



P08

Reversible loss of consciousness

E365 – Aviation Human Factors

SCHOOL OF
ENGINEERING

Need to sleep

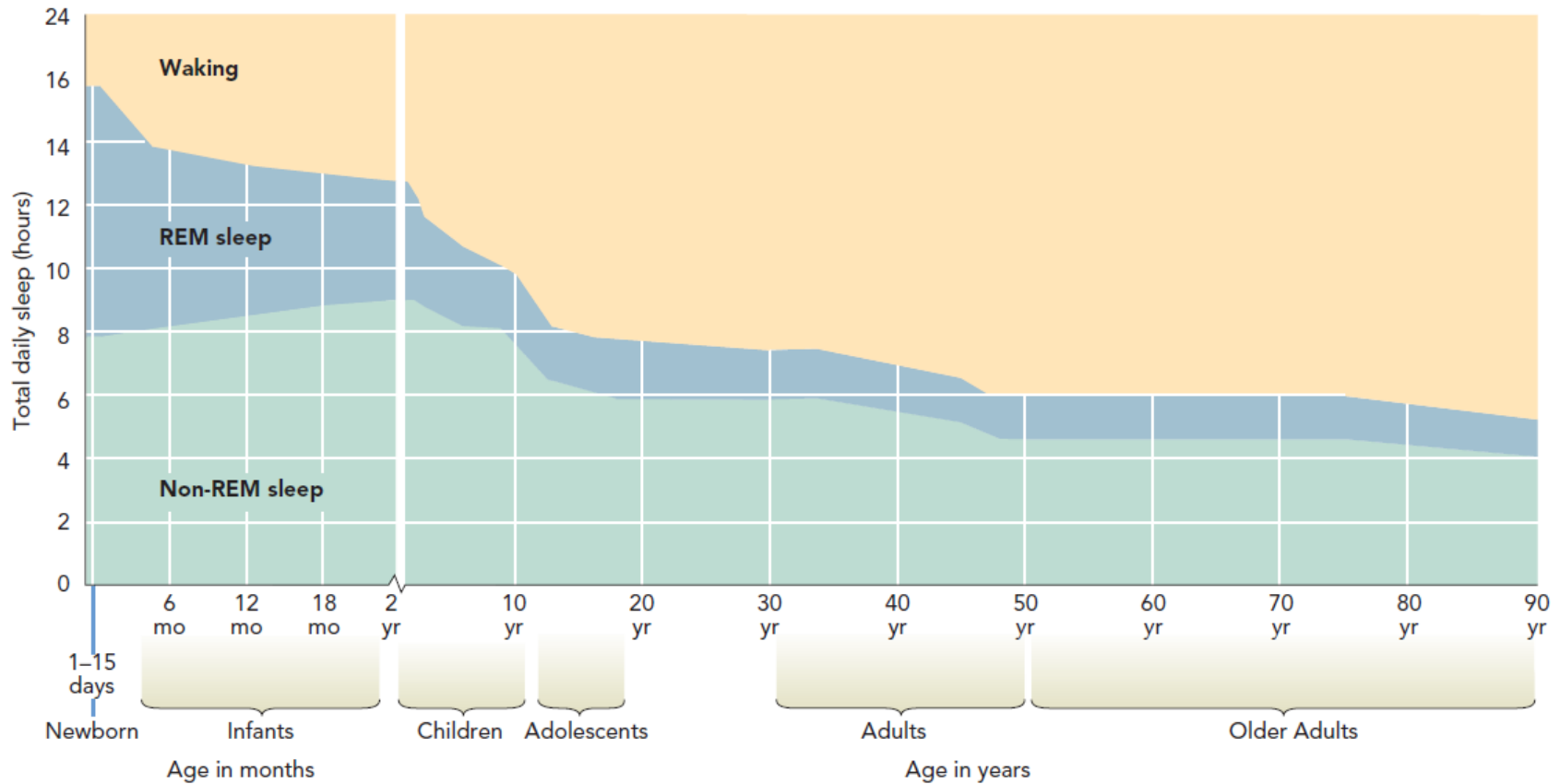


- Sleep is a natural state of rest for the body and mind that involves the reversible loss of consciousness.
- You sleep to not feel sleepy.
- Sleep restores, replenishes, and rebuilds the brain and body, which the day's waking activities can wear out.
- We have to sleep because it is essential to maintaining normal levels of cognitive skills such as speech, memory, innovative and flexible thinking.
- Different individuals have different needs for sleep
 - Age is a significant factor

Need to sleep



- Generally, the older we get, the less sleep we need.



