

Notes: Huberman Lab Podcast

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Abstract

This document is a collection of notes from the Huberman Lab podcast. The podcast deals with neuroscience and neuroscience-related tools. Neuroscience is the study of the brain and the nervous system and aims to understand the biological basis of learning, memory, behavior, perception, and consciousness. Do not consider these notes as medical advice. I recommend that you listen/watch the episodes on your own and only use these notes as supplementary material. Some ideas which are important might not appear here and some ideas which are mundane might get a lot of space. The notes are just a collection of things that were information to me and not a full-blown transcript.

Episode 1: How Your Nervous System Works & Changes

- Brain \subset Nervous System
- Brain \iff Spinal Cord \iff Body \iff Brain (my best attempt at drawing K_3). The Mobius Strip analogy
- The Black Stain
 - Changed understanding of structure of nervous system from complete fibrous unit to cellular theory
 - [The Black Stain That Changed Neuroscience - YouTube](#)
 - [The Neuron Doctrine \(1860-1895\) | The Embryo Project Encyclopedia \(asu.edu\)](#)
 - [A Deep Dive Into the Brain, Hand-Drawn by the Father of Neuroscience - The New York Times \(nytimes.com\)](#)
 - [The Nobel Prize in Physiology or Medicine 1906](#)
 - [Santiago Ramón y Cajal: Biography of a Great Thinker | History of Science - YouTube](#)
 - [Beautiful Brain: The Drawings of Santiago Ramon y Cajal: Swanson, Larry W., Newman, Eric, Araque, Alfonso, Dubinsky, Ms. Janet M.: 9781419722271: Amazon.com: Books](#)
 - [The Life and Scientific Times of Cajal: A Talk with Larry W. Swanson PhD - YouTube](#)
- Bullet wounds taking out specific parts of the nervous system upon entry and exit helped understand how different parts of the brain perform different activities almost mutually exclusively

Sensations are non-negotiable aspects of the nervous system

- Magnetic field-sensing turtles: [Longitude Perception and Bicoordinate Magnetic Maps in Sea Turtles: Current Biology \(cell.com\)](#)
- Perception = Sensation + Paying attention to the sensation

When we're rested, we're able to direct attention in very deliberate ways

- Neuromodulators bias which neurons are likely to be active vs. inactive.
- Discovery of antidepressants
- Emotions are somewhat reflexive, thoughts can be both reflexive and deliberate

Actions or behaviours are the only things that create a fossil (permanent) record of us

- Sherrington: Movement is the final pathway.
 - [The Nobel Prize in Physiology or Medicine 1932 - NobelPrize.org](#)

- [Sir Charles Sherrington's The integrative action of the nervous system: a centenary appreciation | Brain | Oxford Academic \(oup.com\)](#)
- What does it mean for the nervous system to do something deliberately? It means that we pay attention to DPO's:
 - Duration of work
 - Path
 - Outcome
- Impulsivity is a lack of top-down control over our actions (kids can't sit still/blurt things out etc.) *Is this good or bad?*
 - Removal of inhibition (via alcohol etc) also helps increase impulsivity
- While talking about neuroplasticity, we're mostly talking about adaptive plasticity.
- Easy to learn things in the age group 0-25 years. Get's harder after this, and requires effort.
- We can direct neural changes

Plasticity is gated by neuromodulators

- Neuroplasticity doesn't happen as we're learning, it always happens during sleep or non-sleep deep rest (Yoga-nidra)
- Sleep and Focus are equally important for neural changes
- The Autonomic Nervous System controls the handshake between sleep and focus
- Also important
 - How to sleep
 - When to sleep
- Ultradian Cycles

