

Biological Bases of Behavior

AP Psychology

Nature and Nurture

Psychology studies **behavior** 行为 (what a person does) and **mental processes** 心理过程 (what a person thinks and feels). Unit 1 asks where these come from in the body.

Every trait grows from two sources working together. **Heredity** 遗传 is what a person inherits from their parents. **Environment** 环境 is everything that happens around them. Neither one acts alone.

- **Nature and nurture** 先天与后天 always interact. Height is inherited, but poor nutrition lowers it.
- The **evolutionary perspective** 进化论视角 explains behavior that helped ancestors survive and reproduce. Fear of snakes is easy to learn because it once kept people alive.
- **Twin and adoption studies** 双生子与收养研究 separate the two sources. If identical twins raised apart are still similar, heredity matters for that trait.

Note: the exam does not ask about genes, DNA, or chromosomes. It asks how heredity and environment together shape behavior.

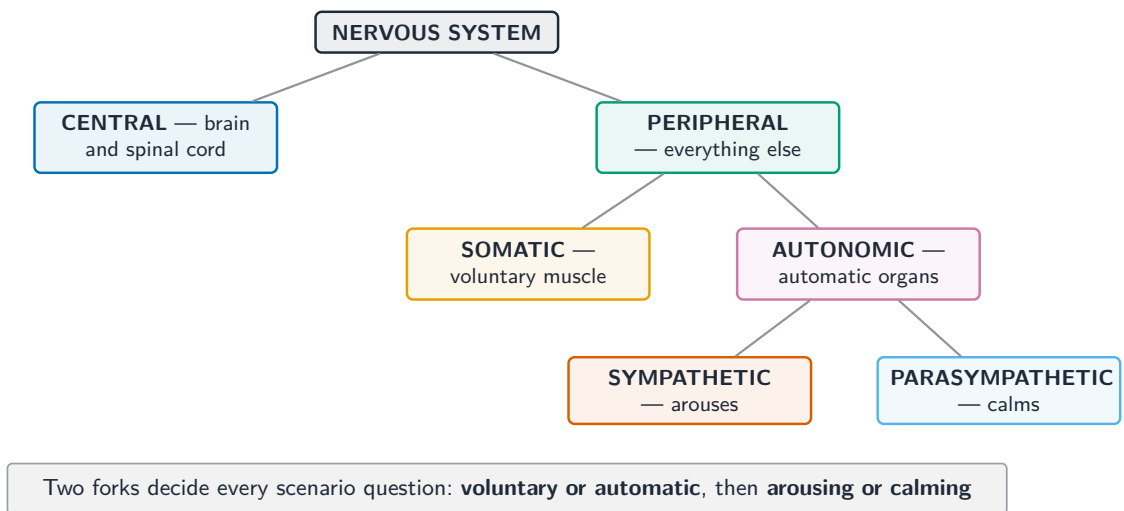
The Nervous System

The **nervous system** 神经系统 carries information around the body. It has two main parts.

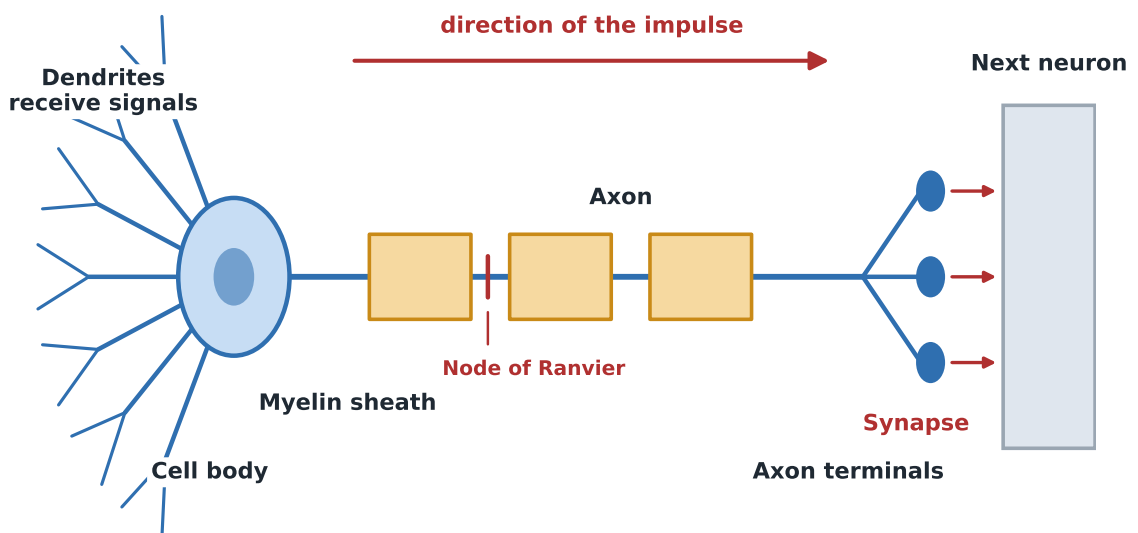
The **central nervous system (CNS)** 中枢神经系统 is the brain and the **spinal cord** 脊髓. It interacts with every process in the body.

