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Building Better Brains: The Role of Sleep in Child Development in Child Development

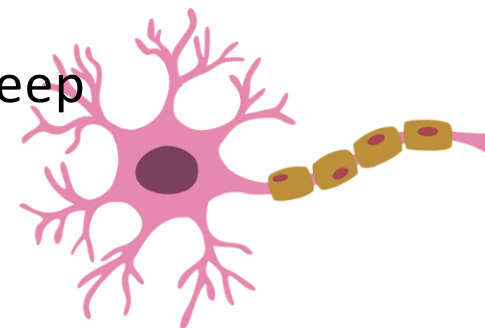
Michael & Susan Dell Center for Healthy Living at the UTHealth School of Public Health Webinar | July 29, 2026

Christine W. St. Laurent, PhD, MPH, CSCS

Department of Kinesiology
School of Public Health and Health Sciences
University of Massachusetts Amherst

Webinar Overview

1. Explore sleep as a foundational pillar of brain health, development, and overall well-being in children and adolescents
2. Discuss how sleep supports learning, memory, emotional regulation, and healthy brain development
3. The impacts of insufficient sleep on brain development and brain health outcomes
4. Acknowledge key family, school, and community factors that shape children's sleep health
5. Highlight practical, evidence-based strategies for promoting healthy sleep habits



My Perspectives



MOOVE & SNOOZE LAB
UMASS AMHERST

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PART 1

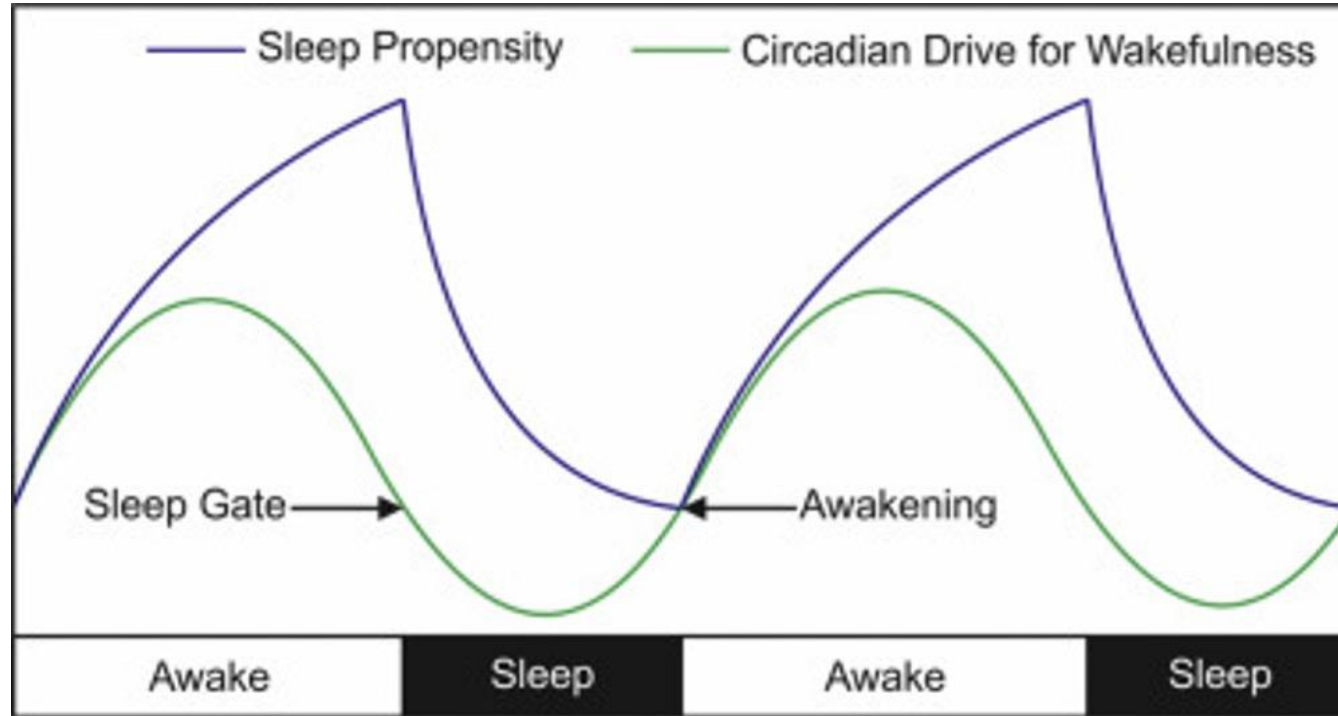
Sleep Health

What is Sleep?

“Sleep is a naturally recurring and reversible biobehavioral state characterized by relative immobility, perceptual disengagement, and subdued consciousness. As a predictable and easily reversible phenomenon, sleep is distinct from states of anesthesia and coma, which typically involve the absence or suppression of neural activity.”

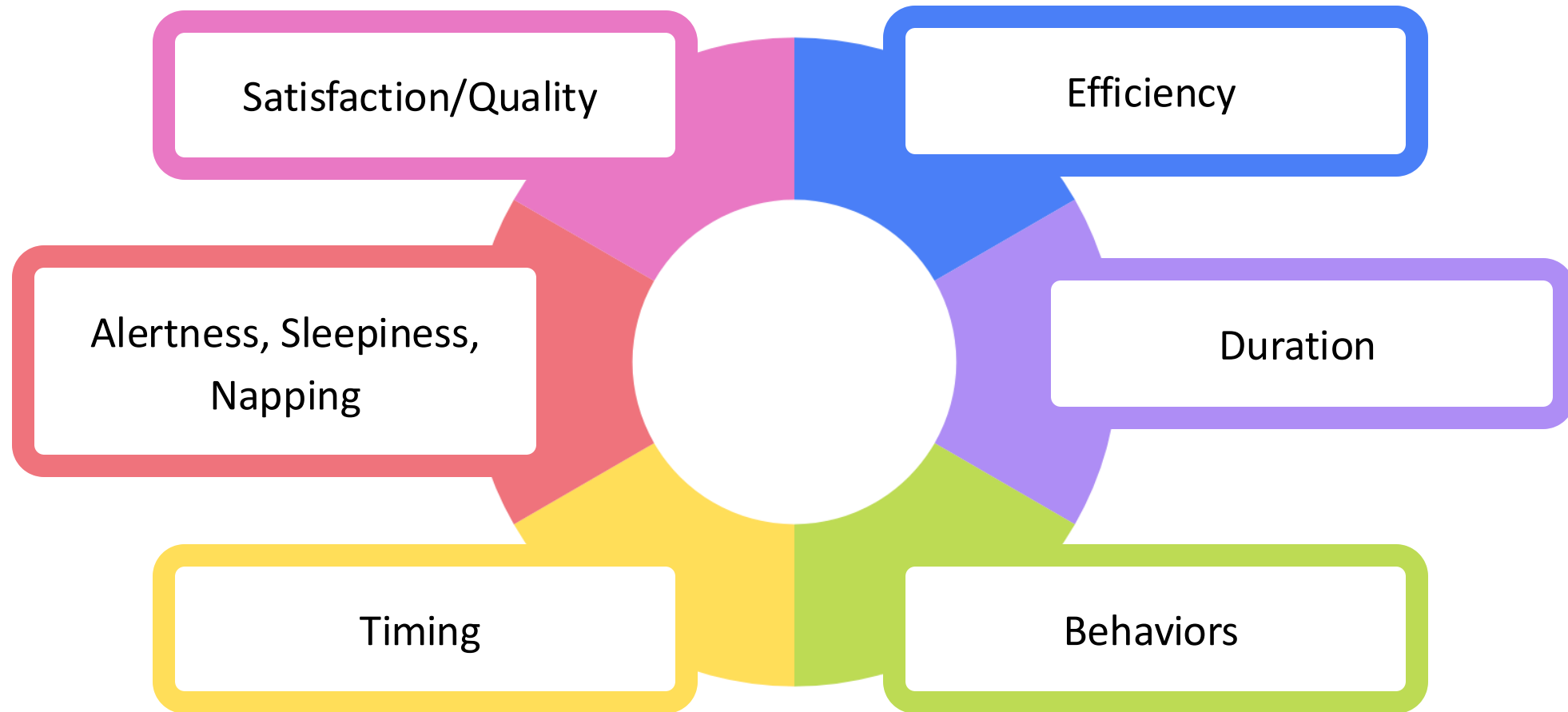


What Controls Sleep?



