To Sleep, Perchance to Dream

The Importance of Sleep

Mini Med School

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a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA
Faculty of Medicine

University of Victoria

let's talk science

Uvic Land Acknowledgment

We acknowledge with respect the Lekwungen peoples on whose traditional territory the university stands and the Songhees, Esquimalt and W̱SÁNEĆ peoples whose historical relationships with the land continue to this day.

Introductions and Disclosures

- About Mini Med School
- About the optional survey
- This talk will be recorded

Introductions and Disclosures

- I am a medical student and not a sleep expert

https://worldsleepday.org/sleep-research

Introductions and Disclosures

- This talk is intended for your entertainment and education, and is not meant to replace advice from your family physician or another health care professional

- Thank you for joining us for our third talk in this series

Introductions and Disclosures

- All pictures used are free stock photos or photos available under a Creative Commons license unless otherwise noted

Agenda

- Introduction to Sleep
- Circadian Rhythm
- Chronotypes
- Sleep Pressure
- Types of Sleep
- Dreaming
- Benefits of Sleep
- Q & A / Break

Agenda Cont’d

- Sleep Pathologies / Sleep and Disease
- Bad Influences
- Sleep Aids
- Napping
- Putting It into Practice: How to Sleep Well
- Reading Recommendations
- Q & A and Closing Remarks

Introduction to Sleep

- A quickly reversible and naturally-occurring state of reduced alertness and responsiveness to stimuli

- We progress through a predictable series of physiological changes (e.g. drop in body temperature) as we fall asleep

- In sleep, we progress stepwise through several types of sleep, each with its characteristic brainwaves

Know Your Audience

- Do you feel that you get enough sleep?

A Timely Topic…

Jahrami H., BaHammam S. A, et al. Sleep problems during the COVID-19 pandemic by population: a systematic review and meta-analysis. *Journal of Clinical Sleep Medicine.* 2021; 17(2): https://doi.org/10.5664/jcsm.8930.

- People are not sleeping well right now – perhaps more so than usual
- A 2017 meta-analysis estimated a 15% prevalence of sleep problems in the adult general population (albeit in China)
- A 2021 meta-analysis put this at 32% across 13 countries

How Did Sleep Evolve? Why?

- We don’t know the specifics (evolutionary theories are not easily tested)

- We do know that wakefulness is damaging to the brain and precludes rest and recovery of the brain and the rest of the body

- Sleep and sleep-like states are found in most multicellular organisms despite the obvious drawbacks of sleep

How Did Sleep Evolve? Why?

- The way humans sleep (proportion of REM sleep etc.) fosters frontal lobe development and therefore social functioning and complex thought

- Sleep is essential to life

How We Used to Sleep

- A few years ago, there were many articles circulating re: shift-sleeping (“two sleeps”) in history – segmented sleep at night.

- Possible, but likely not universal

- However, to this day…

Sleeping Worldwide

- Siesta culture

Pop Quiz!

- TRUE or FALSE: all else being equal, an older adult needs less sleep than a younger adult.

How We Sleep Here & Now

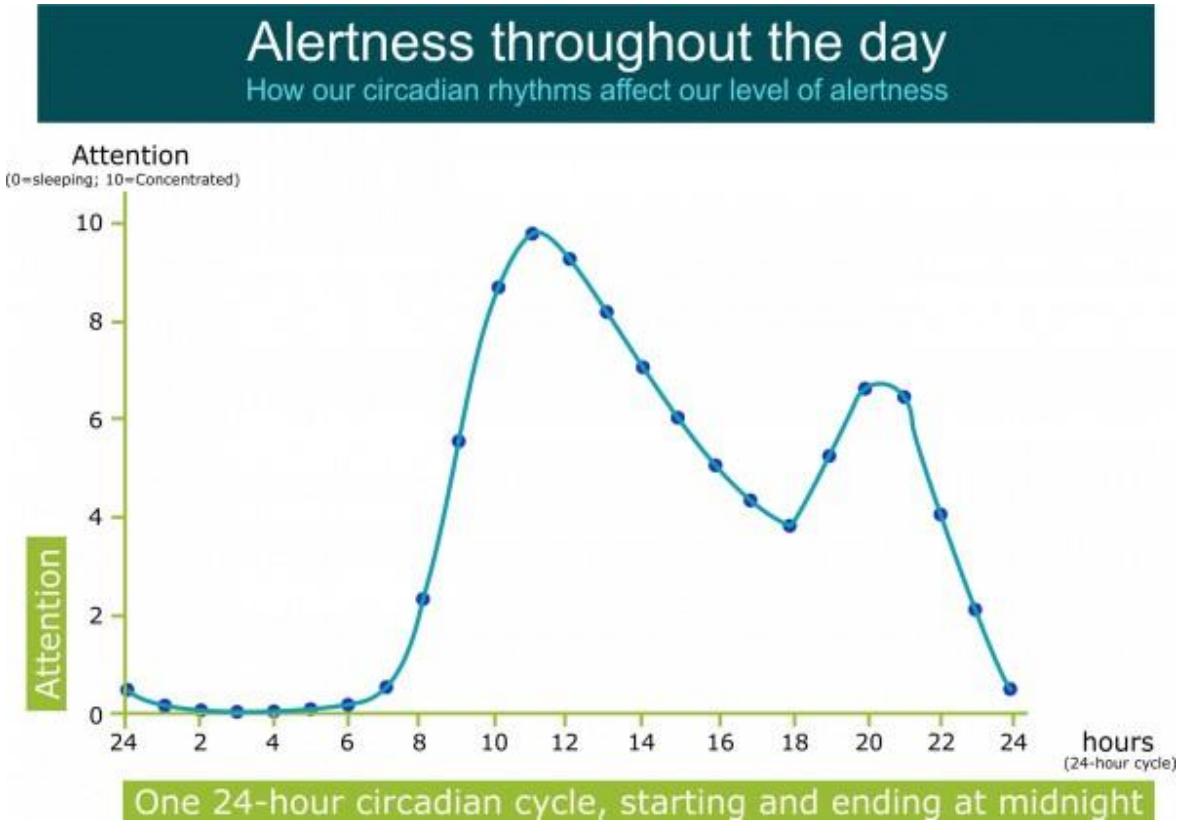
- Most adults (and children over 5) in North America sleep in one “shift” without naps