The **peripheral nervous system (PNS)** 周围神经系统 relays messages between the CNS and the rest of the body. It divides again:

- The **somatic nervous system** 躯体神经系统 controls **voluntary** 随意的 movement, such as raising your hand.
- The **autonomic nervous system** 自主神经系统 controls **involuntary** 不随意的 processes, such as heartbeat and digestion. It has two branches that work against each other: the **sympathetic nervous system** 交感神经系统 prepares the body for action (the “fight or flight” response), and the **parasympathetic nervous system** 副交感神经系统 calms the body down afterwards.



Neurons and How They Fire



A neuron receives at the dendrites, fires along the axon, and passes the message across the synapse

Two kinds of cell do the work. **Neurons** 神经元 transmit information. **Glial cells** 神经胶质细胞 provide structure, insulation, communication, and waste transport. Together they are the building blocks of all behavior and mental processes.

A neuron has **dendrites** 树突 that receive signals, a **cell body** 细胞体, and an **axon** 轴突 that carries the signal away. Many axons are wrapped in a **myelin sheath** 髓

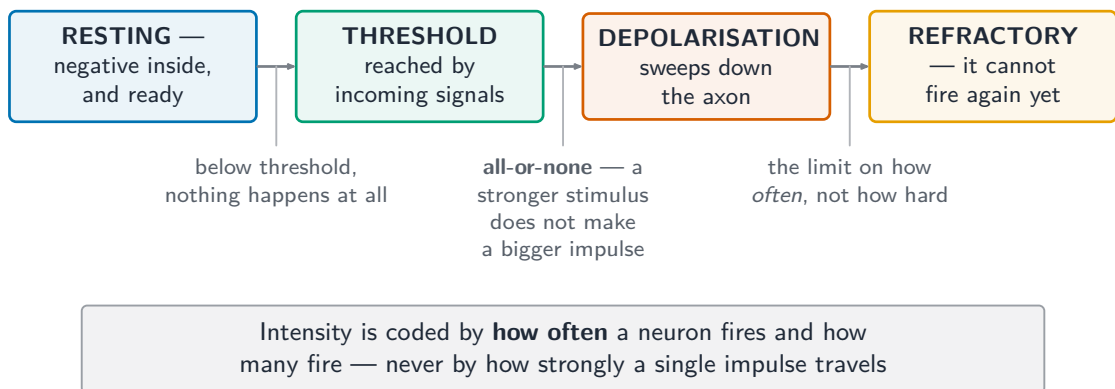
鞘, which speeds the signal up.

Neural transmission follows a set order:

- At rest the neuron holds a **resting potential** 静息电位, ready but not firing.
- If incoming signals pass the **threshold** 阈限, the neuron **depolarizes** 去极化 and fires.
- Firing follows the **all-or-none principle** 全或无原则: the neuron fires at full strength or not at all. A stronger stimulus makes it fire more often, not harder.
- Straight after firing there is a **refractory period** 不应期 when the neuron cannot fire again.
- At the **synapse** 突触, the gap between neurons, chemicals cross to the next cell. Leftover chemicals are taken back in a process called **reuptake** 再摄取.

Damage to this process can cause disorders such as **multiple sclerosis** 多发性硬化 or **myasthenia gravis** 重症肌无力.

In the spinal cord, the **reflex arc** 反射弧 shows the system working as a unit. **Sensory neurons** 感觉神经元 carry information in, **interneurons** 中间神经元 connect inside the cord, and **motor neurons** 运动神经元 carry the command out - all before the brain is involved.



Neurotransmitters, Hormones, and Drugs

Neurotransmitters 神经递质 are the chemicals that cross the synapse. Each has its own job, and the effect can depend on where in the nervous system it acts. A message is either **excitatory** 兴奋性的 (making firing more likely) or **inhibitory** 抑制性的 (making firing less likely).

Only these are examinable: **dopamine** 多巴胺 (reward and movement), **serotonin** 血清素 (mood and sleep), **norepinephrine** 去甲肾上腺素 (alertness), **glutamate** 谷氨酸 (the main excitatory transmitter), **GABA** γ -氨基丁酸 (the main inhibitory

transmitter), **endorphins** 内啡肽 (pain relief), **substance P** 物质 P (pain signalling), and **acetylcholine** 乙酰胆碱 (muscle movement and memory).