Sources: Borbély, 1982; Borbély, 2022; Scott & Perlis, 2024; Figures from Chapter 1 of Sleep & Health, 2019

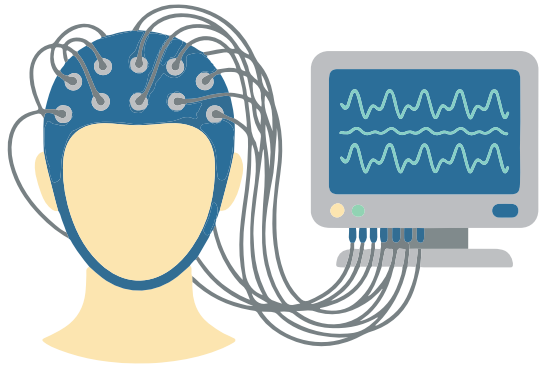
Dimensions of Pediatric Sleep Health



Sources: Buysse, 2014; Meltzer, Williamson, & Mindell, 2021

Common Sleep Measurement Tools

- Polysomnography (PSG)
- Actigraphy, wearable, & 'nearable' devices
- Self/proxy report & questionnaires



Common Sleep Metrics

Sleep Quantity

- Total sleep time
- Time in bed
- Wake after sleep onset
- Sleep onset latency
- REM latency

Sleep Quality

- Sleep efficiency
- Subjective quality
- Fragmentation
- Disturbances

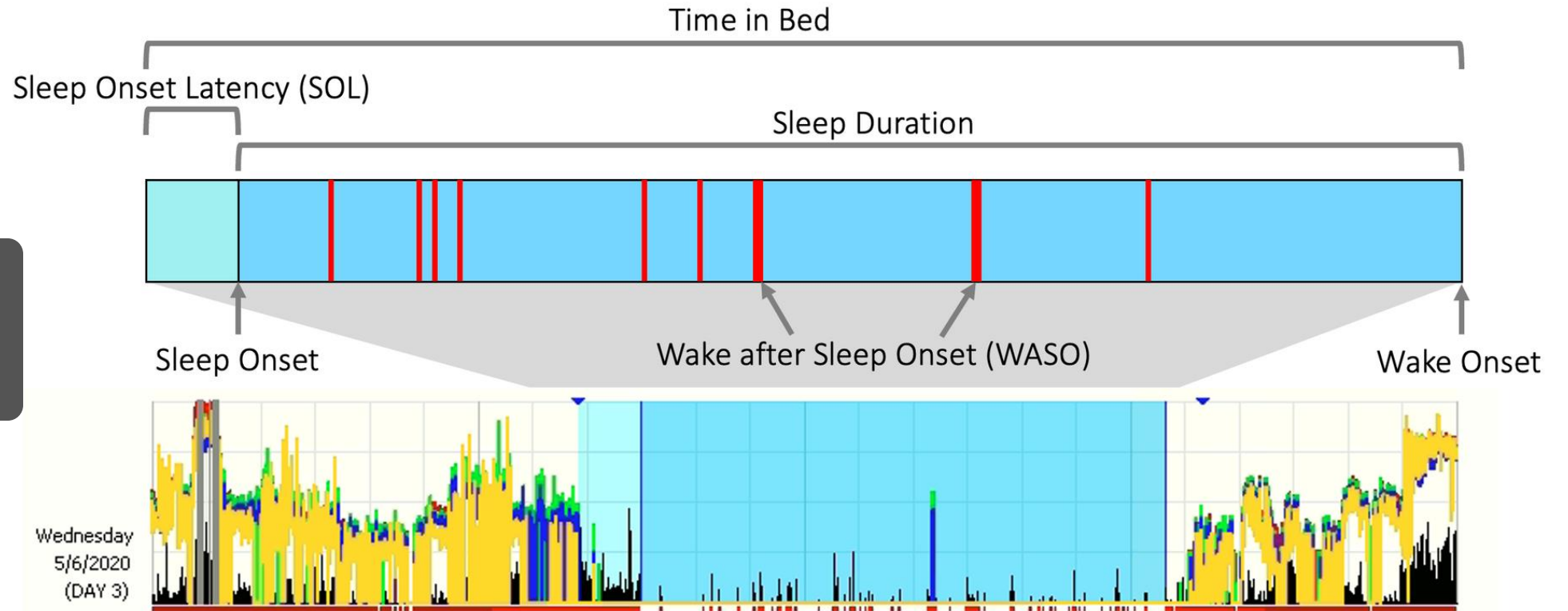
Polysomnography

- Sleep staging
- Sleep spindles
- Slow wave activity
- Slow oscillations

Source: Depner, 2020

Time-based Sleep Metrics

Actigraphy
Actogram



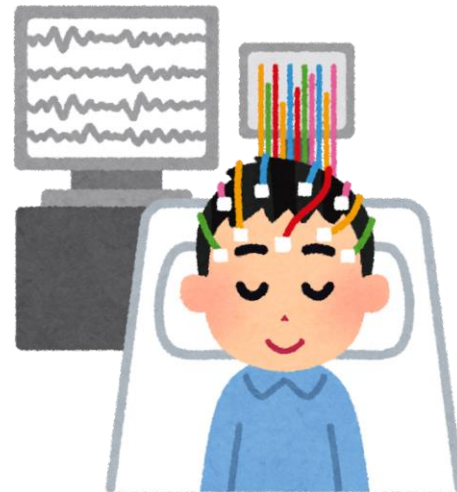
Sleep Physiology

Sleep Stages/Macrostructure

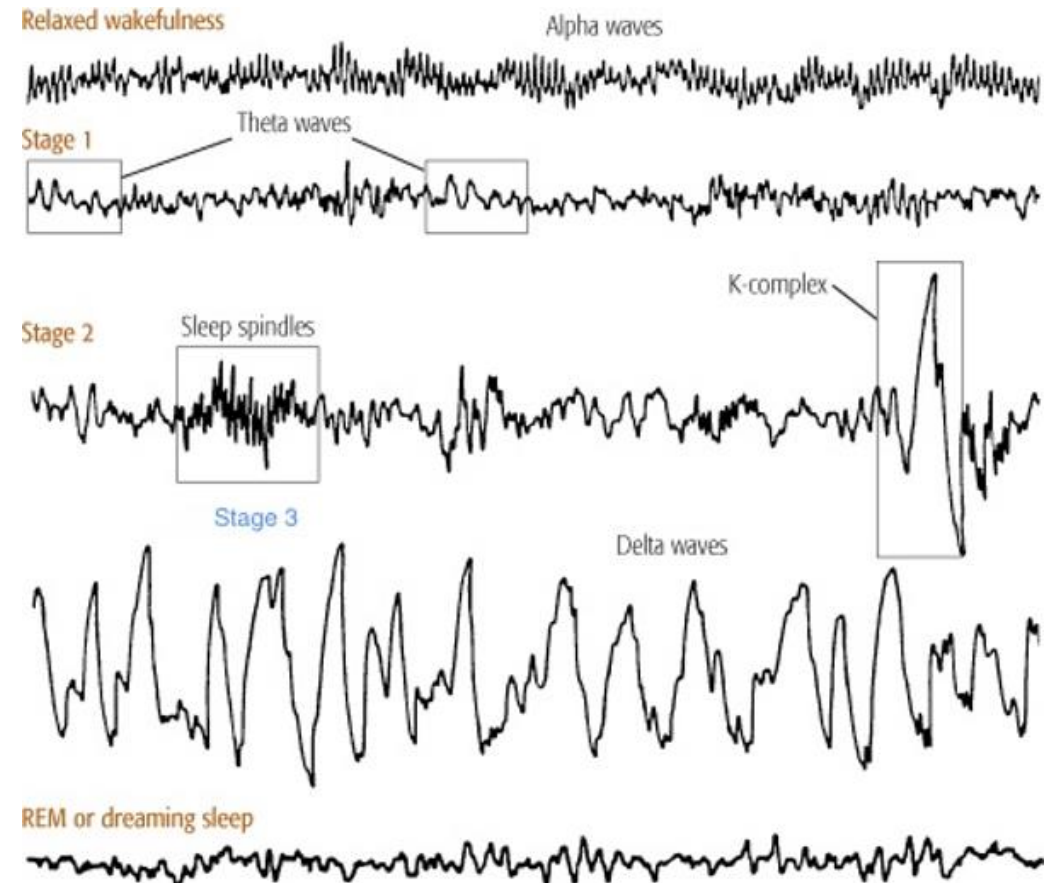
- Rapid eye movement (REM or R)
- Non-REM (NREM or N) 1
- N2
- N3