Stages of sleep

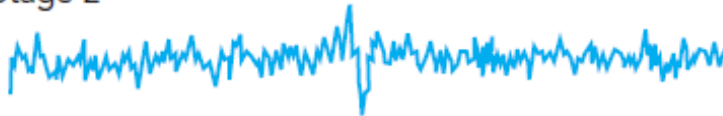


Stage 1



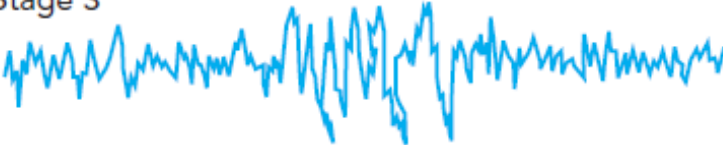
Light sleep lasting up to 10 minutes; includes theta waves (low frequency, low amplitude)

Stage 2



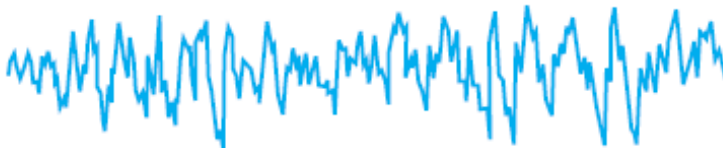
Deeper sleep characterized by occasional "sleep spindles" (brief high-frequency waves), lasting up to 20 minutes

Stage 3



Progressively more muscle relaxation and emergence of delta waves (slower); lasts up to 40 minutes

Stage 4



Deep sleep when sleeper is difficult to rouse; delta waves—large, slow brain waves—occur

Stage 5: REM sleep



Instead of reentering stage 1 sleep, the individual shows EEG patterns similar to those of relaxed wakefulness; most dreaming occurs in this stage; lasts for about 10 minutes in first sleep cycle of the night and up to 1 hour in the last

Slow-wave sleep

Paradoxical sleep

Effects of sleep deprivation



- Negative effects after a night with insufficient sleep
 - grumpiness, grogginess, irritability, forgetfulness, poor concentration, shorter attention span
- With continued lack of sufficient sleep, the part of the brain that controls language, memory, planning and sense of time is severely affected.
 - Difficulty in responding to rapidly changing situations and making rational judgments.
- Impact on emotional and physical health due to chronic sleep deprivation
 - stress
 - high blood pressure
 - increased risk of obesity because chemicals and hormones that play a key role in controlling appetite and weight gain are released during sleep.

Sleep disorders



- **Insomnia**
 - The inability to sleep – a problem in falling asleep, waking up during the night, or waking up too early.
- **Snoring**
 - Snoring occurs when the soft palate tissue at the back of the throat relaxes too much, obstructing the entrance to the throat. As air tries to pass through, the soft palate vibrates and produces the snoring sound.
- **Sleep apnea**
 - Individuals stop breathing because the windpipe fails to open or because brain processes involved in respiration fail to work properly.
- **Somnambulism**
 - Sleepwalking - takes place during stages 3 and 4, usually early in the night, when a person is unlikely to be dreaming.

Sleep debt



- For each day, sleep debt =
 - Hours of sleep needed – Hours of sleep achieved
- For an individual who accumulates sleep debt throughout the weekdays, he/she can “repay” part this debt by sleeping a couple of hours more over the weekend
- However he/she is not likely to be able to pay more than 2 hours at a time. There will be debt left and he will still face symptoms of sleep deprivation over the course of his week.

