Introduction to Sleep Medicine

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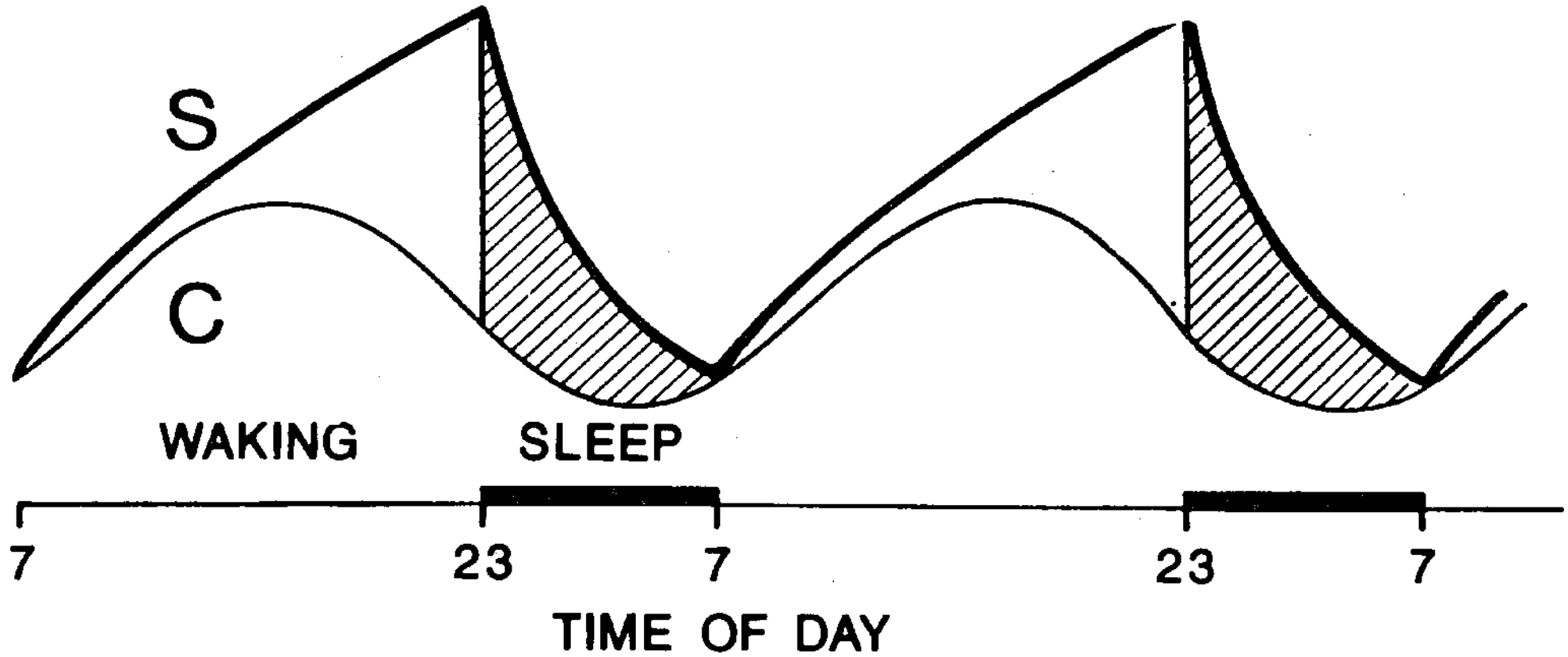
What is Sleep?