Microstructure

- Sleep spindles
- K-complexes



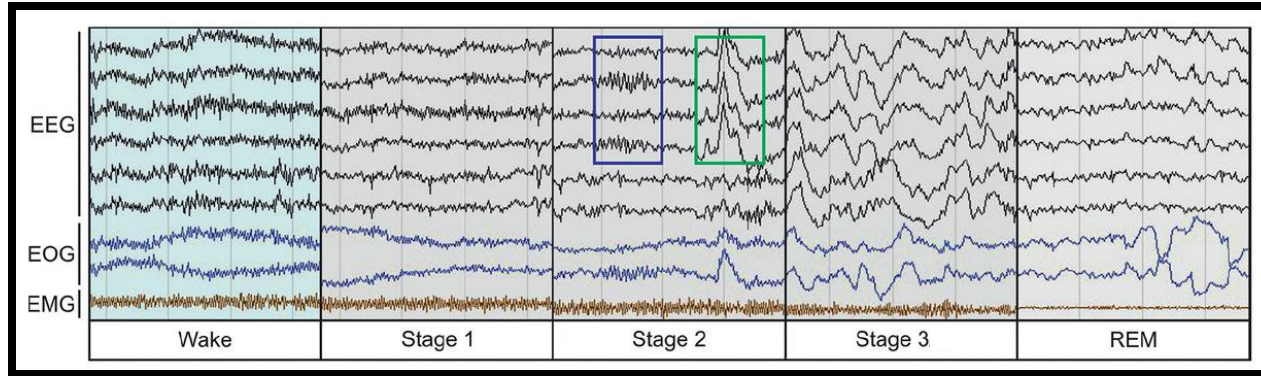
Source: Berry, 2012



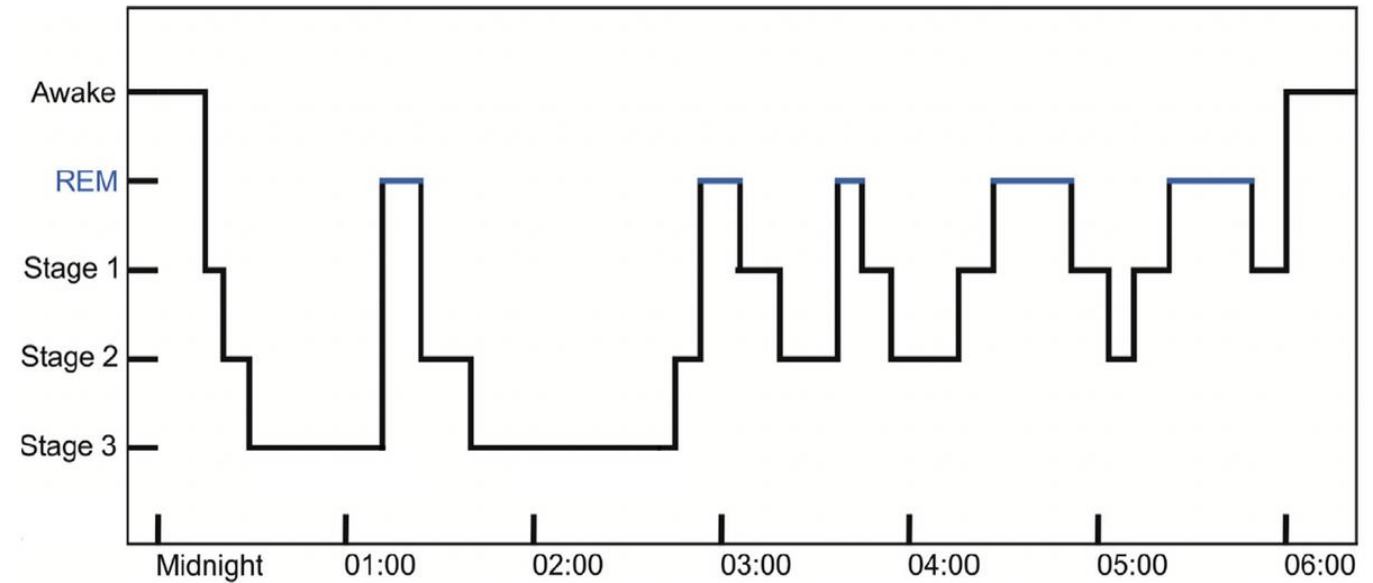
Sleep Stages

Stage	Key Characteristics	Connections to Brain Health & Development
N1	Transition between wakefulness and sleep Easy to awaken	Helps the brain shift from alertness to restorative sleep
N2	Stable sleep Heart rate and body temperature decrease Largest proportion of sleep time	Associated with learning, memory processing, and integration of new information
N3	Deepest and most restorative sleep stage Difficult to awaken	Supports physical restoration, synaptic remodeling, brain plasticity, memory consolidation, & healthy neurodevelopment
REM	Active brain state Vivid dreaming is common Occurs more frequently toward morning	Supports learning, emotional processing, neural organization, memory consolidation, and brain development, particularly early in life

PSG Somnogram



Figures from Chapter 1 of Sleep & Health, 2019



Sleep Across Early Childhood

Daytime Napping Prevalence

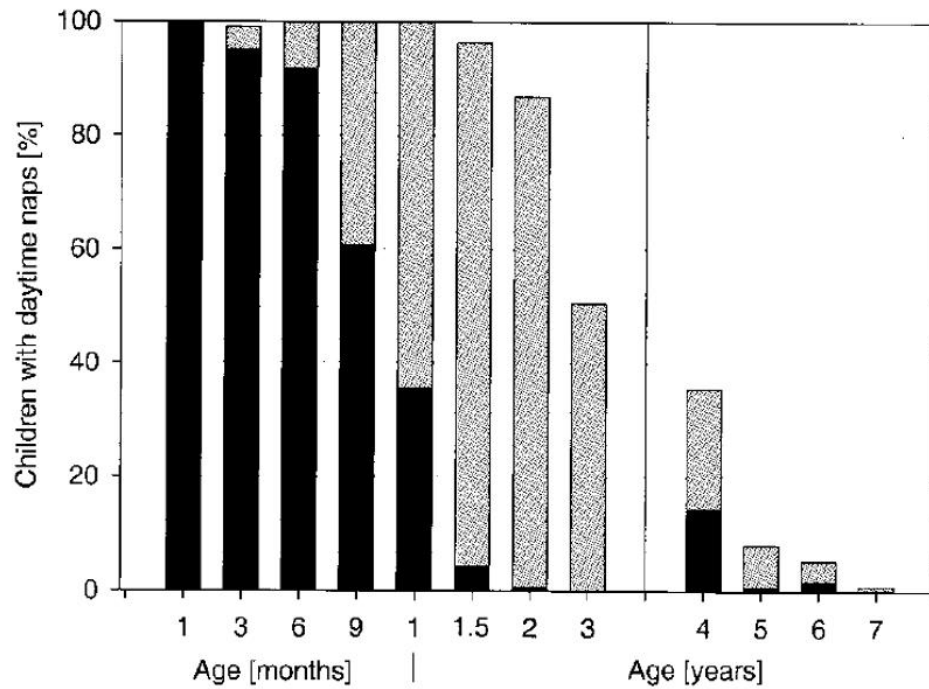
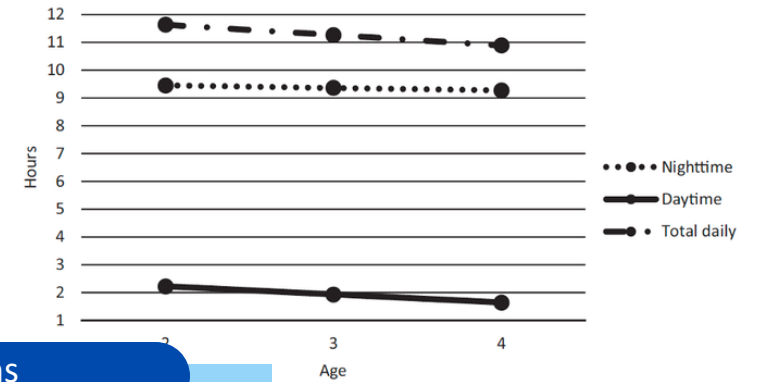