- Many adults run on less than the recommended 7-9 hours (per CDC and National Sleep Foundation) of *sleep opportunity* per night

- Sleep and rest are frequently disrespected!
  - Artificial light late
  - Limited exposure to natural light
  - Caffeine
  - Perception of sleep as “wasted time”

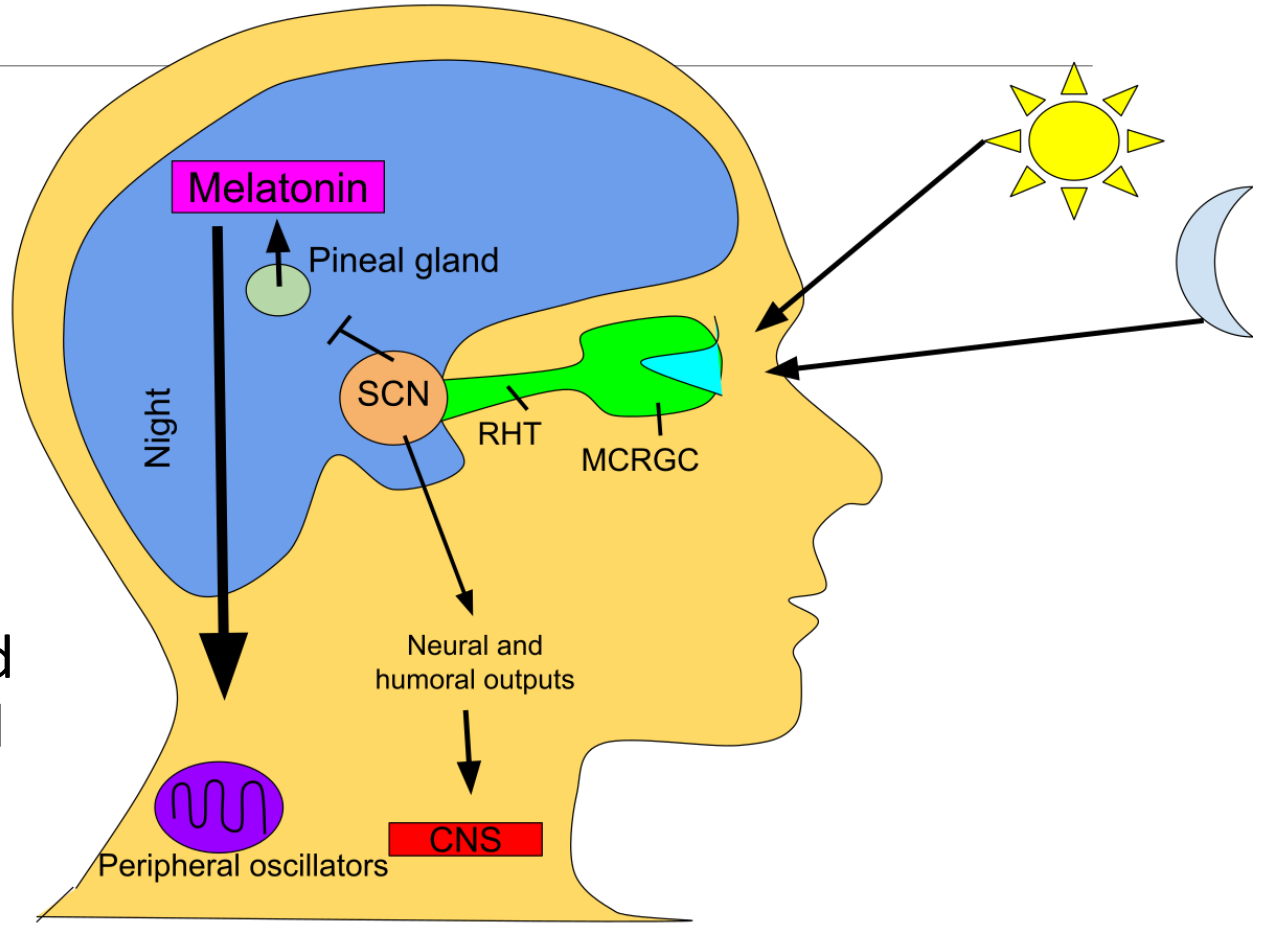
Circadian Rhythm

- Our natural rhythm of wakefulness naturally lasts “around a day” (*circadian*)
- We have a peak in the morning, a trough in the early-mid afternoon, and then a second wind
- The rhythm still exists without light’s input, but light helps to fine-tune it



Circadian Rhythm

- Suprachiasmatic nucleus (SCN), influenced by light, adjusts our 24-hour ‘clock’
- Setting sun cues SCN to stop repressing pineal gland
- Pineal gland releases melatonin
- Most of us naturally begin to get tired a few hours after sunset (w/o artificial light)



Are you a….

