

Sleep Hygiene and the Acutely Ill Child



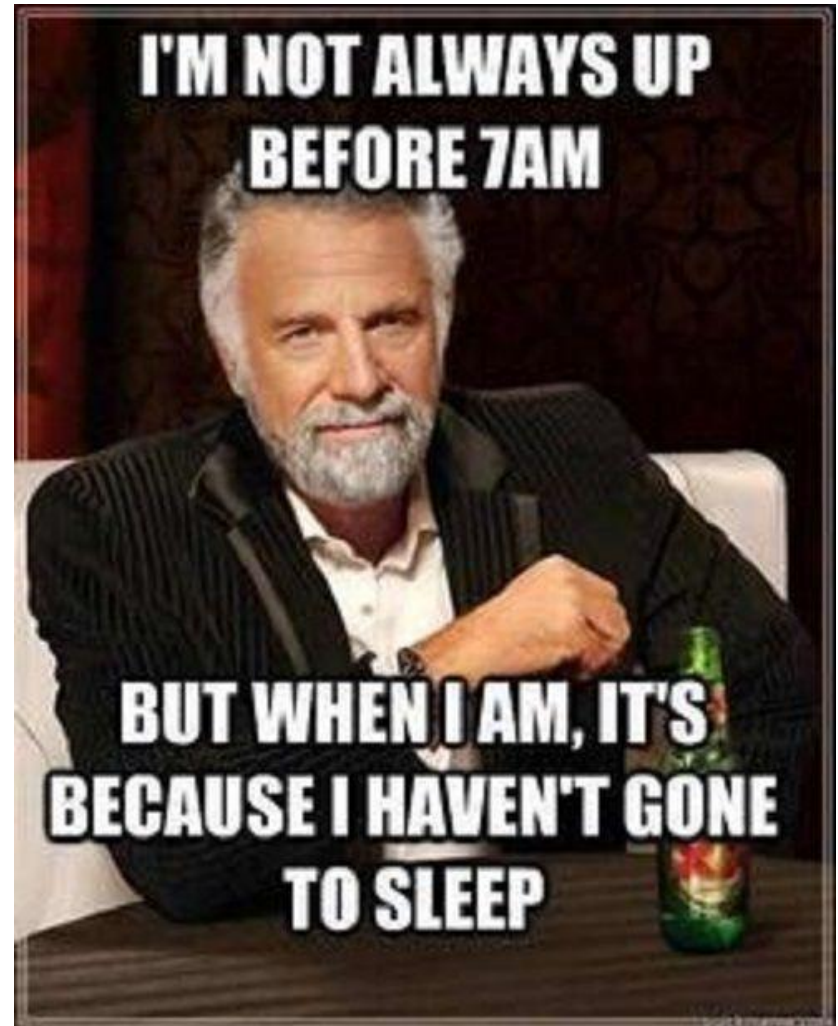
CEDARS-SINAI[®]
LEADING THE QUEST[™]

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Declaration of Financial Interests or Relationships

I have no financial interests or relationships to disclose with regard to the subject matter of this presentation.

And....



Objectives

The learner will be able to :

1. Recite the stages of sleep.
2. Describe the basics of the circadian rhythm.
3. Recite at least 3 potential conditions caused from sleep deprivation.
4. Recite at least 3 reasons to increase patient sleep satisfaction.
5. Identify a minimum of 4 ways to promote patient sleep hygiene.



The Importance of Sleep



- Physiological Functions
 - immunity, hormonal regulation, thermoregulation, and ontogenesis, memory retention, tissue regeneration
- Sleep Deprivation
 - increased blood pressure, increased risk for diabetes, obesity, decrease of growth hormones
 - can be fatal

The Importance of Sleep

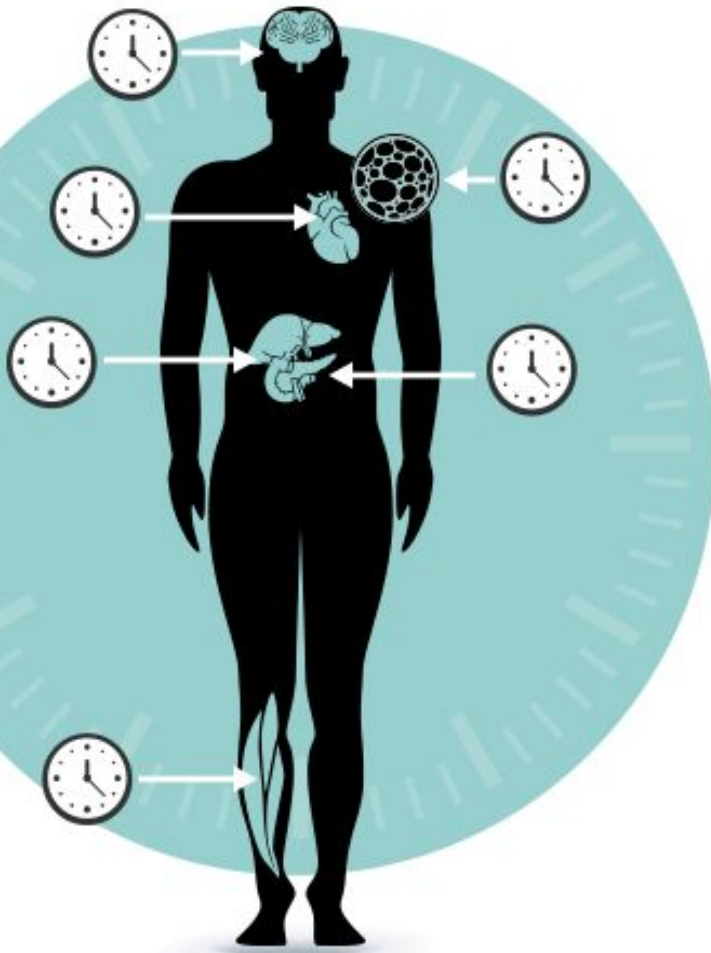
- Sleep promotes adapted cognitive and emotional responses in the waking state
 - like performance improvement
 - emotional balance
 - social cognition



Circadian Rhythm

- The intrinsic timekeeping system modulates many physiological systems, including daily rhythms in core body temperature, cortisol, and appetite.
- The circadian system also actively drives wakefulness during the habitual waking day, helping to offset the progressive increase in sleepiness from the sleep homeostatic system.
- They respond primarily to light and darkness in an organism's environment.
- Circadian rhythms are found in most living things, including animals, plants, and many tiny microbes.