Figure 4 from Iglowstein et al., Pediatrics, 2003

Sleep Time Patterns



Efficiency Patterns

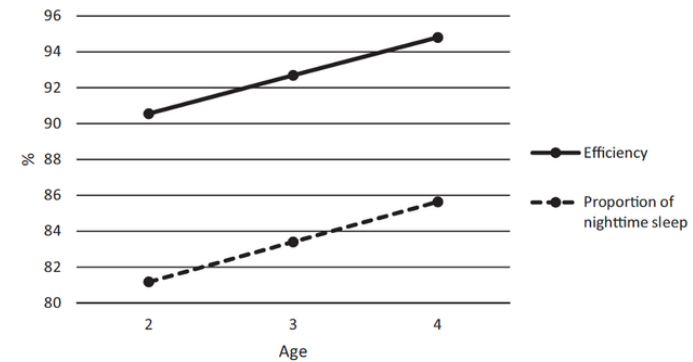
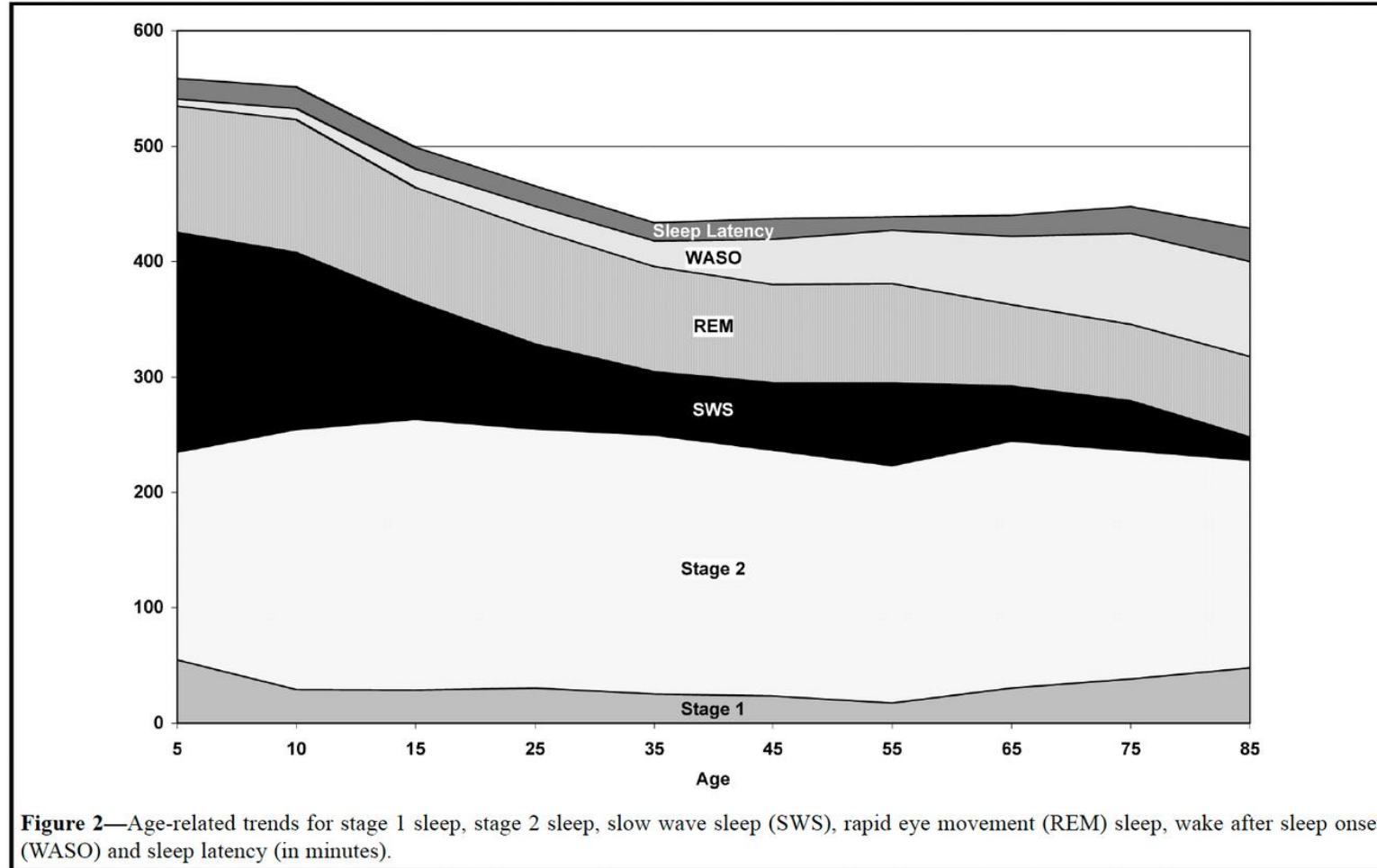


Figure 2 from Tétreault et al., Dev Psychobio, 2018

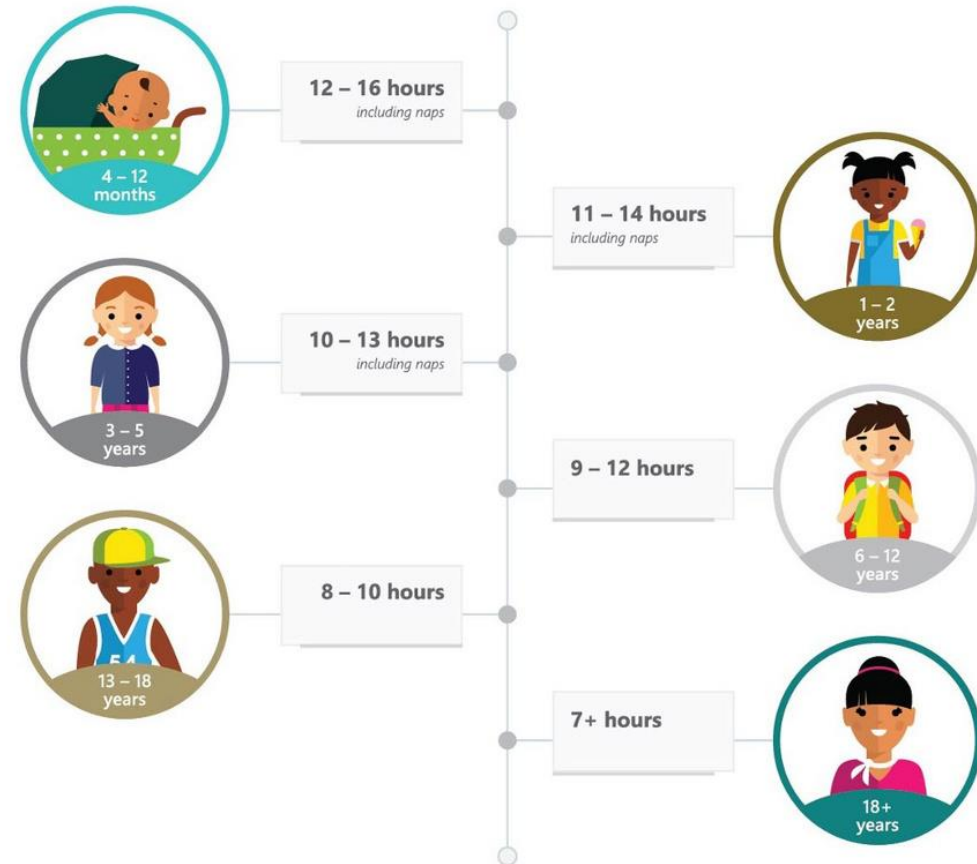
Sleep Stages Across Development



Source: Ohayon et al, 2004

Sleep Recommendations

American Academy of Sleep
Medicine Sleep (AASM): Infants &
Children



Sleep is Active

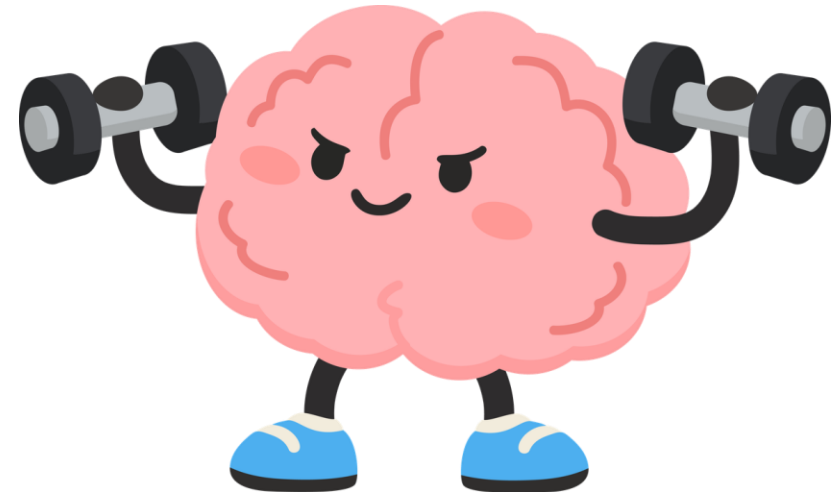
During sleep, the brain:

- Consolidates memories
- Processes information
- Strengthens neural connections
- Removes metabolic waste
- Regulates emotions
- Conserves metabolic energy

