Sleep

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Why Is Sleep Important?

Sleep touches on multiple facets of our overall health

- Encourages muscle repair

- Supports hormone regulation and metabolism

- Helps with formation of long-term memories

- Lesser demands on circulatory and respiratory systems

Adults are recommended to sleep at least 7 hours each night

How Do We Know When Someone Is Sleeping?

Slow and steady breathing

Snoring

Slower brain activity … for the most part

Slower heart rate
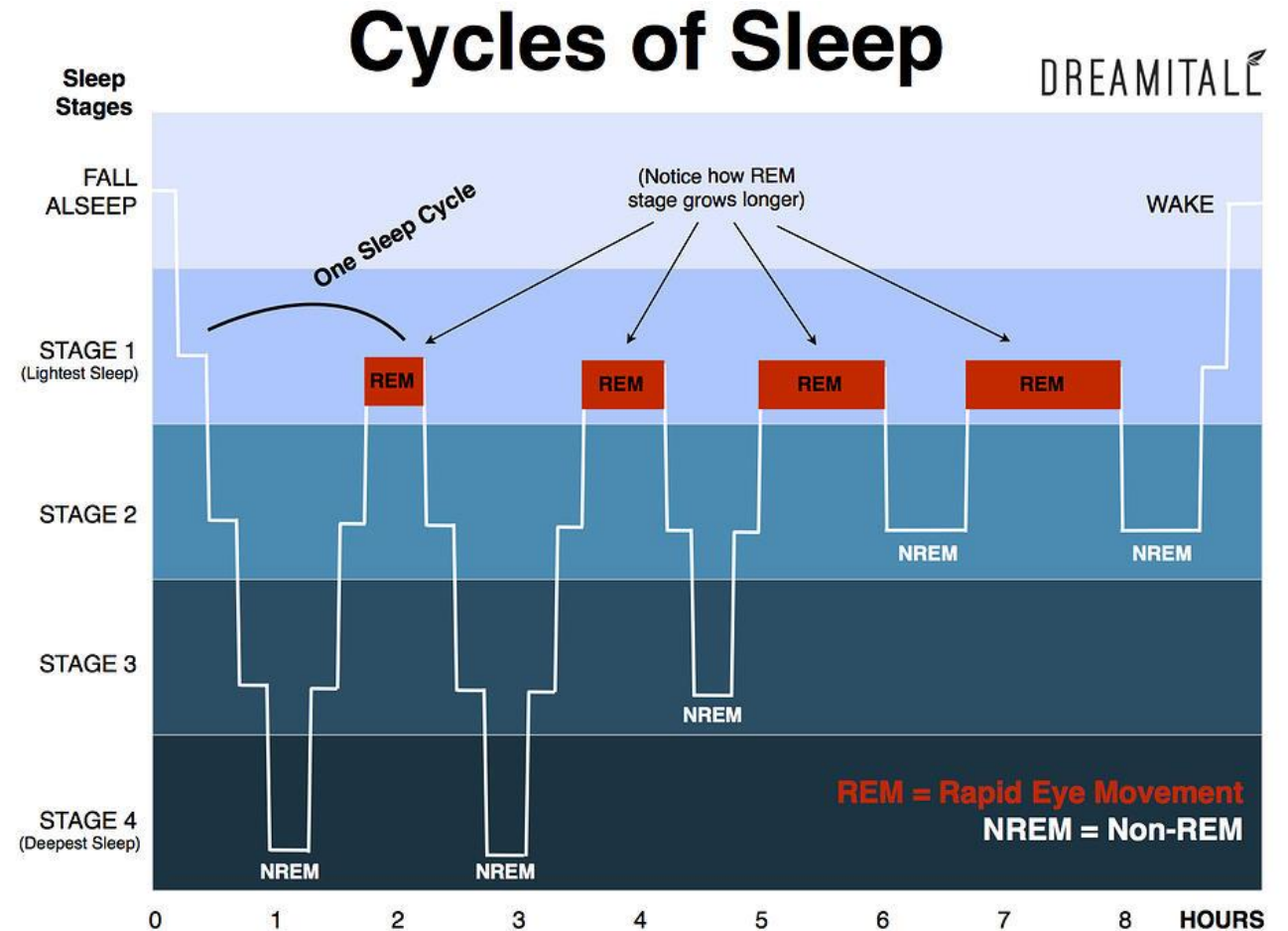
Lack of body movement

In a dark and quiet room

Evening or nighttime

Lying down in bed

What Are Some Important Features of Sleep?

