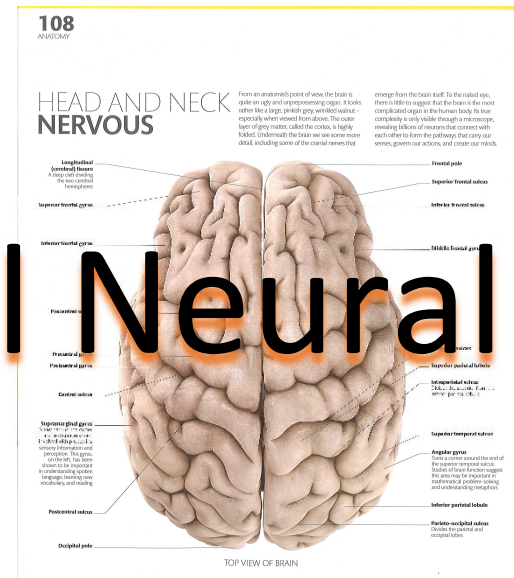




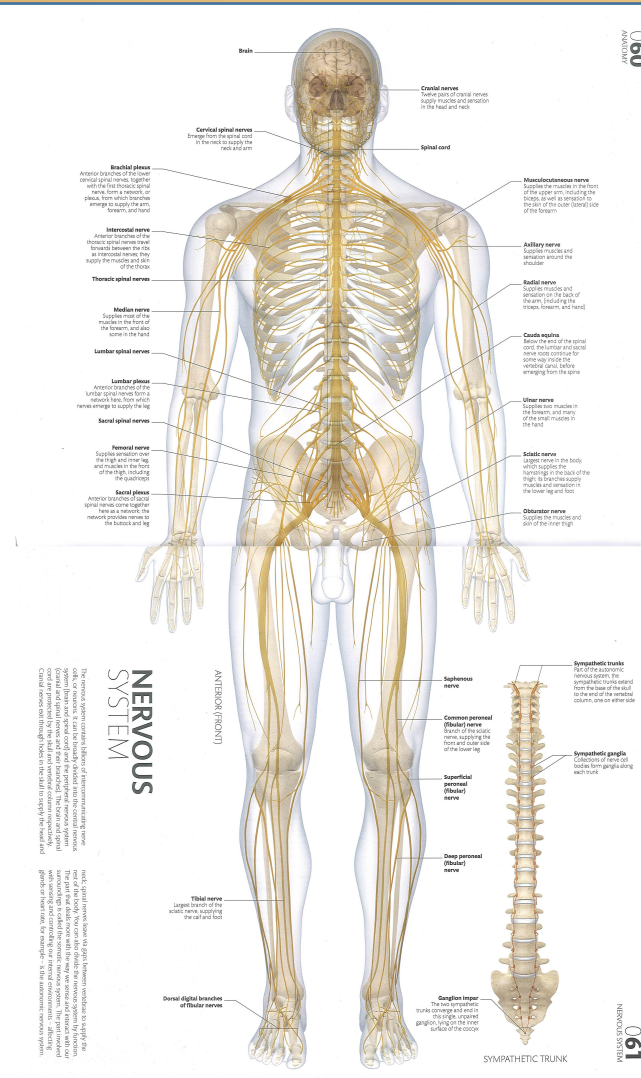
Central Neural System



Central Neural System



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The movement of charged particles through channels in the neuron's membrane generates electrical impulses that travel along the axon. Such impulses (known as action potentials) are conducted slowly in axons without an insulating layer of myelin and tend to leak away. In myelinated axons, a small patch of the membrane is exposed between myelin segments and the impulse "jumps" to the next gap, which speeds up conduction. At the end of an axon, the signal is transmitted across a tiny gap (synapse), to the next neuron or to a muscle cell, by chemicals called neurotransmitters.

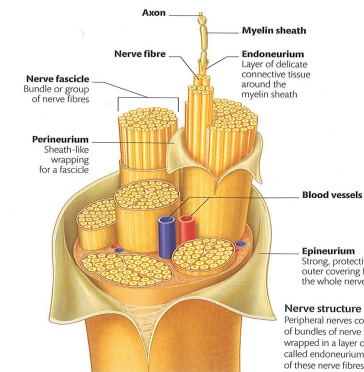
This artwork shows the detailed structure of a neuron from the central nervous system. A single neuron such as this can make contact with hundreds of other neurons, creating an incredibly complex network of connections.