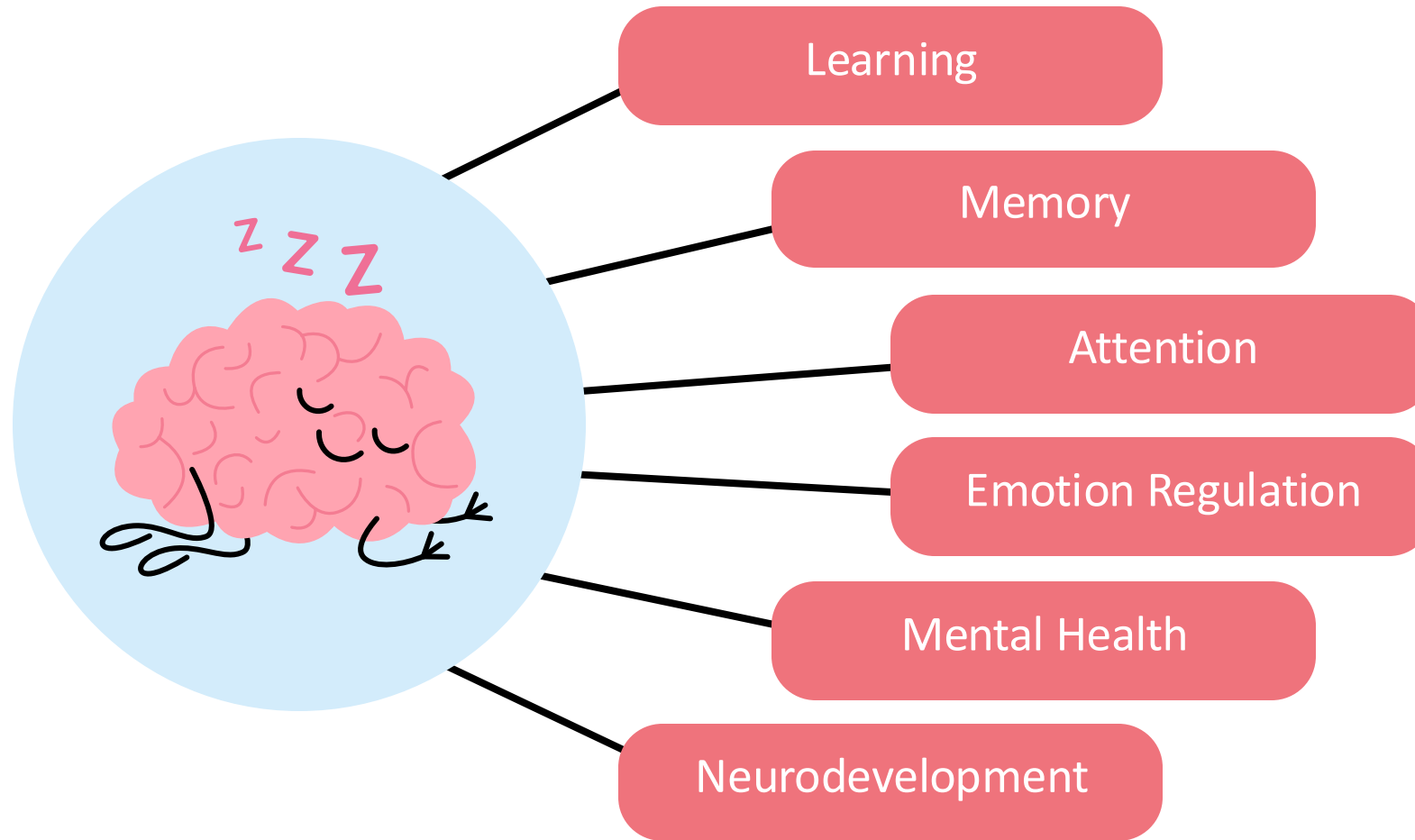


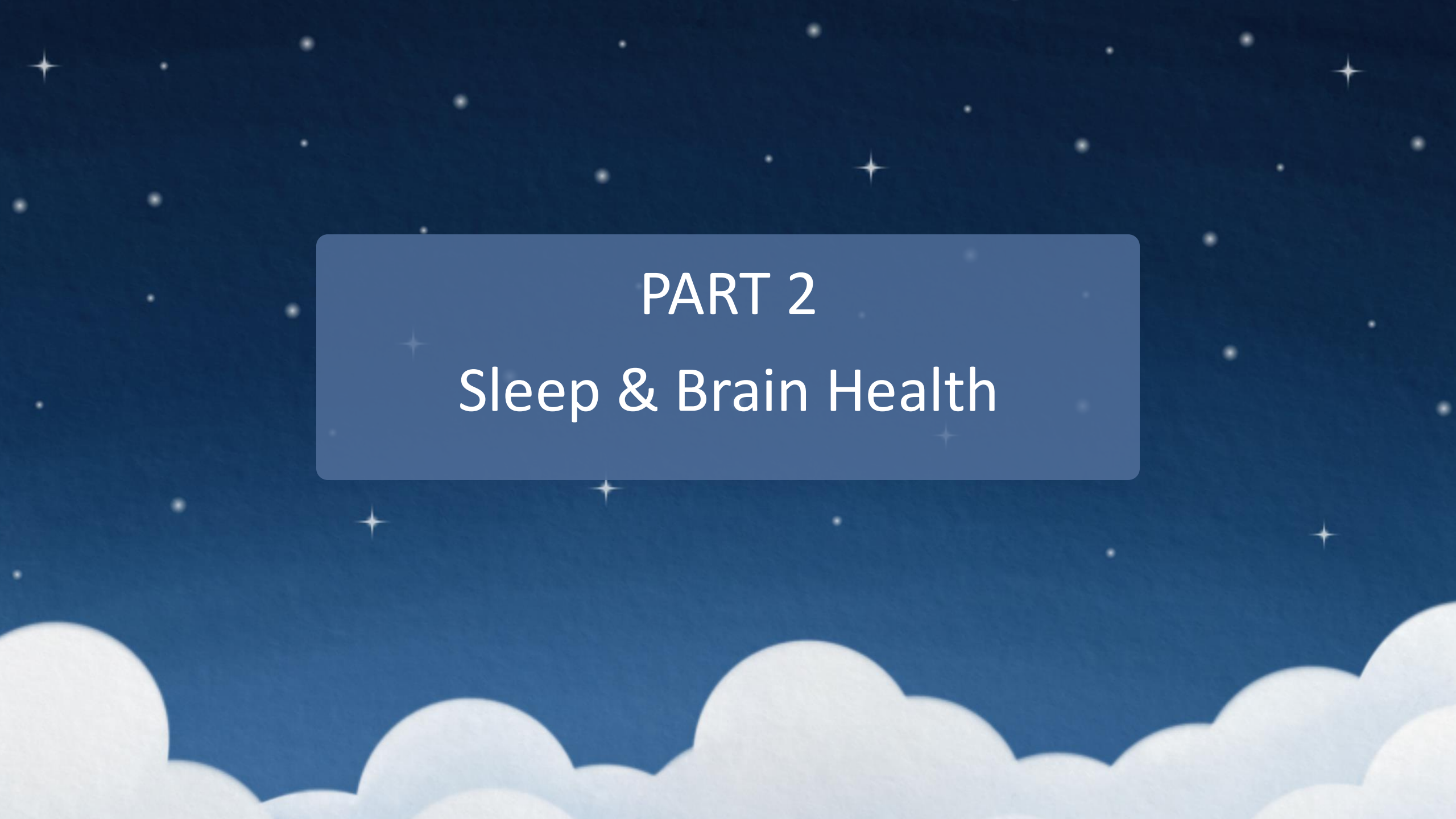
Brain Health

- Learning and memory
- Attention and self-regulation
- Emotional well-being
- Mental health
- Healthy neurodevelopment



