

## How to Stop Headaches Using Science-Based Approaches | Huberman Lab Podcast

In this episode, I discuss the causes and treatments of different types of headaches, including tension headaches, migraines, sinus and cluster headaches, as well as menstrual and other hormone-based headaches. I describe how to distinguish between the different headache types and how to select the right treatment, including prescription-based and non-prescription-based treatments, behavioral and nutrition-based approaches. I also explain the evidence and mechanisms supporting the use of omega-3 fatty acids, high dose creatine, peppermint oil, turmeric, acupuncture and more. Additionally, I touch on traumatic brain injury, the causes of photophobia, aura, and the link between spicy foods and thunderclap headaches. By the end of this episode, listeners and viewers will have a comprehensive understanding of headaches, their types and the best way to prevent and stop them.

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Welcome to the Huberman Lab podcast, where we discuss science and science-based tools for everyday life, I'm Andrew Huberman and I'm a professor of neurobiology and Ophthalmology at Stanford school of medicine. Today we are discussing headaches. Headaches are something that everybody will suffer at some point in their lifetime. Of course, some people suffer from headaches, far more often than others, and for many people, headaches can be incredibly debilitating, limiting their ability to work, to socialize, to sleep, to exercise essentially to live life. In any kind of normal way, as we'll soon discuss, there are many different kinds of headache. We have migraine headaches, tension headaches, cluster headaches today I will review all the different types of headaches and what the underlying biology of each and every one of those types of headaches is as well as, fortunately, the many excellent treatments that exist for the different types of Headache, in fact, what we'll soon discuss is that by understanding which type of headache you have and a little bit about the underlying biology of each different type of headache, it becomes quite straightforward to select the best treatment options for you to, for instance, provide relief from Frequent and recurring tension headaches, cluster headaches, even sinus headaches, the sorts of

headaches that are associated with sinus infections and colds, where the sinuses get clogged up, and you experience headache. So while today's episode focuses on all aspects and types of headaches, it will have tremendous relevance for everybody. So for those of you that experience headache every once in a while, where only when you're sick or have a sinus headache or for those of you that suffer from debilitating migraines, today's conversation actually has a bit of optimism woven into it, meaning there are excellent treatments For each and every one of the different types of headaches - and I was quite impressed and excited to learn when researching this episode - that the treatments for headache range from, of course, prescription drug treatments and over-the-counter medications of the sort of type that most of us have Heard about ibuprofen, acetaminophen and so forth, so-called anti-inflammatory drugs. But it turns out, there are many natural treatments for headaches that when compared to those over-the-counter drugs and even some prescription, drugs appear to be easily as effective and in many cases more effective than the typical drug treatments, many of which can carry side effects. That is the drug treatments carry side effects, whereas the natural treatments appear to not carry side effects. Now, of course, anytime we have a discussion about natural treatments. There are likely to be some eye rolls out there and people thinking. Oh, you know this is going to be a bunch of woo science well far from it as you'll, soon learn today, each and every one of the treatments for each and every one of the different kinds of headaches is grounded in solid biological understanding of why that Particular treatment ought to work and does work so, for instance, you'll learn that some headache arises because of muscular pain. Other headache arises because of excessive vasodilation. The arteries and blood vessels get bigger and wider, and so there's a pressure and a swelling within the cranium that people experience as a headache, and it turns out that many of the more natural treatments out there can address either the muscular pain issue or the vasodilation Issue or other issues and underlying mechanisms for headache so again, while headaches are very intrusive, irritating and in some cases debilitating there is certainly light at the end of this tunnel, meaning by the end of today's episode. Each and every one of you will have an array of excellent treatment options that you can choose from in order to address and provide relief from any of the different types of headache. Before we begin I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford, it is, however, part of my desire and effort to bring zero cost to Consumer information about science and science related tools to the general

00:03:51 Sponsors: Thesis, LMNT, Maui Nui, Momentous

public in keeping with that theme I'd like to thank the sponsors of today's podcast our first sponsor is thesis thesis makes custom nootropics and as many of you know I'm not a fan of the word nootropics because nootropics means smart drugs and as a neuroscientist I can tell you there is no neural circuit in the brain for being smart thesis understands this and has designed different nootropics in order to bring your brain into specific States for specific types of work so for instance for Creative work or to engage with more Focus or to give you more energy for cognitive or physical work so with thesis they'll design custom nootropics for you that will allow you more focus better task switching more creativity and so on and they'll be sure to include only the ingredients that you want and not the ingredients that you don't I've been using thesis for more than a year now and I can confidently say that their nootropics have been a total game changer for me I like the clarity formula prior to Long bouts of cognitive work or the Energy Formula prior to physical workouts if you'd like to try your own personalized nootropic starter kit go online to [takethesis.com](https://takethesis.com) Huberman you'll take a brief three-minute quiz and thesis will send you four different formulas to try on your first month again That's [takethesis.com](https://takethesis.com) Huberman and use the code Huber minute checkout for 10 off your first box today's episode is also brought To Us by element element is an electrolyte drink that has everything you need and nothing you don't that means the exact ratios of electrolytes are an element and those are sodium magnesium and potassium but it has no sugar I've talked many times before on this podcast about the key role of hydration and electrolytes for nerve cell function neuron function as well as the function of all the cells and all the tissues and organ systems of the body if we have sodium magnesium and potassium present in the proper ratios all of those cells function properly and all our bodily systems can be optimized if the electrolytes are not present and if hydration is low we simply can't think as well as we would otherwise our mood is off hormone systems go off our ability to get into physical action to engage in endurance and strength and all sorts of other things is diminished so with element you can make sure that you're staying on top of your hydration and that you're getting the proper ratios of electrolytes if you'd like to try element you can go to [drink element](https://drink.element.com) That's [lmnt.com](https://lmnt.com) Huberman and you'll get a free element sample pack with your purchase they're all delicious so again if you want to try element you can go to [element.com](https://element.com) Huberman today's episode is also brought To Us by Maui Nui which I can confidently say is the most nutrient dense and delicious red meat available Maui Nui spent nearly a decade

building a USDA certified wild harvesting system to help balance invasive deer populations on the island of Maui I've talked before more on this podcast and we've had guests on this podcast that have emphasized the critical role of getting quality protein not just for muscle repair and protein synthesis but also for repair of all tissues including brain tissue on a day-to-day basis and the general rule of thumb for that is one gram of quality protein per pound of body weight per day with Maui Nui meats you can accomplish that very easily and you can do that without ingesting in excess of calories which is also critical for immediate and long-term health I should say that Maui Nui meats are not only extremely high quality but they are also delicious I particularly like they're jerky so they're venison jerky I also have had Maui Nui venison in various recipes including ground venison some venison steaks and I love the taste of the venison it's lean but it doesn't taste overly lean or dry at all it's incredibly delicious so if you'd like to try Maui Nui venison go to [mauinuyvenison.com](http://mauinuyvenison.com) Huberman to get 20 off your first order again That's Maui News [venison.com](http://venison.com) to get 20 off your first order the Huberman Lab podcast is now partnered with momentous supplements to find the supplements we discuss on the Huberman Lab podcast you can go to [live.momentous.com](http://live.momentous.com) spelled out live [momentous.com](http://momentous.com) Huberman and I should just mention that the library of those supplements is

00:07:47 Headache Sources: Muscle Tension; Blood Flow & Meninges

Constantly expanding again, That's [livemomentis.com](http://livemomentis.com) Huberman, let's talk about headaches and as we are soon going to learn, there are different types of headaches and different types of headaches arise from changes in different types of tissues in the head area and indeed in the neck area as well. Now, one of the key things to understand is that if you want relief from a headache you need to understand which tissue is mainly involved in creating that type of headache. So, for instance, many people suffer from what are called tension headaches now. Tension headaches are a little bit of a misnomer, because many people might think oh tension, I'm under a lot of tension and stress, and therefore I get tension headaches and indeed stress can cause tension headaches, but tension. Headaches are really the sort of headache that you feel around the top part of the head, not the very top but sort of where you would put a headband so above the eyes and around the head. It doesn't have to be experienced all the way around the head, but the main underlying reason, that is the tissue system that mainly underlies tension. Headaches is the muscular system. There are a lot of muscles on the skull Believe It or Not, of course, on the neck, and they allow you to move

your neck and head. There are a lot of muscles that lie parallel to the skull and oftentimes. Those muscles will undergo excessive amounts of constriction. Now there are, of course, muscles and the jaw that can also lead to headache and jaw ache, and things of that sort and neck aches and headaches. So what we're really pointing out here is that the muscles are a key player in the formation of different types of headache, Tension, Headache in particular, but of course muscles and muscle tension can be evolved in the other types of headaches as well. Okay, so I just want to highlight muscular issues as one particular source of the ache in headaches, the other tissue that can be prominently involved in generating the ache of a headache or the so-called meninges. Now the meninges, in addition to being a fun word to say, or a bunch of tissues, that line the outside of the brain and reside between the brain and the skull. So you might think okay between the brain and the skull, there's probably just a little bit of fluid and the brain is right up next to the skull, but it turns out. That's not the case. The brain is actually encased in a very thick, very durable, Sac or casing. That's wrapped around it tight like Saran wrap. It actually has a name which is dura d-u-r-a, and so you can remember, Dura, durable and, having done some surgeries, many surgeries before on brains of different types, ranging from Human, even though I'm not a neurosurgeon as a clinician ranging from Human to other types of species. What you find is that the dura is exceedingly durable. Getting through this thing really requires an a very sharp razor blade, so the brain is actually sitting in a very fibrous like Sac that you simply could not open up with your fingertips under any conditions. It's really durable, the meninges are in that general area and also encasing the brain and the meninges provide an additional buffer between the brain and the dura and the skull. So again you don't want to think about the brain as just sitting right next to the skull. It's close by, but there are a bunch of other thin fibrous tissues, many of which are very thin and fragile and others of which such as the dura that are very, very strong, because they're very fibrous, almost like a uh if you've ever felt, for instance, the Sale of a of a sailboat, you might think. Oh it's just this big flapping sheet in the wind. It is anything but a sheet in the Wind. It is a very, very strong and durable material. Now the proximity of the dura and the meninges to the brain and the fact that everything is wrapped very tightly together and the fact that there's a lot of vasculature, so that would be arteries. Blood vessels and capillaries are all in that area. On the top of the brain and throughout the brain, the fact that all of that is in very close proximity and wrapped really tight in this very durable sac is one of the reasons why, when blood vessels or arteries or both become dilated, they open. There creates a pressure between the brain and those tissues and because there isn't much distance between the tissues like the dura and the meninges and the skull there's also pressure that allows for the brain to literally sneak up, or I should say, give the impression that your Brain is expanding up against your skull, so the point here is that, while muscular

tension can give rise to headache, the other thing that can give rise to headache is so-called vasodilation, the expansion or the widening of the arteries, blood vessels and capillaries, and one of the Reasons why that gives rise to headache is because there's simply not a lot of space for that expansion to go. It doesn't allow anything, except for the brain, to push up against that very durable tissue and that very durable tissue to push up against the skull and even though the brain itself doesn't have pain receptors, That's right. The brain itself doesn't have pain receptors. That is why a neurosurgeon can take off a piece of skull and can probe around in the brain with an electrode, and the person is completely unaware and in order to get through the skull, of course, that little skin flap has to be removed from the Skull - and that requires a little bit of topical anesthetic, but really you don't need any anesthetic to go into the brain itself, because there aren't pain receptors on the brain itself. However, the tissues surrounding the brain, such as the dura the meninges and the vasculature that then reaches up, believe it or not into the skull. The vasculature doesn't actually stop right beneath the skull it actually blood vessels it get into the skull and they're actually portals by which blood can move within the skull itself. Well, what that means is that, since all of the tissues are very close by and very compact, with respect to one another, any increase in the size of the portals that allow movement of blood there and the fact that there are what are called nociceptors noci nociceptors. These are essentially pain receptors because of the presence of pain receptors in the tissues around the brain. When there's an increase in the size of those vascular portals the arteries capillaries and vessels, we experience that as intense pain and pressure. And fortunately there are excellent treatments for dealing with that intense pain and pressure. But keep in mind that the intense pain and pressure, that is the consequence of vasodilation, that is the widening of these different vascular portals, is very different than the type of pain

#### 00:14:06 Headache Sources: Neurons; Inflammation & Sinus Headache

That arises from muscular tension, as is the case with Tension, Headache. Okay, so now we have two sources of pain. That is the ache in headache, and there are two more that we need to think about in trying to better understand the different types of headaches that we'll discuss and in terms of trying to understand which are going to be the best treatments for the different types Of headaches and those are neural and inflammatory responses, so let's talk about the neural type. First, there is a type of headache that many people unfortunately suffer from we'll get into this in a bunch more detail in a moment, but those are called cluster headaches. Cluster headaches are headaches that arise not from the surface. People don't

experience them as kind of a tightening of the forehead and the neck and the jaw. But rather it feels as if the headache is coming from deep within the head and in particular from behind the orbit of one or the other eyes, and sometimes both eyes for those of you that have ever experienced cluster headaches. They are extremely painful, even the more where I should say, the relatively more minor cluster headaches are extremely painful and the severe ones are exceedingly painful. Cluster headaches arise from Deep where this we get the Sensation that they are rising from deep within our head, as opposed from the surface inward, because they are neural in origin and there's a particular nerve pathway called the trigeminal nerve. That often is the origin of these cluster headaches that people experience behind the eye. The trigeminal, as the name suggests, has three branches: try, Okay, so there's a branch that essentially extends to the eye, there's also a branch that extends to the mandible right to the uh. To the lip and there's a branch that extends more or less to the to the nasal area, and so this trigeminal nerve becomes inflamed or in other ways, is hyper activated in some cases and that causes the Deep pain below the eye. Because it is that first branch of the trigeminal nerve, which is the ophthalmic branch which tends to be activated first, so people start feeling as if there's a pain behind their eye, in particular on one side, oftentimes, there's lacrimation, which is tearing up there, can be some Nasal discharge, another common symptom of this type of headache - that is the cluster headache, is that the pupil sometimes will become very small, the pupils of the eyes and they won't dilate even in darkness. So there are a bunch of things that are going on on one or both sides of the face that seem to arise from deep within the head or it's almost as if it's coming from the brain outward and That's because it's neural in origin. Okay, so we've got muscular origins of headaches. We've got meningeal origins of headaches, that is the the stuff around the brain and as it relates to the vasculature, and we have neural origins of headaches and, of course, there's inflammation origins of headaches. Now. Inflammation is a term that gets thrown around a lot these days. People are talking about. You know this reduces inflammation inflammation is bad and - and I I suppose in some cases and when inflammation is really widespread across the brainer body, it's bad, but I don't think any of us should think about inflammation per se as bad. What I mean is inflammation is just one form of signaling in the body which of course includes the brain. Inflammation of a tissue is one way in which a set of cells, so these could be, for instance, uh cells of the immune system, and we cover this. In a detailed episode all about the immune system, if you'd like to check that out, you go to Hubermanlab.com just put into our search function, immune system, and you can find that episode by the way all of our episodes are searchable by keyword, Hubermanlab.com and it'll. Take you to specific episodes and time stamps for the topics you're interested in so for sake of this discussion about headache. Inflammation is going to be the case when one particular tissue in and