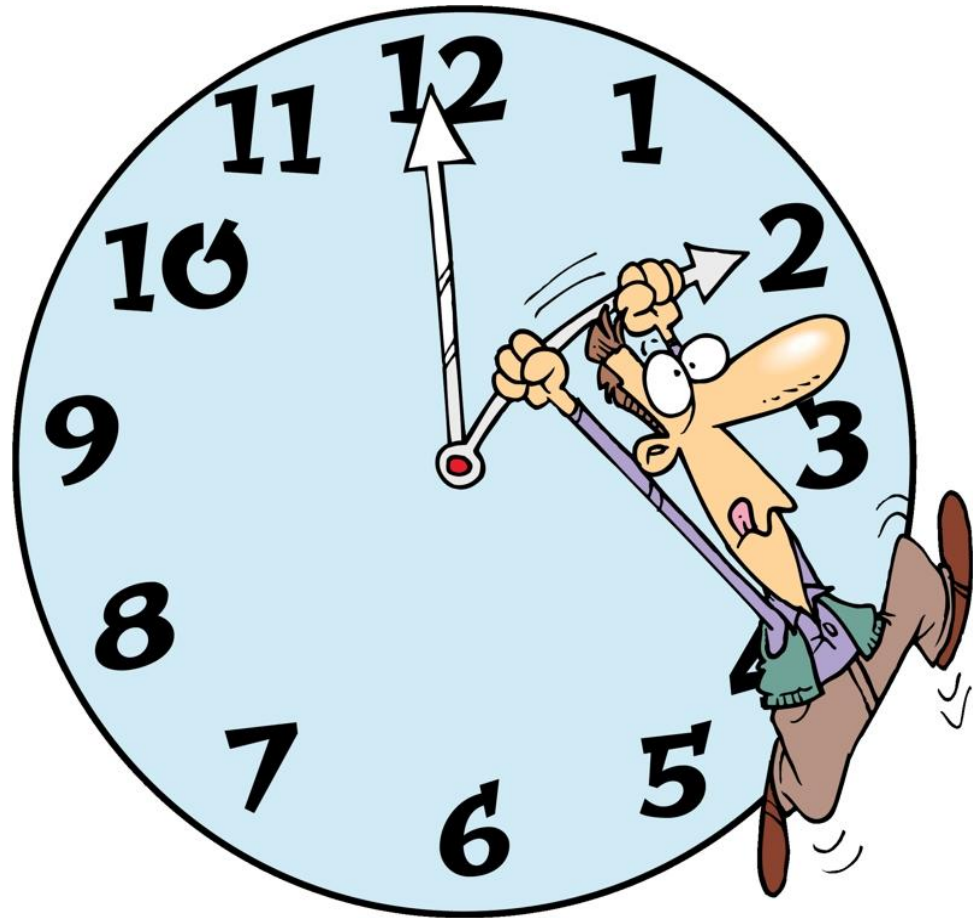
Circadian Rhythm



- Biological clocks are an organism's innate timing device.
 - They're composed of specific molecules (proteins) that interact in cells throughout the body.
 - Biological clocks are found in nearly every tissue and organ.
 - Researchers have identified similar genes in people, fruit flies, mice, fungi, and several other organisms that are responsible for making the clock's components.

Circadian Rhythm

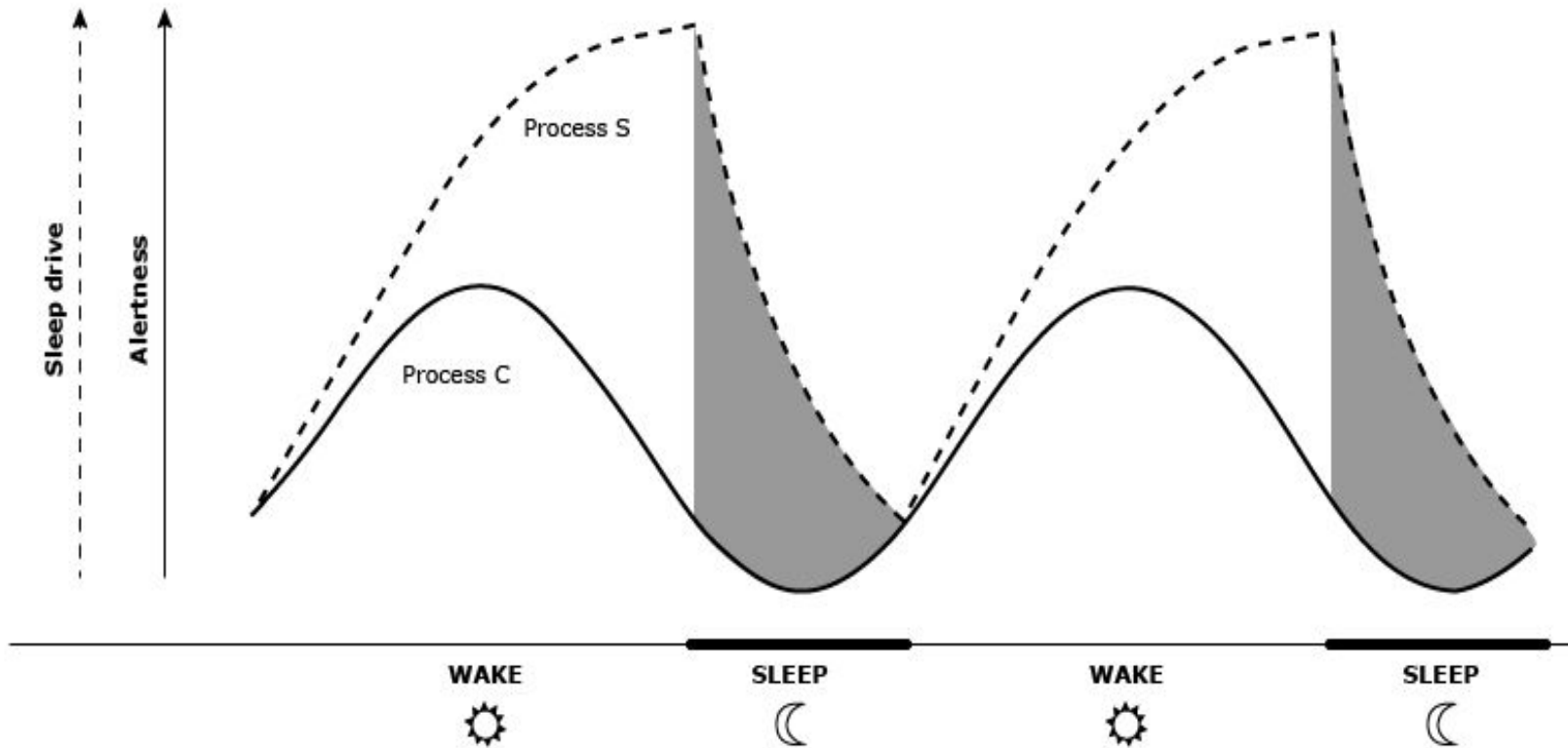
- A master clock in the brain coordinates all the biological clocks in a living thing, keeping the clocks in sync.
 - In vertebrate animals, including humans, the master clock is a group of about 20,000 nerve cells (neurons) that form a structure called the suprachiasmatic nucleus, or SCN.
 - The SCN is located in the hypothalamus and receives direct input from the eyes.



