

Huberman Lab: Essentials: How Your Brain Works & Changes



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This Essentials episode introduces how the nervous system creates sensations, perceptions, emotions, thoughts, and behaviors, as well as how we can change our nervous system — a phenomenon known as neuroplasticity.

About Dr. Andrew Huberman

American neuroscientist, professor at Stanford University, and host of the *Huberman Lab* podcast. His academic work focuses on brain development, function, and neuroplasticity, while his podcast translates complex science into actionable tools for everyday health and performance. He holds a PhD from UC Davis and conducted post-doctoral work at Stanford, where he has a lab and teaches medical students.

[What follows are quotes from the episode above. These quotes stood out to psychotherapist Emil Barna in his listening. They are not meant to be exhaustive nor representative of the entire episode. This resource must not

replace medical and/or other professional advice.]

"The **nervous system** includes your **brain** and your **spinal cord**, but also all the connections between your brain and your spinal cord and the organs of your body [... and] all the connections between your organs back to your spinal cord and brain."

"**Sensation** is a non-negotiable element of your nervous system. You have **neurons** in your eye that perceive certain colors of light and certain directions of *movement*. You have neurons in your skin that perceive particular kinds of *touch*, like light touch or firm touch or painful touch. You have neurons in your ears that perceive certain *sounds*. Your entire experience of life is filtered by these, what we call **sensory receptors**"

"Anyone that tells you you can't **multitask**, tell them they're wrong [...] in old world primates of which humans are, we are able to do what's called **covert attention**. We can place a spotlight of attention on something, for instance, something we're reading or looking at, or someone that we're listening to. And we can place a second spotlight of attention on something we're eating and how it tastes, or our child running around in the room, or my dog. You can split your attention into two locations, but of course you can also bring your attention, that is your perception to one particular location. You can dilate your attention, kind of like making a spotlight more diffuse, or you can make it more concentrated."

"there's a certain category of chemicals that has a very profound influence on our emotional states. They're called **neuromodulators**. And those neuromodulators have names that probably you've heard of before, things like **dopamine** and **serotonin** and **acetylcholine**, **epinephrine**."

"Neuromodulators are really interesting because they bias which neurons are likely to be active and which ones are likely to be inactive. A simple way to think about neuromodulators is they are sort of like playlists that you would have on any kind of device where you're going to play particular categories of music. So for instance, dopamine, which is often discussed as the molecule of reward or joy, is involved in reward and it does tend to create a sort of upbeat mood in when released in appropriate amounts in the brain. But the reason it does that is because it makes certain neurons and neural circuits, as we call them, more active and others less active. Okay, so serotonin, for instance, is a molecule that when released tends to make us feel really good with what we have, our sort of internal landscape and the resources that we have. Whereas dopamine, more than being a molecule of reward, is really more a molecule of motivation toward things that are outside us and that we want to pursue."

"**Thoughts** are really interesting because in many ways they're like perceptions, except that they draw on not just what's happening in the present, but also things we remember from the past and things that we anticipate about the

future. The other thing about thoughts that's really interesting is that thoughts can be both **reflexive**, they can just be occurring all the time, sort of like pop-up windows on a poorly filtered web browser, or they can be **deliberate**. We can decide to have a thought. And a lot of people don't understand or at least appreciate that the thought patterns and the neural circuits that underlie thoughts can actually be controlled in this deliberate way."

"if you want to understand **neuroplasticity**, you want to understand how to shape your behavior, how to shape your thinking, how to change how you're able to perform in any context, the most important thing to understand is that it requires top-down processing. It requires this feeling of agitation. In fact, I would say that agitation and strain is the entry point to neuroplasticity."

"Plasticity in the adult human nervous system is gated, meaning it is controlled by neuromodulators. These things that we talked about earlier, dopamine, serotonin, and one in particular called acetylcholine, are what open up plasticity."

"it's actually very easy to get neuroplasticity as an adult through traumatic or terrible or challenging experiences. But the important question is to say, why is that? And the reason that's the case is because when something very bad happens, there's the release of two sets of neuromodulators in the brain: epinephrine, which tends to make us feel alert and agitated, which is associated with most bad circumstances and acetylcholine, which tends to create a even more intense and focused perceptual spotlight."

[If the following is true, then it stands as a powerful argument towards the principles that undergird trauma reprocessing therapies: novelty and emotion. For example, if I were to combine elements of Clinical EFT with EMDR and IFS and Somatic Experiencing, I'll be highlighting a traumatic events through sensation (and encouraging the client to think about the most stressful part of that event through visualisation) while pairing it with another novel focus on the here-and-now. This creates a dual focus, centres attention, shifts mood through attenuation of SUD, and has the effect of rescripting the event in future. IFS can provide an avenue to provide deeper support once the affect is lower. This, again, goes back to what I've written about in other notes: principles are more important in therapy than mastery of any one particular treatment. I've made a case for this before, but this is yet another area where it makes sense.]