around the head area is releasing molecules cytokines, which sometimes are called inflammatory cytokines, but there are also non-inflammatory or anti-inflammatory cytokines, but inflammatory molecules that are signaling to the rest of the body. Hey there's something going on here: there's either some intrusive object, and indeed, if you were to get you know a bb or a splinter into a particular uh. You know skin area there'd be a lot of inflammation, so it could be the introduction of a foreign physical object into an area that will cause inflammation. It can be the presence of some sort of local toxin in that area. It could be a more systemic inflammation. Nonetheless, inflammation in the neck and head area, where, frankly anywhere within the sinus area, so this would include the mouth, the nose around the eyes, because the sinuses many of us think of sinuses as just our nose. But actually, if I were to show you a skull. A human skull or any other kind of skull you'd be very hopefully intrigued to learn that the skull is just not one big piece of solid bone or a you know, a top with a jaw below it. It actually has all these small what are called fenestrations little holes and canals that run through the skull and through the depth of the skull like little tubes. You've got them down here on your mandible. You've got them above your lips. You have them um on either sides of your nose. Those are the sinuses. The sinuses allow the passage of different fluids through the skull, because the skull, even though it's bone, it's not a dead tissue right in a live person or animal. The skull is a very active living tissue. Indeed, all bone is active, living tissue and it needs to be nourished with blood. It needs to be nourished with cerebral spinal fluid. In the case of the skull, it needs to be nourished with all sorts of important things. So those sinuses oftentimes can become clogged, as is in the case with sinus headache which we'll talk about in a little bit, but more generally anytime, there's inflammation of one given area of the body, so it could be a shoulder. It could be the neck. It could be the mouth, it could be the nose or in the case of the headache it could be any portion of the head or neck. What happens is inflammation while it's a very efficient signal, it's much like the siren on an ambulance or a police car, and that it sends out a very broad signal. That's very clear. Something is wrong here and needs to be dealt with. It's not very specific. So it's very robust, but it's not very specific. So, for instance, if there's a little bacterial infection or a little viral infection, the inflammation response to that site of infection tends to be far more widespread than the actual site of infection. It's a little bit different when you have a foreign object there like a splinter or some other foreign object, that tends to be a bit more localized and the immune system is always trying to limit the the extent of inflammation by putting in different scar tissues. Indeed, a lot of the things that we think of as kind of gross, you know pustules and boils, and things like that, I know it's. A gross topic are ways in which our body tries to restrict the amount of inflammation, but the face area and the head itself are so heavily infused with blood vessels and there's a constant perfusion, as we

say, of blood and cerebral, spinal, fluid and other things through. This incredibly metabolically active tissue that we call our brain and our eyes. Those are by far the most metabolically active tissues in our entire body. Even if we're running hundreds of miles in Ultra marathons, your brain is still far more metabolically demanding than all the muscles of your body combined, no matter what the conditions, because of that there tends to be a generalization or a spreading out of any inflammatory response, and That inflammatory response, then can trigger the pain mechanisms or what we've experience as pain mechanisms in the other three types of tissues that we talked about. So, for instance, if you have a systemic infection or you're experiencing inflammation of any kind, and it has anything to do with or encroaches on the face or head area that can easily and almost always spills over into activation of nerve cells can give rise to neural. Based headache or to the meninges and can give rise to meningeal, headaches and, of course, to the muscles and to muscular type headaches. So we've got muscular origins of the ache in headache. We have meningeal origins of the achin headache. We have neural origins of the aching headache and we have inflammation-based origins of the ache in headache and that pertains to all the different types of headaches that we're going to talk about. And it's important to keep in mind that there are these different sources of the ache and headache and that sometimes they exist alone, and sometimes they exist in combination. However, this isn't important, however, all pain or, I should say all experience of pain as a perception is going to be neural in origin. When we experience pain, whether or not it's a pin prick or a cut stub our toe, we trip and fall or a headache. It is neural in origin, it is the nervous system and nerve cells that are going to carry that signal that we perceive as pain. So as we talk about the different sources of pain and different types of headache, we will also talk about. Of course, I think what most people are interested in today's discussion, the different treatments for the different types of headache, and why? Each of those different treatments work, but by understanding a little bit about how pain arises in the nervous system and certainly by understanding the different types of headaches. You know what is a tension headache. I gave you some impression that it's running around your head, like a headband in many cases, versus cluster headache, which starts deep below the eye. Often it feels as if it's emerging from deep in the brain versus migraine, which we'll get into in a moment by understanding the different types of headaches. You should be able to quickly pinpoint what type of headache you have what types of tissues are likely involved and therefore, what types

Of treatments are going to most quickly and most completely relieve that type of headache. Okay, so for the next three to five minutes - and I promise no more I'm going to explain how pain arises at the level of nerve cells - and I suppose this is one of those times when, if I had a highlighter pen that could go out and across The the microphones and speakers leading to your ears - I would use it here because what I'm about to tell you is perhaps one of the most important things to understand about your nervous system. That is your brain and you, which is that while you have trillions of neurons - and we hear that you have trillions and different types of neurons in your brain and they come in different shapes and sizes and do different things and some make dopamine and some make Serotonin and so make glutamate, and on and on the key distinction among different types of neurons. That is the three types of neurons that I believe everybody scientists are. No everybody should understand exist are some neurons nerve cells are what we call motor neurons in the sense that they control the contraction of muscles, sometimes for walking other neurons control. The movements of your fingers, scientists call those digits other ones, your toes. They also control the beating of your heart, although That's a slightly different mechanism and slightly different type of tissue than is involved in generating motor movements of your limbs. These are neurons that we call motor neurons because their goal or their purpose - I should say they - don't really know what their their goal or purpose is, but what they do is they make sure that muscles contract, so that certain things happen in your body like your Heart beats, or you move your limbs, you lift your eyelids or your eyebrows rather and so on and so forth. Other types of neurons are what we call Sensory neurons. They communicate the same way that motor neurons do that. Is they fire? What we call Action? Potentials which are just electrical signals they release neurotransmitters like any other neuron, but they respond to certain events in the environment or the environment within the body, but they are not responsible for generating muscular contractions. So we call these Sensory neurons. Some Sensory, neurons sense, light touch. Other Sensory, neurons sense, firm touch, other sensory, neurons, sense, pain, other Sensory, neurons sense light brushing on the skin. In fact, you have Sensory neurons, believe it or not. That respond specifically to the light, brushing of a hand across your skin, any region of your body, and if that particular region of your body happens to have hair on it and you stroke the skin in the direction that the hairs lay down. We experience that as pleasurable, whereas, if you stroke in the direction opposite to the the way the hairs lay down, we experience that as not pleasurable, so these Sensory neurons respond in some cases, for instance, within the auditory system. They respond to sound waves and your eye. They respond to photons of light, sometimes photons of light of particular wavelengths that we think of as red, green, blue and so on. Sensory neurons, don't

move muscles, they respond to things in the environment and they exist within us. So we have Sensory neurons that sense, for instance, pressure within our head or pressure within our gut how full or empty our gut is pain within our tissues, like our liver or or any kind of other internal organ. So we've got motor neurons, Sensory, neurons and then the last kind of neuron is what we call modulatory neurons. These are the ones that adjust the relationship between the sensory neurons and the motor neurons to determine whether or not we do anything in response to a sensory input. That is whether or not if a sensory, neuron fires sends it electrical potential, whether or not it will generate a motor change. Let me give you a very simple example of this, so for those of you listening I'll, just explain what I'm doing and for those of you watching you'll be able to see. I'M holding my hand out in front of me if I were to touch the top of my hand with my fingertip I can deliberately override that is. I can modulate that more typical reflex, which is that, when something touches us, if we're not aware of where it's coming from, we typically move away from that thing. That touches this is a very natural response, but we can decide we're not going to move away. We can decide to stay still or we can decide to move toward the thing that touches us, but typically, if you were to walk up to somebody and you were to touch them, they'd either turn toward you on the side that you touch them or they'd, step Away, it's rare that they're going to step into you, but you could decide that you were not going to move away or you could step into the direction of touch and That's because you have modulatory neurons that can adjust the conversation in a very context-dependent way. As to whether or not the sensory neuron will cause motor neurons to contract or not, okay, so we've got motor neuron, Sensory, neurons and modulatory neurons and you're, probably thinking by now. Why are we talking about this? I thought we were talking about headache. I thought we're going to talk about treatments for headache, but this turns out to be very important because you could imagine - and in a moment I'll explain how. Let'S say you have tension headaches, you're, somebody that has the classic symptoms of tension. Headache. Let me tell you what those are. These are headaches again that occur more or less on on the in a kind of a headband like fashion, or they tend to start there and exist around that. These are very common. They can arise from a number of different sources rise from sleep deprivation. They can rise from excessive use of caffeine. Intake we'll talk about why that is, they can arise from stress. They can arise from very low level, viral infections or bacterial infections, but we experience these as just as headaches, where you've been thinking too hard or working too hard or life has been stressful. They'Re often also associated with jaw pain and jaw, tightness and neck tightness, so tension headaches everything you'd imagine muscular tension could cause. Well. If you want to treat tension headache, you can imagine that, because all headache is neural, that you'd want to go after some sort of neural mechanism to treat them. But of course we now

know that there are three types of neurons. There are motor neurons, Sensory, neurons and modulatory neurons, so we have choices, we can say. Okay, do we want to turn off the muscles in the head jaw and neck that are hyper contracted? For instance, you want to take a muscle, relaxer or relaxedant, or would you want to try and change the sensory input itself? Maybe don't change the way the muscles are behaving but shut off the sensory part of it, your ability to sense it. There are certainly ways you can do that, or would you want to adjust the modulatory neurons? Would you want to make it such that you have the headache, but you don't perceive the headache that is you cut off communication between the sensor and the motor so that the muscles relax turns out? There are treatments and approaches for each and every one of those. Each and every one of those has different advantages and disadvantages, but, as you can quickly see, we are going to have different types of headaches and different approaches to treating headache. But if you keep in the back of your mind that you have neurons that contract muscles to create movement or tension of muscles, remember you can turn off those neurons and allow those muscles to relax. You have Sensory neurons that sense, input and actually sense the pain and you have modulatory neurons, which can allow you to adjust the relationship between the sensory neurons and the motor neurons and, of course, some of you are probably screaming at me by now saying wait. Why would you ever want to deal with the motor neurons or or the modulatory neurons once you want to just go straight to the source and just cut off the pain? Ah well, the problem there is that many painkillers have other issues as well. In particular, they can be sedative. Many of them can be habit forming or even addictive, and for many people, not all but many people they don't want to take drugs. Whether or not they're, over-the-counter or prescription drugs or even more natural supplement based type treatments, and they would rather use, for instance, a behavioral approach in which they can modulate. They can deliberately turn off the communication between Sensory

### 00:31:05 Tension Headaches

Neurons and motor neurons and turns out those approaches exist as well. Okay, so at this point I promise you that I'm not going to give you any more of a biology lesson in terms of pain, sensing and headaches as a more uh conceptual phenomenon. Instead, what I'd like to do next is talk about the different types of headaches, and I think this is something That's very important and not often discussed, except for those people out there that, unfortunately suffer repeatedly from certain kinds of headaches like migraine or cluster or tension. Headache, but I think for most people out there who experience headache and again, that is

everybody at some point - experiences headache rather than just think of headache, as one thing understanding the major types of headache and how they differ from and are similar to one another will Really help you identify what the best source of treatments for those are. So I'd like to talk about what the different types of headache are now. The first type of headache we're going to discuss is the tension, type headache again. Tension type headaches tend to start off, not always, but tend to start off as more or less a Halo or a headband around the forehead in the area above the eyes often also include the jaw the neck muscles and can extend even into the upper back again. This can be caused by some low level of infection, but more often than not tension type headaches are going to come on because of some chronic psychological stress, usually combined with lack of sleep, usually combined with lifestyle issues and, of course, without getting into a long discussion About it, anytime, you have lack of sleep you're going to have excessive stress anytime. You have excessive stress, you're, going to have to make sure you're offsetting that by getting proper sleep, most people don't when they're under excessive stress. By the way we have excellent tools. We're grounded in excellent science available to you at zero cost. If you are experienced chronic stress or even short-term stress, we have a master stress episode of the human Lab podcast again just go to Hubermanlab.com and all That's time stamped for you. Tension type headaches begin in a more or less a headband pattern, but can really extend to other tissues as well, not so often in the face, but really the head and often will start to climb up toward the top of the head. They are not always in this Halo pattern. Sometimes they can be localized to one area such as the you know, the back of the head or the front of the head or one side of the head more than others, and That's often the case because of tension.

