



MIND & LIFE

## Mind & Life Podcast Transcript

### Dave Vago – Meditation, Neuroscience, and Self

Original Air Date: May 30, 2024

Retrieved from: <https://podcast.mindandlife.org/dave-vago/>

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**Opening Quote – Dave Vago (00:03):** *What does that mean, that the self is an illusion? If the self is changing all the time, there's always an opportunity to shift your mental habits and your behaviors in a positive way. We now see there's evidence that mindfulness can do this. And how you reframe or shift your mental habits is really predicated on how you integrate all that wisdom into a new self. If we were all, as one humanity, to cultivate that non-dual sense of love and kindness for everyone around us, that kind of love would dissolve our problems, if we could truly do it.*

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**Intro – Wendy Hasenkamp (00:45):** Welcome to Mind & Life. I'm Wendy Hasenkamp. Today I am speaking with contemplative neuroscientist Dave Vago. Dave's work is at the intersection of mind, brain, philosophy, religion, and the nature of self. He's been in this field for over two decades, so he has a wealth of experience and perspective to share.

(01:10) In our conversation, we cover a wide range of his research, including his interest in how experience unfolds, both in our brains and subjectively on a very fine time scale, like the level of milliseconds. This has a lot of implications for unconscious processes in our minds that can create a kind of filter on our world. We talk about biases in our attention, how thoughts can be "sticky" and how to unstick them, and how meditation can change and expand our sense of self. Dave shares a number of theories he's developed about how mindfulness works, and we also discuss some of his clinical work looking at mindfulness for chronic pain, and some exciting new research into the effects of mindfulness on the glymphatic system. I'll leave it to Dave to get into what that is and why it matters, but it's a very cool new frontier in biology and health. I've been really fascinated to learn about it. Dave also shares about the new International Society for Contemplative Research and their upcoming conference in July in Italy, which sounds amazing. I definitely encourage you to check that out if you're interested in this kind of research.

(02:27) There's lots more from Dave in the show notes, including many of the papers we discuss in this episode. I love how Dave keeps touching back on interconnection, whether that's between the people in this field, the ways that our brains process information, or dissolving the boundary between self and other. You can really hear how that concept infuses his work. Alright, I hope you enjoy this conversation as much as I did. I'm really happy to share with you Dave Vago.

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**Wendy Hasenkamp (02:59):** It is such a pleasure to welcome Dave Vago to the show today. Dave, it's great to see you. Thanks a lot for being here.

**Dave Vago** (03:06): Wendy, it's an absolute pleasure. I love your podcast.

**Wendy Hasenkamp** (03:09): Oh, thanks so much. It's awesome to have you on. One of the many things I love about hosting this show is getting to learn a little bit more about folks that I've known for a long time, and hearing backstories and things like that. So I don't know your backstory, so how did you get into neuroscience and meditation, and when did those come together for you?

**Dave Vago** (03:29): I just love this question and how you start the podcast with that question for everybody. It kind of weaves this beautiful tapestry of origin stories with all of your guests. How did we all get here? And if you really prescribe to this concept of interdependence, we can trace my research and why I'm here with you, Wendy, and the entire field of contemplative science back to... I like to think that it goes back to the intention of the Dalai Lama. I'll try to unpack that a bit.

(04:01) The Buddha described this idea of dependent origination and interdependence, described as this profound interconnectedness that we have that exists amongst all phenomena. And it explains that sort of causal nexus of conditions really for all of the things, all situations, we're all linked in some way, and we all serve as conditions affecting each other. From the Buddhist perspective, this is a key principle to understanding the nature of our suffering and our liberation. But let me just try to weave a few threads here based on my own experience, and I think tying it to His Holiness, the Dalai Lama will make sense.

