Huberman Lab: Essentials: Breathing for Mental & Physical Health & Performance | Dr. Jack Feldman

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About Dr. Andrew Huberman

American neuroscientist, professor at Stanford University, and host of the popular *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.

About Dr. Jack Feldman

World leader in understanding how the brain controls breathing. In a landmark discovery, he identified a small region of the brain stem, which he named the preBötzinger Complex, as essential for generating breathing rhythm in fetal, neonatal and adult mammals.

[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. All quotes are to be read in this context and must not replace medical and/or other professional advice.]

[Unless otherwise stated, all quotes below are Feldman's]

"there are differences between **nasal and mouth breathing**. At rest, the tendency is to do nasal breathing because the air flows that are necessary for normal breathing is easily managed by passing through the nasal cavities. However, when your ventilation needs to increase, like during exercise, you need to move more air, you do that through your mouth because the airways are much larger than and therefore you can move much more air."

"the principal muscle is the **diaphragm**, which is sitting inside the body just below the lung, and when you want to inhale, you basically contract the diaphragm and it pulls it down. And as it pulls it down, it's inserting pressure forces on the lung, the lung wants to expand."

[Mouth breathing cf. nasal breathing]
"Clearly there are differences between nasal and mouth breathing. At rest, the tendency is to do nasal breathing because the air flows that are necessary for normal breathing is easily managed by passing through the nasal cavities. However, when your ventilation needs to increase, like during exercise, you need to move more air, you do that through your mouth because the airways are much larger than and therefore you can move much more air. But at the level of the **intercostals** and the **diaphragm**, their **contraction** is almost agnostic to whether or not the nose and mouth are open."

"a key step in the ability to develop a large brain that has a continuous demand for **oxygen** is the diaphragm. Without a diaphragm, you're an amphibian."

"In the context of things like **breath practice**, I'm a bit agnostic about the effects of some of the different patterns of breathing. Clearly, some are going to work through different mechanisms, and we can talk about that, but at a certain level, for example, whether it's primarily diaphragm where you move your abdomen or not, I am agnostic about it. I think that the changes that breathing induces in emotion and cognition, I have different ideas about what the influence is, and I don't see that primarily as which particular muscles you're choosing, but that just could be my own prejudice."

[Physiological sighs]
"It turns out we sigh about every five minutes, and I would encourage anyone who finds that to be an unbelievable fact, is to lie down in a quiet room and just breathe normally, just relax, just let go, and just pay attention to your breathing, and you'll find that every couple of minutes, you're taking a deep breath and you can't stop it. You know, it just happens. Now, why? Well, we have to go back to the lung again. The lung has these 500 million-hour VLI, and they're

very tiny. They're 200 microns across, so they're really, really tiny. And you can think of them as fluid-filled, but they're fluid-lined, and the reason they're fluid-lined has to do with the esoterica of the mechanics of that. It makes it a little easier to stretch them with this fluid line, which is called surfactant. Your **alveoli** have a tendency to collapse. There's 500 million of them. They're not collapsing at a very high rate, but it's a flow rate that's not trivial. And when an alveolus collapses, it no longer can receive **oxygen** or take **carbon dioxide** out. It's sort of taken out of the equation. Now if you have 500 million of them and you lose 10, no big deal. But if they keep collapsing, you can lose a significant part of the surface area of your lung. Now ***a normal breath is not enough to pop them open. But if you take a deep breath through nose or mouth, it doesn't matter. It's just increased that lung volume because you're just pulling on the lungs, they'll pop open about every five minutes. And so we're doing it every five minutes in order to maintain the health of our lung***."

"when we're talking about breathing affecting emotional cognitive state, it's not simply coming from **pre-Butzinger**. There are several other sites. Let me sort of discuss, I need to sort of go to that. One is **olfaction**. So when you're breathing, normal breathing, you're inhaling and exhaling. This is creating signals coming from the **nasomucosa** that is going back into the **olfactory bulb**, that's respiratory modulated. And the olfactory bulb has a profound influence and projections through many parts of the brain. So there's a signal arising from this rhythmic moving of air in and out of the nose, that's going into the brain that has contained in it a respiratory modulation. Another potential source is the **vagus nerve**. The vagus nerve is a major nerve, which is containing **afferents** from all of the **viscera**. (Signals from the viscera.) It also has signals coming from the **brain stem** down, which are called **efferents**, but it's getting major signals from the lung, from the gut, and this is going up into the brain stem. So it's there. There are very powerful receptors in the lung. They're responding to the expansion and relaxation in the lung. And so if you record from the vagus nerve, you'll see that there's a huge respiratory modulation due to the mechanical changes in the lung. Now, why that is of interest is that for some forms of refractory depression, ***electrical stimulation of the vagus nerve can provide tremendous relief***. Why this is the case still remains to be determined, but it's clear that ***signals in the vagus nerve, at least artificial signals in the vagus nerve, can have a positive effect on reducing depression***. So, it's not a leap to think that under normal circumstances, that that rhythm coming in from the vagus nerve is playing a role in normal processing."

Huberman: "What are some of the other features of our brain and body, be it blinking or eye movements or ability to encode sounds or any features of the way that we function and move and perceive things that are coordinated with breathing in some interesting way?"

"Almost everything. So we have, for example, on the autonomic side, we have

respiratory sinus arrhythmia. That is, during expiration, the heart slows down. Your pupils oscillate with the respiratory cycle. Your fear response. Let's take something like depression. You can envision depression as activity sort of going around in a circuit. And because it's continuous in the nervous system, as signals keep repeating, they tend to get stronger. And they can get so strong, you can't break them. And I mean, all of us get depressed at some point. But if it's not continuous, it's not the long last thing, we're able to break it. Well, there are extreme measures to break it. [...] We could do **electric-combulsive shock**. We shock the whole brain. That's disrupting activity in the whole brain. And when the circuit starts to get back together again, it's been disruptive. And we know that ***the brain, when signals get disrupted a little bit, we can weaken the connections. And weakening the connections, if it's that in the circuit involved in depression, we may get some relief***. If an electroconvulsive shock does work for relieving many kinds of depression, focal deep brain stimulation does the same thing, but more localized or transcranial stimulation. You're disrupting a network. And while it's getting back together, it may weaken some of the connections. If breathing is playing some role in this circuit, and now ***instead of doing like a one second shock, I do 30 minutes of disruption by doing slow breathing or other breathing practice, those circuits begin to break down a little bit, and I get some relief. And if I continue to do it before the circuit can then build back up again, I gradually can wear that circuit down***."

"I find I get tremendous benefit by relatively short periods between five and maybe 20 minutes of doing **box breathing**. It's very simple to do."

These notes were collected by psychotherapist and author Emil Barna 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