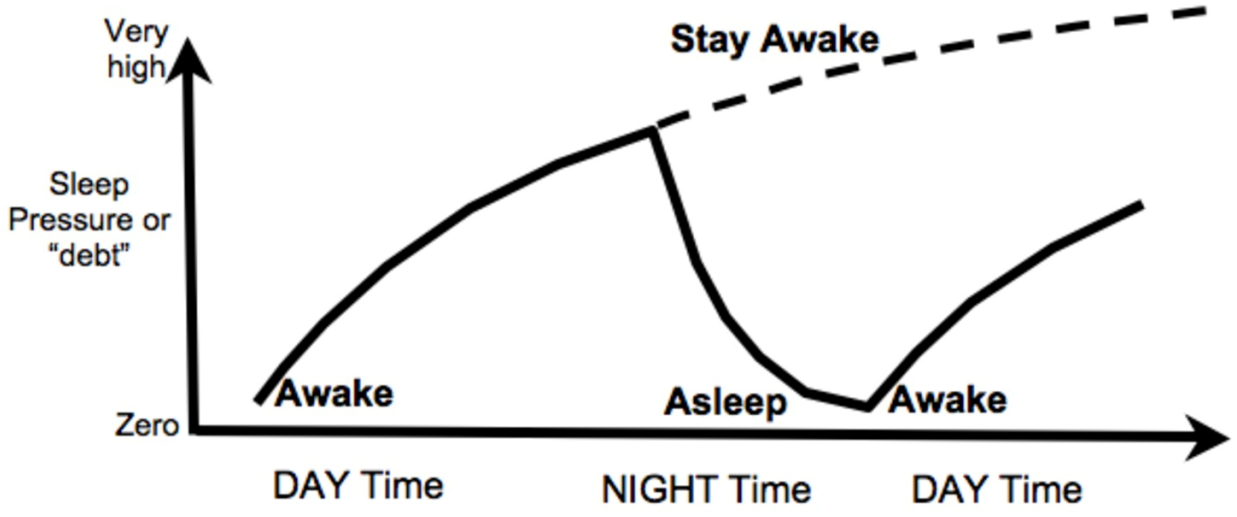
- Night owl
- Early bird
- Something in between
- These categories are fictitious!

Chronotypes

- Some people really are “owls”, “larks”, etc.
- Evolutionary theories: less vulnerability to the group as a whole if not everyone sleeps at once
- Routines and environmental changes can make keeping different hours easier

- Variation exists among age groups too
- Few “short-sleepers” really exist
- Most of us need about 8 hours of sleep opportunity

Sleep Pressure: Adenosine and Caffeine



- In addition to our normal rhythm of alertness, we have sleep pressure
- Sleep pressure is drive to sleep that increases as we stay awake longer
- Mediated by adenosine

Sleep Pressure: Adenosine and Caffeine

- Caffeine reversibly binds the same receptors that adenosine usually clings to
- Blocks adenosine from binding and thus prevents us from perceiving levels of adenosine accurately
- More on caffeine later…

Types of Sleep

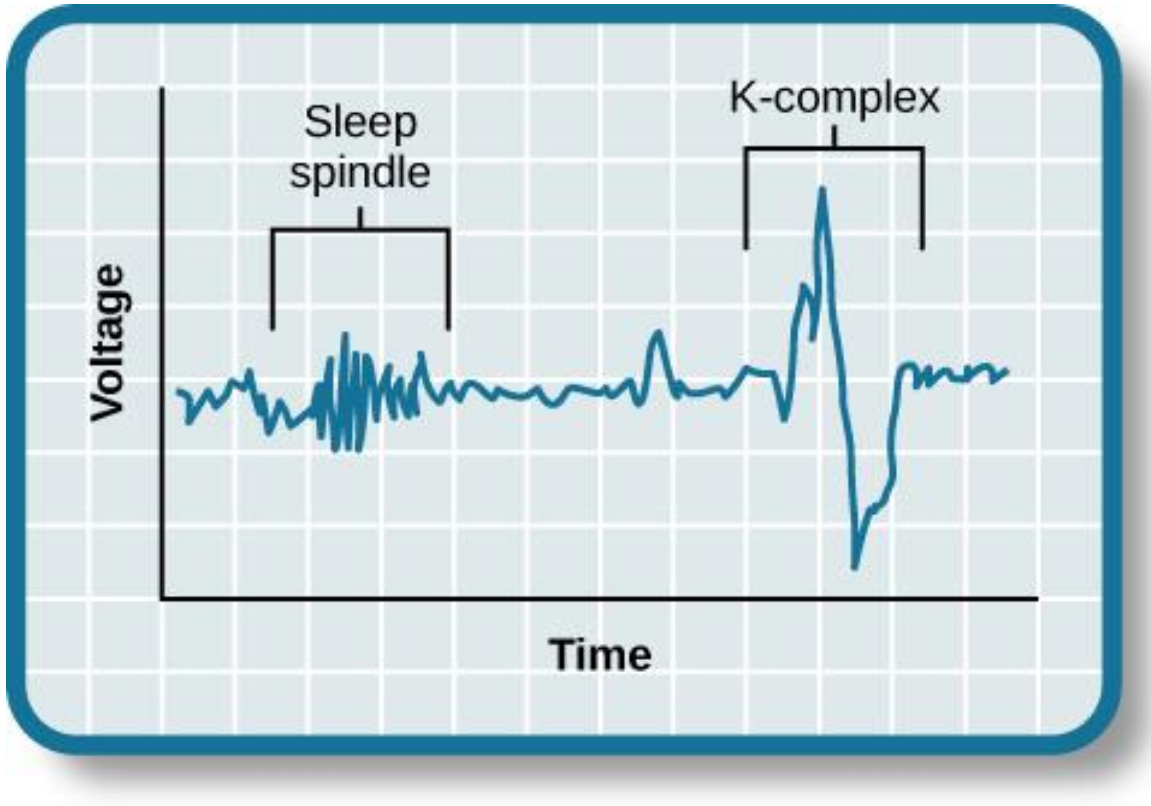
- WHAT is REM?
  - A type of sleep?
- Something to do with computers?
  - An American rock band?