(04:43) Of course, His Holiness was always curious about science since he was young. So he always wondered how things worked, he took apart everything, rebuilt it... And because of that interest in science, Mind & Life came into existence, right? Skip a few causal links in the chain and here we are today having this discussion. I think about Sogyal Rinpoche who said something like, "If we are interdependent with everything and everyone else, even our smallest, least significant thoughts, words and actions can all have real consequences throughout the universe." And so I believe that many of the people that you have hosted on your podcast, if not the majority, have similar intentions that align with those of His Holiness to reduce suffering, and to use science to explore the nature of mind in a rigorous way.

(05:38) On a personal level, I can say that I've always had a fascination with the power of mind since I was really young. My mom always says that I asked a lot of questions about the origins of everything. I like to think that I had two bumper stickers in my youth that kind of define my natural curiosity and general approach to life. One was "Question the answers" and the other was from J.R.R. Tolkien, "Not all those who wander are lost." And those perspectives continue to drive my motivation for sharing knowledge and scientific inquiry and just the general sort of journey for life. With that sort of foundation, I continued to be inspired by a lot of teachers who really got me hooked on science. I was fascinated by neurophysiology and the brain. I remember learning once that each cell has, out of the 37 trillion cells in our body, that they have this resting electrical potential of -70 millivolts, and how altogether it can create this electrical field, or enough current, to power one light bulb. And that's amazing to think that we have this electrical activity that's happening all around us. We create this electrical field. We don't see it. So I was always really curious about how the brain and the body carried this electrical charge and how it could be studied.

(07:08) Skip to undergraduate years, I studied brain and cognitive sciences. Actually, in 1995 I was part of the first class of five graduates to graduate with this degree. It was a brand new degree that didn't exist before, so it was kind of part of the cognitive neuroscience revolution. I was interested in mixing cognitive neurosciences with philosophy of mind and religious studies. So I was trying to create actually

an interdisciplinary major. And then this brain and cognitive sciences major came about. But in that process, I was taking a lot of religion and philosophy classes.

(07:46) And there was one class that just totally inspired me by Douglas Brooks. He's a Hindu Vedanta scholar, and the class was called the Asian Search for Self. The class introduced me to Vedism, classical Hinduism, Buddhism, how these wisdom traditions conceive of the cosmos, the illusory nature of the self, and life's ultimate goals. It was really the first time that I started to ponder this idea of self-transformation through meditation. And I started to really be interested in this Buddhist lens of no-self or *anatman*, which describes that sort of impermanent illusory nature of self. That was fascinating for me to think like, okay, what does that mean, that the self is an illusion? And then there's this alternate kind of conception of self, the *atman*, which from the Hindu Vedanta perspective is a permanent unchanging core self that is one with the divine and persists across lifetimes. So how do you grapple with those different ways of understanding the self?

(08:59) And I just dove into books. I think Walpola Rahula's *What the Buddha Taught* was what I had to read from that class. And then I read Nyanaponika Thera's *The Heart of Buddhist Meditation* and Thich Nhat Hanh's *Miracle of Mindfulness*. I just started getting into as many Buddhist texts as possible, and I was really taken deeply by the Buddhist teachings. They were like the perfect parallel for neuroscience, at least from my perspective, in trying to understand the mind. So that's where I started to think of a translational perspective. How do these Buddhist models and conceptions, or epistemology, of mind translate into more cognitive and neuroscientific processes? How do we make that translational gap? It was really, I think during those studies with Dr. Brooks and all my extended reading of Vedanta and Buddhist literature that I decided that I needed to experience firsthand what meditation was all about. So it was my junior in college and I went to my first Goenka style Vipassana meditation retreat in Western Massachusetts.

**Wendy Hasenkamp** (10:05): That's a pretty intense way to get into it.

**Dave Vago** (10:09): Yeah, and I think if I didn't do it that way, if I didn't go dive deep, into the deep end right away, I don't know if I would've had the same sort of profound transformative kind of shift for me. Because 10 days of silence—no writing, no devices, no interactions with anyone except for meditating together—that was profound for me. And I started practicing regularly.