- Time in bed
- Total sleep duration
- % of REM sleep
- # of body movements
- # of noise events
- Breathing rate
- # of airflow stoppages

What Can Go Wrong With Sleep?

- **Insomnia:** Trouble falling or remaining asleep

- **Apnea:** Breathing disruptions
    - **Hypopnea:** Shallow breathing
    - **Obstructive apnea:** Airway blockage
    - **Central sleep apnea:** Breath holding

- **Restless leg syndrome:** Tingling sensation that causes the urge to move the legs

Continuous positive airway pressure (CPAP) machine for helping control breathing
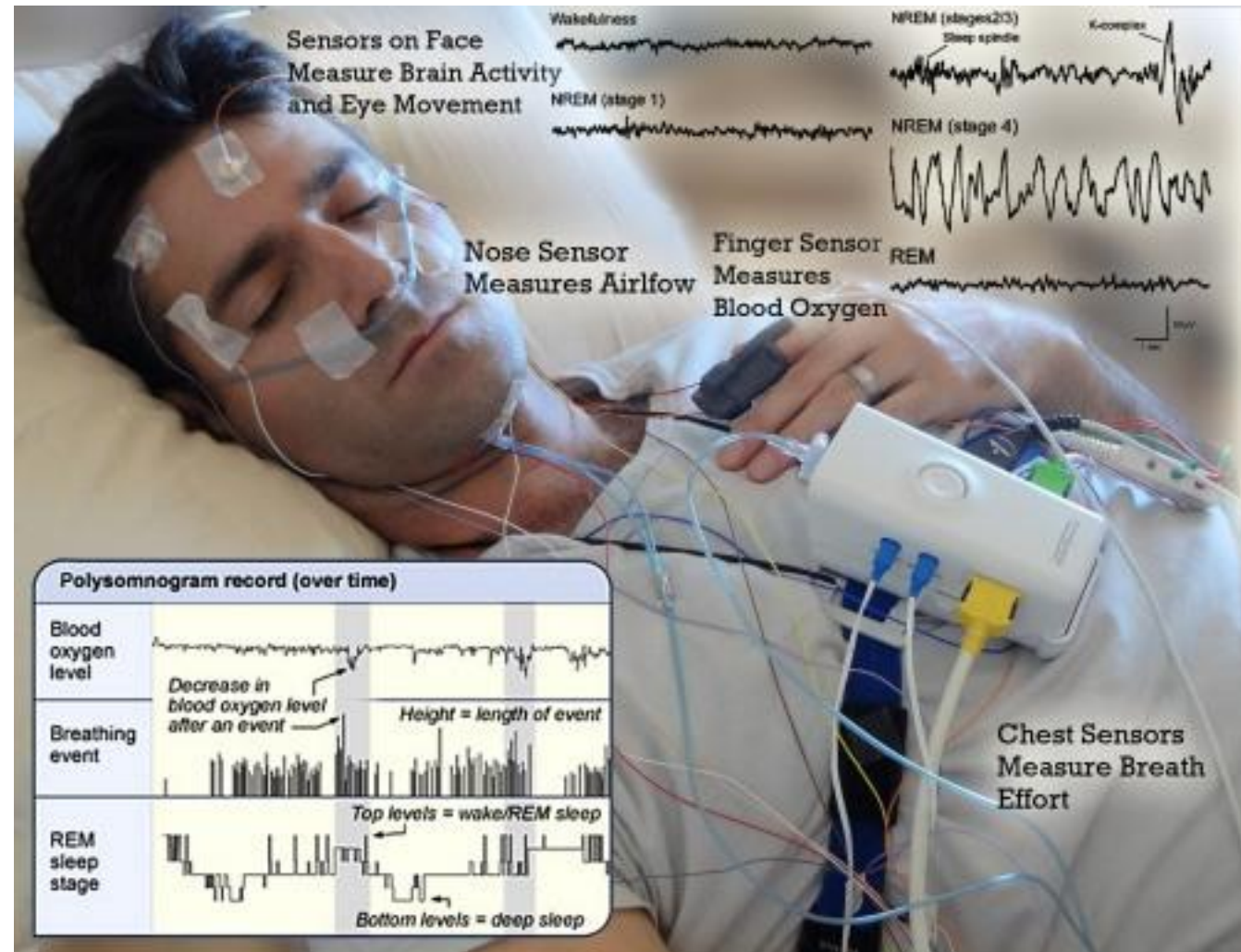
How Can We Monitor Sleep?

The gold standard is polysomnography (PSG)

PSG entails monitoring physiology during sleep

- Typically done in a sleep clinic
- Typically requires significant instrumentation

Measures signals ranging from breathing rate to brain activity

How Can We Monitor Sleep?