Types of Sleep

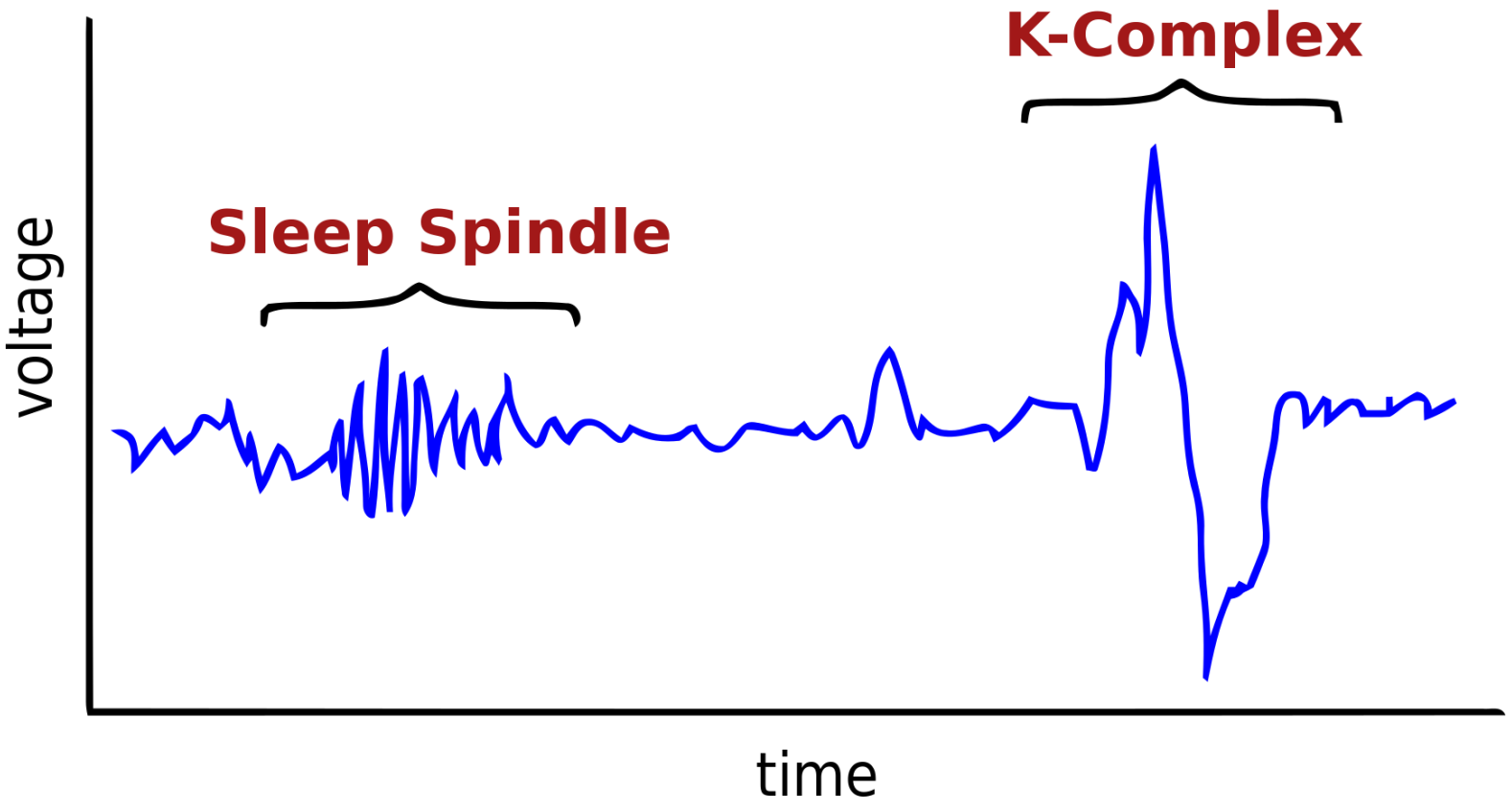
- REM = “Rapid Eye Movement”

Types of Sleep

- NREM (75-80%)
  - N1 (light)
    - Nodding off
  - N2 (intermediate, ~50%)
    - Transfer of memories to long-term storage
    - Sleep spindles and K-complexes first appear
  - N3 (slow-wave or deep sleep, ~10%)
    - Memory consolidation cont'd
    - Growth hormone release
- REM
  - Dreaming
- 90-minute cycles



Types of Sleep



On Dreaming

- Occurs during REM sleep
- The muscles of our limbs are usually *atonic* (paralyzed)
- "Sleep on it!": solve problems via association, creativity
- "You'll feel better in the morning.": decoupling experience and emotion

Benefits of Sleep

- Too many to list, but a few follow:

  - Enhanced memory and attention
  - Better social awareness
  - Improved emotional regulation
  - Increased creativity
  - More accurate hunger cues
  - Strengthened immune function
  - It goes without saying – but better energy!

So…

- What interferes with sleep and what helps with it?
- Stay tuned! We will explore this after the break.

Q&A

- Ask me anything (within reason!)
- We will also have a Q & A at the end of the talk.
- What I can't answer now, I may be able to find out. You may also email uvicmms@gmail.com with questions after the presentation.

Intermission

Agenda Cont’d

- Sleep Pathologies, Sleep and Disease
- Bad Influences
- Sleep Aids
- Napping
- Putting It into Practice: How to Sleep Well
- Reading Recommendations
- Q & A and Closing Remarks

Not Getting Enough Zzzzs

- Take the “benefits” list and flip it – insufficient sleep:
- Undermines immunity
- Adversely affects your mood and cognition
- Makes you hungry (leptin, ghrelin imbalance)
- Increases your sensitivity to pain

Instead of my scaring you, let’s look at some common sleep problems and factors that interfere with sleep, plus solutions and suggestions for a better rest

Pathologies of Sleep

- BIG THREE:
  - Insomnia
  - Sleep Apnea
  - Restless Leg Syndrome

Poll

- Do you often have trouble:
  - Falling asleep
  - Staying asleep
  - Both
  - Neither

Insomnia

- Two main types (may overlap)
  - Onset insomnia
  - Maintenance insomnia
- Significant distress/impairment
- Dissatisfaction with sleep quality or quantity *despite* giving oneself adequate sleep opportunity
- >=3 nights/week for >=3 months, *no other condition* causing these symptoms
- Very often, a “pure” insomnia comes from worry/anxiety
- Overactive SNS: racing thoughts, higher body temperature…

Insomnia

- Treatment usually comes down to
  - Sleep hygiene (best practices)
  - CBT-I
- CBT-I is Cognitive Behavioural Therapy for insomnia
- Consists of exercises and practices targeted to reduce worry and anxiety in insomniacs

Poll

- Do you snore?