**Wendy Hasenkamp** (10:40): Can you say a bit about what was shifting or what happened for you there?

**Dave Vago** (10:43): Oh, man. Gosh. Well, one of the things that I learned from doing Vipassana practice was... ha, how to wake myself up from falling asleep. *[laughter]* But the other was, it was this opportunity when you sit for a long period of time, what I found was... I was having a lot of trouble with Anapanasati, which was just focus on breath. Focus on breath, and count if you need to. And I just kept coming back to all these thoughts, all this stuff that's in my mind. And I was struggling with what to do with those thoughts. But you have an opportunity to talk to the teachers in the evening time, and I talked about it and they said, "Just keep doing the counting technique if that's helpful."

(11:28) And eventually what I ended up realizing for myself was that if I just sat long enough and explored every thought that I had, eventually those thoughts would just disappear, because I explored them. I let them come. I watched them. Instead of pushing them away, I would basically do an inventory, and would end up with a control-alt-delete. *[laughter]* When I emptied that spaciousness that arises from no more thoughts, that's when I started to have some profound experiences. Probably some

of the most profound experiences I ever had meditating was from that first retreat. So I'll always cherish those experiences, for sure.

(12:14) So that was a huge shift for me to think about that way, but I still didn't think that I was ever going to be able to study meditation. It was just a practice that I wanted to continue. And then I was trying to think of whether to go to grad school or med school. I started actually a pen pal relationship with J. Alan Hobson. He wrote a book called *Chemistry of Conscious States*, and he actually created this model, the Activation Synthesis Model. It was a biological based model of how dreams arise, and that, I was really fascinated by. I wanted to do what he does and that's why I wanted to correspond with him. It's always great to get a good mentor, and he became one for me. We wrote letters to each other. (I still have them. It's like a romance, really.) [laughter] He died a few years ago, but he did give me the best advice about whether... You know, I was trying to decide med school or grad school, and he said, "Graduate school is the intellectually more rigorous route. You would become an expert in something, whereas medical school would be more versatile."

(13:25) And I just love that advice. I give it to all my students as well. Of course, I decided to do the intellectually more rigorous route, as history would have it. I went to graduate school at the University of Utah, studied learning and memory. I was doing behavioral pharmacology and electrophysiology to study the influence of acetylcholine and dopamine on different pathways into the hippocampus, and their modulatory influence on encoding consolidation and retrieval [of memories]. Really, some of our findings were that depending on when—"when" was the key component—when you interfered with the neurochemical cascade of molecular events following exposure to what we were looking at (fear conditioning, so learning fear and associating fear with a spatial context), you could impact that consolidation. So you would put them in a fear conditioning chamber and shock them. And a week later, if they went back into that environment, they would freeze, knowing that that's a consolidated memory.

**Wendy Hasenkamp (14:27):** This is animal models, right?

**Dave Vago (14:28):** This is animal models. Yeah, I was doing rats, which I really am happy I was exposed to that, but I couldn't continue doing animal research after a while. It really was difficult for me.

**Wendy Hasenkamp (14:39):** I had the same experience.

**Dave Vago (14:43):** Yeah, I struggled with that a lot, just ethically, morally. I felt like I needed to do human research. So I did shift. But it was some interesting work that came from that, looking at the temporal nature of memory consolidation and how critical those windows are. Because we found that if you block a very specific receptor, like the alpha-7 acetylcholine receptor, it only would disrupt memory consolidation if it was six hours after the fear conditioning. And that alpha-4 beta-2 receptor blockage would only disrupt memory consolidation if it was done within 15 minutes of exposure. So that was really fascinating to me. I really got into studying memory.

