

Exercise walk-through

# 9.6

## Higher functions: sleep, memory and language

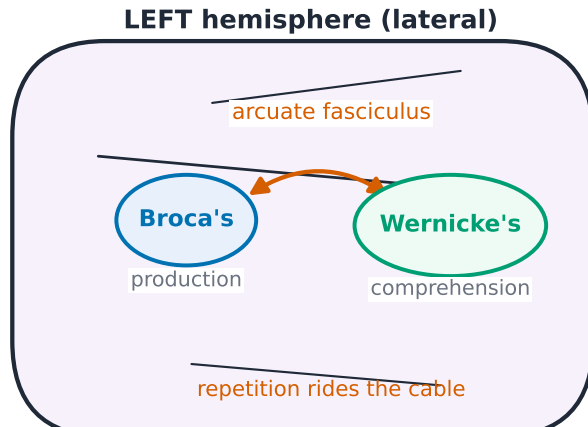
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University Medicine

## Higher functions: architecture predicts disorders

- 1 **Sleep** ~90-min cycles  $\times$  4-6: N3 delta (0.5-4 Hz, growth hormone) early; REM ~20-25 %, atonia, lengthens toward morning.
- 2 **Memory** Hippocampus episodic, striatum procedural, amygdala emotional, cerebellum conditioned - HM proved the dissociation.
- 3 **Language** Broca non-fluent, Wernicke fluent-empty, **arcuate fasciculus** = repetition destroyed (conduction).

# Language areas and their connections



## three aphasias, three sites

| site              | fluency               | comprehension | repetition |
|-------------------|-----------------------|---------------|------------|
| <b>Broca's</b>    | non-fluent, effortful | intact        | impaired   |
| <b>Wernicke's</b> | fluent, empty         | impaired      | impaired   |
| <b>conduction</b> | fluent                | intact        | DESTROYED  |

*fluency names the front; content names the back;  
repetition names the cable*

memory: hippocampus episodic · striatum procedural · amygdala emotional · cerebellum conditioned  
sleep: ~90-min cycles × 4-6 · N3 delta early · REM ~20-25 % late

Broca produces, Wernicke comprehends, the **arcuate fasciculus** repeats.

## Exercises 2.1-2.3

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**2.1** Which sleep stage dominates the first cycles, and at what frequency? [3]

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**2.2** HM lost new episodic memory but kept skill learning – name the two systems. [3]

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**2.3** Which aphasia destroys repetition with fluency and comprehension intact? [3]

## Exercises 2.1-2.3

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**2.1** Which sleep stage dominates the first cycles, and at what frequency? [3]

**2.1**

- N3 (slow-wave sleep), delta 0.5–4 Hz ✓.

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**2.2** HM lost new episodic memory but kept skill learning – name the two systems. [3]

**2.2**

- Hippocampus (episodic) and striatum (procedural) ✓.

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**2.3** Which aphasia destroys repetition with fluency and comprehension intact? [3]

**2.3**

- Conduction aphasia – the arcuate fasciculus is cut ✓.

## Exercise 3.1

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**3.1** A fictional sleep study: 8 hours, five cycles.

Explain the architecture (N3 dominates cycles 1–2; REM episodes lengthen toward morning) and predict what early-night sleep loss costs (growth-hormone-rich N3) versus late-night loss (REM) ✓. State the REM percentage and two REM features. [8]

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### 3.1

- N3 front-loaded: cycles 1–2 carry most slow-wave sleep ✓.
- REM lengthens toward morning; ~20–25 % of the night ✓.
- REM features: muscle atonia, vivid dreams ✓.
- Early loss costs N3 (growth hormone); late loss costs REM ✓.

## Exercise 3.2

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**3.2** A fictional patient: fluent speech, intact comprehension, repetition destroyed.

Localise (arcuate fasciculus, conduction aphasia) and contrast with Broca and Wernicke lesions on all three axes (fluency, comprehension, repetition). Justify why repetition is the cable's test ✓.

[7]

## Exercise 3.2

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### 3.2

- Conduction aphasia: arcuate fasciculus (the cable) cut ✓.
- Broca: non-fluent, comprehension intact, repetition impaired ✓.
- Wernicke: fluent-empty, comprehension impaired, repetition impaired ✓.
- Repetition requires the front-to-back cable – only its lesion spares both other axes ✓.