00:33:25 AG1 (Athletic Greens)

within muscles of the neck that tend to bias the ache towards one side of the head I'd like to take a quick break and acknowledge one of our sponsors athletic greens athletic greens now called ag-1 is a vitamin mineral probiotic drink that covers all of your foundational nutritional needs I've been taking athletic green since 2012 so I'm delighted that they're sponsoring the podcast the reason I started taking athletic greens and the reason I still take athletic greens once or usually twice a day is that it gets to be the probiotics that I need for gut health our gut is very important it's populated by gut microbiota that communicate with the brain in the immune system and basically all the biological systems of our body to strongly impact our immediate and long-term health and those probiotics and athletic greens are optimal and vital for microbiotic health in

addition athletic greens contains a number of adaptogens vitamins and minerals that make sure that all of my foundational nutritional needs are met and it tastes great if you'd like to try athletic greens you can go to [athleticgreens.com](https://athleticgreens.com) Huberman and they'll give you five free travel packs that make it really easy to mix up athletic

00:34:29 Migraine Headaches, Aura, Photophobia

Greens, while you're on the road in the car on the plane, Etc and they'll, give you a year's supply of vitamin d3k2 again, That's [athleticgreens.com](https://athleticgreens.com) Huberman to get the five free travel packs and the year supply of vitamin D3 K2. The other type of headache. That, unfortunately, is very common is migraine, headaches, migraine. Headaches are defined generally as disorders of recurring attacks of headaches, so people who get migraines often get them in a recurring fashion. Some people get them very often other people get them less often, but migraines are very debilitating. The numbers that is the prevalence of migraine is still pretty debated. One thing that we know for sure is that females suffer from migraine headaches, at a rate at least threefold higher than do males, and surprisingly, this does not seem to have any direct hormonal origin, because we're also going to talk about hormonal headaches. That is headaches that relate to a dip in estrogen and progesterone, a particular phase of the menstrual cycle. That is the ovulatory cycle. So there's a bit of a mystery here and the Mystery is: why is it that migraine headaches occur at such greater frequency in females? Even independently of the menstrual cycle, so when you control for changes in hormones, that still appears to be the case and overall migraines are very common. Now the numbers on migraine, and just how common migraine is, are extremely wide. This was a little bit frustrating for me in researching this episode. You will find, for instance, that 17 of women suffer from migraines. You will also hear that six percent of males suffer from migraines. You will also hear that 43 43 percent of females suffer from migraine. That is recurring headaches that qualify as migraine headaches and that 17 percent of men suffer from migraine headaches on a recurring basis, which is again the definition of a migraine, headache or one of the key definitions. So all we can say for sure is that many many millions of people, maybe even billions of people, suffer from migraine headaches, it's kind of a staggering thing to contemplate, but we know it's extremely common and we know that it's more prevalent in females in any of The studies that you will find in terms of that compare the overall prevalence of headache. It's going to be higher substantially higher in females and males does not seem to be related to the ovulatory menstrual cycle. There are some interesting facts related to that that I'll, just you know, touch on for a moment, pregnancy, for whatever

reason seems to be protective against migraine headaches, that is, women who suffer from recurring migraines before they get pregnant when they get pregnant and often after they give birth they experience fewer migraine headaches, so there may be something hormonal. It may be something else. What do we know for sure? We know that headache that is, the ache in headache is neural. So whether or not the origins are hormonal or whether or not the origins are inflammation or gut microbiome or some other feature of the body brain axis at this point, all we know is that neural pain or the experience of pain at the neural level is the final common pathway and it's more prevalent in females, so, as I mentioned, migraines tend to be recurring, so some people get them once a week. Some people get them once a month. Some people get them far more frequently that they can be extremely debilitating. Oftentimes people experience migraine because it is a recurring phenomenon will know when a migraine is coming on. They'll say my migraine is coming on the kind of sense it coming. There's this notion of Aura and we'll talk about Aura in a little bit. Some people think of Aura just as visual aura or the sense of kind of a haloing of light, with the sense that there's something outside the body. The actual definition of Aura is that it's the experience that something is about to happen. It's this kind of feeling of anticipation. It's not *deja vu*, *deja vu* is different and very interesting in its own right, but different. It's this feeling that something's about to happen and the fact that aura is such a prominent feature of migraine, headaches or at least that people feel that the headache is coming on long before they feel the actual ache of the headache and the other debilitating symptoms suggests that migraine has something of deep neural origin that it arises from deep within the nervous system, spinal cord and brain, and that it's not something like a tension. Headache that is going from outside in you know the constriction of the muscles in the jaw and head so migraine. Headaches are very different than tension headaches, even in terms of how they come on or their onset. The other feature of migraine - headaches that I think is important to note - is that dilation of the vessels remember the vasodilation, so the widening of those pipes that we call arteries vessels and capillaries is a very prominent feature of migraine and fortunately that allows for very particular types of treatment and ways of dealing with this pain specific to migraine headaches. The other feature that's common in migraine. Headaches is so-called photophobia. Many of you are probably familiar with photophobia if you've ever been sleep deprived simply if you're sleep deprived and you go outside in the morning, the light is going to seem very, very bright much brighter than were you to have had a really good night's sleep, and that's because during sleep there are all sorts of reset mechanisms in the brain, there's the washing out of metabolic debris and things in the brain, the so-called lymphatic washout. That's essential, there's also an adjustment of the neural tissue of the eyes which, as many of you have heard me, say before actually two pieces of rain that have been

extruded from the cranial Vault. So your eyes, yes, indeed, are two pieces of brain. The only two pieces of brain outside the cranial Vault and within your eyes, you have neurons and mechanisms that adjust the the sort of sensitivity of your eyes to light and of your brain to light. And when you are sleep deprived or when you have a low-level viral infection or a cold or a flu of any kind, you tend to experience light as brighter than it actually is when you're rested or you're in the healthy state. So photophobia is something That's very. Very common in migraine, and often the photophobia, is a prominent feature of the experience that a migraine is coming on. People will start saying: oh you know it's just too bright in here and normally they'd be able to tolerate that level of sunlight or of indoor lighting with no problem. So there are two aspects of migraine that I think are particularly important to understand. For sake of of the treatment and That's the dilation of vessels, so we if we want to treat migraine, we're going to have to think about things that can constrict blood vessels in the brain area. But we also need to think about photophobia, not photophobia, just as a symptom of migraine, but that maybe by adjusting our sensitivity to light, we can actually short-circuit some of the onset and subsequent pathology of the migraine. That is if we can prevent photophobia partially or completely, can actually offset a lot of the ache of the migraine that would otherwise occur. So That's an exciting Avenue for addressing migraine, headaches, we'll get into photophobia and how to deal with that. We'll also talk about Aura. A little bit more in a few minutes, but for the time being, we've talked about tension headaches. We've now talked about migraine, headaches again, keep in mind. Knowing what kind of headache you have is essential, it's, I would say indispensable for selecting the best treatment. Many people out there will simply get a headache and decide. Oh I'm going to pop a couple of aspirin okay. What does aspirin do? Aspirin'S and anti-inflammatory? It also has pronounced effects on the vasodilation and vasoconstriction system. It actually allows more blood to flow through those arteries vessels and capillaries. A lot of people actually use baby, aspirin or small amounts of aspirin as a way to offset cardiovascular disease. That's another discussion, but what do we know? We know that in migraine, there's a hyper dilation of the blood vessels, a hyper dilation of the very little portals that exist in the brain and around the brain and that are going to cause the pain you're going to activate those Sensory neurons, those non-iceceptors that will Then give us the experience of extreme headache and migraine so taking an aspirin or something like it for migraine. In some cases, the worst possible Choice again. So knowing what kind of headache you are experiencing is going to be essential here. The other thing that you'll sometimes hear is that drinking a cup of coffee or getting caffeine through tea is a great way to deal with headache. Why would that be? Well, it turns out that coffee can cause either vasoconstriction or vasodilation, depending on when you take it and we'll get into the use of caffeine as a treatment for headache, because

indeed it can be a very potent treatment for headache. But you absolutely need to know what kind of headache you are experiencing, because in some cases, drinking caffeine, whether it's in tea or coffee, can absolutely alleviate the pain of a headache. Especially if you catch that onset of a migraine or attention type headache early on. But in some cases it can make it far far worse again, knowing which

### 00:43:10 Cluster Headaches

Type of headache you're experiencing and how the different treatments work is key. Okay, so we have tension, type, headaches, migraine type headaches I think you're starting to get the picture. They have different underlying biologies. The next type of headache is cluster headaches. Cluster headaches are the ones I mentioned earlier that arise from deep within the head. They feel as if they're coming from the inside out and they tend to be on one side or the other. What scientists and clinicians call unilateral and tends to originate behind the eye, and sometimes the nose region, sometimes in the mouth region as well. It feels kind of patchy, but as if it's coming from the inside out and again, That's because of that trigeminal nerve. For those of you listening and not watching this on YouTube, I've got three fingers as if I'm putting up three fingers and I'm I've got one pointed toward my eye. One pointed towards my nose region and one towards my upper lip. The trigeminal nerve is an easy one to remember, and it will completely explain cluster headaches and what to do about cluster headaches in a moment, if you remember that the herpes one virus and not herpes, two, not genital herpes, but herpes one virus is the one that Gives cold sores on the mouth herpes one virus by the way is exceedingly common up to 90 percent of people. Many children in fact have these again. This is not a sexually transmitted herpes, although it can be, of course, transmitted through kissing and sexual contact, but That's not the only origin of it. Okay, it can be passed by skin contact and mucosal contact, um, so mucosomucosal, so that would be kissing, mucosa, lying or even skin to mucosal Linings. That's why it's so common and the reason why cold sores develop on the mouth for people that have herpes one is because the virus actually lives on the trigeminal nerve. And yes, it is true that sometimes the virus will inflame the nerve and the inflammation will occur at the level of the eye, so people do unfortunately, sometimes get herpes of the eye. It actually can be quite dangerous if you have an infection of the eye of a herpes infection in the eye, you should see an ophthalmologist or the nose region. They can experience pain in the mucosal tissue of the nose. More often than not. The most inflammation is occurring on the the branch that innervates the lip or the region close to the lip, and That's why a cold sword develops there.

An immune response there signaling that there's inflammation due to the herpes virus which lives on that neuron for a very long time, neurons, don't turn over in the lifespan, so it can live on there for the extent of of the person's life. However, most people hopefully treat their HSV-1, but if they don't the the sort of frequency and the severity of infections tends to taper off with time. We'll have an entire discussion about viruses and herpes, in particular, in a future episode. But the thing to keep in mind here is that this very nerve is the one that gets inflamed in these cluster type headaches now. Cluster type headaches are associated with a bunch of very uncomfortable symptoms. Again they tend to be unilateral. They tend to begin very deep and they tend to be excruciatingly, painful, excruciatingly painful. They can last anywhere from 30 minutes to three hours. Some people experience these in sleep. In fact, this is one of the cases where men experience a headache more than females men experience, cluster type, headaches that have a sudden onset during sleep at five times the frequency than do females. The origins of that aren't exactly clear. They do seem to have something to do with the biological clock mechanisms, the so-called circadian mechanisms. So if you are a man or woman for that matter and you're waking up in the middle of the night with a unilateral headache - and it seems like it's deep within your um within your head or it's starting there and it's on one side and localized to The eye - and maybe these other regions, the trigeminal, is involved in you - may be suffering from cluster type headache, and you should talk to your physician. The other symptom, That's quite common in cluster type. Headache is a droopy eyelid, which should make sense because the trigeminal innervates the eye region - and there are other nerves that control the eyelid but they're in that General region, and they can be impacted. The other thing is something called meiosis, which is that you can't dilate the pupil I mentioned this before, so those your pupils might get really really small and they won't dilate and the other thing is lacrimation tearing and then nasal discharge all because of a neural inflammation Problem, why do I tell you with such detail about cluster headaches? Well, if you are somebody That's experiencing the kind of pain that is consistent with cluster headache, taking a standard anti-inflammatory or doing something that is going to adjust the vial. The excuse me, the dilation or constriction of blood vessels - may have an indirect impact on cluster headache, but is unlikely to relieve cluster headache, either acutely, meaning right away or in preventing cluster headaches. You have to deal with this as a neural issue and we'll talk about some of the main causes of inflammation and activation of these cluster type headaches at the level of the trigeminal

00:47:47 Hormone-Based Headaches, Menstrual Cycle & Menopause

Nerve in a little bit, because fortunately there are some excellent treatments. The next type of headache that is quite common, are hormonal headaches. Now the phrase hormonal headache should already cue you to the fact that it's far too general a term because there's so many different hormones. Testosterone, estrogen thyroid hormone growth hormone and on and on and on, and they all have many different functions in the brain and body every single hormone and in particular the so-called steroid hormones steroids, again, not just limited to things that people take for Sports. In fact, the steroid hormones refers to estrogen testosterone of the sort that we all make that men and women make naturally and those steroid hormones can impact gene expression. They can are, of course, what turns on the growth of the of the breast tissue of the testicular tissue of the hair growth and on and on, and That's all because of gene expression. If you're really going to change the identity and function of a cell, long term, right, you're going to literally change the breast tissue or change the penile tissue or change the ovarian tissue in some sort of consistent way across the lifespan, you can bet that there are Changes in gene expression and those changes in gene expression occur because these steroid hormones have this incredible ability sort of like the X-Men of hormones to pass through the outer membrane of a cell, which we call the extracellular membrane and into the so-called nuclear membrane. They can go into the area where genes are made and turn on and off different genes. However, they multitask in their life - that is, these steroid hormones like estrogen in particular, and testosterone in particular, can also bind to the surface of cells and impact all sorts of things at the level of the cells that have nothing to do with changes in gene expression And that second mechanism of binding to the surface of cells is one of the ways in which estrogen can control different aspects of headache. Now that doesn't necessarily mean the estrogen gives you headaches. In fact, it's just the opposite. It turns out that low estrogen and another hormone low progesterone combine to give rise to headache because of the ways that low estrogen and low progesterone impact, vasodilation and vasoconstriction, and the inflammatory response we'll talk about how to deal with hormone-based headaches. A particular hormone was headaches that occur because of low estrogen and progesterone in a moment, but the key thing to know is something that we covered in the fertility episode. I did a very long, very detailed episode on fertility, so I'm not going going to go into this in significant detail. Now you can refer to that episode for probably more detail than you ever wanted, but also a lot of tools as it relates to fertility in both males and females. But right now, I'm just going to give you a course overview of that in about 60 to 120 seconds, so that you'll understand when hormonal headaches are most likely to take place. Keep in mind that hormonal headaches are most likely to take place when estrogen and progesterone are lowest. So if you understand that during the follicular stage of the ovulatory slash menstrual cycle, okay, so

menstrual cycle is about 28 days on average, not in everyone. But it's about 20 days on average and the first half of that estrogen starts creeping up up up up up up up up up and as we learn in endocrinology, estrogen, primes progesterone, so estrogen will then Peak and then start to fall pretty quickly right about The time that the egg ovulates an egg is released and will essentially be ready for fertilization if the egg is fertilized a whole bunch of other things happen as it relates to pregnancy. If not, what ends up happening is that during the luteal phase, which is the second half of the menstrual cycle, there's been a buildup of the lining of the uterus because of an increase in progesterone. So estrogen goes up during the follicular phase, then it goes down and then progesterone goes up up up up up which is important for generating that thick lining of the uterus to allow the fertilized egg if it's fertilized to implant and if it's not fertilized. All of that gets released from the body in this bleeding process that we call menstruation if menstruation occurs and day, one of the menstrual cycle is considered the first day in which bleeding occurs. Well, then, what that means is that estrogen is already low, because remember, estrogen was low at the start of the follicular phase and went up up up up up up. Then it comes down right at the time of ovulation and progesterone goes up up up up up during the luteal phase. In fact, it's more than a thousand fold increase in progesterone, but if there's no fertilization of the egg progesterone starts coming down down down down down. What does that mean? That means that, on the first to about the fourth or fifth day of the menstrual cycle, first being the first day of bleeding until about the fourth or fifth day of the menstrual cycle, both estrogen and progesterone are very, very low. And it is at that time at the very beginning of the menstrual cycle, so about the first week of the menstrual cycle that many women are very prone to hormonal headaches hormonal headaches, not because estrogens High. That's a common misconception rather because estrogen and progesterone are both low, and now that you understand the Contour or the underlying reasons for hormonal headache, you can start to ask well what happens when estrogen is low. Well, estrogen has a strong impact on the vasodilation vasoconstriction system, as does progesterone we'll talk about that a little bit later, but now that you know what hormonal headache is at least this one particular type of hormonal headache, which is very, very common. Given the number of women that are menstruating and the fact that low estrogen low progesterone is the cause of the hormonal headache and the fact that, of course, there are women who are no longer menstruating, so they're, either in perimenopause and menstruation, is becoming more infrequent or They'Re in menopause and it deceased entirely. Well now you understand what the origin of the hormonal headache is, and so all we need to know is what do estrogen and progesterone normally do in order to prevent headache and thereby you'll know exactly how to offset. That is prevent or