Why Sleep Health Matters



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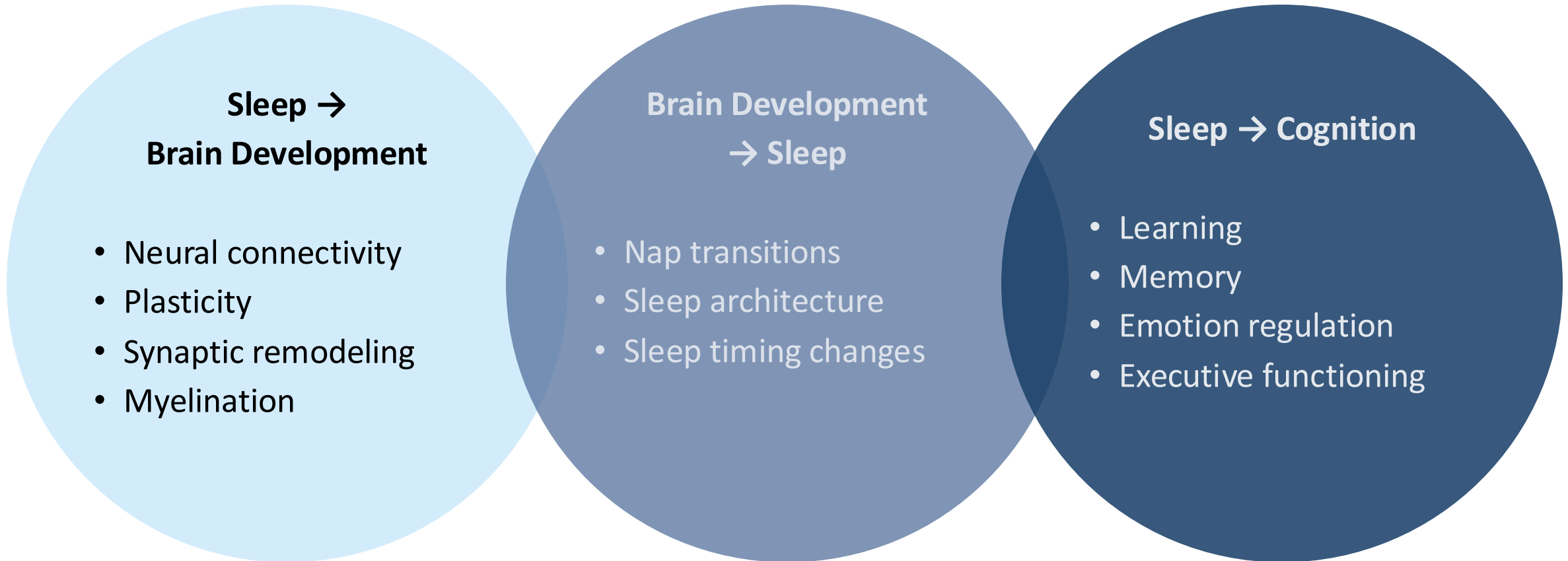
PART 2

Sleep & Brain Health

Brain Development

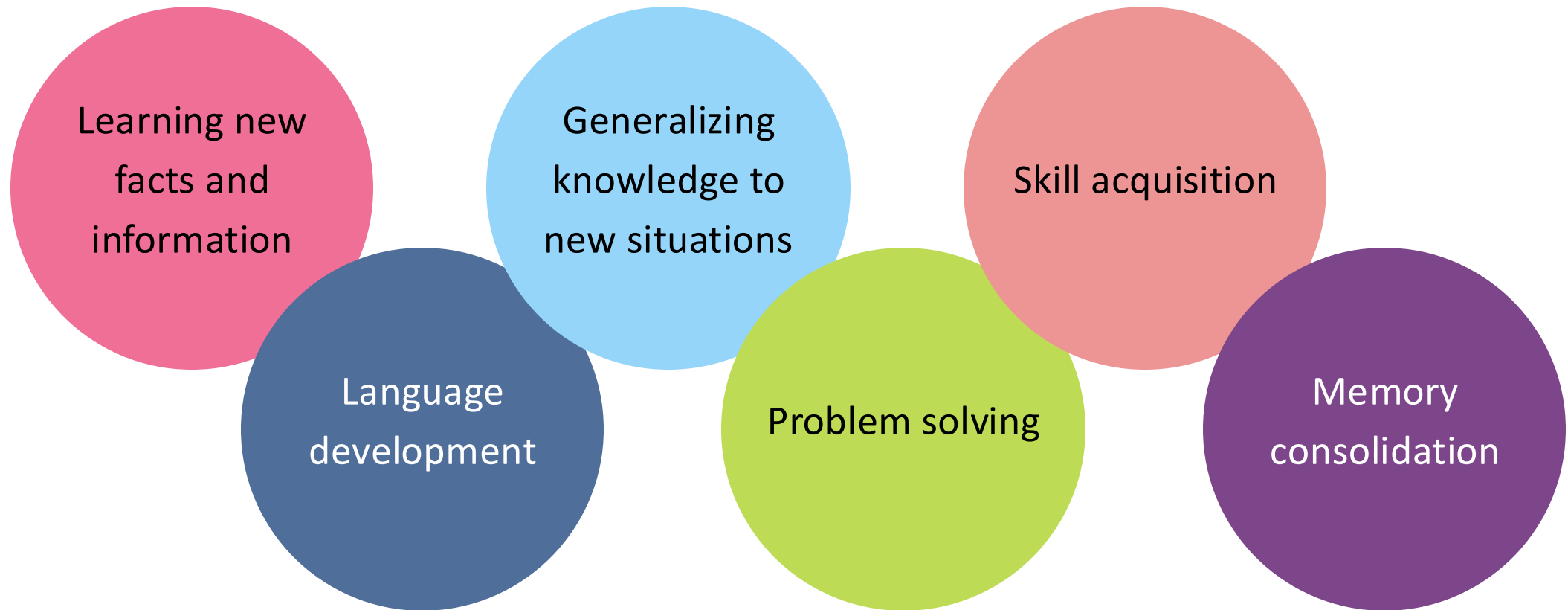
Early Childhood (Birth to ~5 years)	Middle Childhood (~6 to 12 years)	Adolescence (~13 to 18 years)
Building the Brain's Foundation	Strengthening & Organizing Brain Networks	Refining the Brain Adulthood
• Rapid brain growth and development • Formation of trillions of neural connections (synapses) • Development of language, motor, cognitive, and social skills • High levels of brain plasticity enable learning from experiences • Sleep transitions from multiple sleep periods to more consolidated sleep patterns	• Continued growth of cognitive skills • Improvements in attention and concentration • Development of executive functions • Planning • Organization • Self-control • Working memory • Increasing efficiency of communication between brain regions • Ongoing myelination and network development	• Continued maturation of the prefrontal cortex • Synaptic pruning strengthens frequently used neural pathways • Ongoing myelination improves processing speed • Increased capacity for abstract thinking and decision-making • Heightened emotional sensitivity and reward seeking • Biological shift toward later sleep timing

Sleep, Brain Development, Learning & Memory

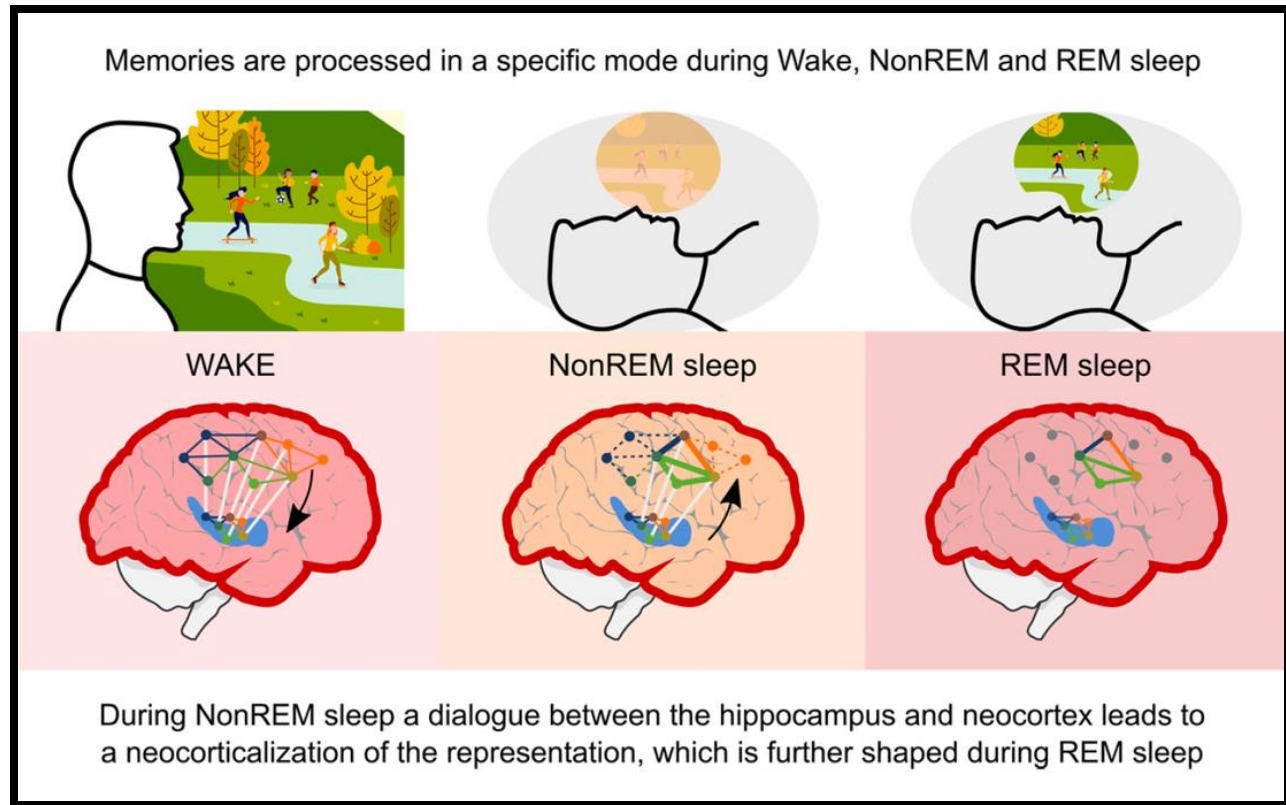
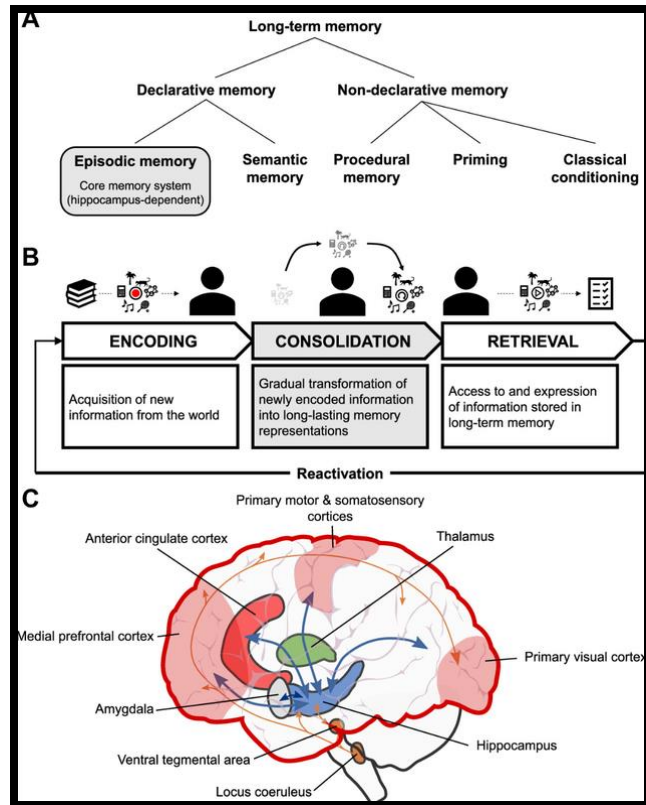