Episode 2: Master Your Sleep & Be More Alert When Awake

- Sleep: Unconscious state that helps us be more wakeful and focused.
- How do we get better at sleeping including falling asleep, sleeping better, and emerging from sleep feeling well rested.
- Adenosine builds up as we're awake, and creates a sleep hunger.
- Caffeine wakes people up, makes them more alert and acts as an adenosine antagonist (binds to the adenosine receptor)
 - Also leads to caffeine crashes
 - Caffeine increases dopamine and epinephrine
- Circadian rhythms govern sleep. When we sleep and for how long is mostly dependent on light
- Wake up around sun rise and the body releases a pulse of cortisol, adrenaline and epinephrine.
- Cortisol is also related to stress but there's a normal healthy rise of cortisol during the day
- A timer sets off when we wake indicating that, in 12-14 hours, melatonin should be released from the pineal gland.
 - Don't take melatonin except in rare cases as it suppresses the onset of puberty
 - Melatonin doesn't help to stay asleep, only to fall asleep
- The rhythm of cortisol and melatonin is endogenous (not governed by light)
- Wake up → light enters eye (retinal ganglion cells) → communicates it to a clock (suprachiasmatic nucleus) → connected to all cells in the body.
 - [Melanopsin-Containing Retinal Ganglion Cells: Architecture, Projections, and Intrinsic Photosensitivity \(nih.gov\)](#)
- The neurons are looking for sunlight at low solar angle. So WATCH THE SUNRISE.
- Very less correlation, but late shifted cortisol activation (8am, 9am or later) causes anxiety disorders and depressions.
- How long should we be outside in the mornings? Usually, 30-60 seconds is enough, but 2 to 10 minutes is the best.

Light is the primary zeitgeber

- Other things like food intake, exercises, and other drugs also help regulate sleep patterns.
- Intergeniculate leaflet helps regulate clock-output using non-photic influences.
- Exercise early in the day
- Getting sunlight around sunset can help protect negative effects of light later in the night.
- Only the cells in our eyes can perceive light and set clocks.

Snakes have holes in their head for light to go directly to the pineal

- Light isn't supposed to arrive in our system at all times.
- The longer we're awake, the more sensitive our retinal cells are to light
- So even a small amount of light from a screen or overhead light activates the clock and makes us feel like we should stay up longer
- [The Circadian Code: Lose Weight, Supercharge Your Energy, and Transform Your Health from Morning to Midnight: Panda PhD, Satchin: Amazon.com: Books](#)
- Have very little light after 8pm. No light at all between 11pm and 4am. Light suppresses dopamine and inhibits learning. The habenula (disappointment nucleus) in the thalamus is activated by light in that time.
 - [Light Affects Mood and Learning through Distinct Retina-Brain Pathways \(cell.com\)](#)
 - [Habenula - Wikipedia](#)
- Location of light
 - The retinal cells reside mostly in the bottom half of the retina, and view the upper visual field (inversion of visual image)
 - The cells were designed to detect sunlight (which is overhead)
 - To avoid improper activation of these neurons in the night, place lights low during the night. Soft warm lights are the best
 - Overhead fluorescent lights are the worst.
 - Candle lights are fine

Shift work and Jet Lag coming up in the future.

- Turning the lights on thirty to forty-five minutes before waking up makes people want to go to bed earlier.
- Naps: provided that they're less than one ultradian cycle (20 min, 30 min, 1 hour etc); can be very good
 - They're not necessary, but there's a dip in energy and alertness at around 2, 3, 4 in the afternoon.
- Some people wake up from naps feeling really groggy. This could probably be because they aren't sleeping well at night. So, they're drifting off to REM or deeper forms of sleep.

Yoga-nidra is a good substitute to napping. NSDR resets our ability to engage in DPOs

- Lot of people have trouble falling asleep because they have a lot of trouble calming down.
- We can all stay up, but we can't easily fall asleep.
- We need to use our body to control the mind.
- Supplements: Magnesium threonate helps with drowsiness. Also mentioned were theanine and apigenin.

A drug is a substance that when injected into a person, produces a scientific publication
-Edward G. Jones

- [Edward G. Jones obituary | School of Medicine | University of California, Irvine \(uci.edu\)](#)
- [Edward G Jones \(nature.com\)](#)

Episode 3: Using Science to Optimize Sleep, Learning & Metabolism

- Moonlight, fireplaces, fires and candles have very negligible effects on the circadian cycle.
- Viewing red light for a few minutes each *morning* can have positive effects on a particular retinal cell type that tends to degenerate with age.
 - The photoreceptor.
 - [Optically Improved Mitochondrial Function Redeems Aged Human Visual Decline | The Journals of Gerontology: Series A | Oxford Academic \(oup.com\)](#)
- Some days of the year are longer than the others. Every cell in our body adjusts itself according to day length even though our brain, body and cells don't know anything about day length. They only know about night length.
 - Light inhibits melatonin
 - If the days are longer, the total amount of melatonin is less and vice versa.
 - Thus, every cell in our body knows the time of the year by duration of the melatonin signal.
- In diurnal animals, the longer the melatonin signal, the more depressed (not necessarily clinically) our systems tend to be.
- Some people are very very strongly tied to the seasons.