Circadian Rhythm

- Sleep homeostatic drive accumulates during wakefulness and promotes the initiation of sleep.
- After the first half of the sleep episode, this sleep drive rapidly diminishes.
- The intrinsic circadian timekeeping system oscillates with a period slightly longer than 24 hours: about 24.2 hours in adults and 24.3 hours in adolescents.
- To maintain alignment with the 24-hour day, the circadian system must adjust, or phase shift, each day via time cues, also called zeitgebers.
 - The most potent zeitgeber is the environmental light-dark cycle.

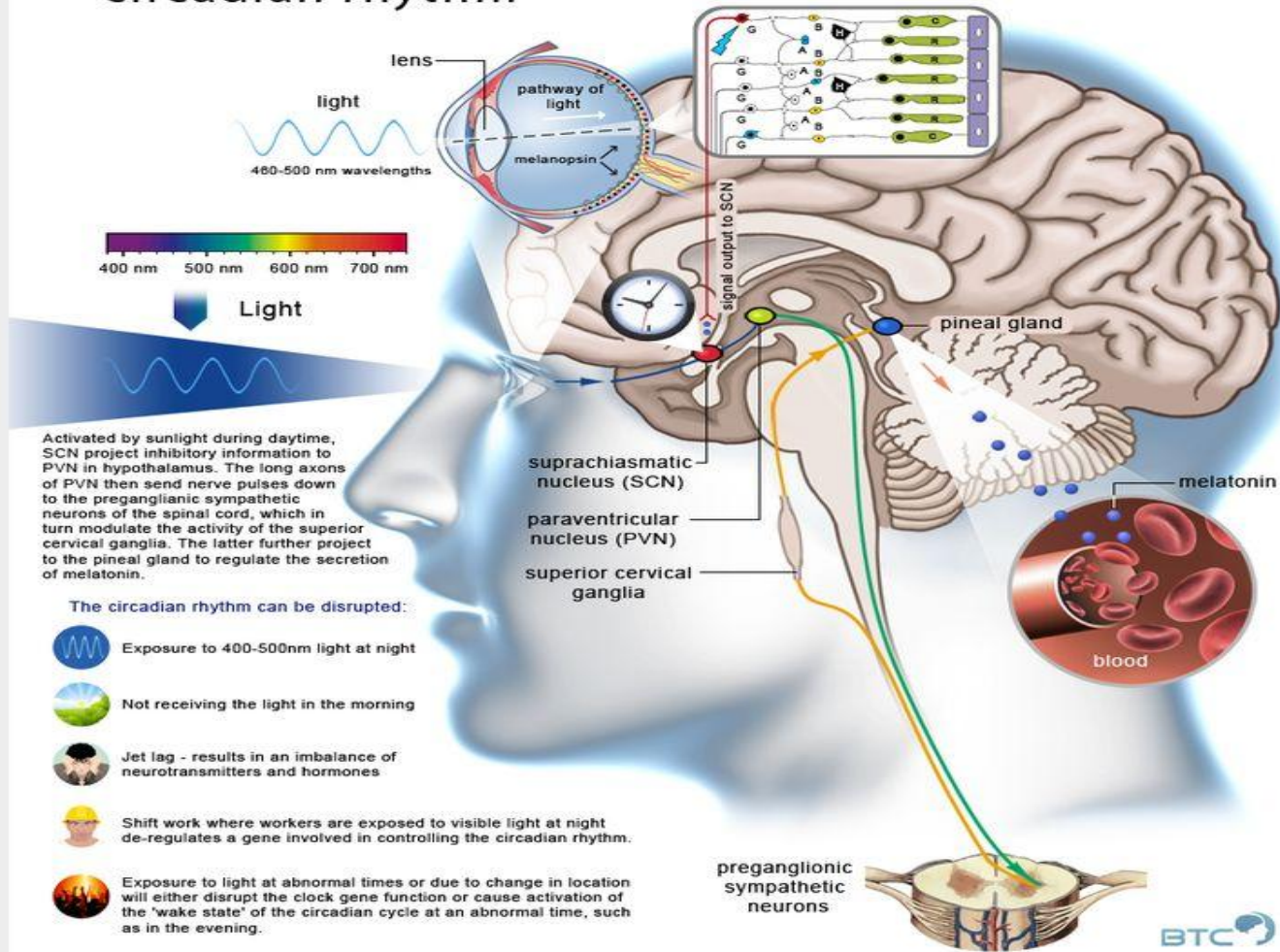
Circadian Rhythm



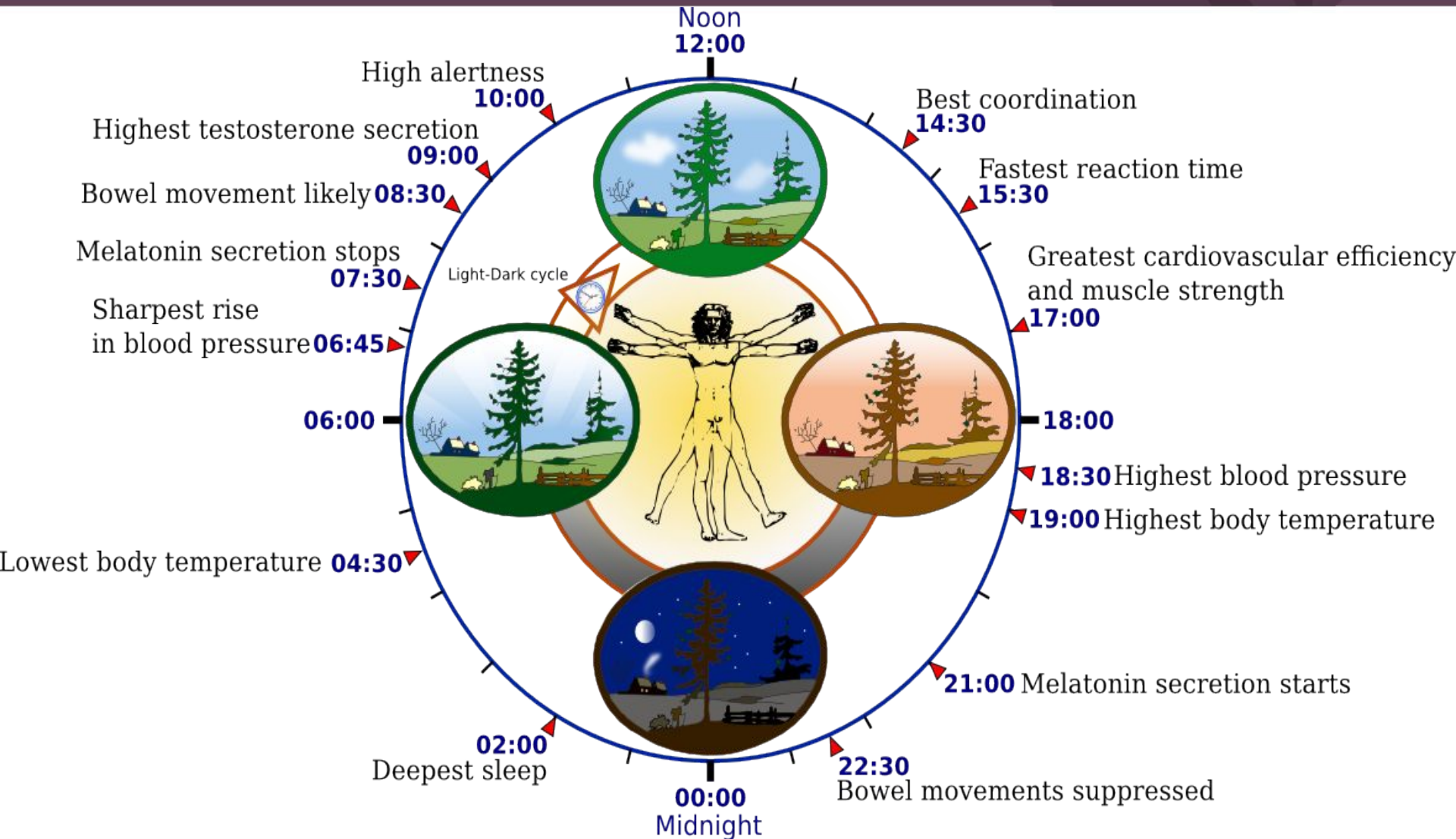
Sleep drive (process S) increases with wakefulness and dissipates with sleep. The circadian signal (process C) oscillates rhythmically across day and night.

Circadian Rhythm