## 00:53:38 Traumatic Brain Injury (TBI) & Headache, Baseline Health

Treat hormonal headache in that first week of the menstrual period, the last type of headache that I'd like to discuss is headache associated with head hits. That is traumatic, brain injury, although I definitely want to underscore the fact that even people who do not have traumatic brain injury can experience headaches as the consequence of hitting their head. So the line between traumatic, brain injury and lower level brain injury is one that still seeks definition. In fact, this is one of the major goals of the clinical field as it relates to concussion. You know it's also. What comes up a lot during the discussion about football? You know these days, you'll see players hit really hard and depending on whether or not they're laying there for five seconds 30 seconds or three minutes, you know the crowd and the uh. The people watching on television and everywhere else are all speculating as to whether or not the person should be allowed to play and to be quite direct. There really is no way to assess the extent of brain damage after the consequence of hitting one's head or having one's head hit, because, first of all, almost all of the best ways to detect traumatic brain injury, except the most severe ones, tend to require a lot of very large equipment like MRI and functional MRI and CT scans, none of which are available on the side of the field or in the locker room, but also because many many, if not most, of the effects of traumatic brain injury are going to occur. Not in the immediate minutes, or even hours after the injury, but several hours days or even weeks after that injury, this is a discussion that we should hold off for a longer full episode on traumatic, brain injury, keeping in mind, of course, that football is this very Salient example of traumatic, brain injury and concussion, as is boxing as is even soccer with heading of the ball, Believe It or Not, repeated low level impact to the forehead and other parts of the head can give rise to over time. Traumatic brain injury without the need for any kind of full-blown, concussion or being quote unquote knocked out, but sports related concussion actually occupies just a tiny fraction of the majority of traumatic, brain injury and concussion, most traumatic, brain injury and concussion, and low-level brain injury. That can accumulate over time to become traumatic for sake of daily living. That is lowered, cognition disruption and mood, sleep, Etc is actually the consequence of things other than Sports. So, for instance, bicycle accidents, playground, accidents, construction accidents and this is often forgotten for some reason. All the sports, in particular football, tend to grab all the attention, as it relates to concussion. Keep in mind that, while for certain people is a path to a living for most people, traumatic, brain injury is going to occur in a car accident, construction, work or other types of work for which people generally don't have many options. In terms of the type of work that they're doing so, they are prone to concussions and head injuries simply by virtue of their work. Without any, you know millions

of dollars, contracts or the opportunities necessarily some cases they do, but necessarily to do other things, and certainly car accidents or bike bicycle accidents are not voluntary events, so the point being traumatic, brain injury and headache related traumatic, brain injury extends far Beyond the realm of sports, and in fact, if you were to look at the numbers, what you find is that more than 90 percent of traumatic brain injury, so people coming into the hospital or clinic are people claiming that they've got consistent, headaches, they're, not sleeping well, Their mood is off they're, feeling more irritable after having hit their head. Even once is not the consequence of sports. It's going to be the consequence of accidents either on at the workplace or in terms of a bicycle or other sorts of Transportation. Based accident, like a car accident, with that in mind, any kind of head hit certainly involves a concussion or traumatic. Brain injury often leads to headaches either infrequent but severe headaches or chronic low-level headaches or a feeling, there's kind of a stuffiness or a fullness to the head. There can be a lot of different Origins to that. A common origin is going to be actual swelling of the, not necessarily the brain tissue directly. But if you recall our discussion about the meninges, which include the dura and the other tissues that surround the brain, they're, actually three layers, that we call the meninges the durages being one of them and there's a very little space between those, the brain, the meninges that Surround it and the skull, it's called the subarachnoid space, very cool right arachnoid, like spider. Well, if there's even a slight bit of swelling in the brain or even distant brain tissue. So, for instance, even if the there's Whiplash so there's swelling of the tissue, muscular tissue and neural tissue in the neck area that can constrict the flow of things like cerebral, spinal, fluid blood flow and indeed mucus and other other things that are essential. We all hear mucus and we think Illness but mucus is a vital, vital substance within the body for a lot of important reasons in health as well as in sickness. Well, if there's less of that liquid and other fluids and mucus being delivered to that space, well, then it can clog up so sort of the plumbing is clogged up or that it's caught at the level of the site of hit or injury, because there's some local Swelling and inflammation there, so there are many different mechanisms that can underlie headache associated with head hits or traumatic brain injury. Now, fortunately, there are some recent data pointing to some what I would call non-obvious treatments for headache in traumatic, brain injury, keeping in mind that anytime we're talking about injury or disease or health for that matter, mental health or physical health. We have to highlight a fact: That's going to come up again and again in every single episode of this podcast and I think it's not being overly redundant to do so, which is that regular, sufficient amounts of deep sleep each night are going to be important for All aspects of mental health, physical health and performance, and have been shown over and over again to reduce the frequency of headache and to reduce the time to repair after traumatic, brain injury and can improve cognition and on and

on and on. So sleep is essential for all the normal things that encourage healthy activity of the different tissues that are involved in brain and body to occur. So sleep deprivation, of course, is going to limit those. But I do want to point out that sleep, sunlight and I've talked about this almost ad nauseam on this podcast, but regular circadian Cycles getting sunlight in your eyes early in the day and in the evening as well and as much as possible throughout the day. Without burning your skin and limiting your exposure to artificial lights at night and on and on, all of which is covered in the light for health episode of The Huberman Lab podcast, the master sleep episode, The Huberman Lab podcast and in the perfect your sleep episode, The Huberman Lab podcast. You can find all that at Hubermanlab.com getting light and avoiding light at the proper times of the 24 hour cycle is also going to favor all the pathways, ranging from gut brain access to the inflammatory anti-inflammatory Pathways neural Pathways, Etc. That, of course, if you do that, you're going to improve and offset any kind of detriment caused by traumatic brain injury, is it treating traumatic brain injury directly? No, but is not getting sufficient sleep, not getting sunlight at the right times of day and getting too much artificial light at night going to make any impact of traumatic brain injury, including headache far worse. Yes, there are certainly a ton of data to support that state statement as well, and then, of course, nutrition and exercise are also important, so we can list out sleep, Sun, proper nutrition exercise and I would put a proper social connection whatever. That means to you, healthy social connections, include romantic friendship, familial and relationship to self those five things - sleep exercise, Sun, nutrition and social connection - are all critical for maintaining baselines of health and raising your baselines of health, and I mentioned that I can segment this out now, Because I think that anytime, we're about to start discussing, pointed treatments that is things that you can take or do to reduce headache or things that you can take or do to improve anything within mental health, physical health and performance. We have to remember that the foundation of mental health, physical health and performance is only set at its highest level by tending to those other things, and that nothing really surpasses any of those things or put differently. There'S no replacement for any of those things in the form of a pill, a powder even a behavioral practice. There are things you can do to offset getting less than ideal sleep, the things that you can use like bright, artificial lights during the day to try and partially offset lack of sunlight. But really there is no exercise pill. There is no sunlight device, although some bright lights are very bright, there's no, no replace basement for actual sunlight, there's, no replacement for actual sleep, there's no replacement for actual nutrition, and I

01:02:08 Tool: Headache Treatment, Creatine Monohydrate & TBI

Do feel it's an important conversation to have as we head into the next segment, which is what can you take or do to reduce headache and in order to address this, we're going to start first with the headaches associated with head hits and traumatic brain injury because Turns out, there's a surprising and very useful approach to doing that, but this same approach also can help offset and treat headache in other conditions as well, meaning not just for headaches caused by traumatic brain injury, but also headaches caused by sudden onset Tension, Headache or migraine. Headache, or even perhaps again, perhaps, cluster type headaches. So the first substance that I'd like to highlight that has been shown to significantly reduce the intensity and or frequency of headaches is creatine. Now creatine, as many of you know, is something that people supplement and take. Most often creatine is discussed in the context of muscle performance, not just for people who weightlift but for people who do endurance exercise, and it's often been said that 5 to 10 grams per day of creatine monohydrate. Depending on how much you weigh 5 to 10 grams per day of creatine, monohydrate can increase, creatine phosphate stores in muscles can bring more water into muscles, can make you stronger, get increased power output, and that is all true. That is all completely true. We discussed this in the Huberman lab podcast with Dr Andy Galpin when he was a guest on the Hebrew and Lab podcast or standard series, and we discussed this extensively in an upcoming episode from Dr Andy Galpin in his special six-part guest Series, where he is a Guest on the Hebrew Lab podcast, but where really he's the one doing the majority of the teaching that series covers everything from strength, hypertrophy endurance and there's an episode on supplementation, where we go deep into the discussion about creatine. Now, in that discussion and again now, we highlight the fact that creatine, While most often discussed online and in the media as a supplement for sports performance, for the reasons I just mentioned, actually has far more data behind it. That is laboratory studies, exploring the role of creatine in the clinical setting. So I'd like to highlight a paper from that literature now that will make very clear as to why creatine is interesting and in fact, very effective for treating headache and particular headache caused by head, hits or traumatic brain injury. The title of the paper is prevention of traumatic headache, dizziness and fatigue with creatine Administration. Now keep in mind. This is a pilot study. It was performed in humans, so when you hear the words pre-clinical that is, if you hear there was a pre-clinical study on blank. That means almost always that the study was performed on animal models, mice, rats, primates, Etc. A clinical trial is something That's carried out on humans, and a pilot study means that the study was carried out on humans, but on a fairly small cohort, a very fairly small group, uh or limited number of subjects. Nonetheless, if the data are robust, as it is in this case of this paper, I think it's worth paying attention to so in

this study, what they looked at was creatine Administration, so what they did is they had people ingest a certain amount of creatine I'll. Tell you in a moment in fluid, so it could be taken in water. Milk with or without food doesn't really matter what time of day they had people take creatine. Why would they have people take creatine after traumatic brain injury and in particular for people that are suffering from headache, dizziness, fatigue, Etc? The reason is that neurons nerve cells rely very heavily on the regulation of calcium in order to generate those Action potentials to communicate with one another. So it doesn't matter if it's a motor neuron, a sensory neuron or a modulatory neuron. They all generate Action potentials or something similar to it and calcium is important for that process. Calcium becomes dysregulated after traumatic brain injury in a number of different ways, in particular in ways that impact the energy production systems of cells that are related to ATP adenosine triphosphate. For those facionados out there that want to look it up, you can simply look up calcium, ATP and neurons, and you can learn about that cycle. Creatine can be stored in muscles, as we talked about before, but creatine and, in particular, the phosphorylated form of creatine, which is the readily available fuel source form of creatine, can also be stored in brain tissue and is actually quite prominently stored in the forebrain. The area where the real estate of of your brain, just behind the forehead, which is involved in planning and action and understanding context. So it's very important for cognition. It's important for personality too, but it's important for a number of different aspects of life that have to do with making plans being able to focus very intensely on your work, etc or on anything for that matter. All functions that become heavily disrupted in people who have traumatic, brain injury and concussion creatine's ability to communicate with the calcium in the ATP system was the motivation behind the study. That is the authors hypothesize on the basis of pre-clinical data in animals, that by increasing creatine stores within the brain, not just in the muscle, but in particular within the brain that the availability of creatine would allow for better cognitive function in general. Now they didn't look at cognition specifically in this paper, but they did look at the other aspects. That is that the bad stuff associated with TBI and they had people supplement with creatine at a level that is much higher than the typical level that people supplement with creatine Simply for Sports Performance. So, as I mentioned before, most people, if they supplement with creatine for sports performance, they take creatine monohydrate, typically five grams per day, sometimes 10 grams per day, if they're about 100 kilograms or or greater in body weight, 100 kilograms is 200 approximately 220. pounds. So the dosage that was used for supplementing creatine in this study to address the potential impact of creatine on headache, dizziness and fatigue, was quite a bit higher than the dosages used simply for muscle performance. In this study they had people take a dose of 0.4 grams of creatine monohydrate per kilogram of body weight so for somebody that weighs

100 kilograms or 220 pounds that would be 40 grams of creatine per day. If someone weighs half that much, they would take 20 grams of creatine per day, and they did that over a period of six months. And we know that when you take creatine over and over day to day that there's a buildup of creatine stores, both in the muscles and within the brain tissue, now what they found as a consequence of this creatine Administration was really striking and, I think quite exciting. They found a very significant decrease in the frequency of headache in people that were supplementing with creatine, as opposed to the controls. Now keep in mind that this is a pilot study, but the effects are very dramatic. They found a very statistically significant decrease increase in the frequency of headache in people that were taking creatine. In fact, if you look at the controls - and you see that they're basically getting headache at a frequency of 90 percent or more after TBI, the reduction in headache frequency is down to about 10 or 12 percent in the people taking creatine. So That's quite quite a dramatic effect and if you look at the other measures, they took keep in mind again. This is a pilot study, so a limited number of subjects. But again the results are very impressive. What they found is that the number of people experiencing dizziness was significantly reduced in people supplementing with creatine, as was the number of people experiencing fatigue and acute fatigue and chronic fatigue again, not chronic fatigue syndrome per se, but chronic fatigue, which was in this study, defined. As a general sense of bodily weakness and even mental weakness, mental weakness is a little bit hard to quantify, but they were very careful to distinguish between cognitive and mental fatigue versus physical and somatic fatigue. They acknowledge that both of those occur in TBI or post-tbi. The headache is quite frequent. Basically, the takeaway of the study is that for people experiencing headache, dizziness and fatigue due to TBI and perhaps - and I want to underline - perhaps because it hasn't really been explored yet, but perhaps headache dizziness and fatigue due to other conditions, symptoms or causes of headache. Creatine monohydrate supplementation might be again might be an excellent candidate for people to try. Why do we say that? Well, first of all, creatine monohydrate is relatively inexpensive. It's considered safe at the dosages used in this study and certainly for sports performance as well, and there are very few other compounds that have been shown to have as significant an impact on headache over the long term, as has creatine monohydrate. In these studies of people. With TBI, it's also important to highlight the fact that many many people suffer from tbis I mentioned earlier and as now there are very few treatments for TBI. You tend to get the basic advice coming back and again, I think it's excellent advice, you know, get proper amounts of sleep, get exercise but don't get another traumatic brain injury. That's obvious, but you'd be surprised how many people go right back to work because they have to, and you know we have to be sympathetic to the fact that many people just can't stop working or

go on disability. So many people have to go back to work. That could be sport or it could be other kind of work where they are then subject to perhaps getting more TBI, maybe they're getting less rest as a consequence - and stress obviously stress is a confounding issue for TBI, but sleep exercise: Sun nutrition. All of those things proper social connection are what people are encouraged to do when they have TBI, but there have been very few compounds, in particular, very few: over-the-counter compounds that are known to be safe, that have shown efficacy in dealing with TBI. So I think that, while this is a pilot study - and we can consider it preliminary - I think it's important enough and the effects were dramatic enough - that people with headache and in particular people with TBI, ought to consider supplementing with creatine in order to deal with their Headaches and of course, I eagerly await other studies, exploring the role of this high dosage of creatine, which is a relatively high dosage of creatine monohydrate for offsetting headache. Meanwhile, I think there are a number of people out there suffering from headache who might consider using creatine monohydrate in an exploratory fashion and seeing whether or not it helps offset their headaches, keep in mind, of course, anytime you're going to add or remove anything supplement or Otherwise, from your from your treatment, your nutrition Etc, I do suggest that you consult with your physician in particular, if you have