Hormones 激素 act outside the nervous system but do a similar job, travelling more slowly through the blood. Again only five are examinable: **adrenaline** 肾上腺素, **leptin** 瘦素 (reduces hunger), **ghrelin** 胃饥饿素 (increases hunger), **melatonin** 褪黑素 (sleep), and **oxytocin** 催产素 (bonding).

Psychoactive drugs 精神药物 change behavior by acting on neurotransmission in three ways:

- An **agonist** 激动剂 encourages neural firing.
- An **antagonist** 拮抗剂 discourages it.
- A **reuptake inhibitor** 再摄取抑制剂 blocks reabsorption, leaving more transmitter in the synapse.

Drug categories: **stimulants** 兴奋剂 (caffeine, cocaine) increase neural activity; **depressants** 抑制剂 (alcohol) decrease it; **hallucinogens** 致幻剂 (marijuana) distort perception; **opioids** 阿片类药物 (heroin) relieve pain. Repeated use can lead to **tolerance** 耐受性, where more is needed for the same effect, and to **addiction** 成瘾, with **withdrawal** 戒断反应 symptoms when use stops.

The Brain

The brain is studied from the bottom up, because the lower structures handle the most basic jobs.

- The **brain stem** 脑干, including the **medulla** 延髓, controls breathing and heart rate.
- The **reticular activating system** 网状激活系统 controls alertness and arousal.
- The **cerebellum** 小脑 controls coordination, balance, and some **procedural learning** 程序性学习.
- The **limbic system** 边缘系统 sits inside the cerebral cortex and includes the **thalamus** 丘脑 (a relay station for the senses), the **hypothalamus** 下丘脑 (hunger, thirst, temperature), the **pituitary gland** 脑垂体, the **hippocampus** 海马体 (forming new memories), and the **amygdala** 杏仁核 (fear and emotion).

The **cerebral cortex** 大脑皮层 is divided into two **hemispheres** 半球 and four lobes: the **occipital lobes** 枕叶 process vision at the rear; the **temporal lobes** 颞叶 process hearing and language at the sides; the **parietal lobes** 顶叶 hold the **somatosensory cortex** 体感皮层 for touch; and the **frontal lobes** 额叶 handle higher-order thinking and **executive function** 执行功能.

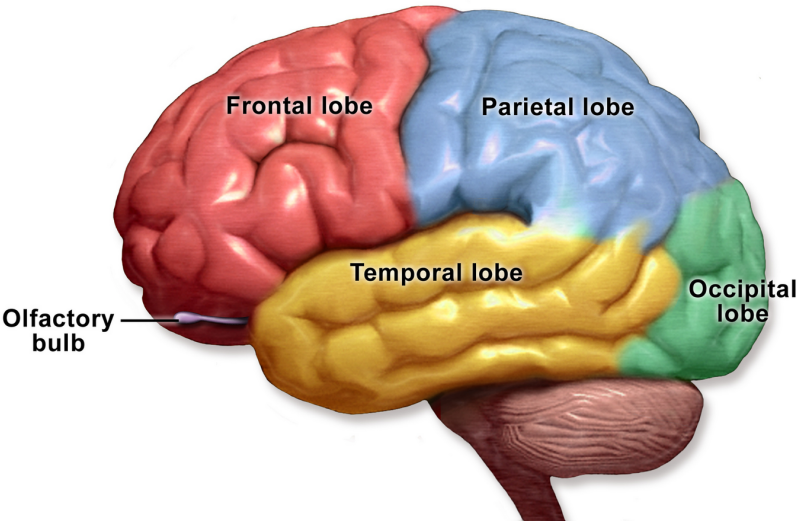
Language sits mainly in the left hemisphere: **Broca's area** 布罗卡区 for speech production and **Wernicke's area** 韦尼克区 for comprehension.

Split-brain research 裂脑研究, done on patients whose **corpus callosum** 胼胝体 was cut to treat severe epilepsy, shows the two hemispheres can work independently. Researchers present information to one **visual field** 视野 at a time, because each field is processed by the opposite hemisphere.

Brain plasticity 大脑可塑性 is the brain's ability to rewire itself and form new connections, which supports recovery after damage. Research methods include **EEG** 脑电图 and **fMRI** 功能性磁共振成像 scans, case studies, and **lesioning** 损毁法.

REGION	WHAT IT DOES	DAMAGE LOOKS LIKE
brainstem and medulla	breathing, heart rate, arousal	life-threatening — these are not optional
cerebellum	balance, and smooth learned movement	clumsy, uncoordinated movement
hippocampus	forming new long-term memories	old memories intact, no new ones
amygdala	fear, and emotional salience	blunted fear, poor threat learning
frontal lobe	planning, judgement, inhibition	impulsivity and personality change

Scenario questions arrive as the **third** column. Learn the table in that direction and the retrieval matches the question



Consciousness and Sleep

Consciousness 意识 is awareness of internal and external events, and it varies in level.