The diagram illustrates three types of neurons, each with labeled components: Dendrite, Cell body, and Axon.

- UNIPOLAR NEURON:** This neuron has a single process extending from the cell body, which branches into dendrites on one side and an axon on the other.
- BIPOLAR NEURON:** This neuron has two distinct processes: one extending from the cell body to form dendrites, and another extending to form the axon.
- MULTIPOLAR NEURON:** This neuron has multiple dendrites extending from the cell body, and a single axon extending from the opposite side.

TYPES OF NEURON

Types of neuron
Neurons can be classified according to how many projections (dendrites and axons) extend from the cell body. The most common is multipolar, with three or more projections. Unipolar neurons lie mainly in the sensory nerves of the peripheral nervous system. Bipolar neurons are found in only a few locations, such as the eye's retina.



PERIPHERAL NERVE

Nerve structure
Peripheral nerves comprise bundles of bundles of nerve fibres. Axons are wrapped in a layer of packing tissue called endoneurium. Small bundles of these nerve fibres are packaged in perineurium to form fascicles, and several fascicles are bundled within epineurium to form the nerve.

Structure of the spinal cord
Like the brain, the spinal cord contains grey matter (mostly neuron cell bodies) and white matter (axons), and is covered in the same three layers of meninges: dura mater, arachnoid, and pia mater (see p.115).

Spinal nerve
Sensory and motor
nerve rootlets merge
to form a spinal nerve

Motor nerve rootlet
Bundles of fibres emerging from the ventral side (front) of the spinal cord carry signals to skeletal and smooth muscle

Anterior fissure – deep groove along the front of the spinal cord

subarachnoid space

Nerve fibre tract
Bundles of nerve fibres carrying signals to and from the spinal cord and the brain

White matter
Made up of the axons of neurons

Grey matter
Cell bodies of neurons

Central canal
Cerebrospinal fluid fills the narrow central canal and nourishes and protects neurons.

Sensory nerve rootlet
Bundles of fibres emerging from the dorsal side (back) of the spinal cord carry incoming signals from sensors in the skin and muscles

Sensory root ganglion
Cell bodies of sensory
nerves cluster in ganglia

SPINAL CORD



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ANATOMY

Body of corpus callosum
The largest commissure (or bundle of connecting nerve fibres) between the two hemispheres, this forms the roofs of the lateral ventricles

Septum pellucidum
This 'translucent partition' is a thin dividing wall between the two lateral ventricles

Superior frontal gyrus

Cingulate gyrus
"Cingulum" is the Latin for girdle and this gyrus wraps closely around the corpus callosum; it is part of the limbic system, which is involved with emotional responses and behaviours

Genu of corpus callosum
The anterior (front) end of the corpus callosum is bent over - "genu" means knee in Latin

Anterior commissure
A bundle of nerve fibres connecting parts of the two cerebral hemispheres

Optic chiasma
The crossover point where the two optic nerves meet and swap fibres, then part company as the optic tracts, which continue on each side of the brain towards the thalamus

Hypothalamus
Plays an important role in regulating the internal environment of the body, by keeping a check on body temperature, blood pressure, and blood sugar level, for instance

Pituitary gland
Produces many hormones and forms a link between the brain and endocrine system

Mammillary body
Part of the limbic system of the brain

SAGITTAL SECTION
THROUGH BRAIN

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HEAD AND NECK • NERVOUS

Interthalamic adhesion
Connection between the thalami on each side of the brain

Cerebrum
The largest part of the brain, consisting of the two cerebral hemispheres

Thalamus
Processes and relays sensory and motor information to higher brain centres

Splenium of corpus callosum
The posterior end of the corpus callosum

Choroid plexus of the third ventricle
A choroid plexus is formed where the inner and outer membranes of the brain come together; it is full of capillaries and produces cerebrospinal fluid, which flows into the ventricle

Pineal gland
Produces the hormone melatonin and is involved in the regulation of sleep-wake cycles

Superior colliculus
Involved in visual reflex pathways, including the pupillary light reflex, which makes the pupils constrict when bright light hits the retina

Tectum of the midbrain
The roof of the midbrain

Cerebral aqueduct
A narrow channel connecting the third and fourth ventricles

Inferior colliculus
Involved with auditory pathways, including reflex responses to loud noises