circadian rhythm



Circadian Rhythm



Stages of Sleep

- **What role does each stage of sleep play?**
- NREM (75% of night)
 - As we begin to fall asleep, we enter NREM sleep
 - Composed of stages 1-4
- REM (last stage)

Stage 1 and 2

- **Stage 1**

- . Between being awake and falling asleep
- . Light sleep

- **Stage 2**

- . Onset of sleep
- . Becoming disengaged from surroundings
- . Breathing and heart rate are regular
- . Body temperature drops

Stage 3 and 4

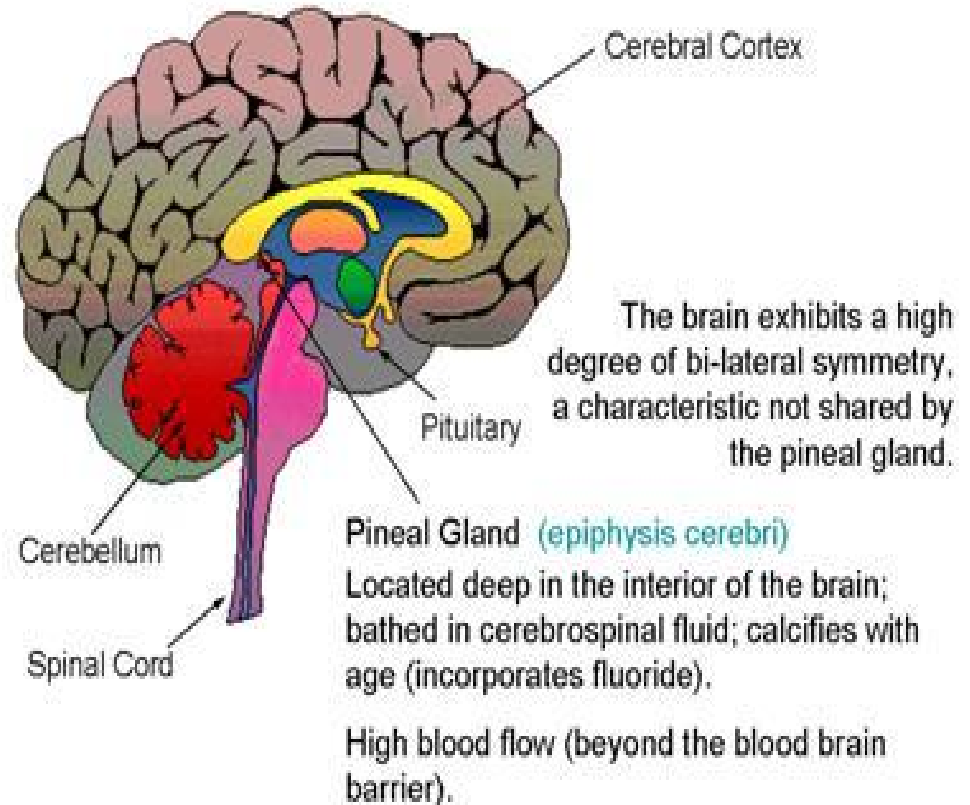
- Deepest and most restorative sleep
- Blood pressure drops
- Breathing becomes slower
- Muscles are relaxed
- Blood supply to muscles increases
- Tissue growth and repair occurs
- Energy is restored
- Hormones are released, such as: Growth hormone, essential for growth and development, including muscle development