(15:28) And this is where I think I come back to the Dalai Lama because in 2004, I was still in graduate school, I saw the dialogue at MIT with His Holiness and these great scientists—Dan Gilbert, Steve Costin, Nancy Kanwisher, Evan Thompson, and Richie Davidson. It was just like, wow, there's a great spiritual leader having a conversation about the mind with neuroscientists. So it led me to just discover this is a possible path for research. I mean, it was perfect. And then there just happened to be this Summer Research Institute that started in 2004. I applied for 2005, and I was like, "I gotta meet Richie Davidson. I think I want to do what he's doing, too." So that was my first science conference where not only did I get

to learn science and how it relates to meditation, but also be barefoot and meditate, which was pretty awesome.

[\(16:31\)](#) So I was just finishing my PhD around 2005. It was the right time, right place. I met Yoshi Nakamura, who was also a meditation practitioner from Utah. He was studying pain at the medical center in Utah. And we connected at SRI, and I was like, "Great. I want to stick around Utah a little longer." And I took a postdoc with him to study the impact of mindfulness on chronic pain. That's when I applied for a Varela Grant in 2005 to do my first study on fibromyalgia, a chronic pain condition. And this is just a great population to study the impact of mindfulness for a few reasons.

[\(17:11\)](#) For those of your listeners who don't know, fibromyalgia is a chronic pain condition with widespread muscle tenderness, chronic pain, fatigue, high levels of anxiety and fear associated with pain. So fear comes up again. And so individuals have these attentional biases, and these are tendencies to allocate attention toward or away from threatening, emotional, or socially relevant stimuli (like angry faces or words). And there doesn't necessarily have to be awareness. This is what I thought was really fascinating. There's a wealth of research in anxiety showing that attentional bias occurs with mood-congruent information, like threat. So there's these biases that are inherent in how we process the world. You may not even have awareness that you have those biases.

**Wendy Hasenkamp** [\(18:02\)](#): Can you give an example of what "mood-congruent" something might look like for someone?

**Dave Vago** [\(18:06\)](#): Yeah. Maybe the best way to describe this is the hypervigilant avoidant model of attentional bias. The way this works is that you have rapid selective attention towards something that could be potentially threatening that's meaningful to you. So for chronic pain patients, it's pain. Pain-related words, pain-related images, they have this hypervigilant kind of orientation to threat-related content. Then there's also a tendency for avoidance. It's a defensive function that follows hypervigilance in which perceived threat shifts attention away from threat, reflexively. Or strategically—and this is where, again, the temporal nature of processing is so key, because you can be reflexively avoidant and have no idea that you're avoiding the world that's relevant to you; or you can be more strategic about avoidance where like, "I don't want to see that. I know it's not good for me." You can see both of those aspects and you can measure it both behaviorally and neurophysiologically.

[\(19:14\)](#) So there's this heightened sensitivity, vigilance and orientation towards threat, and a reduced processing of threat or avoidance of threat. And this all happens very effortlessly and automatically, in the first 200 milliseconds of detecting a stimulus that could be threatening. So there's no awareness there. It's just a pattern of perceptual processing. And when individuals do engage with the threat, then there's often difficulty disengaging from that threat, suggesting a more ruminative kind of processing or self-reflective...

**Wendy Hasenkamp** [\(19:49\)](#): It's like, sticky.

**Dave Vago** [\(19:50\)](#): It's sticky! Exactly. This is that stickiness... We talk about that in the Buddhist model, right? Stickiness. And how stuck can you get when you start to get something, a thought that's negative or self-reflective, the threat's going to harm me, or even I'm a horrible person who can't handle pain. You just start thinking about it and you're stuck, and you weren't able to just let it go.

[\(20:16\)](#) In fact, there's great data that we know, Antoine Lutz, Heleen Slagter, a lot of work that came out of Richie's lab shows that long-term [meditation] practitioners do a really good job of being able to

perceive an object, even if it's emotionally charged, and attentionally let it go very quickly. You see this in a lot of different experiments, probably the one that's of most relevance is the attentional blink task. That task showed very clearly that if you show many stimuli very quickly, within 300 milliseconds of each other, you can see a brain response to one stimulus and you may not even see a response in the brain to a stimulus that's within 300 milliseconds of the first stimulus.