Tegmentum of midbrain

Fourth ventricle

Pons

Median aperture of the fourth ventricle
Cerebrospinal fluid escapes from the fourth ventricle via this opening in the midline, as well as through an opening on each side, into the subarachnoid space around the brain and spinal cord

Cerebellum

Medulla oblongata

Spinal cord

HEAD AND NECK NERVOUS

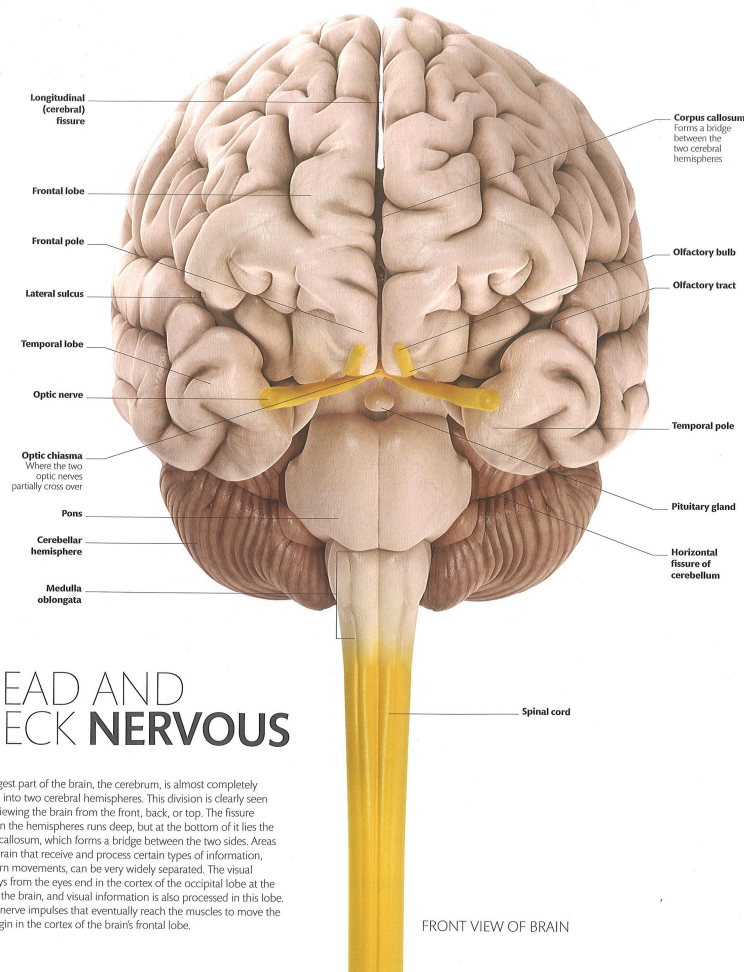
This median sagittal section - a vertical slice right through the middle of the brain - shows clearly the corpus callosum, which links the two hemispheres. We also see that the brain is not solid: there are cavities within it. Two spaces (or ventricles) lie inside each hemisphere, while the third and fourth ventricles are located on the midline. These spaces are full of cerebrospinal fluid. Beneath and behind the cerebrum sits the cerebellum. The grey cortex of the cerebellum is more finely folded than that of the cerebrum, with fissures separating its leaves (or folia). Sliced through like this, the inside of the cerebellum reveals a beautiful, tree-like pattern. In this section, we can also see clearly all the parts of the brainstem - the midbrain, pons, and medulla.