Sources: Mason et al., 2021; Lokhandwala & Spencer, 2022

Sleep Supports Many Types of Learning



Memory Consolidation



Source: Figures from Lutz, Harkotte, & Born, 2026

Napping as a Window into Brain Development

- Polyphasic > Biphasic > Monophasic
- Timing of nap cessation varies widely
- Habitual napping may reflect ongoing maturation of memory systems
- Children who still nap may rely on more frequent opportunities for memory consolidation
- Eliminating naps too early may not align with developmental needs for some children

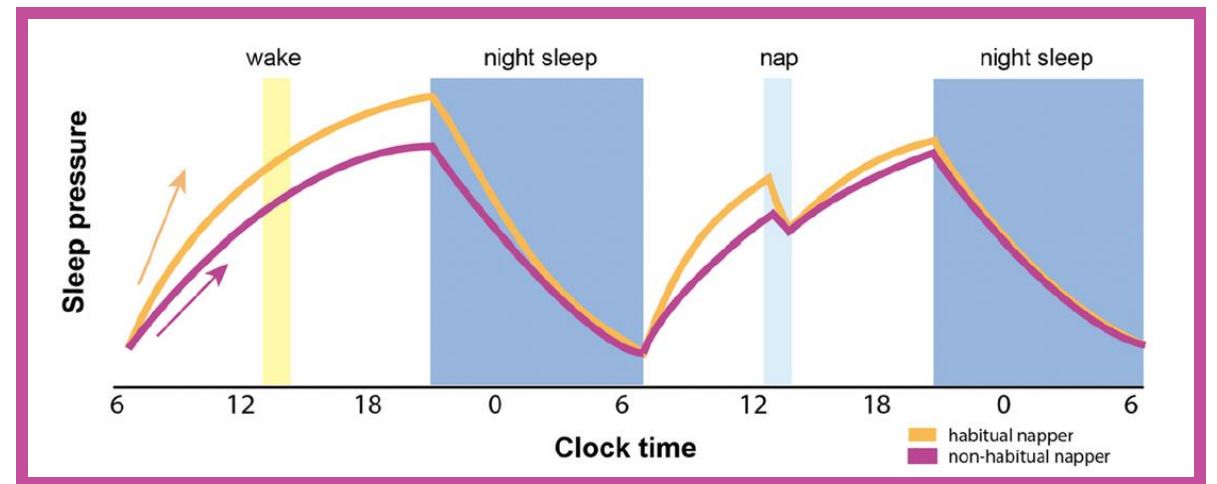


Figure 1 from Lokhandwala & Spencer, 2022

Napping & Memory in Early Childhood

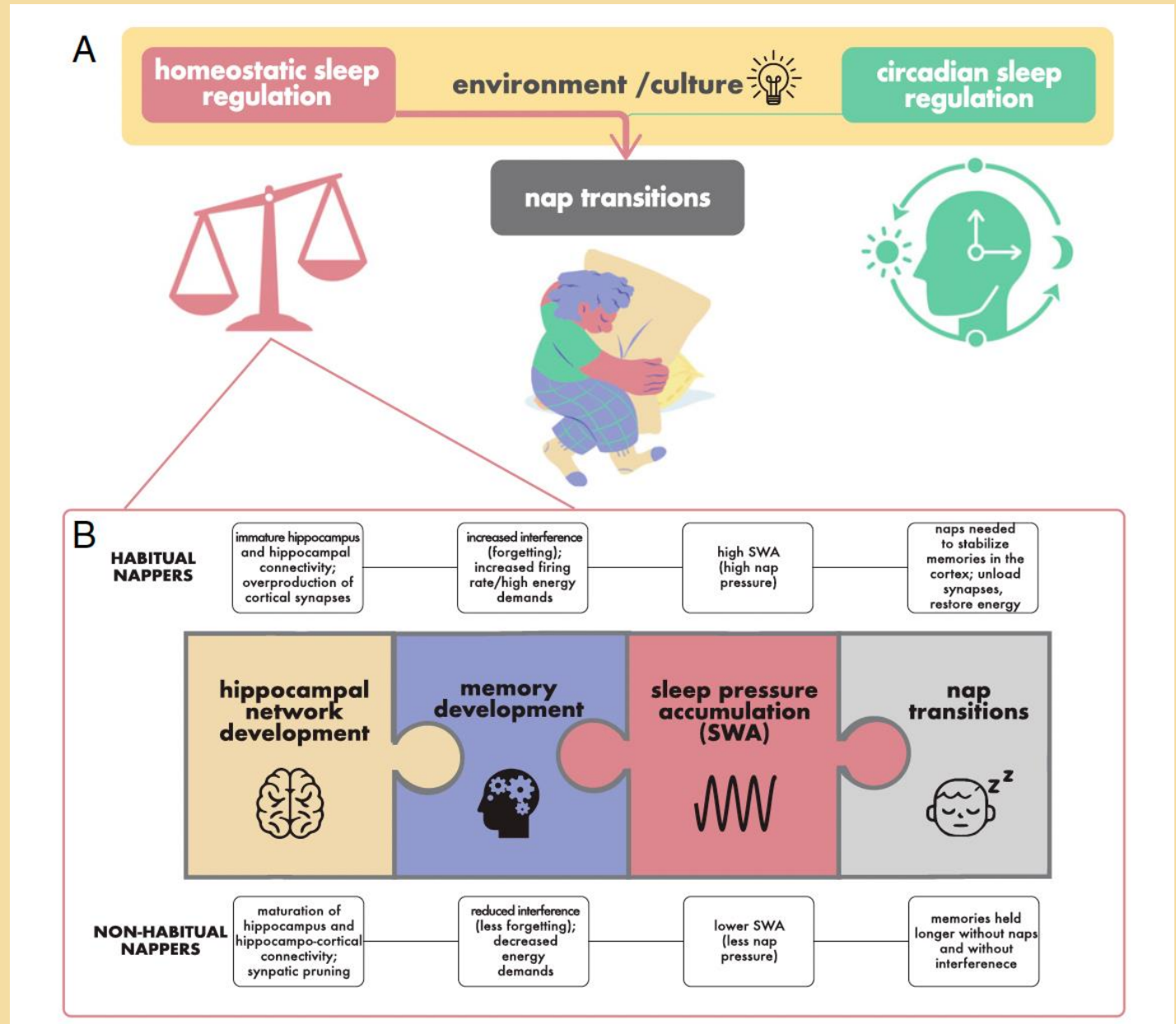


Figure 1 from Spencer & Riggins, 2022

Emotional Regulation



- Recognize emotions
- Regulate emotional responses
- Cope with stress
- Respond adaptively to social situations
- Maintain positive mood & affect