01:12:22 InsideTracker

chronic headaches I don't say that to protect me I say that of course to protect you I'd like to take a brief break and thank our sponsor inside tracker inside tracker is a personalized nutrition platform that analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals I've long been a believer in getting regular blood work done for the simple reason that many of the factors that impact your immediate and long-term Health can only be analyzed from a quality blood test the problem with a lot of blood and DNA tests out there however is that you get data back about metabolic factors lipids and hormones and so forth but you don't know what to do with those data inside tracker solves that problem and makes it very easy for you to understand what sorts of nutritional behavioral maybe even supplementation based interventions you might want to take on in order to adjust the numbers of those metabolic factors hormones lipids and other things that impact your immediate and long-term Health to bring those numbers into the ranges that are appropriate and indeed optimal for you inside tracker's ultimate plan also now includes a measure of April lipoprotein b apolipoprotein b sometimes also called APO B has

emerged in recent years as among the most important measures to evaluate your overall levels of cardiovascular health and health overall and That's because apolipoprotein B levels are predictive of cardiovascular function disease and things that cardiovascular function and disease can impinge on including brain Health and Longevity if you'd like to try inside tracker you can visit [insidetracker.com](https://insidetracker.com) Huberman and get 20 off any of inside

#### 01:13:55 Headache Treatment, Omega-3 & Omega-6 Fatty Acids (Linolic Acid)

Tracker'S plans - That's inside tracker.com Huberman to get 20 off what I'd like to discuss next, I find extremely exciting. Why? Well, what I'm about to describe is a compound, or, I should say, a set of compounds that are available over the counter that have been shown to be very effective in reducing the frequency and intensity of headaches and not just one kind of headache. But multiple types of headaches, so what I'll describe has been shown to have significant effects in reducing the intensity or frequency of tension, type headaches, migraine type headaches as well as hormone type headaches that are related to the menstrual cycles that I described earlier now. There are a lot of data centered around this General topic, but I'm going to focus on three main papers, but I haven't told you yet, of course is what is the compound that I'm referring to? What is this over-the-counter compound? Well, it turns out this over-the-counter compound. Is not just available over the counter it's also available in food, so it turns out that nutrition can have a very strong impact on the frequency and intensity of headache. Although supplementation with this particular compound can accomplish the same thing as well. What I'm referring to here are omega-3 fatty acids. Many of you are probably familiar with omega-3 fatty acids. These are fatty acids that come in the form of so-called EPA and DHA and omega-3 fatty acids are commonly distinguished from the so-called omega-6 fatty acids. Omega-6 fatty acids come in a bunch of different foods and they, of course, can be supplemented as well. Omega-3 fatty acids come in a bunch of different foods and can be supplemented as well. Common forms of omega-3 fatty acids - or, I should say, common sources of omega-3 fatty acids in Foods - include fatty ocean fish, including salmon salmon skins, sardines, anchovies things of that sort. Common sources in supplement form are so-called fish, oil capsules or liquid fish oil, again omega-3 fatty acids, and almost always, when we're talking about omega-3 fatty acids. We're talking about a combination of EPA and DHA. But really it is the quantity of EPA omega-3 fatty acids. That seems to be the most impactful for the sorts of Health metrics that we're going to talk about in a few minutes now with respect to omega-6 fatty acids. The most typical food sources of

omega-6 fatty acids are seed oils. I know. Nowadays, seed oils have become quite controversial. I've given my stance on this in a prior podcast, but I'll, just repeat it for those of you that haven't heard it. I am not of the belief that all seed oils are bad, that they're all inflammatory that they are killing us or making us sick, that they are the major cause of metabolic dysfunction, Etc. However, I think it is very clear - and I learned this from Dr Lane Norton when he was a guest on this podcast and taught us all about nutrition in great depth. I highly recommend that episode, if you're interested in nutrition, that people are consuming a lot more oil generally and a lot of those oils that people are consuming more of nowadays include a lot of the so-called omega-6 fatty acids and a lot of those oils are seed. Oils, the particular omega-6 fatty acid - That's going to be relevant for today's discussion is linoleic acid and that is common in a lot of seed oils. So again, I'm not going to tell you that seed oils are bad. However, it does seem to be the case that many people are consuming far too many seed oils and, in doing so are consuming far too many calories and perhaps are consuming too much of the Omega six fatty acids relative to the omega-3 fatty acids. Now, with that said, I think there is General agreement among nutritionists and health professionals that we could all stand to get more omega-3 fatty acids, perhaps for cardiovascular health, although That's a little bit debated, but certainly for immune system function for mood and for functioning of the Brain and for the potent anti-inflammatory effects of Omega-3 so again Omega-3s can be sourced from food, both animal based and plant-based. You can simply go online and look up the various food-based sources, but in thinking about headache and different treatments for headache. There are some recent studies exploring how supplementing with omega-3 fatty acids and in one case, how supplementing with omega-3 fatty acids and deliberately reducing the amount of linoleic acid, the omega-6 fatty acids, how that can impact headache. So the first study I'd like to describe in reference to the role of omega-3 fatty acids and headache was published in 2018, and the title of the paper is long chain, omega-3 fatty acids and headache in the U.S population. There are a number of things that I really like about this study. A few of those include the fact that they looked at an enormous number of people, that is, they included 12 317 men and women. I like the fact that they included men and women in the study age, 20 or older, and that they broke down the population into categories that included age. They certainly looked at race and ethnicity. They looked at educational background. They looked at body mass total energy intake, which is really important. If you think about it, people are going to be eating and within the thing things that they eat they're, going to be consuming some Omega-3s, hopefully as well some omega-6s and if they're eating far more then they're going to get far more of likely going to get Far more of both of those things than they would ordinarily, if they were eating smaller amounts, so they controlled for total caloric intake in a way that I find

particularly useful for looking at these kind of data. So the reason they explored Omega-3s is worth mentioning. Omega-3 fatty acids are known to have an anti-inflammatory effect that anti-inflammatory effect is mediated through a couple of different Pathways. We won't go into these in too much detail now, but the omega-3 fatty acids keep in mind actually make up various parts of cells in the brain and body. That's right! The membrane that remember, I talked before about how steroid hormones can go through the different membranes of the cells, the outer membrane and the inner membrane. A lot of those actual membranes, the structural constituents of neurons and other cells are actually made up of, or include certain fatty, acid, long-chain fatty acids and the omega-3 fatty acids are important for or the actual construction of those tissues, as well as having anti-inflammatory effects. Through things like limiting prostaglandins and other things that can cause inflammation okay, so there are a bunch of different ways that omega-3 fatty acids can be useful. They refer in this study to an earlier study that looked at the so-called analgesic effect. The pain, relieving effect analgesic means pain, relieving effect of omega-3 fatty acids in what had been a randomized controlled trial and in that previous paper, what they found was that diets high in Omega-3s and low in omega-6s, okay, so high three low six and as compared to Diets that were just reduced omega-6s, they found a greater analgesic effect of increasing Omega-3s, while also reducing omega-6 fatty acids. So, in the context of the seed oil discussion, although keeping in mind that omega-6s can come from other sources as well, if omega-6s were just reduced on their own, there wasn't as great, in effect in terms of reducing pain and inflammation, as there was when omega-3 fatty Acids were deliberately increased and omega-6 fatty acids were reduced again in all of these studies, because these are the ones in which they controlled things. Well, as we should, as we say, they are holding constant the caloric intake. So it's not just that you're removing fat eating less fat, there's, actually a removal of certain fats and fatty acids and a replacement of those with omega-3 fatty acids. In one case, in the other case, it's just a reduction in omega-6s and you're, using other food types and macronutrients to offset that that reduction in calories caused by reducing omega-6s the basic takeaway. That they're, relying on marching into the study, is that increasing, Omega-3s and reducing omega-6s seems to be beneficial for reducing pain. And indeed, in this study they find something quite similar, which is that when you hold caloric intake constant and when you look at omega-6s, whether or not you decrease, omega-6 fatty acids or not, you find. Is that increasing omega-3 fatty acids in the diet so either consumed through food sources or by supplementation, was associated with a lower prevalence of severe headache or migraine so severe tension, type headache or migraine? So this is promising and points to the fact that long chain, omega-3 fatty acids, are likely to have either a pain, reducing and there's evidence for that and or an inflammation reducing effect that can

## 01:22:14 Tool: Omega-3 Supplementation, Omega-6 Fatty Acids & Inflammation

Significantly reduce the severity of headache, in both tension type headache and in migraine. So That's the first study. The second study is a more recent study. It was published in 2021 that used a, I would say, a more or less similar type of overall design is the one I'd refer to earlier. The title of this paper is dietary alteration of what they call N3, but those are omega-3 and n6 omega-6. Sorry for this shift in nomenclature, I didn't write the paper dietary alteration of omega-3 and omega-6 fatty acids for headache reductions in adults with migraine, and this was a randomized control trial. Randomized control trials involve having people be in one condition where they do one thing, and then they get swapped randomly into another condition, so they serve as their own internal control and that controls for all sorts of things like differences in sex differences in age, differences in Health background in any number of other variables, as best as one can in this study, they had people either ingest a diet that had increased Omega-3s, so increased EPA and DHA, or increased EPA and DHA and reduced amounts of linoleic acid. Okay. So That's going to reduce omega-6s or a control diet in which they had people taking well, it's essentially the average intake of Omega-3s and omega-6s, and you can probably already guess what the general results of the study are going to be. The general results were that there were reductions in headaches. Okay, the really cool thing is: it was a massive reduction in headache. Okay, this was, they refer to it as a robust reduction in headache, in particular, for the subjects that increase their Omega-3s and reduce the amount of linoleic acid that they took. The other thing that I really like about this study is that, while they don't know the exact underlying mechanism for the effect, they did spend some time delineating what it is that the omega-3 and omega-6 fatty acids are likely doing to either offset or exacerbate headache. Now I didn't say that omega-6 fatty acids exacerbate headache, but it does seem that people who ingest more linoleic, acid and omega-6 are experiencing more inflammation, and that is evident in a bunch of different conditions. One, for instance, is or increases in things like cgrp cgrp is a molecule, That's associated with the calcium, signaling pathway, it's involved in vasodilation, the expansion of the blood vessels and capillaries, and That's known, as I mentioned earlier, to exacerbate certain forms of headache. Okay, there are also forms of headache that can be caused by vasoconstriction. We'll talk about one very dramatic example, perhaps as we get toward the end, it's a very uncommon example, but um it's a it's called Thunderclap headache and trust me. You do not want Thunderclap headache. Um and so we'll talk about Thunderclap headache a little bit later, that involves constriction of the blood vessels. In any case, in this

paper, they they didn't study mechanism directly, but they're resting on this known analgesic anti-pain, as well as known anti-inflammatory Pathways related to increasing omega-3 intake and simultaneously resting on the idea where I think there's. I think we now can say conclusion that omega-6 fatty acids, in particular linoleic acid, can increase inflammation by way of increasing things like cgrp vasodilation and some other Pathways related to the so-called inflammatory cytokine Pathways and there's a whole discussion nowadays of What's called the inflammatorium. So the basic takeaway is that if you are interested in reducing headache, it may be beneficial, at least according to these two studies and another one I'll talk about in a moment to increase amounts of omega-3 fatty acids, and that can be done again through the ingestions Of foods, although, based on the dosages that we'll talk about in a moment, increasing omega-3 fatty acids by taking liquid form fish oil, which is perhaps the most cost effective way to supplement Omega-3s or capsules, which is perhaps the most efficient way to supplement Omega-3s, relate to A level of one gram or more of EPA per day. Again, That's the EPA form in particular, so if you're, for instance, taking supplemental fish oil or you're, getting your Omega-3s from food and you're getting what you determine to be 2 000 milligrams or two grams per day of Omega-3s, keep in mind. That's going to include EPA ndha, and it does seem that getting above one gram per day of EPA, omega-3 fatty acids, either through food or supplements or both is going to be the critical threshold for reductions in the frequency and intensity of headaches. That include both tension. Headaches and migraine headaches now some people will find actually that ingesting far more omega-3 fatty acids generally through supplementation but again can be accomplished through Foods as well can also be beneficial for other things, such as mood and indeed, there's a whole literature related to effects of Ingesting one to three grams: again, three grams per day of EPA, so That's going to require quite a high intake of Omega-3s in whatever form or supplement you decide to take those into your body, but that that can improve mood and so forth. The basic range that I was able to find in the meta-analysis, so meta-analyzes are where a researcher will look at the results of a bunch of different studies, focused on the same thing. Look at the different strength of those studies. They'LI, do all sorts of cool statistical gymnastics like remove the most potent study, the one that had the greatest effect and see whether or not they're still an effect of some treatment or, for instance, they will swap in and out different studies and different combinations to see Whether or not any one study is really leading to the conclusion that a given treatment does something in any case, in the meta-analysis of omega-3 fatty acids, for the treatment of headache, and that includes all the different kinds of headache they found in exploring a huge range Of Omega-3 supplementation, ranging from 200 milligrams, all the way up to 2 000 milligrams per day. It really was at the one gram or higher dosage per day, where