Central Neural System



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ANATOMY

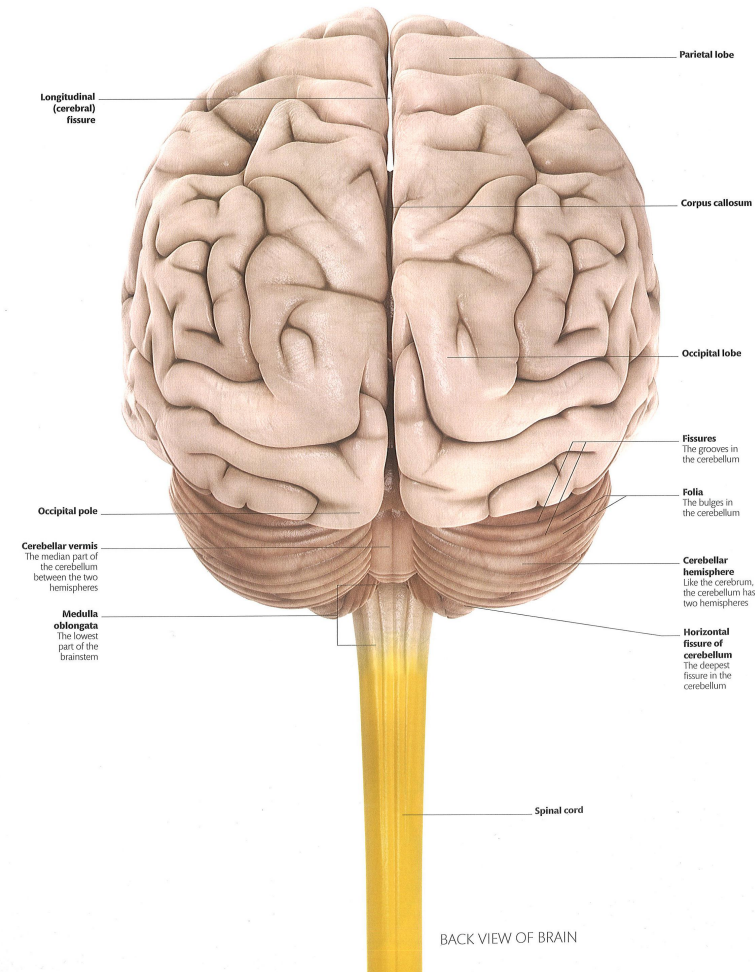


HEAD AND NECK NERVOUS

The largest part of the brain, the cerebrum, is almost completely divided into two cerebral hemispheres. This division is clearly seen when viewing the brain from the front, back, or top. The fissure between the hemispheres runs deep, but at the bottom of it lies the corpus callosum, which forms a bridge between the two sides. Areas of the brain that receive and process certain types of information, or govern movements, can be very widely separated. The visual pathways from the eyes end in the cortex of the occipital lobe at the back of the brain, and visual information is also processed in this lobe. But the nerve impulses that eventually reach the muscles to move the eyes begin in the cortex of the brain's frontal lobe.

