Recipe for Sleep

Neuroscientist Chiara Cirelli:
Uncovering Sleep

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Chiara Cirelli Studies Shuteye

Neuroscientist Cirelli wants to find a recipe for sound sleep.

Sleep

- Is necessary for all animals
- Varies among animals
- Is a powerful restorative

Question:

In what phase of sleep do humans dream?

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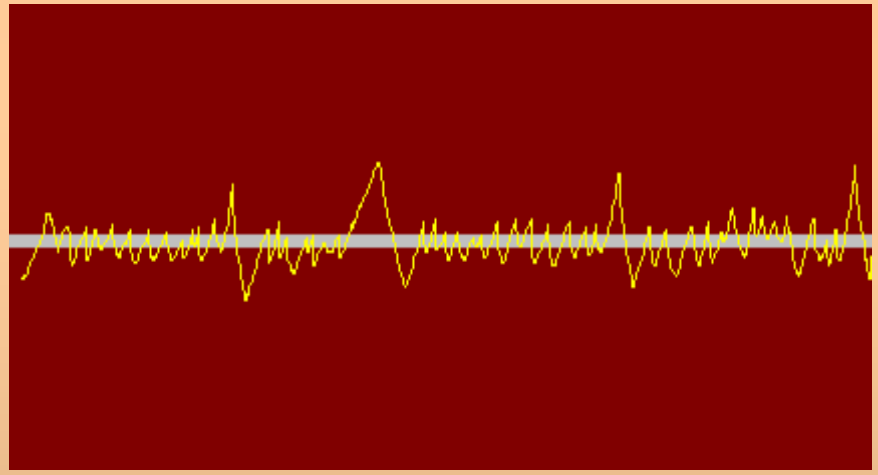
Answer: REM

REM = Rapid Eye Movement



During the REM phase of sleep, brain waves are

- Fast
- Short
- Narrowly spaced
- Sometimes quite similar to brain waves of wakefulness

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Why Do We Sleep?

To give the body a chance to repair itself?

To give the brain time to organize its thoughts?

What some scientists suspect

So that we can learn more the next day?

→ What Cirelli suspects

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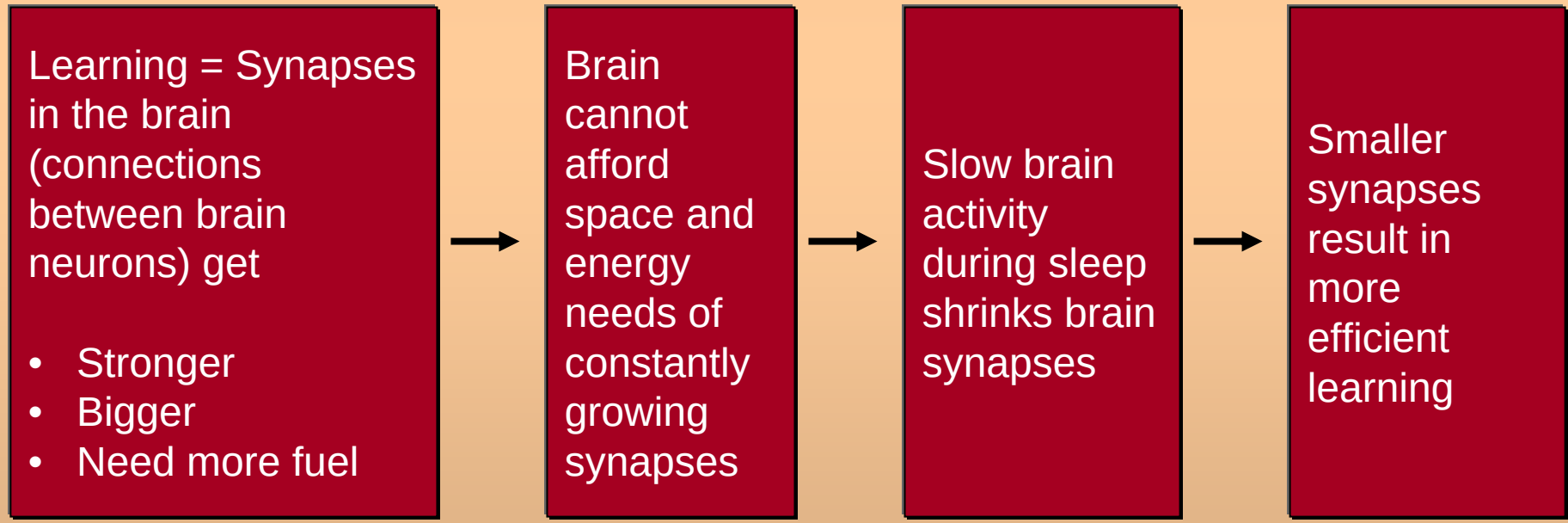
Cirelli's Synaptic-Strength Hypothesis

Wakefulness = Learning new things



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Testing Cirelli's Hypothesis

Compare 2 groups of rats
- Average intelligence
- Above average intelligence

Measure brain activity during wakefulness while
- Average rats lounge around
- Smarter rats get mental challenges like grabbing food pellets from a small opening

Measure brain activity during sleep

Study sleep patterns

=

Dissimilarities could point to a connection between learning and sleep

Findings

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Fruit Flies Are Model Organisms

Drosophila melanogaster
(fruit fly)

Fruit flies are perfect tools for studying heredity, or genetics.

Cirelli uses fruit flies to study genes that affect sleep.

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Sleep Genes and Fruit Flies

- Fruit flies have a lifespan of a few months, and female fruit flies lay eggs every day
- Fruit flies sleep about 12 hours every night
- Scientists know almost all the genes for about a dozen species of fruit flies

Why are these traits attractive to scientists who use model organisms in their work?

How do scientists know this information?

How might scientists use this knowledge?

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Sleepless in Madison

Previously, Cirelli would awaken sleeping fruit flies by shaking the test tubes where they ate and slept.

Cirelli is trying to identify genes that allow some fruit flies to stay awake after sleep deprivation

Now, Cirelli uses a robotic arm that tilts and drops a frame containing the test tubes of sleeping fruit flies, jolting them awake.

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Cirelli Discovers Minisleeper Flies

- Minisleeper flies have a genetic mutation that allows them to function on less sleep than normal flies
- Minisleeper flies also have “shaker” gene mutation
- Humans have a similar gene and protein
- Problem: minisleeper flies don’t live as long as sleepier ones

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Research Applications

How might Cirelli's work with fruit fly genes eventually help humans sleep better, and what is the "fly in the ointment" of such an application?