Suicide rates tend to be highest in the spring, but that has to do with the aspects of suicide which is that oftentimes people will commit suicide not at the very depths of their energy levels, but as they're emerging from those depths.

- Melatonin is synthesized from serotonin. Serotonin is associated with well-being that comes from feelings of being calm and content.

Serotonin does not stimulate action, it tends to stimulate stillness.

- Epinephrin makes us feel like we have to move and when released in high amounts, leads to what we call stress.
- Epinephrin = Adrenaline except that the former is released by the brain and the latter by the adrenal glands.
- Voluntary wheel running by mice because they like looking at the wheel move in front of them
- Exercise buckets: 30 hours after waking, 3 hours after waking and 11 hours after waking helps to optimize performance and reduce injury.

There are good data to show that when you learn new spatial environments, there's a replay of those environments (place-cells) that fire in our brain in the same way they were fired when we were learning it while awake.

- [Replay of Learned Neural Firing Sequences during Rest in Human Motor Cortex \(cell.com\)](#)
- [Nootropic - Wikipedia](#): Not specific as to what cognitive algorithm it is trying to engage.
- [Frog Experiment \(terrificscience.org\)](#)
- [Temperature as a universal resetting cue for mammalian circadian oscillators \(nih.gov\)](#)

Temperature is the effector of the circadian rhythms.

- Cold-induced shiver can reduce body fat via brown fat increasing body temperature
- Fasting leads to states of alertness and vice versa
- Self-experimentation
 - Write down, each, when you went outside to get sunlight, and when you did that relative to waking.
 - Note meal times, note exercise times
 - If you did a NSDR, write that
 - Don't be neurotic about it, but after a while, patterns will emerge
 - Be a scientist of your own body.

Episode 4: Find Your Temperature Minimum to Defeat Jetlag, Shift Work & Sleeplessness

- 24 hour cycle of body temperature variation (all cells inherently know this via suprachiasmatic nucleus)
- When we stray too much away from diurnal to nocturnal, there are loads of negative consequences
- 100k LUX before 9 am is ideal (maybe 10 am). Use LightMeter app if you want to measure.
- Middle of the day is the circadian dead zone (which means we can't reset our circadian cycles even with sunlight)
- Study showed that 2 days of waking up with the sun and avoiding light at night reset melatonin and cortisol rhythms.
 - [Circadian Entrainment to the Natural Light-Dark Cycle across Seasons and the Weekend: Current Biology \(cell.com\)](#)
- Jetlag decreases the lifespan of humans. Travelling westward is easier than the other way
 - Humans are able to maintain alertness more than they are able to shut down and sleep. So going eastward requires us to sleep earlier while going westward just means we sleep later.
 - [Chronic jet-lag increases mortality in aged mice - PubMed \(nih.gov\)](#)
- Jet lag = Travel fatigue + time zone jet lag
- Temperature minimum is the point in every 24 hour cycle when temperature is minimum
 - The temperature signal rallies all the cells in our body to perform stuff.

The temperature minimum is the absolute reference point for shifting your circadian clock

- **Exposure to light, exercise and eating 0-4 hours after temperature minimum phase advances our clock and exposure to light, exercise and eating 0-4 hours before temperature minimum phase delays our clock.**
- Insomnia = feeling excessive sleepiness during the day
- Clock in liver?
 - [The circadian clock and liver function in health and disease - ScienceDirect](#)
- The pineal gland releases very small amounts of DMT, but it is so small that there are no effects.
- Melatonin inhibits gonadotropin-releasing hormone (which is a hormone released by the thalamus) which causes the inhibition of luteinizing hormone (a hormone that produces estrogen in ovaries and testosterone in Leydig cells)
 - Melatonin $\uparrow \Rightarrow$ GnRH $\downarrow \Rightarrow$ LH $\downarrow \Rightarrow$ Testosterone and Estrogen \downarrow
- [Intensive Care Unit Psychosis \(nih.gov\)](#)
- When body temperature is increasing, get light and when body temperature is decreasing, stay away from light.

Provided mistakes are not dangerous, lethal, etc., you certainly want to make a few mistakes and learn from them

- Babies can't really see very well
- The fastest rate of aging that any of us will ever undergo is puberty