Smartwatches and other wearables can monitor heart rate, motion, and even respiration rate

These signals can be more reliable during sleep since the devices remain still through the night
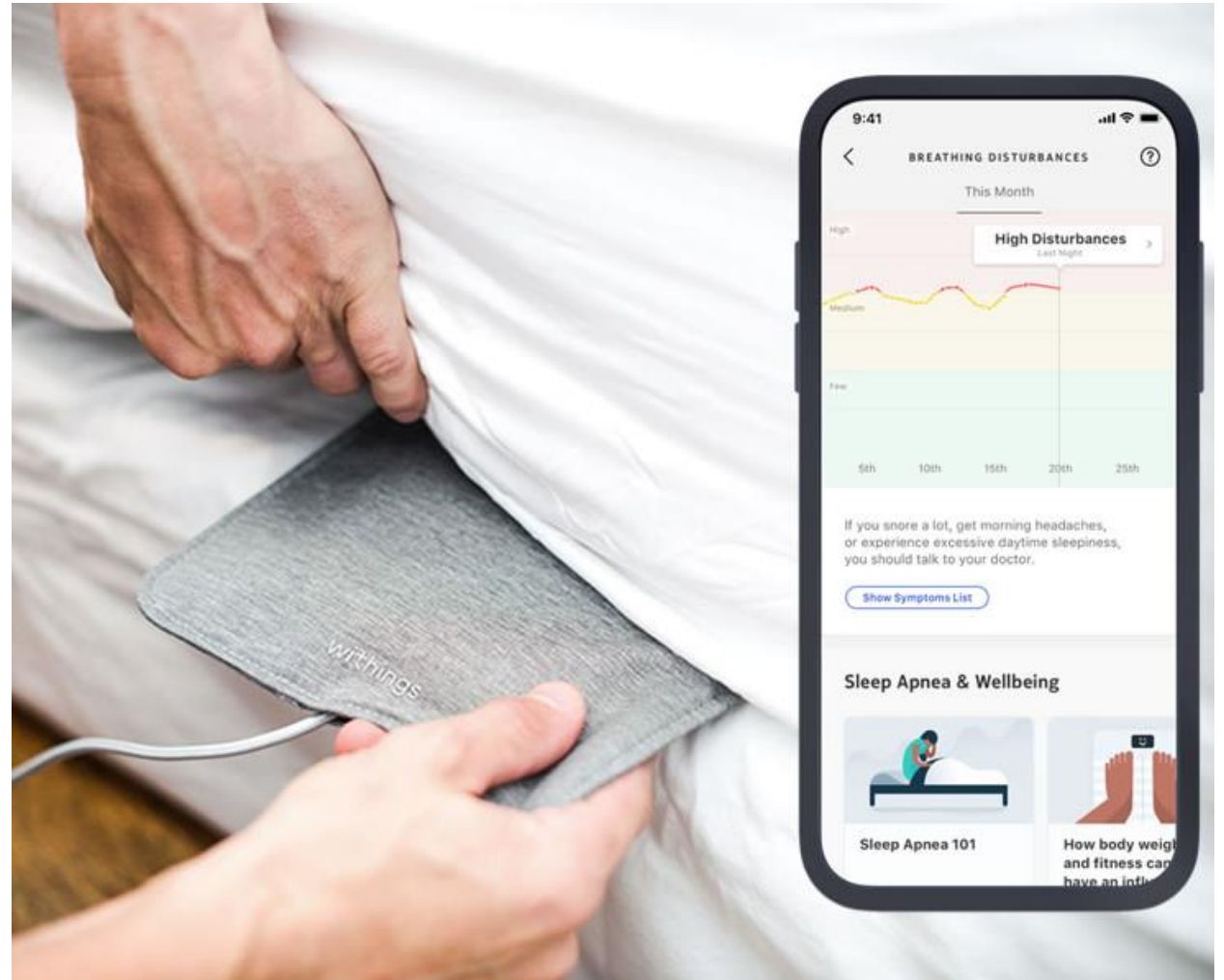
How Do We Know That Someone Is Sleeping?

Mattress sensors detect breathing rate (and even heart rate, purportedly) via pressure sensing

- Piezoelectric
- Capacitive
- Conductive fabric

Pressure on its own measures time in bed, so extra processing is needed to identify actual sleep time

Resources

Sleep Disorders
([Sleep Foundation '22](#))

Technical Review of Polysomnography
([Vaughn and Giallanza '08](#))