## 01:28:11 Hormone Headache Treatment & Omega-3s

The significant impact on reducing headache, frequency and intensity was found, and, just very briefly earlier. I mentioned that. Not only is omega-3 fatty acids, supplementation been shown to be effective in reducing the frequency and intensity of headache in tension type and migraine type headache, but it's also been shown to improve outcomes for premenstrual syndrome related headaches. These are what we refer to earlier as hormone-based headaches again. The low estrogen low progesterone associated with certain phases of the menstrual cycle, as well as other phase of the menstrual cycle, are often associated with headache in uh study entitled effective omega-3 fatty acids on premenstrual syndrome. A systematic review and again meta-analysis what they found, and here I'm paraphrasing. The conclusion was that omega-3 fatty acids could yes effectively reduce the severity of PMS symptoms and one of the symptoms in particular that they found what that was reduced. Was the pain related symptoms associated with headache, and they actually had some very nice hypotheses as to why that likely would be, and in fact point out that in earlier studies, omega-3 fatty acids have actually been considered as non-steroidal anti-inflammatory drugs. In some cases - and indeed there are prescription forms of omega-3 fatty acids - and I highlight that not because I think people need to run out and get the prescription form of omega-3 fatty acids, they're actually quite hard to obtain and quite expensive, but because I think oftentimes. When we're talking about something like omega-3 fatty acids, the fact that they are available over the counter in a supplement or by liquid or available in food for that matter leads many people to conclude that, oh you know, this is supplementation. This is something that um. You know it's going to have relatively weak or minor impact on things like headache or other health metrics, but let's just say that the fact that it exists as a prescription, drug and its highest potency form, at least in my opinion, points to the potency of omega-3 Fatty acids in dealing with analgesic effects that is reducing pain and anti-inflammation, as well as some of the known cardiovascular improvements that are associated with increasing omega-3 fatty acid intake. Put simply Omega-3s are not just something that comes from food or supplements. They are also being marketed. As prescription drugs, so I do think they need to be considered as quite potent and at least as far as these papers that again include meta-analyzes of many other papers and data sets indicate that supplementing with omega-3 fatty acids, to a point where you're getting above one Gram per day of EPA is not just going to be beneficial for treating and reducing the frequency and intensity of one particular type of headache, but many types of headaches

and when you combine hormonal headaches, tension headaches and migraine headaches, you account for more than 70 percent Of the total types of headaches that are out there, the effects of Omega-3s on cluster headaches and some of the other types of headaches, at least to my knowledge, have not been evaluated. There'S no reason to think that Omega-3s would not be beneficial for those types of headaches, but at least as far as the data sets we talked about here are concerned. It is clear. Omega-3 fatty acids are going to be a very potent way to reduce pain and to reduce

### 01:31:24 Tool: Aura, Photophobia & Offsetting with Red Light

Inflammation in ways that can reduce the frequency and the intensity of different kinds of headache before we continue our discussion about many, not commonly known and yet very potent treatments for different forms of headache. I want to touch on a topic we mentioned a little bit earlier and also provide a treatment that is in a way to alleviate something and That's photophobia and Aura. Now keep in mind that earlier I referred to Aura as this sense that something's about to happen, that is true and that meaning that is an accurate description of Aura. But oftentimes people also come to understand Aura as the feeling that something surrounds a given object visually or even that people have a sense that something's around them. So again, this can be a little bit vague. But this idea that aura is a sense of something about to happen or that visually or in an auditory way and or maybe even in kind of a sense that something is about to happen. In a certain environment and the reason I'm making uh kind of Arc shapes with my hands for those of you that are just listening, I'm making art shapes with my hands is that aura is often described as kind of a Halo or a um emanating out from From one's body or from something that they're looking at again, nothing spiritual about this in the context of the discussion about migraine and headache, but rather many people experience photophobia, sometimes with aura. Sometimes no - and I just want to touch on a couple of the mechanisms by which aurum photophobia occur and mentioned just briefly - a pretty well established way that people can start to offset photophobia and again. I mentioned that because many people experience photophobia in headache, but there are also a number of people that experience photophobia, even if they don't have intense headaches. So photophobia is pretty common, pretty debilitate. It actually is one of the reasons why people feel not well and need to leave work or not go to school or or leave school, these kinds of things or lay in bed all day or dim. The lights not go outside again, sunlight being so congruent with health. You can imagine how photophobia can lead to all sorts of negative, Downstream consequences. Okay, so what is Aura and what is

photophobia? The exact origins of ARA aren't exactly clear, but it is generally thought that what Aura represents is what's called spreading, depression, and this is not depression of one's mood, although it can be associated with that. This is depression of neuronal activity, again neurons communicate with one another by generating electrical impulses that travel down the length of their of their so-called axons, which are like little wires, and then they dump neurotransmitter out at the so-called synapse and impact the electrical activity of other Neurons depression is a electrical or, I should say a chemical electrical. Chemoelectrical is the proper term phenomenon in which the excitability of neurons is reduced. So again doesn't have anything to do with depression as a mood State per se. Rather, it is a reduced excitability of neurons and it's been shown in some Imaging studies that aura is associated with a back to front so from the back of the brain to front spreading depression like a wave of lowering levels of electrical excitability and because this originates In the visual cortex, which is in the back, so That's the part of your brain that is making sense of visual images coming in through the eyes and relayed through other stations in the brain that people will start to see a kind of Halo of light or That they'll start to feel that the light around them is literally surrounding their body or some other object or body that they're looking at and then it spreads forward in the brain and That's when it tends to stretch over into other so-called sensory modalities. Sensory modalities. Being things like touch or hearing, so people will get the sense that kind of seeing something in their periphery of their Vision. Then they'll start feeling something around them. There'S a sense that something's about to happen, so is this: spreading wave of depression goes from Back to Front people experience a number of these different semi-abstract sensory phenomena that we Call Aura. Okay. So That's how Aura originates now. Photophobia is a little bit different photophobia. We Now understand because of some beautiful work that was done at Cliff saper's Lab at Harvard Medical School and some other Laboratories showing that photophobia originates from a specific set of neurons in the eye. We call these the intrinsically photosensitive melanops and ganglion cells, which is really just a mouthful of nerd, speak for neurons in the eye that connect to the brain, these so-called ganglion cells that respond most robustly to bright blue light or other shortwavelength light. So you've got short wavelength light that is blue and greens or short wavelengths, and then long wavelet light, which is red or you know it can even be out past red will be infrared. We don't detect infrared consciously other species do like pit vipers can see in the infrared they can even heat sense. So short wavelength light is going to be light. That's That's bright, blue, green, it's what's very common in fluorescent bulbs that are commonly used in household lighting and workplace lighting and other forms of artificial lighting. It's also, of course, present in sunlight. Sunlight includes a huge range of wavelengths, including long wavelength, light. Of course, you've seen that as the Reds and

oranges in the sunset and so on, those intrinsically photosensitive retinal ganglion cells in the eye respond best to bright, green or blue light, and they send connections to a bunch of different places in the brain, including the so-called Central circadian clock superchiasmatic nucleus, that sets your day night sleep wake rhythms. This is why I encourage people to view sunlight in the morning to set this system in motion to avoid bright light exposure at night from artificial sources in order to not send wake-up signals from the eye to the brain and then on to the rest of the Body, but these intrinsically photosensitive retinal ganglion cells are also known to connect with other areas of the brain. Many other areas of the brain, in fact, and one of the important areas of the brain they connect to as it relates to photophobia, is an area of a structure called the thalamus. The thalamus is an egg-like structure that sits in the center of the brain and it serves as a kind of a switchboard like a sensory relay by which information coming from the eyes from the ears from The Touch system Etc are funneled into different compartments. In the thalamus and then sent to different other areas of the brain, so think of it kind of like an old-fashioned, switchboard or um, you could think of it. Uh sort of like a in an airport. You go uh to a particular um wing of the airport. Then you go to a particular gate and so on, you're getting funneled progressively through uh narrower narrower channels until you arrive at your particular plane much in the same way, the thalamus has a bunch of different entry points, so it's sensory information coming in from a bunch Of different sources and those sources get routed into progressively narrower and narrower funnels to eventually arrive at the accurate place for their function. So these intrinsically photosensitive gangling cells send connections to a small but important area of the thalamus called LP. It's denoted, L, the letter and P with lateral, posterior thalamus, or that I should say it's the lateral posterior nucleus of the thalamus for uficionados out there, and then the neurons in that location are going to respond. That is they're going to be activated by bright blue light, green light or any kind of bright light originating from artificial sources or from sunlight and the neurons there that respond to that have a very interesting pattern of connections. They send connections up to the so-called sensory cortex, so a bunch of different layers throughout the cortex that are not associated with visual perception. That is they're not associated with understanding that there are shapes and Contours in the environment, but rather to neurons that are involved in the detection of pressure, pain and other forms of sensory information at the level of what the meninges we talked about the meninges earlier. So again, while the brain itself does not have a sensory system to detect pain, the tissues around it do and the tissues around those tissues, that is the stuff around the meninges themselves, can respond to pain and intracranial. Pressure is also relayed through the meninges to our conscious awareness that there's pain. So what does this mean for photophobia? It means that bright, blue light and green light and, of course, light from

sunlight. We'll activate these neurons in the eye, these intrinsically photosensitive ganglion cells, which then activate the lateral posterior, neurons, LP neurons and those LP neurons, communicate with areas of the brain that are specifically tuned to different sensory phenomena and, in particular, pain at the level of the meninges And intracranial pressure, what this means is that when we have headache or if we simply have photophobia on its own, that bright light is actually the trigger for pain, sensing and even the creation of pain at the level of the meninges and intracranial pressure. What does this mean in terms of dealing with or treating photophobia? Well, most people deal with photophobia by deciding to turn off or dim all the lights and simply getting under the covers or wearing a very um low, brim hat and putting on sunglasses, and they want to lie down and sometimes because uh migraine can be associated with Nausea or even vomiting, and it's severe instances rather, but one very simple way to avoid activation of these retinal ganglion cells that would trigger photophobia is that if you are starting to feel like you have a migraine coming on or you have photophobia coming on to shift To using patterns of light that are in the longer wavelength domain, what that means practically is Shifting to using very orange, ideally dim, but very orange and red light. Now. This is not a call for people to go out and invest in expensive red light therapies. Admittedly, there are some excellent case uses for red light therapy, particularly for acne wound healing, even for improving Vision, especially in people beyond the age of 40 for some hormone augmentation. We talked all about that in the episode that I did on light and health again, you can find that at [Hubermanlab.com](https://hubermanlab.com) everything time stamped. What I'm talking about here would be simply having some red light bulbs on hand for any time that you need to remain awake but you're, starting to experience. Photophobia these red light bulbs can be purchased very in expensively. You know, as party lights, you can buy these online, so there is no specific need to get any uh. I would say red light. That's designed specifically for photophobia or anything that sort you can find the cheapest um red light available out there and those will simply work the idea being that for many people who are experiencing photophobia, they want to reduce that feeling of pain and pressure in their head. Experience through photophobia, they also might want to stay awake, get some work done and do things so operating under red light, or, I should say, living working, Etc under red light, would allow you to stay awake, not have to hide under the covers, if you're experiencing photophobia In addition - and I mentioned this at the beginning of the episode - but many people find photophobia to be a entry point or a trigger to headache, so what happens? Is they start to experience some Aura, some onset of photophobia, and then the photophobia itself leads to this feeling of malaise that then converts into headache? And so, while there are not a lot of clinical data on this just yet an emerging idea in the realm of headache treatment is the idea that if you can offset some of the early signs, you can offset

some of that photophobia and aura, perhaps to the Use of dim red lights or red lights, as I've described a moment ago, then you might be able to reduce the probability that you're going to have a migraine or other type of headache entirely. So again, no need for expensive red lights, but you can find red lights very easily online and simply have them on hand or replace the current lights that you have on your nightstand or in whatever room you happen to be in with these red lights, these red Lights are also, I should mention very useful in limiting the amount of cortisol, a stress hormone that is very healthy for us to release at high levels early in the day, in fact, viewing sunlight will increase cortisol levels. It's another reason why? What I'm about to say is relevant to photophobia, but if you want to keep cortisol levels low in the evening and at night, and indeed you do and improve the transition to sleep, and indeed your sleep overall, reducing cortisol at evening time and at night time is Extremely beneficial and red lights will help you accomplish that. I talked about that in the episode on light and health. So the point here is that if you suffer from photophobia with or without aura, using red lights and not simply dimming ordinary artificial lights or feeling that you have to turn off, all lights entirely is going to be one relatively inexpensive or, I should say, a very Inexpensive in some cases, because these red lights can be found very inexpensively online way to be able to continue with your daily activities at

#### 01:44:15 Tool: Tension Headache & Botox Treatment

Least, in an indoor environment, if you are suffering from photophobia, so shifting back to ways to reduce the intensity and frequency of different kinds of headaches, we haven't talked so much about tension headaches specifically. So That's what I'd like to do now is you recall tension? Headaches are going to be muscular in origin again, keeping in mind that everything's neural when it comes to pain, everything's normal when it comes to everything. Frankly, because every organ and tissue system in our body is ultimately controlled by our nervous system. But tension. Headaches are often associated with tension of the muscles that are on the skull of the jaw of the neck and can be quite painful for many people and debilitating, and the most common treatment for this that most people rely on that is, is to take non-steroid anti-inflammatory. So things like acetaminophen ibuprofen, sometimes aspirin and things of that sort and oftentimes those can be helpful. There are a couple things to keep in mind, however. The NSAIDs non-steroid anti-inflammatory drugs oftentimes will work very well at first, but people quickly develop a tolerance to them, meaning they're going to have to take more and more in order to get the same effect and oftentimes. They can't take more and more because some of them are very hard on the liver and in addition to that,

some of them can offset some other things that you really want. So, for instance, it's now known that non-steroid anti-inflammatory drugs can offset some of the benefits of exercise, and that makes sense, because a lot of the Adaptive benefits of exercise actually come from experiencing a lot of inflammation acute. That means you actually want inflammation during a resistance, training, workout or even your endurance workout, but then that inflammation triggers an adaptation event or series of adaptation. Events that leads to Greater strength, greater speed, more muscle, more endurance whatever it is that you happen to be training, for so reducing pain can be good, of course, but not if you have to take more and more of a given drug that it has side effects On the liver and can offset the effects of exercise and so forth, the other issue with non-steroid anti-inflammatory drugs is that many of them simply do not work for many people or again they'll work, the first time and the second time, but then they stop working. They also tend to lower body temperature. I think most people are aware of this, because many of these same drugs are used in order to reduce fever. But if you are taking non-steroid anti-inflammatory drugs simply to reduce your headache and your lowering core body temperature that can have all sorts of Downstream issues related to sleep, wake Cycles to metabolism to immune system function more generally and on and on. For that reason, there's been quite a lot of exploration of alternatives to non-steroid anti-inflammatory drugs, for the treatment of headache and indeed pain generally, but today we're talking about headache now, as it relates to Tension Headache, one of the more advanced kind of modern treatments that you Sometimes hear about is Botox right Botox. I think most people are familiar with as the thing that people get injected into their face around the eyes or around the lips or elsewhere. In order to quote unquote, reduce wrinkles. It was discovered some years ago when Botox treatments were being done for cosmetic reasons, that it could often be very effective for relieving headache if injected into the muscles and the way that it works is that, of course, Tension. Headache involves a tension of the muscles, a kind of a we'll call it clinching or cinching up with the muscles. But we're really talking about is contraction of the muscles and That's controlled by neurons neurons, which are neuromuscular so neuromuscular neurons that don't form synapses with or connections with other neurons. They form synapses with muscle they release acetylcholine onto the muscle, and that makes the muscle contract. This is the way you move the limbs of your body. This is also a way the muscles of your head contract and can give you tension, type headaches. Botox arises from or is rather botulinum neurotoxin botulinum neurotoxin is a toxin. That's found in canned goods, not all canned goods, of course, and what it does is it. It prevents a certain step in the release of so-called neurotransmitter in the little packets that they live in, which are called vesicles little little spheres of neurotransmitter live at the end of neuron nerve Terminals and are released onto the muscle, make the muscle contract botulinum

neurotoxin Cleaves. A particular protein in there for you aficionados, who want to look this up. It's a really cool mechanism. It Cleaves something called Snap 25.. Snap 25 is involved in the fusion of those little spheres, with the membrane of the neuron and releasing of the neurotransmitter. So when botulinum neurotoxin is present at the nerve muscle interface, those nerves cannot communicate with the muscle and, as a consequence, the muscles undergo kind of flaccid tone. They just kind of relax there underneath the skin sure wrinkles are relieved, but if Botox is injected into the muscles themselves, it can provide long-lasting relief of certain types of headaches, in particular tension type headaches. So while it seems like a bit of an extreme treatment, people who suffer very badly from tension type headaches due to hyper contraction of the muscles of the forehead or around the temples or around the Jaws or the or certain parts of the the neck and the Musc muscles of the neck that encroach on the on the back of the skull or that actually connect to the back of the skull can achieve tremendous long, lasting relief from these Botox injections, sometimes for weeks or months or even longer, people go in for periodic uh. You know re-ups of Botox. It actually is quite safe, despite the fact that botulinum neurotoxin is quite dangerous. It's given in very low Doses and given locally, so those are the only muscles affected. So That's how Botox is used to