The sleep/wake cycle is a **circadian rhythm** 昼夜节律 of about 24 hours. **Jet lag** 时差反应 and shift work disrupt it.

Sleep stages are identified by **EEG** patterns. **NREM sleep** 非快速眼动睡眠 covers stages 1 to 3; **hypnagogic sensations** 入睡幻觉 occur as you fall asleep. **REM sleep** 快速眼动睡眠 is called **paradoxical sleep** 异相睡眠 because the brain looks awake while the body is most relaxed, and most dreaming happens here.

Two examinable theories explain dreams: **activation-synthesis theory** 激活-综合理论 (the brain interprets random activity) and **consolidation theory** 巩固理论 (dreams reflect memory processing). Sleep itself is explained by **memory consolidation** 记忆巩固 and **restoration** 恢复 theories.

Note: the psychoanalytic theory of dreams is outside the exam's scope.

Sleep disorders disrupt waking behavior and health: **insomnia** 失眠, **narcolepsy** 发作性睡病, **sleep apnea** 睡眠呼吸暂停, **somnambulism** 梦游 (sleepwalking), and **REM sleep behavior disorder** 快速眼动睡眠行为障碍.



Sensation

Sensation 感觉 is detecting information from the environment and **transducing** 转导 it into neural signals the brain can use. Detection needs a certain **absolute threshold** 绝对阈限.

- The **just-noticeable difference** 最小可觉差 is the smallest change a person can detect.
- **Sensory adaptation** 感觉适应 is reduced sensitivity to an unchanging stimulus - you stop noticing a smell.
- **Sensory interaction** 感觉相互作用 means the senses work together. **Synesthesia** 联觉 is when one sense triggers another.

Vision. Light is focused onto the **retina** 视网膜 by the **lens** 晶状体 changing shape, a process called **visual accommodation** 视觉调节; when this fails the result is **nearsightedness** 近视 or **farsightedness** 远视. **Rods** 视杆细胞 lie in the periphery and detect shape and movement in low light. **Cones** 视锥细胞 sit in the **fovea** 中央凹 and detect colour and detail. Colour vision needs two theories: **trichromatic theory** 三色理论 (blue, green and red cones) and **opponent-process theory** 对立过程理论, which explains **afterimages** 后像. Damage to the occipital lobes can cause **prosopagnosia** 面孔失认症, or face blindness.

Hearing. Sound is air movement; wavelength gives **pitch** 音高 and amplitude gives **loudness** 响度. Pitch perception is explained by **place theory** 位置理论, **volley theory** 齐射理论, and **frequency theory** 频率理论. **Sound localization** 声源定位 tells us where a sound comes from. Hearing loss may be **conduction deafness** 传导性耳聋 or **sensorineural deafness** 感音神经性耳聋.

The chemical senses. **Olfaction** 嗅觉 is the only sense not relayed first through the thalamus. **Gustation** 味觉 covers sweet, sour, salty, bitter, **umami** 鲜味, and **oleogustus** 脂味. The two interact: without smell, taste is muted.

Touch, pain, and body position. Skin receptors transduce touch; “hot” comes from warm and cold receptors firing together. Pain is processed in body and brain, and **gate control theory** 闸门控制理论 explains why attention changes how much it hurts; **phantom limb** 幻肢 sensations show the brain’s role. The **vestibular sense** 前庭觉 controls balance through the **semicircular canals** 半规管, and **kinesthesia** 动觉 is the sense of body movement.

Worked example (a real AP exam question). The 2025 Article Analysis Question asked students to “*Identify the research method used in the study*” and then to “*Explain the extent to which the research findings may or may not be generalizable using specific and relevant evidence from the study.*” A full-mark answer to the second part names the limitation **and** ties it to evidence: “*The findings may not generalize widely because participants were undergraduate students at one university, so the sample was not representative of the general population.*” Notice the shape: **Explain** needs a claim plus the evidence behind it. Naming the method alone answers part A, not part E.

Exam tips

- Learn only the listed **neurotransmitters** and **hormones**; the exam will not ask about others, and the endocrine glands are out of scope apart from the pituitary.
- Keep **sensation** separate from perception: sensation is detecting and transducing, perception is interpreting (Unit 2).
- The **all-or-none principle** means intensity is coded by how *often* a neuron fires, never by how strongly.
- Match structure to job before you write: hippocampus forms memories, amygdala handles fear, cerebellum coordinates movement.
- **Sympathetic** arouses, **parasympathetic** calms. If a question describes a racing heart, name the sympathetic branch.
- Say what a scan can and cannot show. **fMRI** shows activity over time; **EEG** shows electrical patterns and identifies sleep stages.