- Greater emotional reactivity
- Poorer emotion regulation
- More negative affect
- Increased behavioral difficulties
- Elevated risk for mental health concerns

Sources: Mason et al., 2021; Lollies et al., 2021

School Performance



Healthy Sleep Supports

- Attention, concentration, & classroom engagement
- Learning & memory consolidation
- Executive functioning
- Emotional regulation & stress management
- Positive mood & social functioning
- Physical health, growth, & daytime functioning
- Mental health & psychological well-being
- Healthy decision-making & behavior regulation



Poor Sleep Can Lead To

- Daytime sleepiness & fatigue
- Reduced attention, focus, & concentration
- Difficulties learning & retaining new information
- Weaker memory performance
- Poorer executive functioning & self-regulation
- Increased emotional reactivity & irritability
- More behavioral difficulties & impulsivity
- Greater stress & poorer coping skills
- Reduced motivation & school engagement

Sources: Beebe, 2012; Carsadon, 2011; Short et al., 2011; Hysing et al., 2014

Mental Health

- Children with mental, behavioral, & developmental disorders are more likely to experience short sleep duration than their peers
- Across childhood & adolescence, poorer sleep is consistently associated with worse mental health outcomes
- Sleep quality, regularity, & sleep schedules may be as important as sleep duration for mental health
- Sleep problems are increasingly recognized as contributors to the onset, maintenance, & severity of psychiatric symptoms (rather than simply consequences of mental illness)

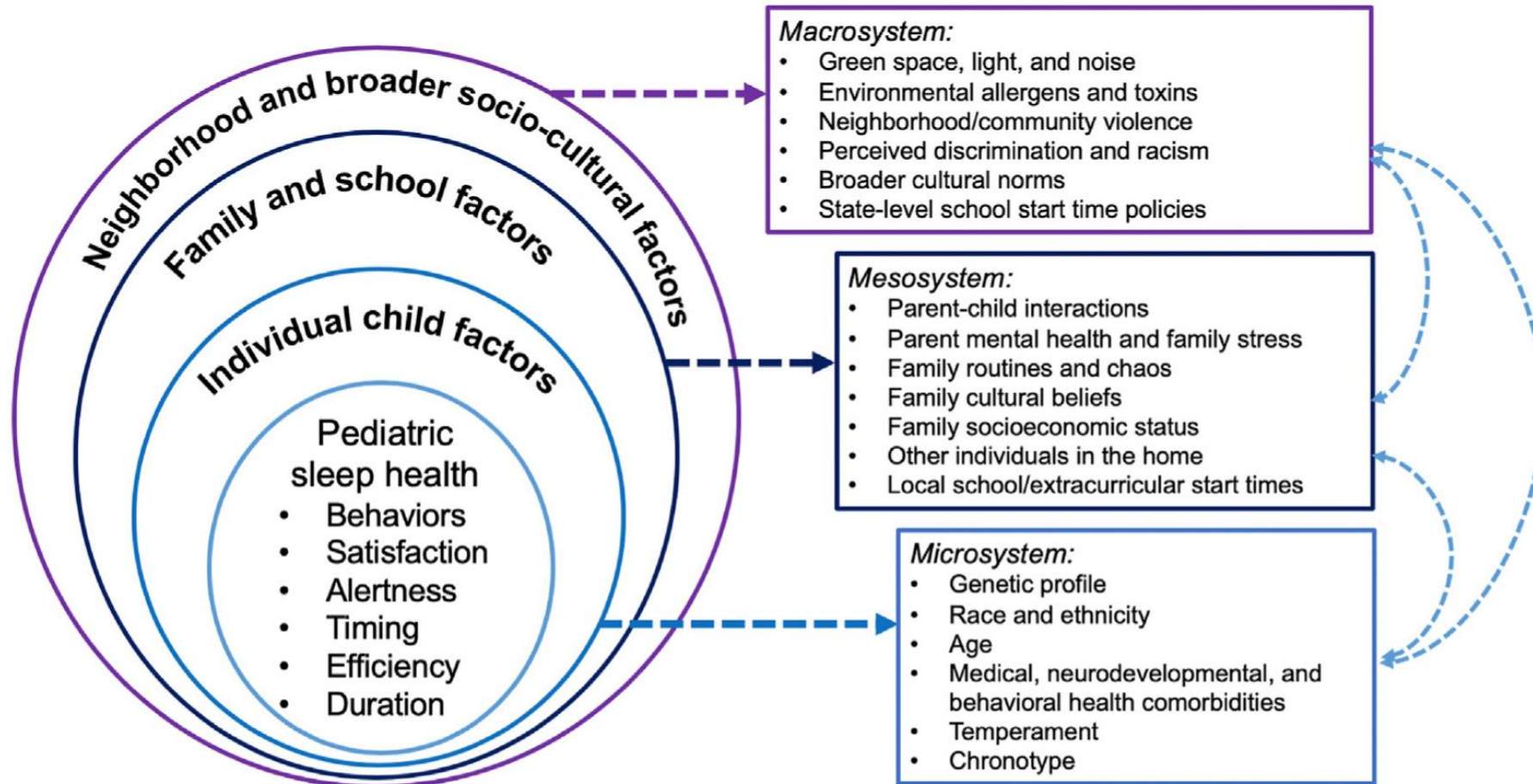
Sources: Qiu & Morales-Munoz, 2022; 2011; Claussen et al., 2023; Tarokh & Herrera, 2025

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PART 3

Supporting Healthy Sleep: A Shared Responsibility

Social-ecological Factors & Sleep



Source: Meltzer, Williamson, & Mindell, 2021

Sleep Needs are Not Identical for Every Child

- Age and developmental stage
- Neurodevelopmental conditions (e.g., ADHD, autism)
- Anxiety and emotional challenges
- Chronic health conditions
- Individual differences in sleep need



Sleep Occurs Within a Family Context



- Family schedules
- Caregiver shift work
- Multiple jobs
- Financial stress
- Crowded housing
- Noise and light exposure
- Technology access and use

Policy & Environment Determinants of Pediatric Sleep

Education & School Policies	Housing & Neighborhood Environment
• School start times • Homework expectations & workload • Extracurricular scheduling • Before- & after-school care schedules • Sleep education in schools	• Housing quality • Residential crowding • Noise exposure • Access to climate control (heating/cooling) • Light pollution • Neighborhood safety • Housing stability/homelessness
Employment & Economic Policies	Media & Technology Environment
• Parent/caregiver work schedules • Shift work & night work • Multiple-job demands • Paid family leave policies • Flexible work arrangements • Family economic stability	• Availability of 24/7 digital media • Social media norms • Device use expectations in schools • Technology design that promotes nighttime engagement

Policy & Environment Determinants (cont'd)

Community Infrastructure	Health Care Systems
• Commute and transportation demands • Travel time to school • Access to parks & recreation • Community noise (traffic, airports, industrial areas)	• Access to pediatric care • Access to behavioral sleep medicine • Access to pediatric sleep specialists • Sleep screening in primary care • Insurance coverage for sleep evaluation & treatment
Sociocultural Factors	Equity & Social Determinants
• Cultural norms about sleep • Societal attitudes toward productivity & rest • Expectations regarding adolescents' schedules • Public awareness of sleep health	• Socioeconomic status • Structural racism & discrimination • Neighborhood disadvantage • Access to health-promoting resources • Environmental exposures that disproportionately affect some communities

What Helps?

Child & Family

- Consistent sleep opportunities
- Calming bedtime routines
- Developmentally appropriate schedules
- Limiting caffeine and stimulating activities before bed

Health Care Providers

- Screening for sleep concerns
- Identification of sleep disorders
- Parent guidance and support

Schools

- Sleep education
- Reasonable homework demands
- Later school start times for adolescents

Communities & Policy

- Safe neighborhoods
- Housing stability
- Family-friendly work policies
- Access to pediatric sleep services

When Should Parents Seek Help?

Sleep Symptoms

- Snores regularly
- Has pauses in breathing during sleep
- Has persistent difficulty falling asleep
- Wakes frequently at night
- Experiences excessive daytime sleepiness

Daytime concerns

- Difficulty paying attention
- Behavioral changes
- Mood concerns
- Declining school performance

Developmental Concerns

- Sleep problems that interfere with daily functioning
- Sleep patterns that seem inconsistent with developmental expectations

Key Takeaways

- Sleep is a foundational pillar of brain health
- Sleep supports learning, memory, and emotional well-being
- Sleep and brain development are deeply interconnected
- Childhood and adolescence are critical periods for healthy sleep
- Supporting sleep is an investment in lifelong health and development

Thanks for listening!

CONTACT INFORMATION & RESOURCES

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