FRONT VIEW OF BRAIN

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HEAD AND NECK • NERVOUS



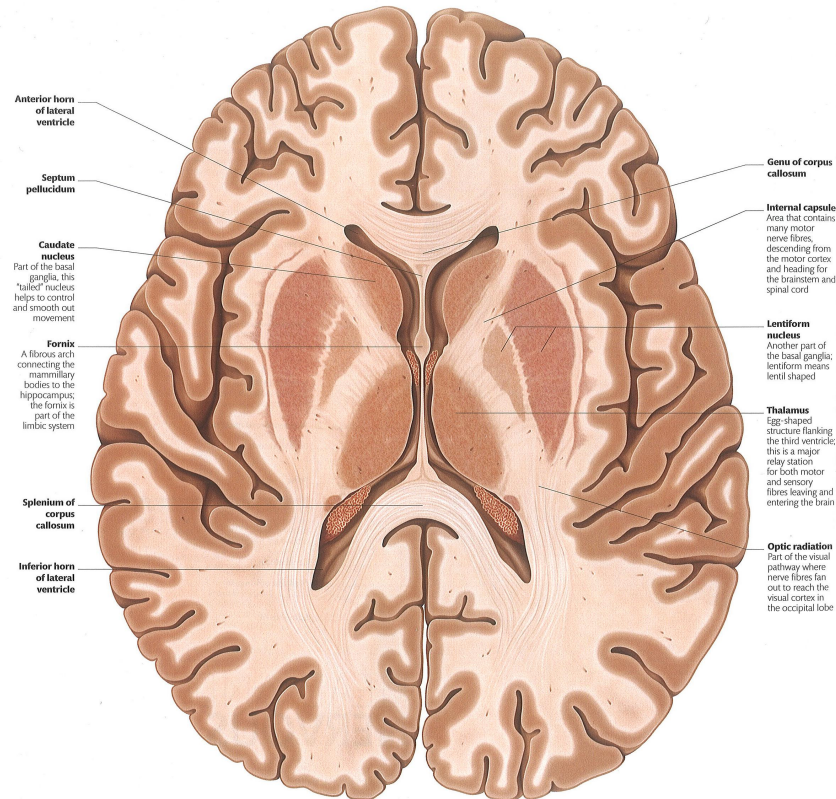
BACK VIEW OF BRAIN



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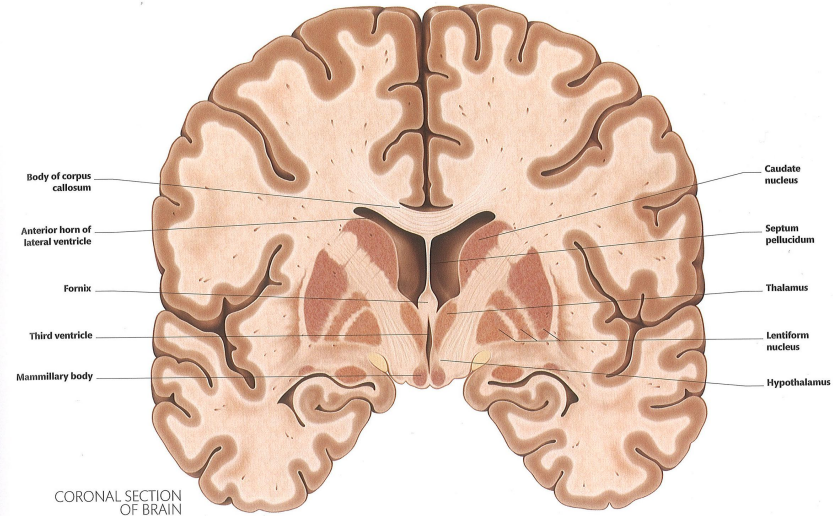


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ANATOMY



TRANSVERSE SECTION OF BRAIN

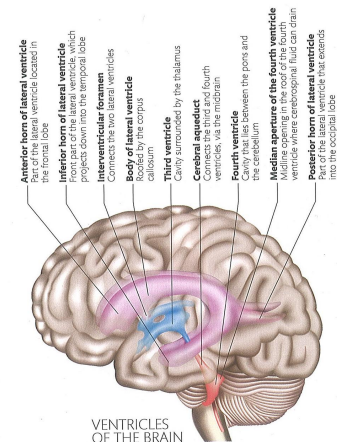
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HEAD AND NECK • NERVOUS



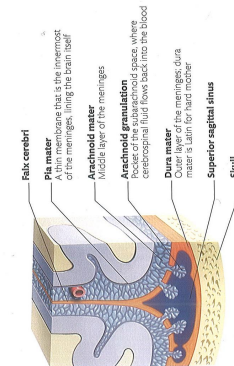
CORONAL SECTION OF BRAIN

HEAD AND NECK NERVOUS

The brain is protected by three membranes called the meninges (which become inflamed in meningitis). The tough dura mater layer is the outermost covering, which surrounds the brain and the spinal cord. Under the dura mater is the cobweb-like arachnoid mater layer. The delicate pia mater is a thin membrane on the surface of the brain. Between the pia mater and the arachnoid mater there is a slim gap – the subarachnoid space – which contains cerebrospinal fluid (CSF). Mainly produced by the choroid plexus in the brain's lateral ventricles, CSF flows through the third ventricle into the fourth, where it can escape via small apertures into the subarachnoid space.