**Wendy Hasenkamp (21:05):** Right. It's like your cognitive apparatus is busy processing the first one, so you don't actually even process something that comes really quickly afterwards.

**Dave Vago (21:14):** Exactly. And there's something so profound to that, when you think about how often that happens in our lives. We pay attention to something, and because we allocate resources to that object, we lose everything else. And so what Heleen and Antoine were showing was that meditators have a keen ability to drop that stickiness and see both objects. Within 300 milliseconds of each other, the brain is responding, suggesting that meditators are just more efficient at how they allocate attention so that there's less of that stickiness.

**Wendy Hasenkamp (21:50):** Which makes sense, because that's what you train a lot of... Certainly in the beginning of meditation, like you were talking about on your first retreat—letting a thought play itself out and kind of dropping it. That's all part of that training, right?

**Dave Vago (22:02):** Yeah, and first, it's overwhelming, right? It's always there and you just get consumed by the thought or the feeling inside. But as you get better in terms of your training, you're able to... I think the resolution in which you can attach your attention to an object becomes greater, such that you're able to drive that sort of insight and wisdom wedge between stimulus and response in a much faster way. Stimulus comes, stimulus comes and you respond at a faster rate. And I think that's what the data is showing—and that's what we saw with the participants who had fibromyalgia (they all happened to be female).

**Wendy Hasenkamp (22:43):** And mindfulness was helpful for them to...

**Dave Vago (22:46):** Yeah, so we gave them a mindfulness intervention based on the MBSR model, Mindfulness-Based Stress Reduction, and all the participants showed clinical improvements in anxiety, current and usual levels of pain. There was even a 14% reduction in worst levels of pain. So we wanted to know, was attentional bias a mechanism that could explain the clinical improvement?

**Wendy Hasenkamp (23:09):** Yeah. It's so interesting when you get into this space around pain because (I've talked with Fadel Zeidan too on the show a little bit about this before), there's kind of the difference between some objective measure of pain, like an intensity of a stimulus, versus the unpleasantness of a stimulus, right? And how much does attention play into that? So yeah, I hear all those questions in what you're describing.

**Dave Vago (23:33):** Yeah, the two arrows. I heard you speaking with Elissa Epel too, about stress and how there's this sort of automatic reaction. And then there's the extended—what in this case would be more strategic kind of processing, it's more volitional—that comes later. That's described as the two arrows in the Buddhist tradition. And you see it very clearly, that there's a rating of pain that's physical or sensory-based, and then there's more emotional unpleasantness. How unpleasant is this? And it's very confusing for meditators because they don't really have that kind of unpleasantness to pain stimulus as most normal people do. It's, "Yes, there's a physical sensation here, but is it unpleasant? Maybe. Maybe not."

(24:25) So that's kind of what we were seeing too with these women who have fibromyalgia, is that there's something that could be speaking to how unpleasant the experience was. We know that catastrophizing of pain was one of the major problems that these patients have. There's excessive magnification of pain related experiences, feelings of helplessness, and a lot of rumination that's pushing the experience of pain and the emotional experience of pain into constant thinking, so it interferes with ongoing task demands.

(25:02) And so we use a dot probe task. This task, the way it works is that you can measure aspects of attention—orienting and engagement with an object—depending on how rapidly people respond to a target that's like a pain-related word that is followed by a probe, a dot in the same location as where the emotional stimulus was. And so if you do a rapid presentation of a stimulus, of an emotional stimulus like a pain-related word, what you see is really high avoidance of the threatening stimuli. So there's hypervigilance, meaning that they can detect that there's a stimulus there. There's an emotional word that's pain-related. "Ah, this is horrible. I detect it." And then they immediately look away, without knowing. There are ways, behavioral indices, to assess bias even at really fast time scales. So you can look at the hypervigilance and avoidance model in this dot probe task.

