

Biological Bases of Behavior

AP Psychology ■ Unit 1

AP Psychology



Biological Bases of Behavior

What we will cover

- 1 Nature and Nurture
- 2 The Nervous System
- 3 Neurons and How They Fire
- 4 Neurotransmitters, Hormones, and Drugs
- 5 The Brain
- 6 Consciousness and Sleep

1

Nature and Nurture

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.

- **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.

Nature and Nurture, continued

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.

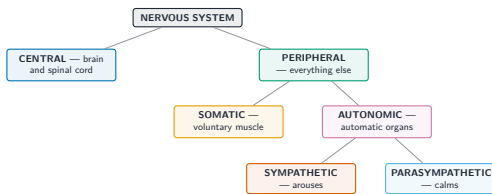
2 The Nervous System

The Nervous System

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

- 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.

Voluntary or automatic, then arousing or calming

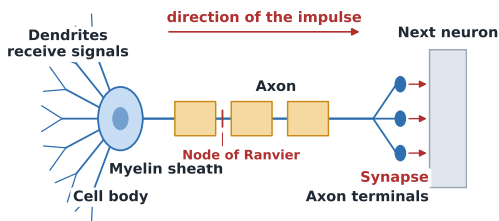


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Neurons and How They Fire

Dendrites receive, the axon carries, the synapse passes it on



- 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...
- Straight after firing there is a **refractory period** 不应期 when

Neurons and How They Fire

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.

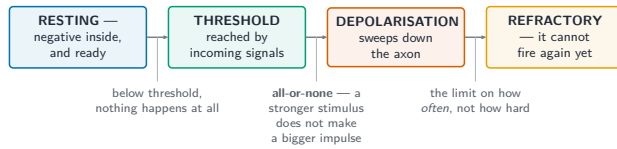
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- Straight after firing there is a **refractory period** 不应期 when the neuron cannot fire again.
- At the **synapse** 突触, the gap between neurons, chemicals cross to the next cell. Leftover chemicals are taken back in a process called **reuptake** 再摄取.

Neurons and How They Fire, continued

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.

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

How a neuron fires



Intensity is coded by **how often** a neuron fires and how many fire — never by how strongly a single impulse travels

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Neurotransmitters, Hormones, and Drugs

Neurotransmitters, Hormones, and Drugs

- 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.

Neurotransmitters, Hormones, and Drugs, continued

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.

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The Brain

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 Brain, continued

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.

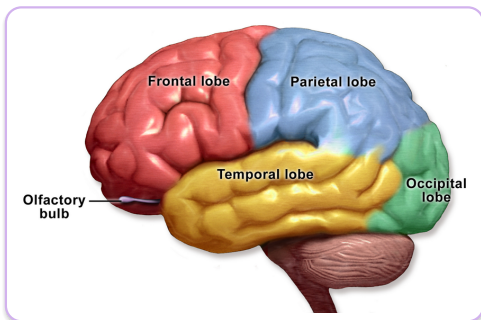
Language sits mainly in the left hemisphere: **Broca's area** 布罗卡区 for speech production and **Wernicke's area** 韦尼克区 for comprehension.

Brain regions, by their deficit

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 movements	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

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The four lobes of the cortex



- **occipital lobes** 枕叶 – vision, at the rear
- **temporal lobes** 颞叶 – hearing and language, at the sides
- **parietal lobes** 顶叶 – **somatosensory cortex** 体感皮层 for touch
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Consciousness and Sleep

Biological Bases of Behavior
↳ Consciousness and Sleep

Consciousness and Sleep

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.

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.



measuring

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Sensation

Sensation

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.

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.

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Recap

Unit 1 – key takeaways

1

Neurons

all-or-none; intensity is firing *rate*

2

Autonomic

sympathetic arouses;
parasympathetic calms

3

Brain

hippocampus memories; amygdala
fear; cerebellum movement

4

Senses

sensation detects; perception
interprets (Unit 2)

Check yourself

- 1 How is stimulus intensity coded in a neuron?
- 2 A racing heart: which autonomic branch?
- 3 What does the hippocampus do?
- 4 What can fMRI show that EEG cannot?

Answers: firing rate (not strength) ▪ sympathetic ▪ forming new memories ▪ activity over time / localisation