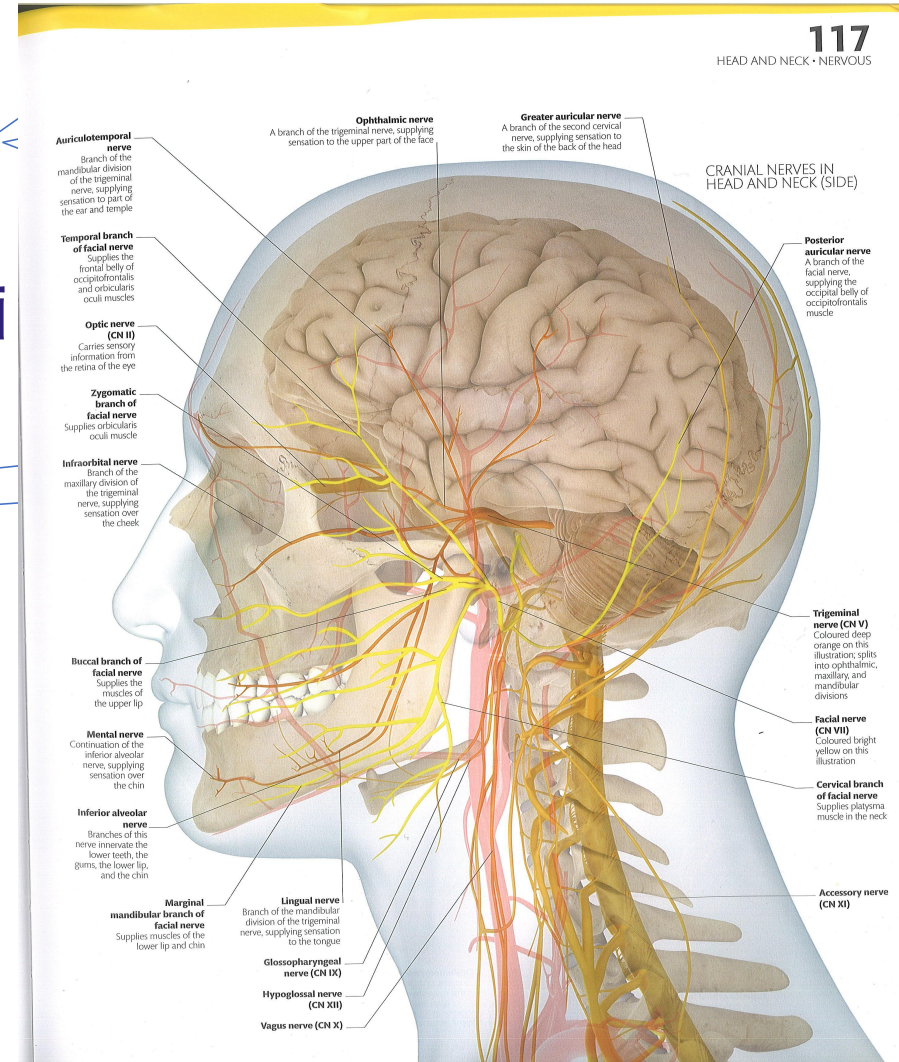
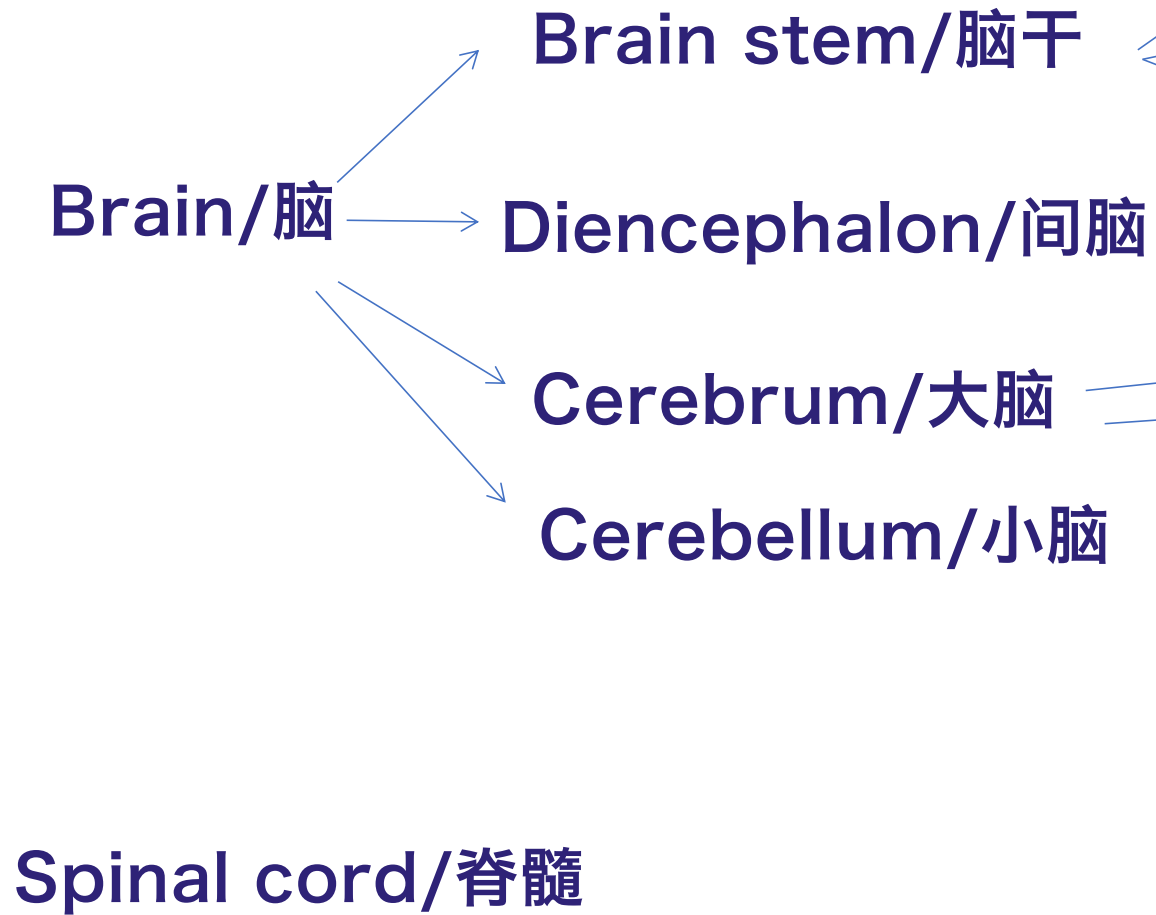
VENTRICLES OF THE BRAIN