REM

- **REM** (25% of night): First occurs about 90 minutes after falling asleep and recurs about every 90 minutes, getting longer later in the night
- Provides energy to brain and body
- Supports daytime performance
- Brain is active and dreams occur
- Eyes dart back and forth
- Body becomes immobile and relaxed, as muscles are turned off

Hormones

- Melatonin is a hormone produced by the pineal gland
- Starts production as dark falls or under dark circumstances
- Known as a “timing messenger”, it signals the body to sleep



Hormones

- Levels of the hormone cortisol dip at bedtime and increase over the night to promote alertness in morning.
- Sleep helps us thrive by
 - contributing to a healthy immune system
 - balance our appetites by helping to regulate levels of the hormones ghrelin and leptin
 - which play a role in our feelings of hunger and fullness.
 - sleep deprivation
 - need to eat more
 - lead to weight gain.



The Glymphatic System

- The lymphatic system is responsible for transporting excess fluid and waste products from the interstitial spaces between cells to the blood.
- The lymphatic system is complex and extends throughout most of the body, but is absent from the brain, leading to questions about how interstitial fluid in this organ is cleared of waste.
- Nedergaard's (2012) discovery, described in Science Translational Medicine,
 - network of microscopic, fluid filled channels, known as the glia cells
 - clears toxins from the brain, much like the lymphatic system clear out metabolic waste products from the rest of the body.

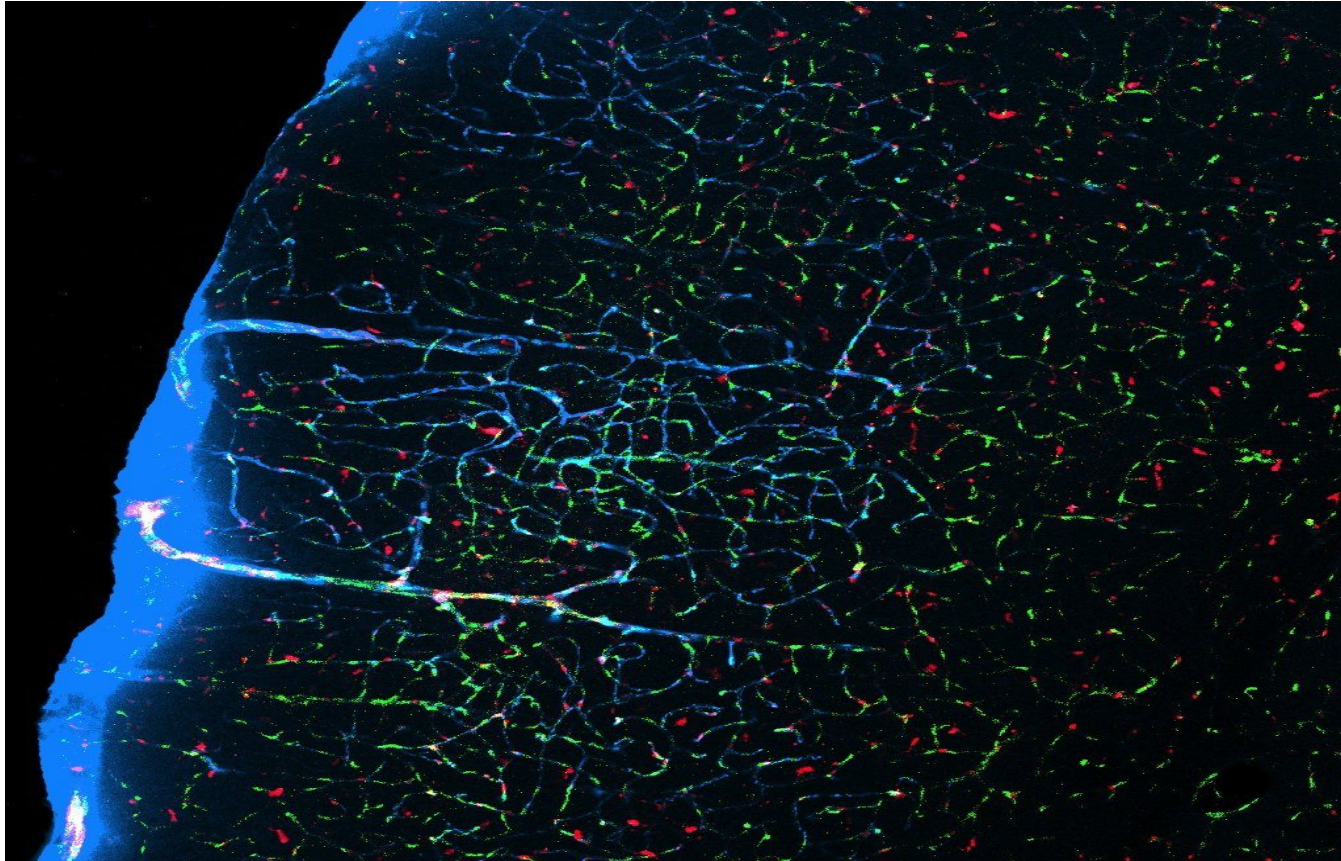
The Glymphatic System

- The glia are the brain's non-neuronal cells and control the flow of CSF through channels in their cell membranes.
- In the brain, blood vessels are surrounded by cells called astrocytes.
 - Astrocytes are a type of glial cell.
- These cells have projections called end feet that wrap around arteries and veins like a layer of piping.
- It is through this pipeline that molecules travel.
- The system uses pressure to push fluid through the brain.
- It's a much faster and more efficient way to carry away waste than diffusion.