Sleep Apnea

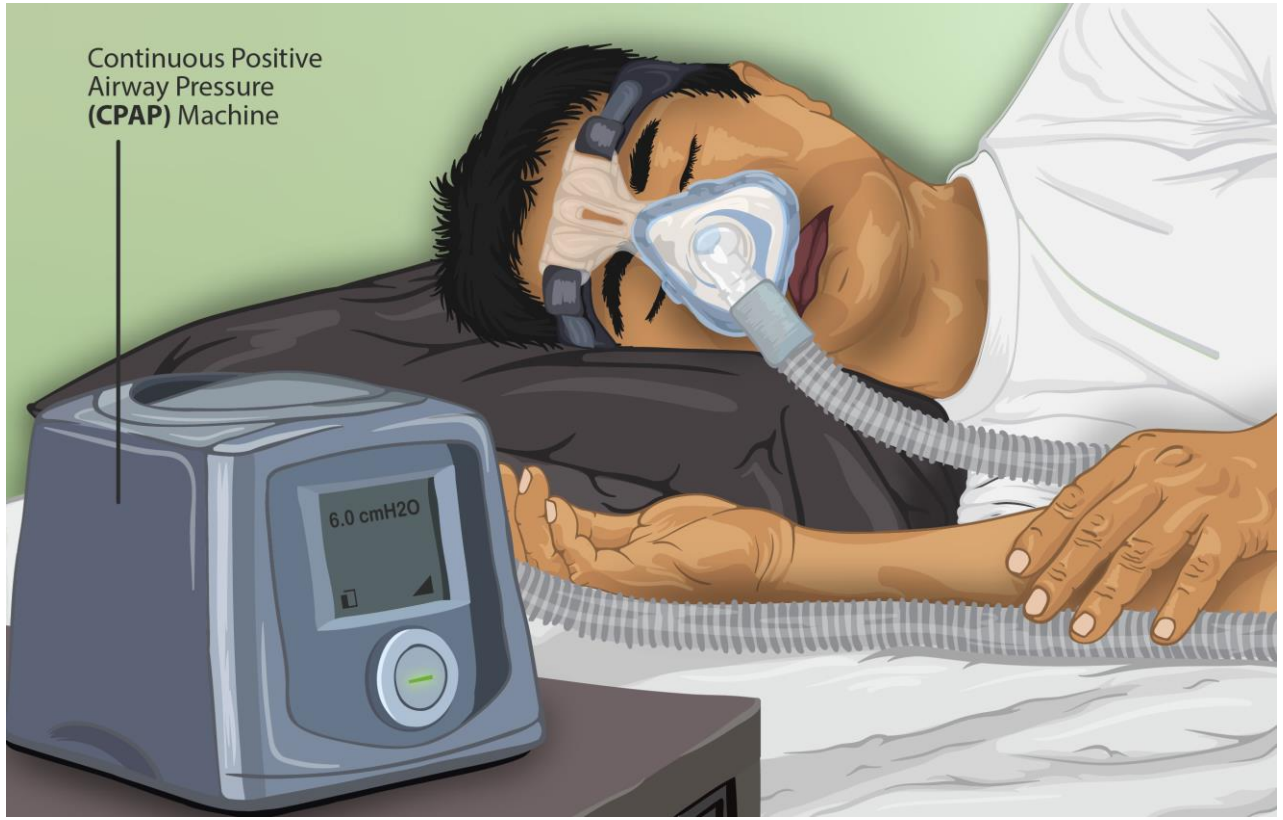
- Breathing stops repeatedly during the night
- Interrupts sleep and creates a fight-or-flight response, increasing levels of stress hormones
- Notable effects: hypertension, increase in risk of cardiovascular disease (30% higher risk of death from heart-related causes)

Sleep Apnea

- Three main types
  - Obstructive
  - Positional Obstructive
  - Central
- Hallmark: snoring
- Waking up not feeling rested, morning headaches, poor mood

Sleep Apnea

- Lifestyle modifications
  - Changing position
  - Avoiding alcohol
  - Weight loss
- CPAP machine
- Oral appliances
- Surgery
- Neurostimulation



Restless Leg Syndrome (RLS)

- An unpleasant to horrible feeling at rest, usually in the legs, usually when trying to sleep
- Relieved by movement
- Most cases are primary, or idiopathic, RLS
  - May come and go
- Secondary RLS is caused by something else
  - A condition (e.g. iron deficiency anemia, chronic kidney disease, diabetes, Parkinson's…)
  - A medication (e.g. antinausea, antiseizure, antidepressant meds, antihistamines)
- Often comes with periodic limb movement disorder (a two-for-one deal)

Restless Leg Syndrome (RLS)

- For secondary RLS, management of a condition or changes in medication can help
- Avoid caffeine, alcohol, tobacco, especially later in the day
- Exercise and practice good sleep hygiene
- Levodopa, dopamine agonists
- Anticonvulsants, sedatives, narcotics