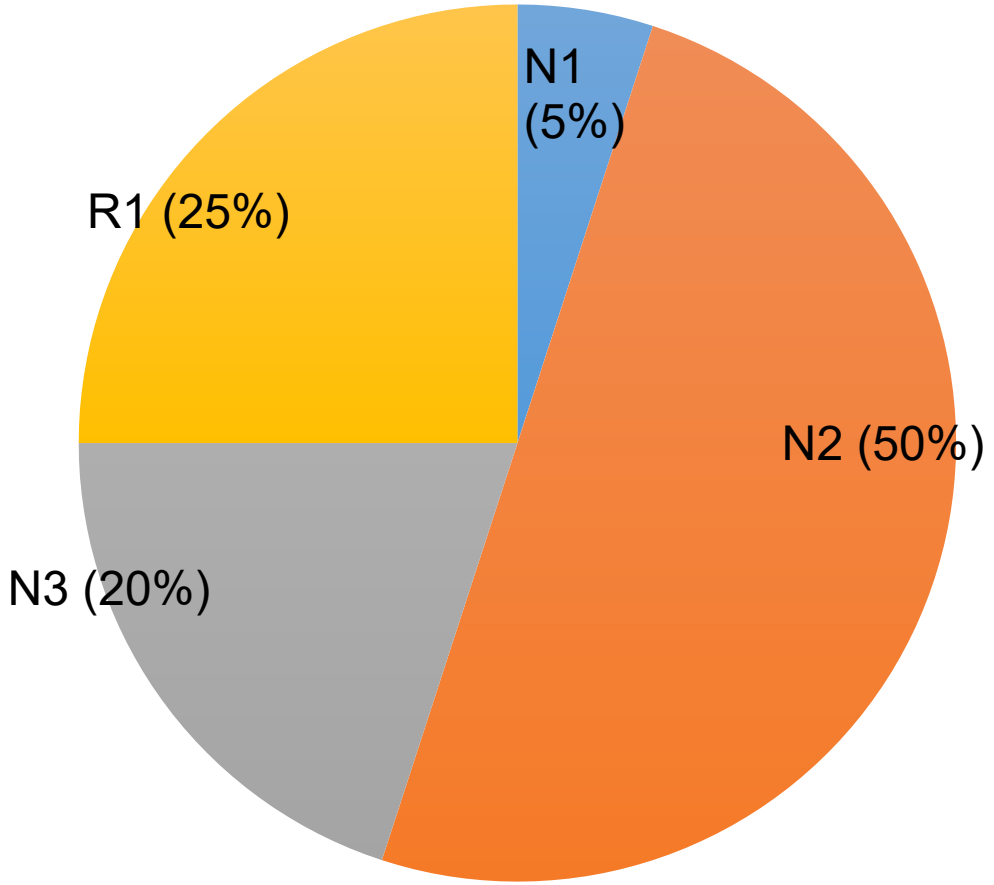
- Alternates with waking
- Associated with postural change (recumbent in humans)
- Decreased response to sensory stimuli
- Low levels of motor activity
- Rebound if deprived of sleep

Phyllis Zee, Update on the Science, Diagnosis, and Management of Insomnia, International Congress and Symposium Series 262, 2006, pg 4

2-Process Model of Sleep Regulation (Borbely 1982)