The Glymphatic System

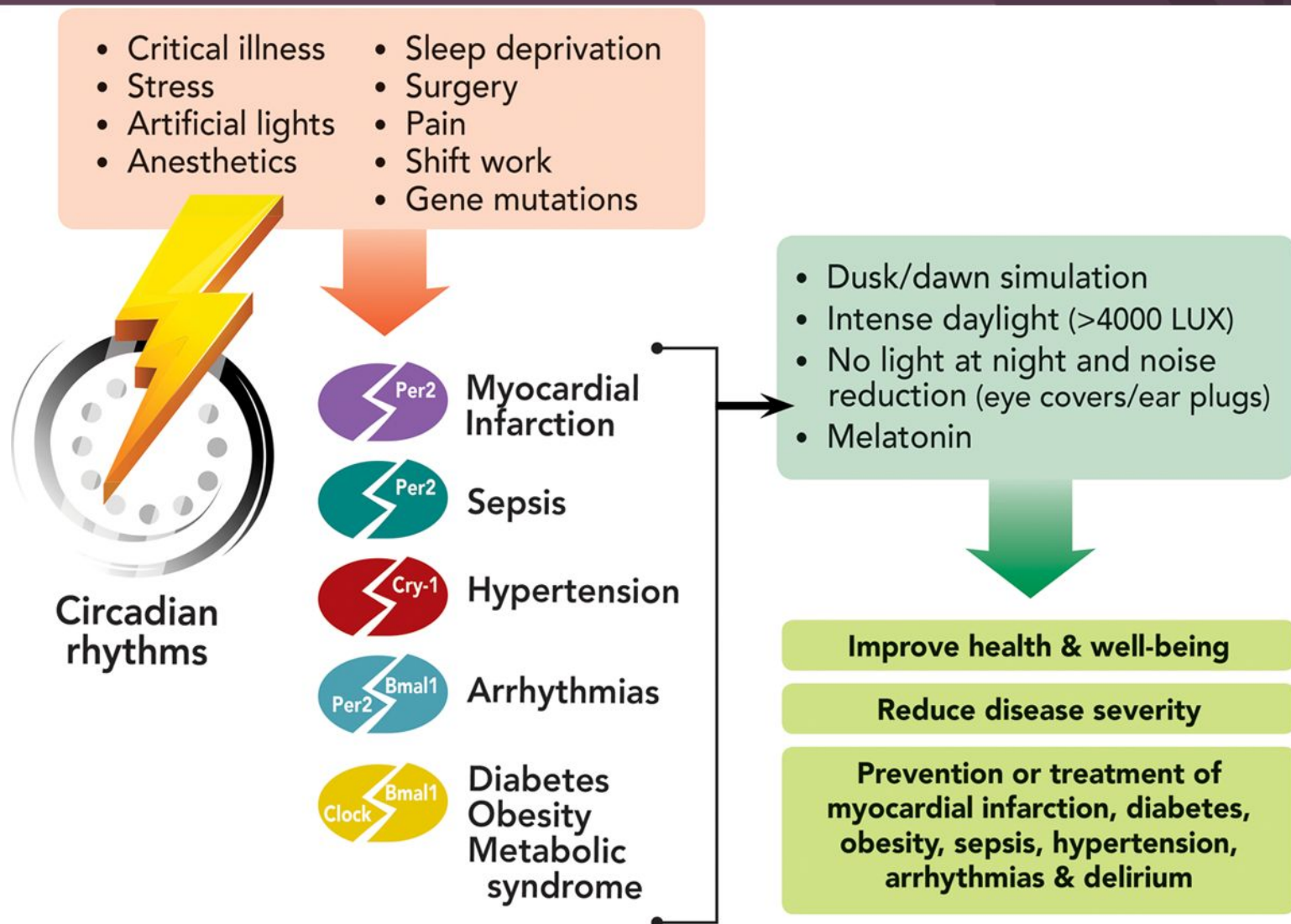
- The research team named this new system the glymphatic system because it is similar to the body's lymphatic system and is managed by the brain's glial cells.
- Instead of carrying lymph, the glymphatic system transports waste-laden cerebrospinal fluid (CSF).
- Stage 3 sleep is especially important for the glymphatic system (Nedergaard, 2012).
- During the stages of deep sleep, stage 3, the glymphatic system washes the brain and rids itself of built up toxins.
- The less time a patient spends in deep sleep, the less toxins the glymphatic system is able to remove.