There Are Others…

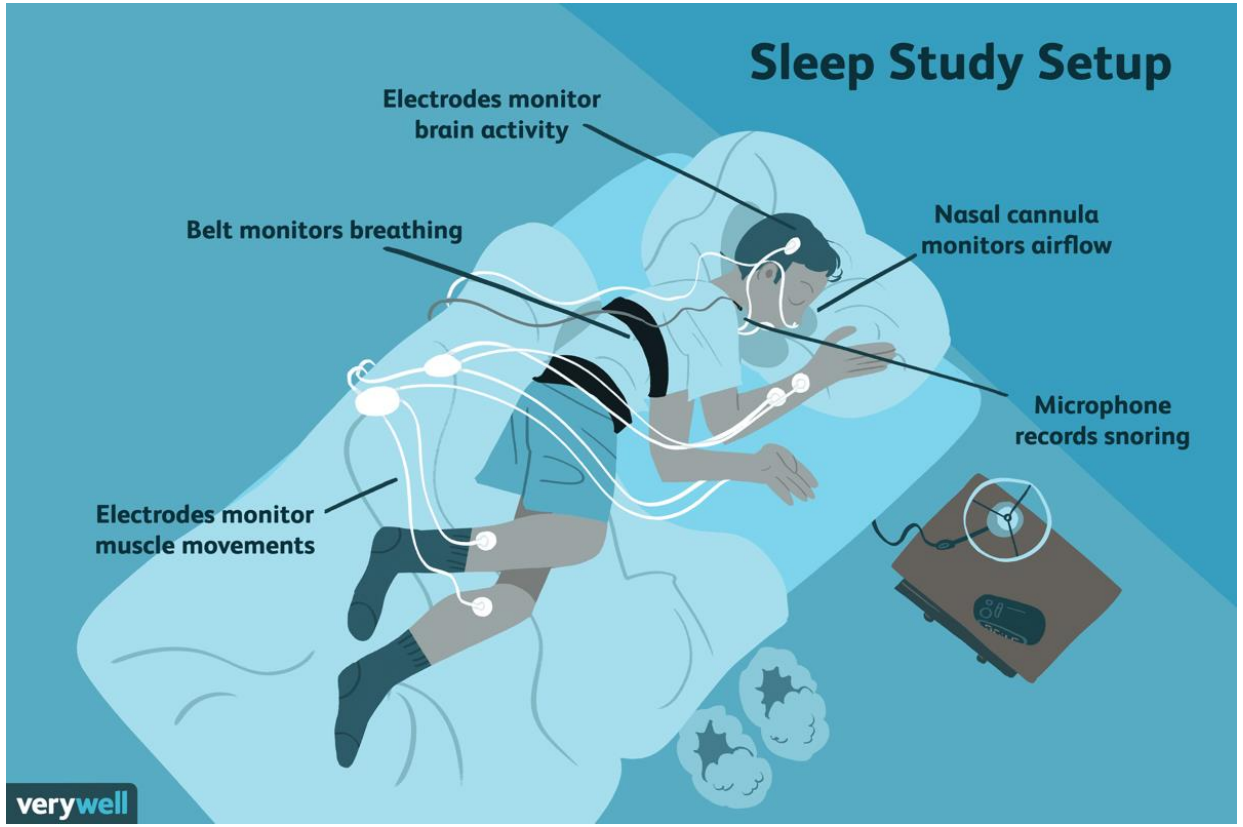
- Hypersomnia
- Narcolepsy
- Shift work sleep disorder
- REM sleep behaviour disorder
- Fatal familial insomnia
- and many more…

Sleep and Disease

- Conditions and medications/treatments can all interfere with sleep:
  - Diabetes, chronic pain, chronic kidney disease, GERD (gastroesophageal reflux disease)
  - Alzheimer's
  - Depression *and* antidepressants; anxiety *and* anxiolytics; asthma *and* asthma medications
- Trouble sleeping due to a condition? A physician may be the best person to speak to
- Wondering if a medication may be interfering with your sleep? Consider consulting a pharmacist, who can discuss side effects, medication timing, and possible alternatives with you

Sleep Medicine

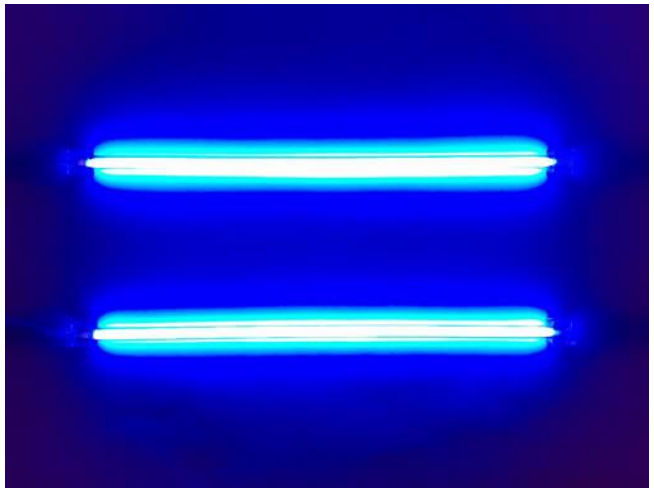
- Sleep medicine doctors have a range of backgrounds
- Physical exam often performed
- Sleep histories are a cornerstone of investigation into sleep problems
- Consider keeping a sleep journal before an appointment
- Sleep studies are generally carried out at a sleep clinic but may be available for remote use (“at home” sleep tests)



Bad Influences

Another BIG THREE:

- Caffeine
- Alcohol
- (Blue) light



Pop Quiz!

- What is the half-life of caffeine in an average individual?

Bad Influences

- We’ve mentioned how caffeine can block our perception of adenosine
- Half-life of caffeine is 5-7 hours
- The adenosine is still there after, waiting to attack!