MENINGES SECTION



Central Neural System





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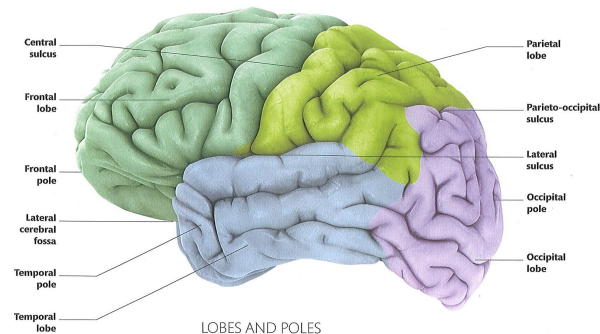


Brain/脑

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ANATOMY

HEAD AND NECK NERVOUS

Compared to other animals, we humans have massive brains for the size of our bodies. The human brain has grown larger and larger over the course of evolution, and it is now so overblown that the frontal lobes of the brain lie right over the top of the orbits that contain the eyes. Think about any other mammal, perhaps a dog or a cat for easy reference, and you will quickly realize what an odd shape the human head is – and most of that is down to our huge brains. Looking at a side view of the brain, you can see all the lobes that make up each cerebral hemisphere: the frontal, parietal, temporal, and occipital lobes (individually coloured, below). Tucked under the cerebral hemispheres at the back of the brain is the cerebellum (Latin for little brain). The brainstem leads down, through the foramen magnum of the skull, to the spinal cord.



LOBES AND POLES

Middle frontal gyrus
The word gyrus comes from the Latin for ring or convolution, and is a term used for the scroll-like folds of the cerebral cortex

Superior frontal gyrus

Inferior frontal gyrus
Includes Broca's area, part of the cerebral cortex that is involved with generating speech

Olfactory bulb

Optic nerve
The second cranial nerve. It carries nerve fibres from the retina to the optic chiasma

Pons
Means bridge in Latin, and is the part of the brainstem between the midbrain and the medulla

SIDE VIEW OF BRAIN

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HEAD AND NECK • NERVOUS

Precentral gyrus
The location of the primary motor cortex – where nerve impulses that lead to muscle movement originate

Precentral sulcus
Divides off the precentral gyrus from the rest of the frontal lobe

Central sulcus
The division between the frontal and parietal lobes

Postcentral gyrus
Lies just behind the central sulcus. The primary somatosensory cortex, which receives sensory information from all over the body

Postcentral sulcus
Divides off the postcentral gyrus from the rest of the parietal lobe

Lateral sulcus
A deep cleft dividing the frontal and parietal lobes from the temporal lobe below

Superior temporal gyrus
Includes the primary auditory cortex, where sensory information related to hearing is received