The Glymphatic System

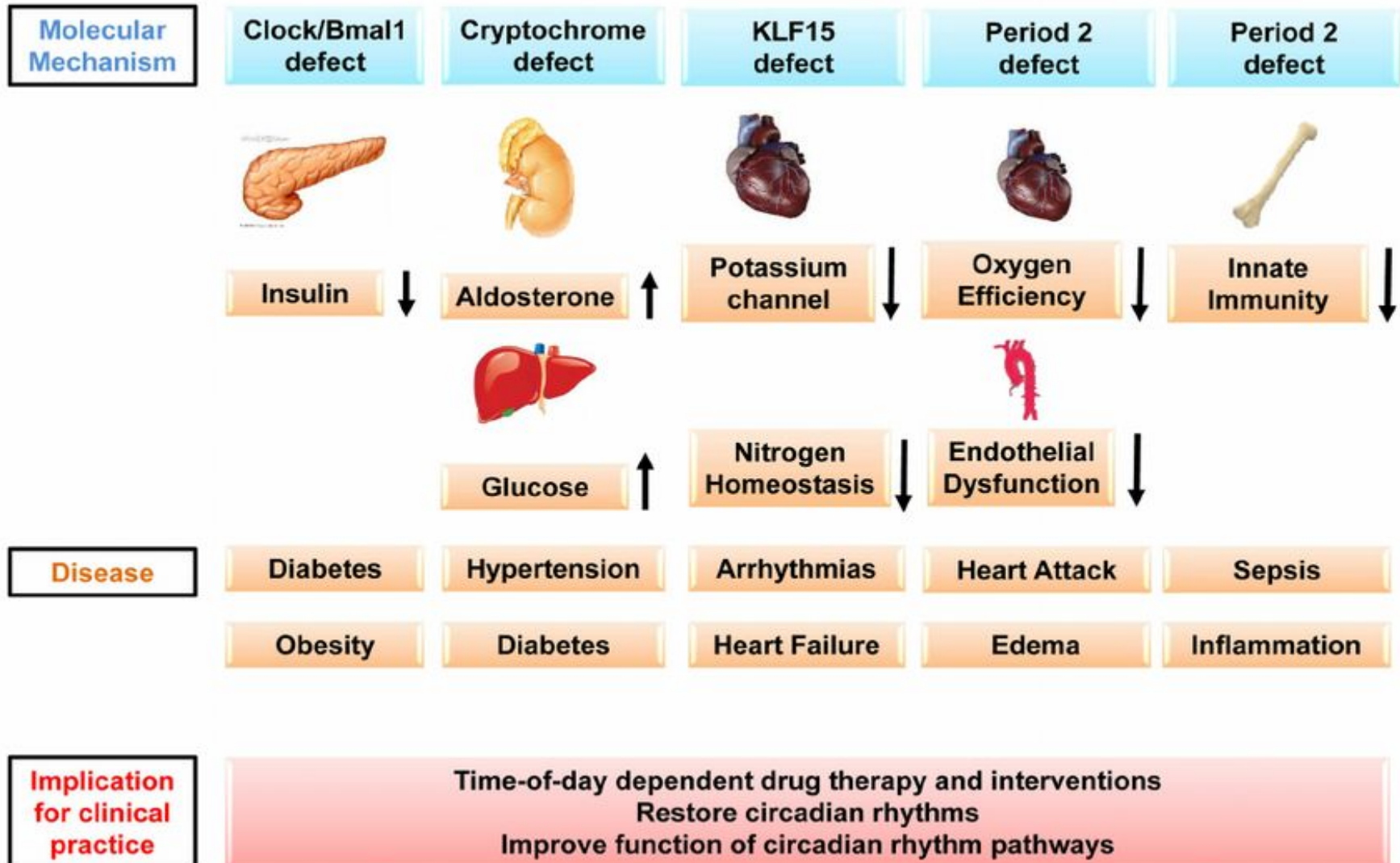


- **Brainwashing.** When mice sleep, fluid-filled channels (pale blue) between neurons expand and flush out waste

Circadian Rhythm Disruptions



Circadian Rhythm Disruption



Disruptions CR in Hospital

ICU

Postsurgical

Critically
III

Inadequate
light
exposure

Reduced
sleep time,
slow wave
and REM

Severely
decreased
total sleep
time

Sleep
occurs in
short
periods

Most sleep
occurs
during the
daytime

Nocturnal
secretion of
melatonin
was absent

Increase in
stage 1 sleep
and
wakefulness

Slow wave
was severely
or completely
depressed

Larger
proportion
of stage 1
and 2

Sepsis

Loss of
melatonin
secretion

Increased
NREM
sleep

Decreased
REM sleep

Increase in
sleep
promoting
cytokines

Mostly
stage 1
sleep

Delay in
melatonin
occurred in
minimal and
major surgery

Research in Sleep Disruption

- One study showed that hospitalized children (ages 8-12) had later bedtimes, later wake times, more night wakings, and less total sleep time (almost one hour less) while in the hospital (Meltzer, L. J., Davis, K. F., & Mindell, J. A., 2012).
- They found that alarms beeping, doors opening/closing/slamming and people talking outside the room were the most bothering noises.
- Eighteen percent of the study participants reported having taken a medication for sleep the previous night in the hospital (vs 3% at home).

Research in Sleep Disruption

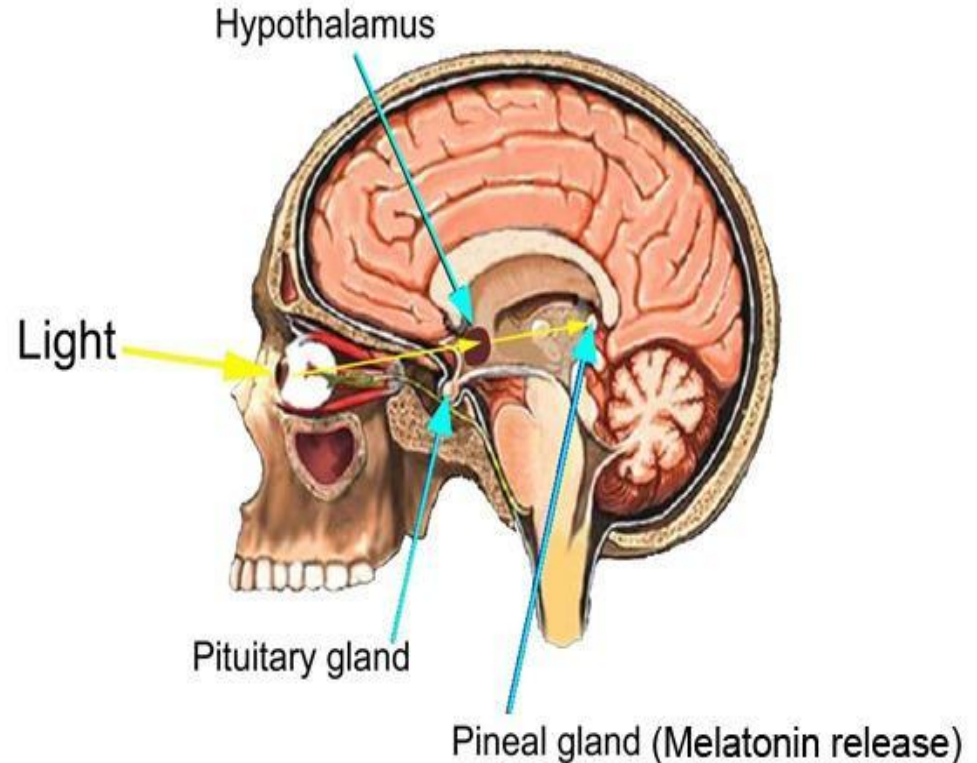
- In the same study, adolescents found that vital signs and noise in the room in the morning were most disturbing, as well as pain at bedtime and during the night.
- Another study, by Stremler, R., Adams, S., & Dryden-Palmer, K. (2015), sought nursing views on why hospitalized children are deprived of sleep.
 - The nurses who were polled felt environmental factors, such as noise level, light exposure, interruptions and parent's sleep space, were among the factors contributing to sleep deprivation in the hospitalized child.

Research in Sleep Disruption

- Numerous articles show negative relationships between hospital noise and sleep.
- Noise level measurements, in a study conducted with critically ill patients, revealed that alarms, pagers and staff conversations were the most significant contributors to noise (Nannapaneni, Ramar, Morgenthaler, Elmer, & Lee, 2013).
- Although the percentage slightly varies, it has generally been shown that roughly 11% to 20% of arousals and awakenings are due to noise (Hsu, Waye & Ackerman, 2012).