Sleep Architecture



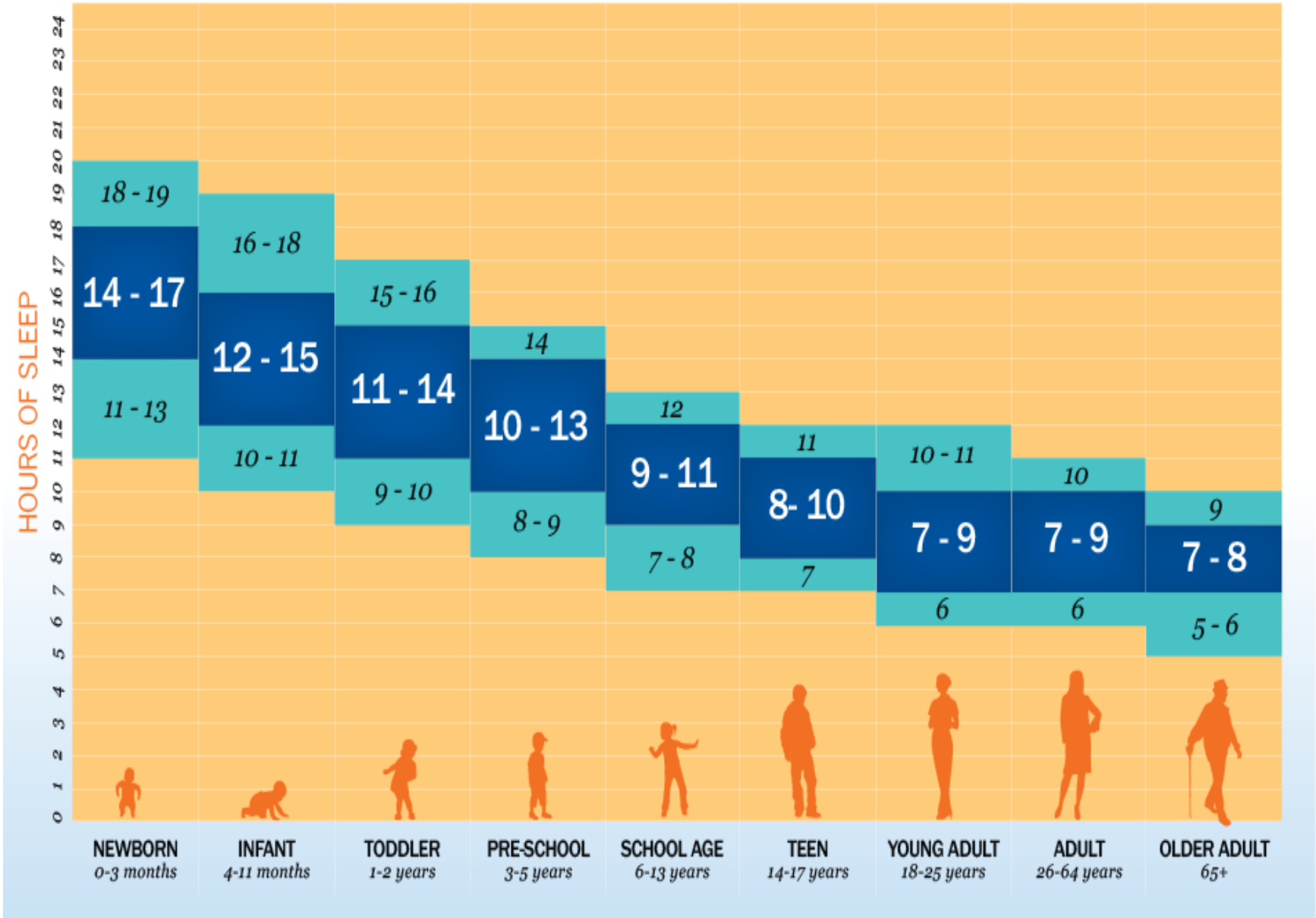
Sleep Cycles

- Approximately 90-110 minutes
- 4-6 cycles per night
- During first cycles R1 (REM) only a few minutes
- First 2 cycles have significant N3
- Later cycles dominated by R1

Sleep Staging is based on which of the following?

- Breathing Patterns
- Arousal Patterns
- Electroencephalogram (EEG) Patterns
- Oxygen Saturation Patterns
- EKG Patterns

Sleep Requirements Vary with Age (National Sleep Foundation)



Sleep Patterns with Aging

- substantial ↑ in variability from individual to individual
- ↓ total sleep time
- ↓ sleep efficiency
- ↓ time to REM onset
- ↑ sleep fragmentation
- N3 (slow-wave sleep) may ↓