#### 01:49:43 Tool: Alternative Headache Treatments, Peppermint Oil, Menthol

Treat headaches and um it's a very effective treatment at that. Of course, many people I imagine - are interested in not just drug based treatments and not Botox type treatments for treating headache but other types of treatments for headache that are of the more so, let's call them natural or um non-drug treatments, and here we're starting to get into the realm of the kind of herbal and oil-based treatments for headache now I confess when I first started researching this area of headache and treatment for headaches. That is um. I found myself approaching it with a bit of trepidation, because when I started to hear about essential oils and about herbal medications and things of that sort, I thought okay well, there'll probably be some effects. I mean. Admittedly, we've talked before on this podcast about things like apogenin epigenin is one of the core components of chamomile and chamomile is known to make people feel a little bit sleepy and can enhance sleep well. Apogenic and high concentration can indeed augment sleep. We talk about this. In our sleep tool kit, by the way we don't just have episodes about sleep master or sleep, perfect, your sleep, Etc. But if you go to the Hubermanlab.com website and you go to the menu and you click on newsletter, you can scroll down. You'll see that we have a tool kit for sleep. This is completely zero cost

to access. You don't even have to sign up, although if you'd like to sign up for future newsletters, you can get those one of the key components of the toolkit for sleep. In addition to behavioral tools and things that are not supplement, based is apogenin, which is this component from chamomile. So the idea that certain herbal derivatives or herbs or Oils could be very useful for improving symptoms of whatever. In this case, improving sleep with apogenin is not unheard of and in fact the data continued to be released all the time that many of the things that we think of as herbal Etc can actually have quite potent effects and so um. While I myself was approaching the discussion about essential oils and um, or I should say, oils right who's to say, if they're essential or not oils and herbs in the treatment of headache, I finished out my research on this literature feeling um. Quite I should say uh, surprised and um and as if I need to really check myself a bit, because what I found is that there are certain herbs and oils, for instance, that far outperform non-steroid and anti-inflammatory drugs for the treatment of headache. That's right. There are certain oils that are available over the counter that, when looked at in many studies, meta-analyzes and I'll tell you about one particular study and a meta-analysis. In a moment, they show that they can reduce the frequency and intensity of headache in a manner that far outpaces What You observe with non-steroid anti-inflammatory drugs with apparently none of the same issues associated with non-steroid anti-inflammatory drugs. So I think it's really worth paying attention to the first of those studies. I'd like to describe to you is one that has now become kind of a classic in the literature. I should say, at least for those that are interested in the atypical treatments for headache, and the title of this paper is effective: peppermint and eucalyptus oil preparations on neurophysiological and experimental alge's metric headache parameters. Okay, what does that mean? Well? This is an interesting study because, rather than look at the effectiveness of peppermint and eucalyptus oil and other oils on headache, what they did is because they want to look at the mechanisms underlying headache which I confess I love the fact that they want to understand the Neurophysiology and not just get subjective ratings of headache, although they did that too, but they really want to understand how these oils can impact things like muscular tension or perception of pain. What they did is they recreated headache in human subjects by using tightening cuffs of the of the head, they cut off blood supply to certain areas of the head. They basically induced headache, and then they measured things like the EMG, the muscle response at the level of electrophysiology in the muscle and, of course, subjective measures of how much people perceive to be in pain or not in pain. I'll give you the broad Contour of the study, because I want to make sure that it's the conclusions that come through most clearly and we will provide a link to the study in our show, note captions. So what they did is they had people use one of four different preparations say preparation, one which includes some peppermint oil and some eucalyptus

oil and all the details about the amount and the relative percentages are in the paper for you to peruse online through the link. I mentioned before so they had four different groups. They had one group apply peppermint oil, but that peppermint oil also contained eucalyptus oil. They had another group used just peppermint oil. They had another group use, just tiny traces of peppermint oil and smaller doses of eucalyptus oil, and then they had a fourth group which was just using Placebo. When I say using what they were doing is they were sponge, applying the oil to the temples and forehead of people and then what they did is they used these different approaches to measure the activation of muscles to measure pain and they then induced head pain. They induced headache so, and they looked at the temporal muscles on the side. They looked at forehead muscles things of that sort, so they used three different types of pain stimuli. They looked at people's sensitivity to experimentally, induced Pain by either providing pressure. So this was kind of a cuff around the forehead or thermal pain, so they actually had them. Basically, heat heat it up at the level of the skin and actually they brought the heat up pretty high to the point where people were rating, the pain almost to the to the point of um excessive pain and pain limits. So they obviously couldn't take them to the point of extreme pain and they had a constriction type condition in which they cut off blood circulation to the pericranial muscles, using an inflatable collar around the cranium and they inflated that to pretty high pressure so kind of a Brutal experiment to be involved in but look they're trying to mimic headache and I think by using these different approaches, they're able to mimic the different aspects of headache and make sure and here's the key point that every person in the study is not just getting the Same treatment for headache, but is getting the same headache and That's something that I think gives this study power. It's not the only way to do a study like this, but it gives it a lot of power in trying to understand which types of interventions are going to assist in headache and maybe even specific dimensions of the pain and headache and basically what they found in The study is that of all the treatments they used, the essential plant oil preparations that contained peppermint and I'll just mention as an aside and in other studies Menthol. So these minty type uh essential minty type um, what we think of as flavors, but are really Aromas as well and as I'll point out the mechanism. In a moment they have the effect of significantly reducing the intensity of the pain. That is subjects could tolerate the pain, far better and experienced less pain, subjectively and the magnitude of the effects were really pretty impressive. Again I went into all this thinking essential oils. Okay, That's like some really woo stuff um. You know I don't know about that, but it turns out that these essential oils, at least the ones that contain peppermint oil with or without eucalyptus oil performed very well in reducing pain. The key takeaway from the study is - and here I'm paraphrasing from the study of that - the combination of peppermint oil eucalyptus oil, and these are basically in a ethanol suspension. Again, people are not

drinking these essential oils. I want to be very clear. They're applying these to the skin around the area, that's in pain and particularly the temple and the forehead increased cognitive performance. I didn't talk about that, but this is the ability to maintain cognitive functioning while in pain. You know here we're talking about headache up until now, just as kind of pain, but that pain can be very debilitating for your ability to work and perform and do other things. So this combination of peppermint oil and eucalyptus oil applied to the skin, allow people to increase their cognitive performance while under pain and had a very muscle, relaxing and mentally relaxing effect. Mental relaxation was, of course, measured subjectively, but remember one of the things that led me to feature this study in this episode in particular, is that they didn't just say: oh my muscles feel more relaxed. They actually saw that the muscles of the forehead and temples and some surrounding muscles were more relaxed when people had these oils on applied to their forehead and the temples, not perhaps to the same degree that one would observe with botox or for the same extent or duration, as one would experience with botox, but much in the same way, which then raises the question of what's going on here I mean: is this all placebo effect? Well, no, because they compared to placebo and they controlled for the odor, of course, of the oil. That was applied so that everyone thought that they were getting essentially the same thing pun intended. But in this case, what they found is that if they applied the essential oil to the forehead and temples that people experience a more or less a cooling sensation or they could feel as if something was happening in the underlying muscle. Well, what was happening. We now know that Menthol peppermint and other things that smell that way and taste that way actually have an impact on the sensory neurons at the level of the skin and can actually inhibit certain sensory neurons and can activate other sensory neurons. Okay. So, in order to understand this, we have to go back to what I said at the beginning of the episode, which is that you have motor neurons. These are neurons that constrict muscles or excuse me that cause contraction of muscles strict them. They cause contraction of muscles. You have sensory neurons, which sense different things, light sound or touch, and you have modulatory neurons, Menthol and Eucalyptus are actually known to activate certain channels in the sensory neurons that respond not just a touch, but also the sensation of cooling. Okay. So when we think of Menthol and peppermint, we think of kind of cool scents and flavors cool, meaning cold and when we think of things like hot peppers capsaicin, we think of anything that has a hot temperature. We tend to think of spicy, so spicy and hot go together and peppermint and menthol and cool go together much in the way that the gum commercials or the mint commercials would lead you to believe, and in fact they're right so what's happening here. Is that the application of these oils is very likely activating channels in the sensory neurons, including the TRP channels, but others as well that are leading to the

analgesic effect by shutting down the heat and pain pathways because heat and pain, while they're not exactly the same? In our nervous system, they are funneled through common pathways, whereas cooling and pain relief are funneled through alternate what we call parallel pathways. So the study on peppermint and eucalyptus oil preparations in reducing pain of headache and different aspects of pain due to headache, I think, are really important because they don't just illustrate the fact that yes, indeed - and you know going record saying it because that's what the data say - and there are other papers to support this statement as well, essential oils applied to the skin can reduce the symptoms of tension, headache in a significant way and actually can lead to some offset of some of the cognitive defects seen with headaches. So that's itself very impressive. I must say surprising, for me kind of put me in my place as somebody thought. Oh essential oils is going to be like okay, but it's actually seemed to um, really hold some merit and when you compare the magnitude of the effect, even though this was an enormous number of subjects, you compare the magnitude to the effect in a paper like this or similar papers on these essential oils to the impact of non-steroid anti-inflammatory drugs and they really hold their own and, in some cases, exceed the positive impact of anti-inflammatory drugs. So for that reason I think we can look at peppermint oils and peppermint and eucalyptus containing oils. Menthol containing oils applied to the skin for the treatment of

## 02:01:35 Tool: Tension Headaches Treatment & Acupuncture

Tension type headache as um among the more potent treatments available out there now another way to approach treatment of tension. Headache is something that many of you have probably heard about before, and then I've talked a little bit about on this podcast in previous episodes and that's acupuncture. We will do an entire episode all about acupuncture, but much in the same way that essential oils. I think for many people, not all, but for many people are considered kind of a woo biology or people. Think of it as a very alternative medicine. Keep in mind that, as the underlying mechanisms of things like these peppermint oils are starting to be discovered or Omega-3s are starting to be discovered, mechanistically, they hold up very well, there's a logic there there's an underlying understanding of not just why they should work, but in many cases how they work in the same way acupuncture, which of course has existed for thousands of years, has been used very successfully to treat headache and other forms of pain. So much so that many insurance companies will now pay for acupuncture as an insured practice. Not all, but many will and in addition to that, the scientific community is starting to understand mechanistically

how acupuncture works. So I don't want to make this the major Focus for now, but very briefly, there's a laboratory at Harvard Medical School run by Chufu. Chufu is well known in the Neuroscience Community for doing excellent work in parsing the mechanisms of touch sensation and pain in particular, so not just touch at the level of skin but pain and pain Pathways, and in recent years his laboratory has started to do studies on How acupuncture works, because, indeed, acupuncture has been known to work to alleviate pain for a long time, but the underlying mechanisms haven't been clear. What Chufu's lab has published now in excellent journals like Nature Science and other journals, is that the precise insertion sites of different needles lead to activation of sensory neurons and their Downstream Pathways in ways that can potentially reduce inflammation and that can be used to potentially reduce The activity of certain muscles, for instance, muscles in the forehead and temples, so when you hear acupuncture can reduce pain. I think some people think oh well, if there's needles sticking out of your face. First of all, that must hurt, and actually the needles are very fine. Needles and skilled acupuncturists can insert them without any pain or actually the person receiving. It doesn't even usually recognize that the needles are in That's how quickly and efficiently they can put them in, and people don't detect any pain, but that has been shown to greatly reduce pain, in particular headache, related pain and back-related pain in some other forms of pain. Chufu's lab has shown that the specific needle insertion sites can activate the sensory Pathways and can deactivate the sensory motor pathways and now you're familiar with Sensory, neurons, motor neurons and modulatory neurons and can modulate the activity of the pain Pathways. By way of impacting the activity of all sorts of different organs, including organs that give rise to some of the inflammatory cytokines. So basically, what I'm saying here is that, thanks to thousands of years of acupuncture and the maps of different insertion sites, we now know - or I should say, people have long known and people in the west are starting to adopt the understanding that acupuncture. Yes, indeed, it really does work for relieving pain and Laboratories. Both in the United States, such as Chufu and elsewhere are starting to find the underlying mechanisms, and those mechanisms include deactivation of the pain Pathways activation of some of the parallel Pathways that assist in shutting down pain or in relaxing the muscles that are causing tension. Type headache, as well as activation of neural Pathways, that impinge on organs that then cause or reduce the release of molecules into the body that give us the experience of pain, so reduced inflammation and, in many cases, increasing anti-inflammatory Pathways. So I just want to be sure to mention acupuncture and a little bit of mechanistic understanding of why acupuncture works, because indeed, acupuncture is shown to be quite effective for the treatment of tension