Technology and Melatonin

- A study from the Light Research Center suggests that light emitted from electronic devices can cause melatonin suppression which affects our circadian rhythm.
- Humans are especially sensitive to short wave light, like the blue and white light emitted from devices.



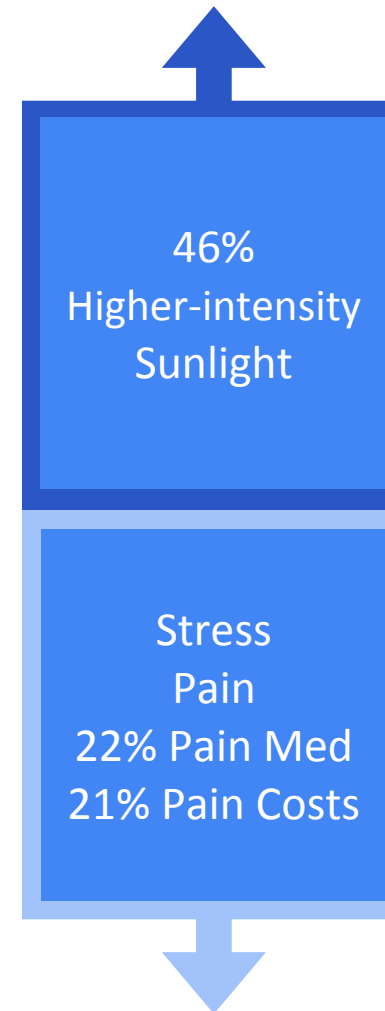
Sleep and the Hospitalized Child

- Many interruptions are unavoidable for the hospitalized patient, especially if the child is critically ill.
- Vital signs, monitoring, assessments and labs are necessary to keep the patient stable.
- Environmental factors that cause sleep interruptions, however, can be mitigated.

Sleep Solutions

Effects of Sunlight

- Randomized prospective study
- Does sunlight in a hospital room modify a patient's psychosocial health, quantity of analgesic medication used, and pain medication cost?
- Cervical and lumbar spinal surgeries
- Bright or the dim side of the same hospital unit postoperatively.
- Standard morphine equivalent of all opioid medication used postoperatively by patients
- Subsequent pharmacy cost



Sleep Solutions

- Three studies show that providing cycled lighting (reduced light levels in the night) in neonatal intensive-care units results in improved sleep and weight gain among preterm infants
- Studies have shown that the noise levels in the ICU are significantly higher than the US Environmental Protective Agency recommended levels
 - hospital levels not to exceed 45 dB during the day and 35 dB during the night

Sleep Hygiene Tips

Sleep schedule	Have regular bedtimes and wake times
Bedtime routine	Do the same things each night (charts can help)
Bedroom	Dark, cool, and quiet rooms are preferred
Set limits	For books, electronics, even scheduled worry time
Naps	Be aware of their impact on nighttime sleep
Security object	Can be of particular use in hospital
Sleep diary	Can help identify problems

Adapted from Mindell JA, Owens JA. A clinical guide to pediatric sleep: diagnosis and management of sleep problems. 2nd edition. Philadelphia: Lippincott Williams & Wilkins; 2010.

Sleep Hygiene Tips

Reduce Noise!

- Keeping the patients' doors closed
- Offer ear plugs
- Posting notices reminding others to minimize noise and conversation
- Reducing the volume of the monitor alarms without compromising patient safety
- Limiting television and telephone volumes
- Reducing beeper/phone volumes or changing to vibrating mode
- Do not bring your phones into the room after bedtime
- Do not talk in or outside patient rooms



**Keep noise levels to <45 dB during day
and < 35 dB at night**

Sleep Hygiene Tips

- Evaluate for underlying sleep disorders
- Address diseases and symptoms interfering with sleep
- Establish a clear day/night light exposure protocol consistent with environmental norms
- Offer eye masks
- Use simple relaxation techniques (eg, music, relaxation tapes)
- Limit patient interactions during typical sleep hours to those that are truly required for patient care
- Consolidate care/collaborate with care partners
- Review medication lists daily and eliminate or choose alternative medications in place of those that may interfere with sleep quality
- Use of sleep measurement tool
- **Educate parents and get parental buy in**



Questions?



References

- <https://sleepfoundation.org/how-sleep-works/what-happens-when-you-sleep>
- <http://time.com/77214/how-technology-destroying-your-sleep/>
- Cirelli C., Tononi G. (2008). Is sleep essential? PLoS Biol. 6:e216
10.1371/journal.pbio.0060216
- Iliff, J., Wang, M., Liao, Y., Plogg, B., Peng, W., Gundersen, G., Benveniste, H., Vates, G., Deane, R., Goldman, S., Nagelhus, E. and Nedergaard, M. A Paravascular Pathway Facilitates CSF Flow Through the Brain Parenchyma and the Clearance of Interstitial Solutes, Including Amyloid β . Science Translational Medicine 15 Aug 2012: Vol. 4, Issue 147, pp. 147ra111 DOI: 10.1126/scitranslmed.3003748
- Lansink C. S., Goltstein P. M., Lankelma J. V., Joosten R. N., McNaughton B. L., Pennartz C. M. (2008). Preferential reactivation of motivationally relevant information in the ventral striatum. J. Neurosci. 28, 6372–6382
10.1523/JNEUROSCI.1054-08.2008

References

- Meltzer, L. J., Davis, K. F., & Mindell, J. A. (2012). Patient and parent sleep in a children's hospital. *Pediatric Nursing*, 38(2), 64-71 8p.
- Morrissey MJ, Duntley SP, Anch AM, Nonneman R. Active sleep and its role in the prevention of apoptosis in the developing brain. *Med Hypotheses*. 2004; 62(6):876-9.
- Nannapaneni, S., Ramar, K., Morgenthaler, T., Elmer, J., & Lee, S. (2013). Sleep fragmentation and deprivation in critically ill patients – is noise a factor? *Sleep Medicine*, 14, e218. doi:10.1016/j.sleep.2013.11.520
- Opp M. R. (2009). Sleeping to fuel the immune system: mammalian sleep and resistance to parasites. *BMC Evol. Biol.* 9:8 10.1186/1471-2148-9-8
- Van Cauter E, Spiegel K, Tasali E, Leproult R. Metabolic consequences of sleep and sleep loss. *Sleep Med.* 2008 Sep; 9 Suppl 1():S23-8.