Bad Influences

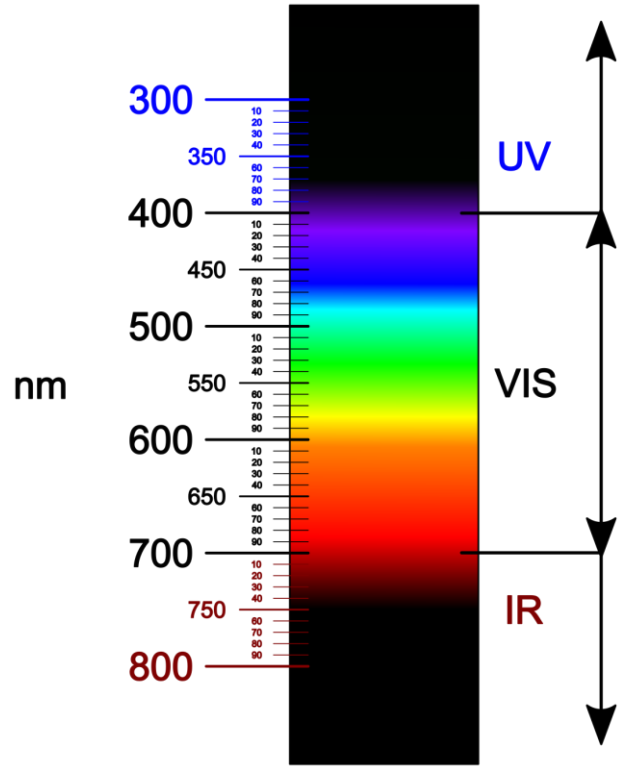
- TRUE or FALSE: A nightcap will help you sleep.

Bad Influences: Alcohol

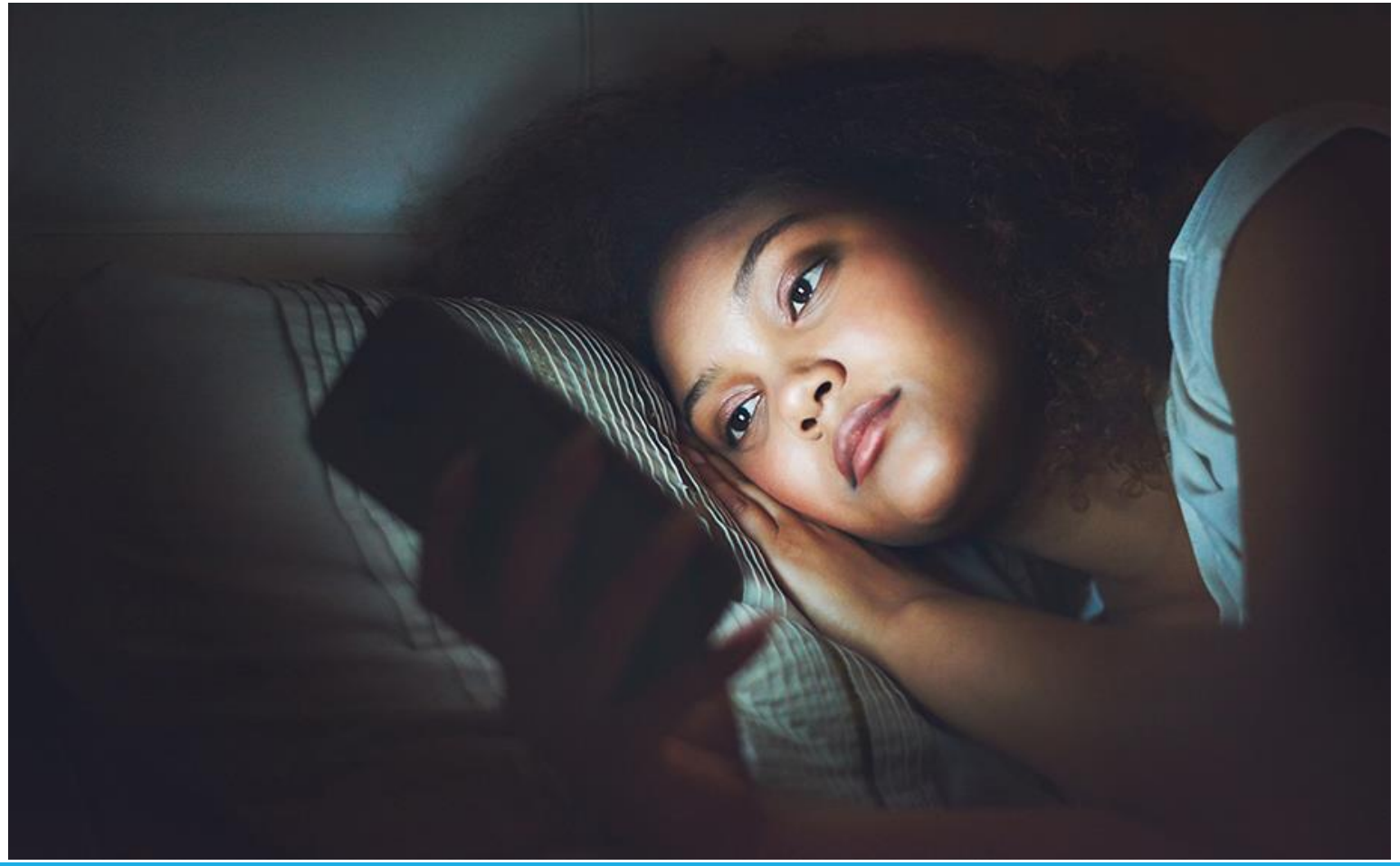
- Sedates, like a medical sedative or anaesthetic
- Does not promote natural sleep patterns
- Leads to fragmented sleep
- Suppresses REM sleep

Bad Influences: Light

- Artificial light after dusk hinders the release of melatonin
- Even incandescent light is sufficient to delay the release of melatonin
- Blue LED light, while more energy-efficient, is worse by far (2x as bad at the same brightness)
- The SCN (suprachiasmatic nucleus) is sensitive to short-wavelength light (i.e. blue light)