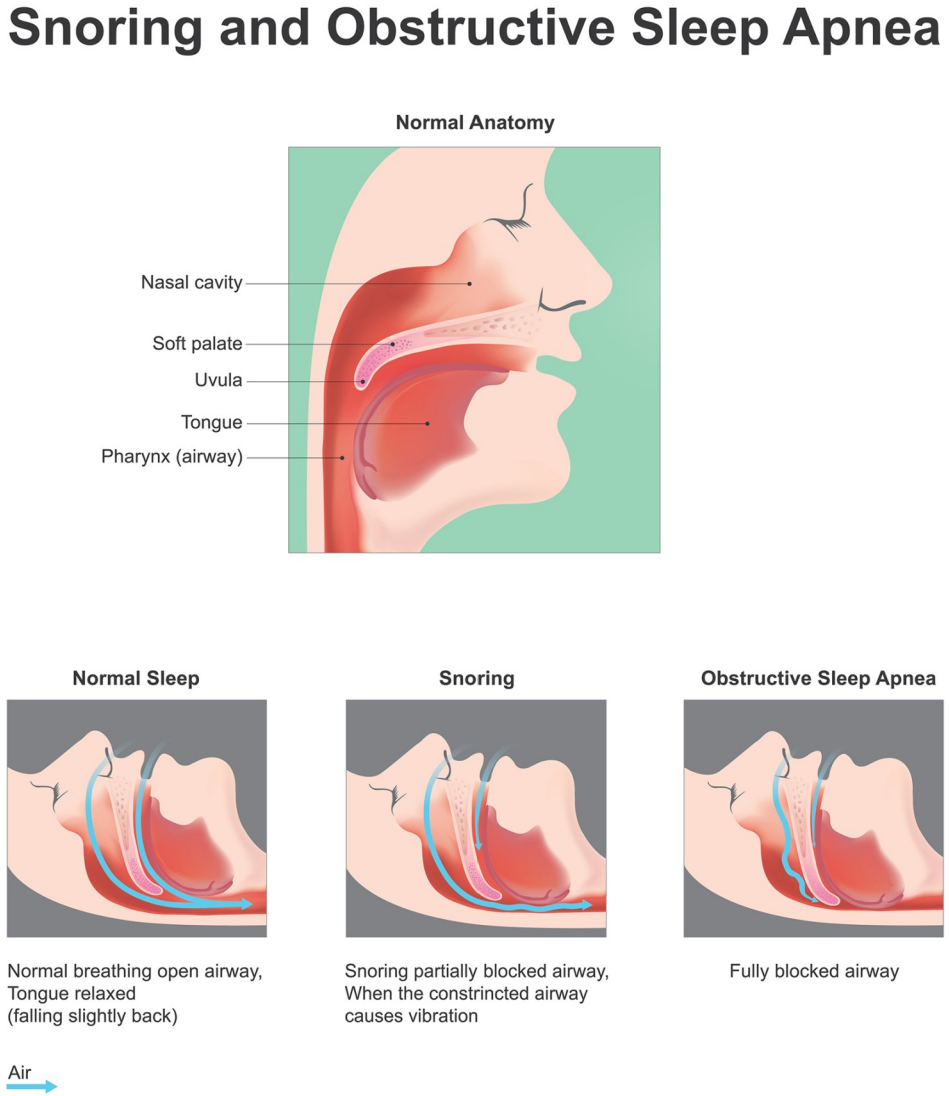
Physiologic Changes During Sleep

	Non-REM	REM
Cardiovascular	↓HR, ↓ BP, ↓variability	↑ HR, ↑ variability
Respiratory	↓RR, ↓variability	↑ RR, ↑ variability
Neuromuscular	tonic	atonic
Endocrine	↓ urine output	

Most Common Sleep Disorders

- Sleep Disordered Breathing
- Sleep Related Movement Disorder (ex. Restless Leg Syndrome)
- Insomnia
- Parasomnia
- Central Disorders of Hypersomnia (ex. Narcolepsy)
- Circadian Rhythm Sleep-Wake Disorders

What is Sleep Apnea?



https://www.sleepwell.org/snoring/

Sleep Apnea: Physiology

Increased upper airway collapsibility

- Oxygen level can drop (but not always)
- $CO_{2\,l}$ level increases

Increased effort to breath

- Increased sympathetic activity (fight or flight reaction)
- Blood vessels constrict → increased blood pressure (BP)
- Increased BP → reflex bradycardia (decreased heart rate)
- Tachycardia (increased heart rate) with recurrent arousals

Why is Sleep Apnea a Problem?

- Poor daytime functioning
- Increased risk of accidents
- Irritability → poor social interactions
- Increased risk of hypertension

Obstructive Sleep Apnea

Risk Factors

- Increased body weight
- Age
- Large neck circumference
- Airway
- M > F
- Menopause

Presenting Symptoms

- Snoring (but many people snore and DON’T have apnea)
- Witnessed apneas
- Excessive daytime sleepiness
- AM headaches
- Dry mouth

Sleep Apnea and Performance

- Chronic partial sleep deprivation
- Decreased attention
- Individual often has poor insight into impaired performance 2°sleep apnea
- Even brief lapses in attention can lead to injury (eg. when driving)

Sleep Apnea Treatment

- Continuous Positive Airway Pressure (CPAP)
- Mandibular Advancement Device
- Surgery
  - Palate/oral surgery
  - Inspire™ (implanted breathing stimulation device)
- Other
  - Weight loss
  - Avoid alcohol

How is Sleep Measured?

- In-Lab Sleep Study
- Breathing, EEG, EMG (monitoring muscle activity), O2, EKG

- Home Sleep Study
- Breathing, O2, +

In-lab Polysomnography vs Home Sleep Testing

In-Lab

- Measures of breathing, EEG, oxygenation, position, video, movements
- 1 technician per every 2 patients
- Inconvenient
- Expensive

Home Sleep Testing

- Large # of different devices, with varying # of signals
- Patient takes device home
- Much cheaper
- Fewer signals and data
- Not appropriate for everyone

National Sleep Research Resource (NSRR)

- Collection of de-identified data from well characterized sleep cohorts
- Includes clinical data elements and physiologic signal data (ex. Polysomnography data), tools for analysis
- Purpose is to make data available for secondary analysis, teaching
- Supported by National Heart, Lung, Blood Institute at NIH
- https://sleepdata.org

Sleep Heart Health Study

- Multi-site cohort study
- Designed to determine whether sleep-disordered breathing is associated with hypertension (high blood pressure), cardiac disease, stroke, and all cause mortality
- 6441 individuals 40 years or older were enrolled between 1995 and 1998
- Participants were evaluated at three time points over study period (1995 – 2003)

Sleep Heart Health Study

- Patients recruited from 9 epidemiologic cohorts in which cardiovascular outcomes had been collected:
  - Framingham Offspring Cohort
  - Hagerstown & Minneapolis/St. Paul sites of Atherosclerosis Risk in Communities (ARIC) study
  - Hagerstown, Sacramento & Pittsburgh sites of Cardiovascular Health Study (CHS)
  - Strong Heart Study sites in South Dakota, Oklahoma, & Arizona
  - Respiratory & Hypertension (HTN) disease studies in Tucson & New York

Sleep Heart Health Study

- Data collected included:
  - In-home sleep studies at the 1st & 3rd study visits
  - Demographic data
  - Cardiovascular outcomes data

Sleep Heart Health Study

- Data was extracted from the SHHS using the NSRR website
- Exercises for the course use this extracted data
- Your completion of data use request through NSRR site is good example of data use agreement

Questions?