## 02:05:41 Tool: Migraine & Herbal Treatment, Caffeine Timing

Type headache and, to some extent migraine headache as well, so we talked about omega-3 fatty acids. We talked about essential oils, we talked about acupuncture, so this episode is starting to sound, like alternative treatments, to headache, including migraine, but I want to be very clear. This is not about alternative treatments. Everything that I'm talking about here has a mechanistic basis, and what we're talking about today are approaches to dealing with headache that, yes, are typically over-the-counter compounds or are grounded in nutrition or in the case of acupuncture behavioral practices, but that are not necessarily meant as replacements. For things like non-steroid, inflammatory drugs or prescription drugs, of course, those things can still be taken. Many people derive benefit from them, but the goal is always. I believe I should hope for people to find ways that they can control their health outcomes and reduce things. Like headache, using a minimum number of things that have other side effects, and that, of course, can also include the use of essential oils in conjunction with things like non-steroid anti-inflammatory, drugs or the use of red light to offset photophobia in conjunction with any number of different Treatments either prescription or otherwise. So I do want to make that clear, and I especially want to make that clear, as I transition to the next segment, where I'm going to tell you about herbal treatments for migraine, and this is based on what I consider a very comprehensive review of many randomized Control studies - indeed, the title of the paper - is herbal treatments for migraine, a systematic review of randomized, controlled studies, and this was published in 2020, and this contains an immense amount of information. So we will provide a link to it for those of you that really want to dive deep on this. In this paper, they focus on a number of different reviews and Analysis of data focused on compounds for the treatment of migraine, ranging from and including things like Menthol and peppermint oil. So we already covered that. So I won't cover that again in detail, but in this review they highlight the results I refer to before plus other results that show that Menthol and peppermint oil can be quite effective in the treatment of tension, type headache and, in this case migraine headache as well. So That's interesting that Menthol and peppermint oils can be used not just to treat tension, type headaches, but migraine headaches as well, and they look at an enormous number of other types of herbal and essential oil type treatments. Everything from coriander to Citron to damask Rose chamomile lavender a bunch of things, so I'm not going to go through each and every one of these in a lot of detail. What I've tended to do today, and I'm going to do now - is to highlight the most potent of these different treatments again: Menthol peppermint oil being among the most potent in addition to that there's a particular pathway, That's associated with headache, and when I say that I Mean the different types of headache which

includes the activation of this thing, that we call cgrp cgrp again, is involved in this calcium regulation pathway and leads to vasodilation of the vessels and arteries and capillaries in a way that can create pain. And this feeling of pressure. Inside the head, which can be very uncomfortable of course now earlier in the episode I mentioned, that I was going to touch on caffeine, and so I'm going to do that now now. The reason I mention caffeine is that there's a sort of lore out there that, if you have a headache drinking a cup of coffee, can eliminate that headache. A few things about that point. First of all, if you are somebody who ingests caffeine every day - and you do not ingest caffeine, you will indeed get a headache and drinking caffeine will relieve that particular headache. So it's absolutely true that caffeine can relieve the lack of caffeine induced headache. That's sort of a duh, but that leads actually to a very important question, which is: why would that be the case? Well, it turns out that caffeine is both a vasodilator and a vasoconstrictor. How does it do that? Well, one of the main ways in which caffeine makes us more alert is that it occupies The receptors for something called adenosine. Adenosine is a molecule that builds up in the brain and body more and more, the longer we've been awake, it's one of the things that makes us feel sleepy. So when we drink caffeine, that caffeine occupies the adenosine receptor and the adenosine cannot have its normal effect of making us sleepy. When that caffeine wears off the adenosine combine and we feel sleepy adenosine is a vasodilator. So when we drink caffeine because it blocks the effects of adenosine, there is a vasoconstriction associated with drinking caffeine. So if you have a headache that is associated with excessive vasodilation and pressure in the head, indeed drinking some caffeine can cause some vasoconstriction by preventing that adenosine pathway. That would normally lead to vasoconstriction and you can get some relief from that headache. However, caffeine is also a vasodilator caffeine has the ability to impinge on the so-called no pathway, the nitric oxide pathway, which is a nerve to blood pathway that involves a few different enzymes that we won't get into right now, but maybe in a future episode that causes Dilation of the blood vessels and, as a consequence, drinking caffeine can also increase vasodilation. So it's sort of a two-pronged effect. Now one of the ways in which you might think about this and perhaps utilize. This is that if you are well rested or if it's early in the day and you've had some sleep, the previous night adenosine levels are very likely to be low, especially if you slept very well the night before under those conditions, when you ingest caffeine, you are Not going to experience the vasoconstriction effects of caffeine, that would ordinarily be there by inhibiting adenosine. Why? Because adenosine is not present at all and under those conditions, drinking coffee ought to lead to some vasodilation, not a lot but nonetheless vasodilation. If, however, you haven't slept well or it's late in the day and you've been up for a long time, drinking caffeine is likely to have more of a vasoconstriction effect, and this is

important because some of the treatments that you hear about that involve using caffeine to treat headache are as extreme as okay if you have a headache at night, drink a cup of coffee and then go to sleep. I actually saw that in the literature which I couldn't quite believe because, yes, indeed, some people can fall asleep after drinking caffeine, but we know very well thanks to the beautiful work and science communications of people like Dr Matthew, Walker from University of California, Berkeley and who's been a guest on this and many other podcasts that, even if you can fall asleep after drinking caffeine, ingesting caffeine within the 10 to 12 hours prior to bedtime is simply not a good idea because of the ways it disrupts the architecture of sleep. So, what's the takeaway about caffeine and headache and vasodilation relation, you need to be very clear on whether or not caffeine tends to remove your headache or exacerbate it. Now this is going to depend on time of day and the amount of adenosine in your system. As I mentioned before, but also, there seems to be a kind of bimodal distribution whereby some people, when they drink caffeine, it really improves their headache and so, in some cases, a very significant effects, whereas other people, when they drink caffeine, it really exacerbates their headache and, as at least as far as I could tell from the literature, it's not easy to predict who those people are going to be. What is reassuring, however, is. It does not seem to be the case that, if you're somebody who experiences relief from headaches by drinking caffeine that suddenly one day to the next you're going to experience a worsening of your headache - and vice versa is also true. So if you're somebody that drinks, caffeine and your headaches get worse, I don't think there's any reason to think that caffeine, one day or from one day to the next rather is going to somehow alleviate your headache. So you have to determine for yourself whether or not headaches are relieved or exacerbated by drinking caffeine and if you're wondering why it's so confusing it's because caffeine hits both the

#### 02:13:26 Tool: Migraine Treatments & Curcumin (Turmeric)

Vasodilation and the vasoconstriction pathways and there's nothing you or I or anyone else can do about it now. The last thing I'd like to talk about in terms of relief for headaches is something that I'm guessing about. Probably 25 percent of you are familiar with, and 75 percent of you are not, which is curcumin. Curcumin is often also referred to as turmeric and turmeric is a root, and curcumin is one of the key components of that root. Curcumin is known to have very potent anti-inflammatory properties. I don't think that's debated at all. In fact, it's so potent as an anti-inflammatory that some people have cautioned against taking high levels of curcumin prior to, for instance, resistance, training, workouts or even

cardiovascular workouts, because it so prevents inflammation that it also can prevent the adaptation response. Because remember the inflammation that occurs during exercise both resistance and cardiovascular exercise is, at least in part, the trigger for the adaptation that it's going to lead to enhanced endurance, enhanced strength, hypertrophy, Etc. Nonetheless, curcumin has been explored in the context of treatment of migraine and it's one of the compounds that was analyzed in extensive detail in this wonderful review that I mentioned a little bit earlier. What I like about this study is that they were able to explore the effects of curcumin as explored in previous research studies and compare those across a large range of different dosages and a large range of combinations with other things like coenzyme Q10, which we've talked about on this podcast before, but I think for sake of this discussion, just really focusing on what curcumin does alone or in conjunction with the omega-3 fatty acids, is what turns out to be the most interesting. First of all, curcumin has been shown to be generally safe for most people at dosages as high as 8,000 milligrams per day or eight grams per day. Now I want to be very clear. I do not recommend that anyone take dosages of curcumin, an AKA turmeric that are that high. Why well curcumin and turmeric not only are anti-inflammatory, but they also can impinge on other pathways, in particular hormonal pathways and in fact, curcumin AKA turmeric can alter the synthesis of something called dihydrotestosterone. Dihydrotestosterone is involved in an enormous range of different bodily functions. It's involved in libido, it's involved in men, in beard, growth and in the regulation of a number of different tissues, both in the reproductive axis and outside the reproductive axis and curcumin is a potent inhibitor of DHT. So I do want to caution that people who take high doses of curcumin and some people who are very sensitive to curcumin will even at low doses, experience reductions in DHT that lead to things that they would not like, such as sufficient reductions in libido. However, curcumin has been shown to be effective as an anti-inflammatory and has been shown to be very effective in treating different types of headache and particular migraine headache. One of the ways in which curcumin does that is to inhibit this thing that I talked about a few minutes ago, which is nitric oxide or NO, which causes vasodilation and in doing that, can reduce the feeling that one has a lot of intracranial pressure. Okay, so curcumin dosages come in enormous range, as I mentioned before, dosages that range anywhere from 80 milligrams taken 80 milligrams per day that is taken for eight weeks time. That's been examined. It's been explored at 80, milligram dosages taken alongside two and a half grams of omega-3 fatty acids or omega-3 fatty acids alone, and against placebo, and the general conclusion of these studies is that curcumin when taken it at dosages of about 80 milligrams. Although for those of you very sensitive to curcumin, probably as low as 25 or even 50 milligrams per day, in conjunction with, although not necessarily at the same time, but taken daily alongside omega-3 fatty acids at two and a

half grams per day, led to significant improvements. In migraine and other forms of headache, meaning both the frequency and the intensity of the headaches that occurred was greatly reduced. One important point about curcumin to keep in mind is that curcumin is known to inhibit something called cytochrome p450, That's associated with an enzymatic pathway and some other things that relate to blood coagulation, so for people that are taking medications that are anticoagulants to prevent clotting. You do need to be very cautious about using curcumin and, of course, with curcumin or any other supplement you

## 02:18:00 Carolina Reaper Pepper & Thunderclap Headache

Should always talk to your doctor prior to including it or removing it from your supplement regimen? So, as you can see, there are a number of different things that, in addition to prescription drugs and over-the-counter pain, medications, things like non-steroid anti-inflammatory drugs can really impact the different aspects of headache and different types of headache in some cases differentially now today, we talked mainly About tension, type and migraine type headaches, because those are the most common forms of headache. There are, of course, the cluster type headaches that are of neural origin talked about hormonal headaches and indeed, some treatments such as Omega-3s, which have been shown to be beneficial for offsetting. The menstrual related headaches now, in the context of the discussion about Omega-3s, keep in mind that Omega-3s can be obtained from supplementation or from nutrition. So you don't necessarily have to take omega-3 capsules or liquid form Omega-3s. If you want to use Omega-3s to Target different symptoms of headache, but that probably is going to be the most efficient way to do it, given that many foods do contain Omega threes. But it's hard to get above that one gram dosage and in fact, most of the studies that we talked about today involved getting two or even two and a half or in some cases on this podcast with previous guests such as Dr Rhonda Patrick. She talked about the advantages of getting as high as three grams of Omega-3s per day, which almost with certainty is going to require some external form of supplementation, even for those of you that are making a point to eat fatty ocean fish with the skin on. So I just want to make sure that I highlight that before we wrap up. I can't help myself but to talk about something that I heard about on the news several years ago, and it sounded too outrageous to be true, but then was confirmed as accurate by one of my neurologist colleagues. That's the fact that eating certain very spicy peppers can induce headache and in some cases, can induce brain damage and bear with me here. I'M not talking about your traditional jalapeno and I'm acknowledging the fact that certain people can tolerate far more spicy taste case. Then do

others, some people are very sensitive to spicy. Some people can tolerate very spicy food and that one can build up a tolerance to spicy food by ingesting progressively your spicy or excuse me, spicy or and spicier Foods over time. Nonetheless, there are these Pepper eating contests out there that um, while not very common, do exist and people challenge each other to eat peppers of um, extreme spiciness and there's one in particular. That's referred to as the Carolina Reaper. By the way, That's not a person, as far as I know, That's a pepper, the Carolina Reaper, which is known to have the most potent spice of any pepper and here's why you would not want to eat the Carolina Reaper a few years ago. At one of these Pepper eating contests, man ate a Carolina Reaper as part of the competition and suddenly experience what's called Thunderclap headache. Thunderclap headache is a unique type of headache, very different from all the other types of headaches. It is not from the surface in so it's not tension, headache, it's not even the cluster type headache of the nerve activation of the trigeminal. It's actually a hyper constriction of the vasculature in the brain caused by the ingestion of the pepper and inflammatory response, and remember that heat and spicy go together in these neural Pathways and a bunch of different heat related and spice related Pathways. Get activated simultaneously when one ingests, something of extreme spice and the blood vessels, and indeed some of the smaller arteries feeding neural tissue shut down, and he experienced this Thunderclap headache, which is a brutal headache and sadly, in his case, um permanent brain damage. So, loss of neuronal tissue because neuronal tissue is very metabolically active. You cut off the blood supply to that tissue. Not only would you feel miserable, maybe even pass out, but lose vision and certain brain areas will actually die off in the absence of blood flow to those areas. We know this more commonly as stroke, so I don't want to strike fear in anybody about eating a you know, a jalapeno or even a very spicy meal from time to time. But if you're not somebody who's familiar with eating very spicy foods, you certainly don't want to enter one of these competitions and just realize that the pathways from Menthol and cool or spicy and hot those aren't just subjective Pathways. These are actually neural Pathways that again originate in our so-called nerds call it the sensory epithelium, so our skin, our our hearing, our eyes and that feed that information into the body to make use of that information. Some case motor movement, so sensory motor. In other cases, the information can be fed through nerve Pathways that goes to the vasculature and causes the vasculature to either dilate or constrict these very spicy peppers, causing, as I just mentioned, extreme cerebro of of the head of vasoconstriction and brain damage. Again, That's not going to be a common thing out there, but nonetheless I encourage people to be very cautious about the Carolina Reaper. So today we talked about headaches and first we highlighted the different types of headache. Making it clear that understanding which headache you might be experiencing can be very beneficial

for understanding which sorts of treatments ought to be best and perhaps also best avoided in trying to alleviate those headaches or prevent them from happening at all. We talked about tension headaches, migraine, headaches, hormone-based, headaches, cluster headaches and traumatic, brain injury related headaches. We talked about different types of treatments ranging from creatine to omega-3, fatty acid, supplementation, some herbal and indeed some essential oil treatments as well as acupuncture, all of which have been shown to have significant impact in reducing the frequency and intensity of headaches and in many cases, Reductions in the frequency and intensity of headaches that are at least as great as the results they're seen with non-steroid anti-inflammatory drugs. Again, I want to highlight that none of these approaches are necessarily designed to be done on their own or in replacement of prescription drugs. From your physician, there are excellent prescription drugs out there that your physician can prescribe for you for the treatment of headache. Nonetheless, I think many people who are listeners of this podcast are interested in the things that they can do in order to inoculate themselves, or at least reduce the likelihood of experiencing headache, especially for people who are experiencing chronic

**02:24:21 Zero-Cost Support, Spotify & Apple Reviews, YouTube Feedback, Sponsors, Social Media, Momentous, Neural Network Newsletter**

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