"you can think of epinephrine as creating this alertness and this kind of unbelievable level of increased attention compared to what you were experiencing before. And you can think of acetylcholine as being the molecule that highlights whatever it happens during that period of heightened alertness. So just to be clear, its epinephrine creates the alertness that's coming from a subset of neurons in the brainstem if you're interested. And acetylcholine coming from an area of the forebrain is tagging or marking the neurons that are

particularly active during this heightened level of alertness. Now that marks the cells, the neurons, and the synapses for strengthening, for becoming more likely to be active in the future, even without us thinking about it"

[Okay, now this is importantly ... If we're going to utilise trauma reprocessing techniques to accelerate recovery, then we'd better use the following interventions to make the changes concrete. NSDR is very important in this case and can be done in-session post-processing.]

"The dirty secret of neuroplasticity is that ***no neuroplasticity occurs during the thing you're trying to learn***. During the terrible event, during the great event, during the thing that you're really trying to shape and learn. And nothing is actually changing between the neurons that is going to last. ***All the neuroplasticity—the strengthening of the synapses, the addition in some cases of new nerve cells, or at least connections between nerve cells—all of that occurs at a very different phase of life, which is when we are in sleep and non-sleep deep rest***. And so neuroplasticity [...] depends on how much attention and focus one can continually bring to whatever it is they're trying to learn. So much so that agitation and a feeling of strain are actually required for this process of neuroplasticity to get triggered. But the actual rewiring occurs during periods of sleep and non-sleep deep rest [NSDR]."

"20 minutes of deep rest, this is not deep sleep, but essentially doing something very hard and very intense, and then taking 20 minutes afterward, immediately afterwards, to deliberately turn off the deliberate focused thinking and engagement, actually accelerated neuroplasticity."

[Clinically, it makes sense to pair a similar sound while processing to post-processing while doing NSDR to accentuate the effects, and then to encourage the person to listen to that sound later on for added effects. Granted, the study investigated tones ... but the principle behind this is what we're after. I like to use Brown Noise to pair with processing, or even EMDR bilateral tones.]

"if people are learning a particular skill, it could be a language skill or a motor skill, and they hear a tone just playing in the background, the tone is playing periodically through the background, like just a bell, in deep sleep, if that bell is played, learning is much faster for the thing that they were learning while they were awake. It somehow cues the nervous system in sleep, doesn't even have to be in dreaming, that something that happened in the waking phase was especially important, so much so that that bell is sort of a **Pavlovian cue**, it's sort of a reminder to the sleeping brain, *Oh, you need to remember what it is that you were learning at that particular time of day*—and the learning rates and the rates of retention, meaning how much people can remember from the thing they learned, are significantly higher under those conditions."

"you might want to interfere with certain aspects of brain states that are away

from the bad thing that happened, the brain states that happened the next day or the next month or the next year. And also I want to make sure that I pay attention to the fact that, for many of you, you're thinking about neuroplasticity, not just in changing your nervous system to add something new, but to also get rid of things that you don't like, right? That you want to forget bad experiences or at least remove the emotional contingency of a bad relationship or a bad relationship to some thing or some person or some event. Learning to fear certain things less, to eliminate a phobia, to erase a trauma. The memories themselves don't get erased. I'm sorry to say that the memories don't themselves get erased, but the emotional load of memories can be reduced."

[sympathetic = alert; parasympathetic = calm]

"sympathetic nervous system sounds like sympathy and then people think it's related to calm. I'm going to call it the **alertness system** and the **calmness system**, because even though sympathetic and parasympathetic are sometimes used, people really get confused. So the way to think about the **autonomic nervous system** and the reason it's important for every aspect of your life, but in particular for neuroplasticity and engaging in these focused states and in these de-focused states is that it works sort of like a seesaw."

[Circadian and Ultradian rhythms]

"Circadian means 'circa about a day'. So it's 24 hour rhythms because the earth spins once every 24 hours. Ultradian rhythms occur throughout the day and they require less time, they're shorter. The most important Ultradian rhythm for sake of this discussion is the 90 minute rhythm that we're going through all the time in our ability to attend and focus. And in sleep, our sleep is broken up into 90 minute segments. Early in the night, we have more phase one and phase two lighter sleep, and then we go into our deeper phase three and phase four sleep. And then we return to phase one, two, three, four. So all night you're going through these Ultradian rhythms"

"we are optimized for focus and attention within these 90 minute cycles, so that at the beginning of one of these 90 minute cycles, maybe you sit down to learn something new or to engage in some new challenging behavior.

For the first five or 10 minutes of one of those cycles, it's well known that the brain and the neural circuits and the neuromodulators are not going to be optimally tuned to whatever it is you're trying to do. But as you drop deeper into that 90 minute cycle, your ability to focus and to engage in this DPO process and to direct neural plasticity and to learn is actually much greater. And then you eventually pop out of that at the end of the 90 minute cycle."

"some people are very good learners early in the day and not so good in the afternoon. So you can start to explore this process even without any information about the underlying neurochemicals by simply paying attention,

not just to when you go to sleep and when you wake up each morning, how deep or how shallow your sleep felt to you subjectively, but also throughout the day when your brain tends to be most anxious, because it turns out that has a correlate related to perception"

These notes were collected by psychotherapist and author Emil Barna in 2025 in his efforts to assist with professional development and further education for himself and those who read them. You can find out more about Emil by visiting www.barnacc.com