is typically defined based on patterns of cell type and density, as well as other markers of putative boundaries (example: **amygdala**; see figure 5.5).

Autonomic nervous system: Part of the peripheral nervous system that is connected with glands and smooth muscle lining organs (such as the heart). Thus, it influences the function of internal organs, which influence the central nervous system in turn.

Axon: The extension of the neuron that comes into close contact with other neurons and typically affects the dendrite of a postsynaptic cell via the synapse.

Basal ganglia: Typically refers to a group of subcortical nuclei, including the **striatum** (caudate plus putamen) and the globus pallidus.

Brainstem: The posterior stalklike part of the human brain that connects the **cerebrum** with the spinal cord; it is composed of the midbrain, the pons, and the medulla oblongata.

Central nervous system: Consists primarily of the brain and the spinal cord. In contrast, the peripheral nervous system consists of the nerves and ganglia (that is, masses of cells) outside the brain and spinal cord.

Cerebrum: The largest part of the brain containing the cerebral cortex as well as several subcortical structures, including the hippocampus, basal ganglia, and olfactory bulb; also called the **telencephalon**.

Complex system: One in which the properties of the system are highly dependent on interactions of its many parts, possibly involving feedback and cycles, as well as nonlinearities. In this context, “complex” should not be equated with “complicated,” which would refer to a system that has many components.

Conditioned stimulus (CS): An initially neutral stimulus that gains affective significance by being paired with an **unconditioned stimulus (UCS)**, such as one that is inherently aversive or negative (such as a shock). A conditioned stimulus can also acquire positive significance by being paired with a conditioned rewarding stimulus or event (such as food).

Cortex: The cerebral cortex, also known as the cerebral mantle, is the outer gray matter neural tissue of the cerebrum of the brain in mammals. It is organized into a series of layers.

Dendrite: The extension of the neuron that typically receives stimulation (from axons).

Emergence: Idea that system properties arise from the nonlinear combination of its parts. Thus, characterizing the parts of a system and combining them by “adding them up” misses important system properties.

Extinction: Learning process by which a **conditioned stimulus** (see definition) is learned to be safe. In this way, the stimulus is treated as safe by the animal.

Forebrain: In animals with vertical posture, it is the most superior part of the brain that contains the cerebral hemispheres. In humans, it contains the cortex and subcortical structures.

Frontal: See **lobe**.

Ganglia (plural of *ganglion*): Masses of neuronal cells. Whereas the cortex is a layered structure, almost all other parts of the brain (such as the **amygdala**) are ganglionic.

Gray matter: See **matter**.

Gyrus: A ridge on the cerebral cortex, generally surrounded by one or more sulci (see **sulcus**). Gyri and sulci create the folded appearance of the brain in humans and some other mammals.

Hindbrain: Portion of the central nervous system in vertebrates that includes the medulla, pons, and cerebellum.

Homology: The same character in different animals, independent of its form and function, inherited from a common ancestor. It applies to animal parts or organs

(like the brain) sharing the same building plan. Having the same embryonic origin within the building plan is one of the main criteria for identifying homology.

Lobe: The cortex is typically subdivided into macro territories called lobes: occipital (at the back of the head), temporal (near the temples and on the side of the head), parietal (at the sides and top toward the back of the head), and frontal (around the frontal part of the head). All locations are for humans.

Matter (gray or white): The gray matter is the part of brain's tissue consisting of neurons and other related cell types, such as glial cells. The white matter contains mostly long-range axons.

Medulla: The medulla oblongata or simply medulla is a long stemlike structure that makes up the lower part of the brainstem.

Midbrain: Portion of the brainstem that is closest to the **forebrain**. Among the regions discussed in the text that are in the midbrain are the superior colliculus and areas that produce the neurotransmitter dopamine (ventral tegmental area and substantia nigra).

Modularity: Degree of interdependence of the many parts that comprise a system of interest. A decomposable system can be said to be modular, whereas a nondecomposable system is not modular. More generally, modularity can be conceptualized as varying from low to high.

MRI: Magnetic resonance imaging is a technique that allows imaging the human brain (and other body parts) by picking up weak magnetic signals in the tissues of interest. Structural MRI is used to examine relatively static tissue properties, such as imaging white matter. Functional MRI is typically based on measuring differences of oxygenation level when specific parts of the brain are "activated" during certain tasks or conditions.

Neocortex: Six-layered cortex in the dorsal pallium of mammals; also called *isocortex*.

Neurotransmitter: Chemicals essential for neuronal communication, typically released from the axon terminal on the presynaptic cell and which bind to the postsynaptic cell. Some common neurotransmitters include dopamine, serotonin, acetylcholine, norepinephrine, and GABA.

Nucleus: Some subcortical areas of the forebrain can be subdivided into several parts called nuclei. See figure 5.5 for some nuclei of the amygdala.

Occipital: See **lobe**.

Pallial amygdala: Component of the amygdala that is of pallial origin. In mammals, it includes the lateral, basal, and accessory basal nuclei.

Pallium: Dorsal division of the **telencephalon** (forebrain). It includes several subdivisions that are comparable across vertebrates. In mammals, its dorsal subdivision (dorsal pallium) is considerably expanded and gives rise to the cerebral cortex.

The pallium also produces during development the hippocampus and the pallial amygdala, so they are said to be of pallial origin.

Parietal: See **lobe**.

Prefrontal cortex: The most anterior part of frontal cortex (see figure 7.3).

Projection: Anatomical pathway comprised of bundles of axons that connect two areas.

Reductionism: Approach to understanding systems or mechanisms in terms of elementary parts or units. A quintessential example is working out how a mechanical clock works based on all its parts, including its many wheels.

Region: See **area**.

Spike: See **action potential**.

Striatum: Part of the subcortex (in the forebrain) consisting of the caudate and the putamen.

Subpallial amygdala: Component of the amygdala that is of subpallial origin. In mammals, it includes the central nucleus and parts of the bed nucleus of the stria terminalis.

Subpallium: Ventral division of the **telencephalon** (forebrain). It includes the **striatum** (caudate-putamen) and parts of the **amygdala** (such as the central amygdala).

Sulcus: A sulcus is a depression or groove in the cerebral cortex. It surrounds a gyrus, creating the folded appearance of the human brain. The larger sulci are called fissures. See also **gyrus**.

Synapse: The space between two neurons that permits the presynaptic neuron to pass a chemical signal to the postsynaptic cell.

System: See **complex system**.

Telencephalon: See **cerebrum**.

Temporal: See **lobe**.

Unconditioned stimulus: See **conditioned stimulus**.

Ventral striatum: The part of the striatum (caudate plus putamen) consisting of its most inferior part. At times, the term is used to refer to the nucleus accumbens. See also **accumbens**.

White matter: See **matter**.

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