How to sleep well



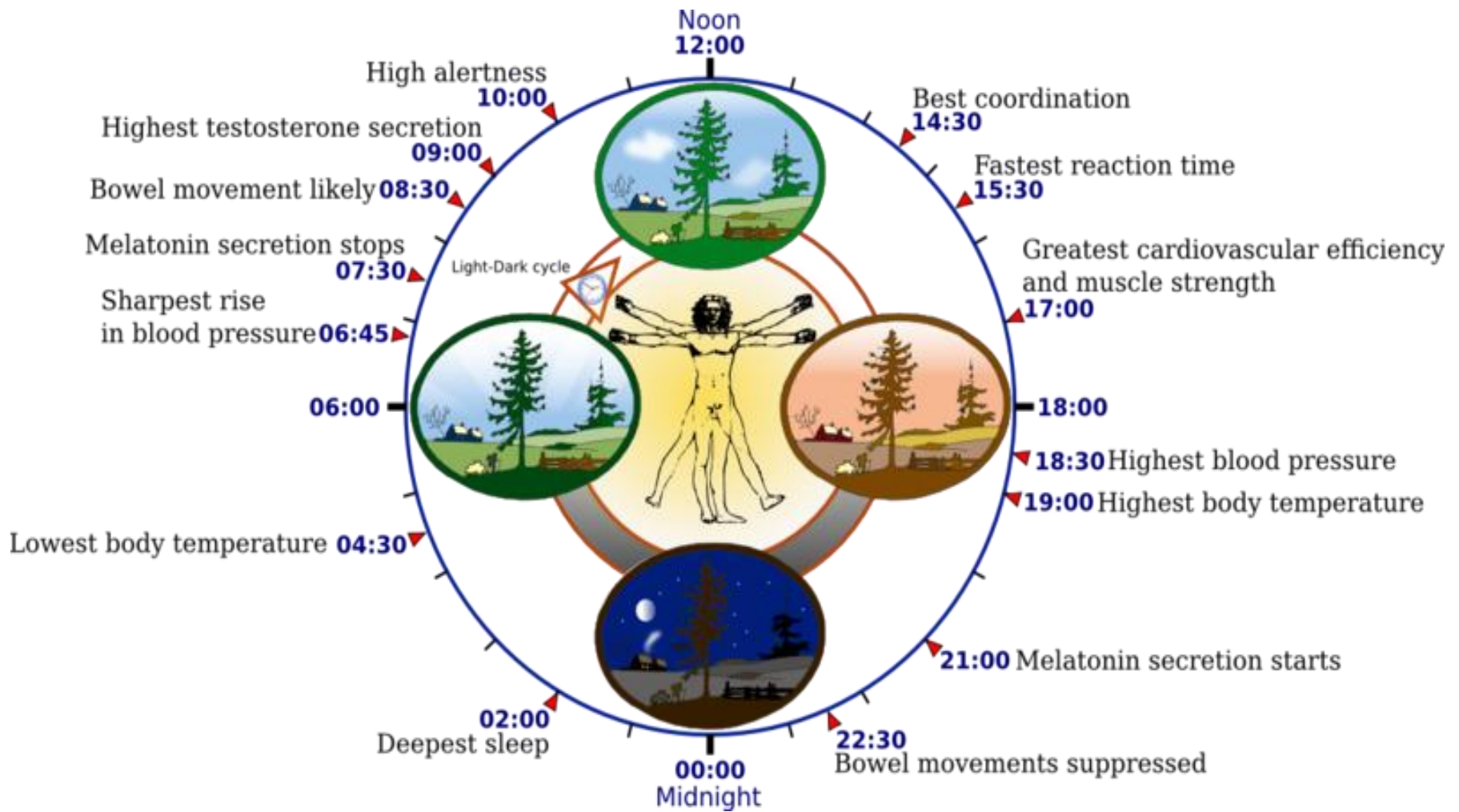
- No disturbance throughout the sleep period.
- Plan a proper work rest schedules
- No late night activities which disrupts the sleeping periods.
- Proper bed, lighting and air conditions necessary to initiate sleep.
- Get proper treatment for sleep disorders.

Naps



- A short sleep, especially during the day.
- Naps as short as 10 minutes can be effective in increasing alertness.
- The longer the nap, the longer the benefits will last.
- However, longer naps are also associated with longer periods of sleep inertia afterward.
 - Sleep Inertia is that groggy feeling when one wakes up.

Human Circadian Biological Clock



Circadian Rhythms



- Daily behavioral or physiological cycles
 - sleep/wake cycle, body temperature, blood pressure, and blood sugar level, melatonin secretion
- The body monitors the change from day to night
 - a small brain structure uses input from the retina to synchronize with the daily cycle of light and dark
 - regulate daily rhythms such as temperature, hunger, sleep, wakefulness and release of hormones such as melatonin
- The lowest point in the circadian rhythms that affect the body's alertness is between 2 a.m. and 6 a.m.
- Can be desynchronized with clock time
 - Jet lag, shiftwork, insomnia
 - Synchronization recovery takes time

Jet Lag



- Jet lag is a physiological condition caused by an interruption of the individual's circadian rhythms.
- The term is generally used when individuals travel by air across different time zones and their bodies are unable to immediately adjust to the new daylight and darkness hours.
- Some negative health effects due to jetlag include
 - Fatigue, insomnia, anxiety, constipation, diarrhea, confusion, dehydration, headache, irritability, nausea, sweating, coordination problems, and even memory loss.

Fatigue



- Physical fatigue
 - exhaustion of the muscles and body
- Mental fatigue
 - a mental condition characterized by a need for rest, and a feeling of exhaustion.
- Sleep and fatigue are intimately related
 - Fatigue normally dissipates during normal rest and sleep.
- Each person has a different ability to withstand fatigue which diminishes with age.

Learning Objectives



- The need to sleep
- Stages of sleep
- Effects of sleep deprivation
- Sleep disorders
- Sleep debt
- Naps
- Circadian Rhythm
- Jet Lag
- Fatigue