Bad Influences: Light



Bad Influences: Light

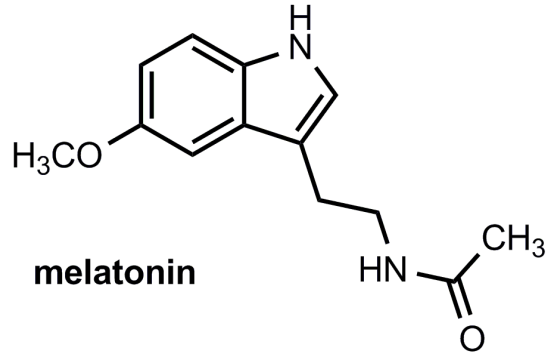
- Solution: mood-lighting
  - Avoid overhead lighting, especially bright overhead lighting, in the evening
  - Yellow-tinted or blue-light filtering glasses are a possibility
  - “Nightlight” function or red light filtering software on devices
  - Blackout curtains or eye masks at night

- But it’s not just the light
  - It’s what we’re doing in the light
  - Stimulation

Sleep Aids

Again, we will discuss three:

- Sleeping pills
- Melatonin
- Gadgets



melatonin

Sleep Aids: Sleeping Pills

- Sleeping pills are sedatives that sedate or calm the cortex
- May interfere with memory consolidation, as deep sleep can be affected
- *Do* slightly improve sleep latency
- Possibly largely placebo effect per 65-study meta-analysis (~4,500 people) in the *BMJ* (British Medical Journal)
- Unfortunate side-effects e.g. drowsiness
- Potential for rebound insomnia
- Proceed with caution under medical guidance

Carter MD, Juurlink DN. Melatonin. *CMAJ*. 2012;184(17):1923. doi:10.1503/cmaj.111765

Sleep Aids: Melatonin

- Recall: secreted by the pineal gland in response to falling light levels
- Peaks ~2 AM
- Effective against jet lag
- Possible efficacy in shift work
- Some effectiveness in improving sleep quality per a 2005 meta-analysis of 17 studies (*n*=284)
  - Increased total sleep time by 12.8 minutes, increased sleep efficiency by 2.2% and decreased sleep latency by 4.0 minutes
  - These effects were maximized at a small (0.3 mg) dose
- Statistically significant, but clinically…? Per 2020 “umbrella review”, lack of consensus
- Seems safe in the short-term; may interact with warfarin (blood-thinner)

Sleep Aids

- Gadgetry
- Sleep trackers
  - May be of interest or help to some
  - Problems: inaccuracy, fuelling worry
- Relaxation aids (e.g. Dodow) and light-based therapies (sunset and sunrise simulators)
  - More benign, less likely to cause distress

Napping

- POLL: Do you nap?

Napping

- 2013 International Bedroom Poll: 35% of Canadians reported taking at least one nap in the two weeks before the poll
- As discussed, our wakefulness does dip in the early-mid afternoon
- A short afternoon nap is beneficial for some, and is integral to some cultures
- Napping too late or too long (>~20 mins) may interfere with your nighttime sleep
- Do what fits your schedule and leaves you feeling rested

How to Get Your Best Rest

- Exercise regularly (attend our exercise talks for inspiration!)
- Eat well and not *too* late (no nightcap, either)
- Limit bright light in the evening; cut out blue light and screens before bed

How to Get Your Best Rest

- Darken your room
- Don’t lie awake in bed for too long
- …But don’t watch the clock

How to Get Your Best Rest

- Keep your room on the cooler side (~65 F / 18 C)
  - A drop in body temperature further stimulates melatonin release
  - To speed this natural process, you might take a hot bath before bed
- Stable sleep schedule all week
  - No alarm = ideal; no snooze button = achievable
- Avoid evening napping

At the End of the Day…

- Know the effects of caffeine on your own body and understand what makes you tense or relaxed
- Develop routines, rituals, and a lifestyle that promote sleep
- Tailor your environment for high-quality sleep
- Take naps if you find them helpful (preferably early and short rather than late or long); skip them if you do not

At the End of the Day…

- "I'll sleep when I'm dead" is not a good motto to live by
  - Sleep has a multitude of important functions and health benefits, and is not wasted time
- Enjoy your sleep… and try not to let it become a source of stress!
- If you are having persistent sleep troubles, seek help

Recommended Resources

- From your local library or bookstore:
  - *Why We Sleep,* Matthew Walker, PhD
  - ***How To Sleep,* Rafael Pelayo, MD**
  - *Sleepyhead*, Henry Nicholls
- Online:
  - Google Scholar (to locate new research articles about sleep); simply search for “Google Scholar”
  - To access these talks: https://www.uvic.ca/medsci/people/instructors/gair-jane.php or search “Dr. Jane Gair”
  - National Institutes of Health (US) – https://www.nhlbi.nih.gov/health-topics/education-and-awareness/sleep-health
  - Bedroom poll: https://www.sleepfoundation.org/professionals/sleep-americar-polls/2013-international-bedroom-poll
  - American Sleep Association: https://www.sleepassociation.org/
  - Canadian Sleep Society: https://css-scs.ca/

Q&A

- Comments or questions about what you just heard? About the talk series?

- Please feel free to email any questions or feedback to uvicmms@gmail.com.

Upcoming Talks

- See your registration confirmation e-mail to access the registration form, or use the link:
- https://forms.gle/tAMb27gZunXL6gHk8

- [ ] Tuesday, May 18 - Exercise (Cardiovascular Health, Hypertension and Diabetes): 9.30 - 11.30 AM
- [ ] Thursday, May 20 - Vascular Disease: 9.30 - 11.30 AM
- [ ] Tuesday, May 25 - Exercise (Mental Health and Cancer): 9.30 - 11.30 AM
- [ ] Thursday, May 27 - Nature: 9.30 - 11.30 AM
- [ ] Tuesday, June 1 - Prehabilitation (Preparation for Surgery): 9.30 - 11.30 AM

Closing Remarks

- Thank you to Dr. Jane Gair, our supervisor for this activity, and to my classmates Julia De Pieri and Nicole Cameron who are delivering several of the talks in this series

- Thank you for attending today!