Superior temporal sulcus
Sulcus is a Latin word meaning groove or furrow

Middle temporal gyrus

Inferior temporal gyrus

Preoccipital notch

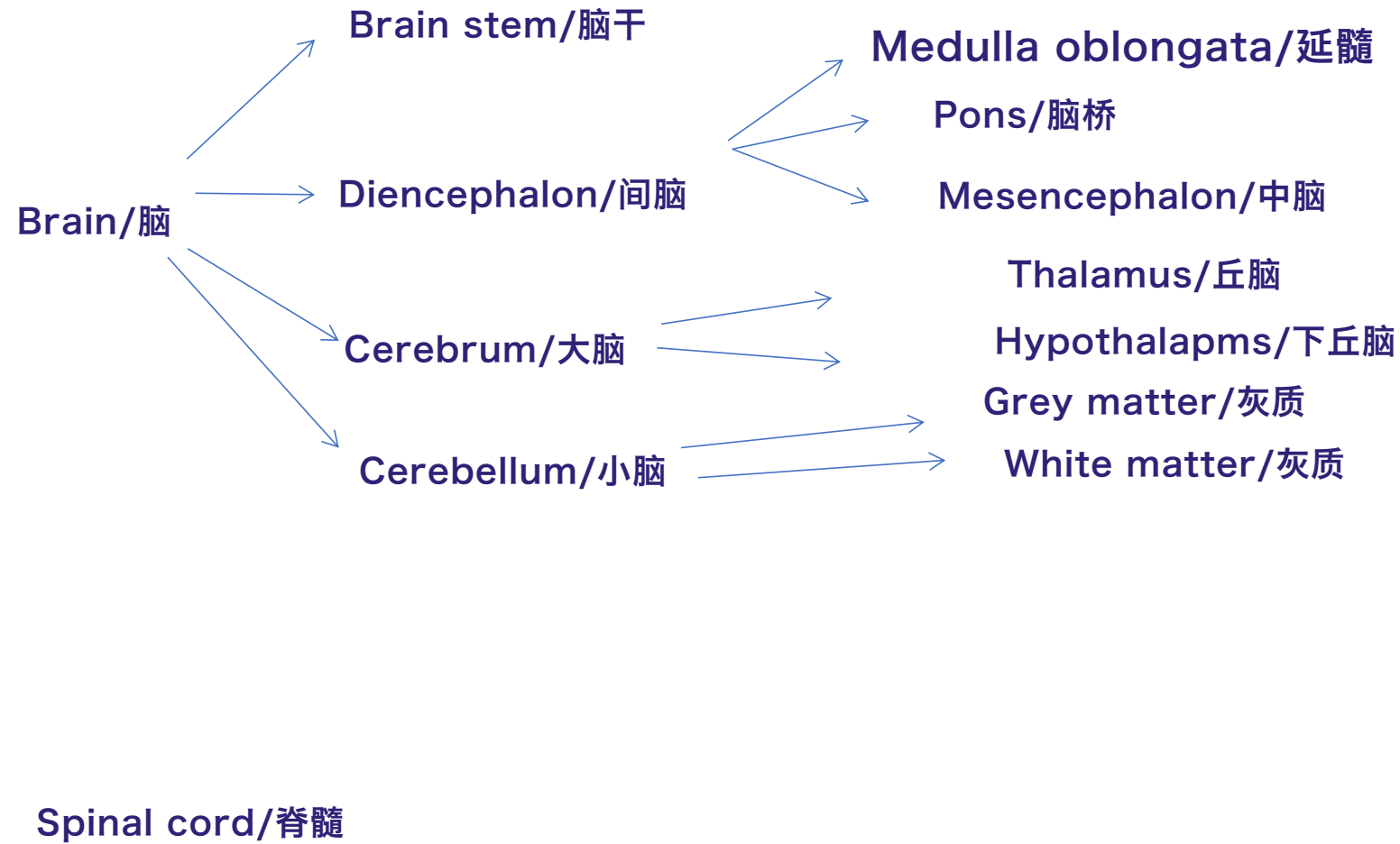
Cerebellum
Sits under the occipital lobes at the back of the brain, responsible for coordinating movement and managing balance and posture

Medulla oblongata
The lowest part of the brainstem, it continues down to form the spinal cord. Contains important centres involved in controlling breathing, heart rate, and blood pressure

Spinal cord



Central Neural System





Central Neural System



Thanks!