(26:03) And then you can look at this disengagement index, which is how quickly one disengages attention from an object. So the slower one is to disengage, the more that stickiness comes. It's assumed that there's more mental processing, rumination, and that could really interfere with ongoing task demands. And it takes a lot of metabolic energy to do that. So we were able to show these biases were there in the women who were not exposed to mindfulness training, and we compared them to women who were exposed to the mindfulness training and found that at the early stages of attention, there was less avoidance. So they were engaging more with pain-related words.

**Wendy Hasenkamp (26:47):** And that's at an unconscious level?

**Dave Vago (26:49):** An unconscious level. That's what's so fascinating, is that it happened so quickly. If you saw how fast a 100-millisecond stimulus is, it's fast. You barely have time to recognize what it is, but your brain is processing much faster than you have awareness, right? Again, it speaks to this temporal nature of how perception and cognition work. And this is what I get really interested in later. I've created these models for what I would call a "temporal chronometry" of attention. It speaks to this idea that even at the early stages of processing, before you have awareness, the brain is already doing so many different things to orient you to salient or relevant information. And mindfulness is demonstrating that it can even alter those biases at the early stages of processing. So that was what we did in my first study in Utah.

(27:52) And then I was fortunate enough to... Well, Mind & Life was actually looking for a neuroscientist to pick up the bandwidth where Richie had none. So I applied for this position and started working part-time for about four years as the Senior Research Coordinator helping establish some of the initial programming that focused on science and research. So the Varela Award program, the Program and Research Council, as it was called back then. And I worked with Rob Roeser, who was the Program Coordinator. Together, we were really a great pair, and I loved working with Mind & Life.

(28:29) But I still tried to keep postdoc-ing. So I actually left Utah, I remained as the Senior Research Coordinator for Mind & Life, and I started studying mindfulness in neuropsychiatric patients and learning neuroimaging methods so I can work with humans more because I was like, "Hey, there's something here. The fibromyalgia patients responded to mindfulness, and there's something to

attentional bias." So I was at Weill Cornell Medical College in New York City, and then I moved to Harvard Medical School. And during my training at both Cornell and Harvard, I focused on developing system-based conceptual models that could explain how mindfulness works. And I developed a model called the SART model, together with my colleagues at Harvard. We also published a paper on how mindfulness works.

**Wendy Hasenkamp (29:19):** Yeah, those are really some of the early influential theory papers when this field was just beginning. I think that paper was one of the first that I remember to really focus in on the self and the concept of the self and how practice might be changing that, which you've continued to look at in so many ways over your career.

**Dave Vago (29:37):** I did. And so yeah, self. Exactly. The self is going to keep coming back into my life and how I study it.

[\(29:43\)](#) – *musical interlude* –

**Wendy Hasenkamp (30:00):** So yeah, maybe can you walk us through a little bit of the SART, as it's called, model?

**Dave Vago (30:05):** Yeah. The SART model was really just a framework for how to understand the mechanisms by which mindfulness can lead to self-transformation. I really did want to go back to this. The original reason why I was interested in mindfulness was how it can affect the self.

**Wendy Hasenkamp (30:22):** Yeah, I love looping that back in. That's cool to hear that.

**Dave Vago (30:25):** Right? So it does come back. That was what I was first fascinated by in Douglas Brook's class. So I focused on different ways the self (S) is impacted by mindfulness. One was self-awareness (A), so greater awareness of our mental habits, removing biases that are inherent in the habitual forms of cognition and perception. Vipassana is the Pali word for insight. Insight in some translations, it's removing the veil of ignorance, revealing the nature of things as they truly are. And so that's part of what we refer to as self-awareness. It's part of what Richie and colleagues have also talked about as essential to well-being. Dan Goleman, I think who was on your podcast as well, talking about self-awareness. It's getting more insight into our mental habits. And so that's key. And I had a whole list of mechanisms that fall under that, including interoception and exteroception: How we gain more insight into our bodily functions with accuracy. And embodiment: How do we situate ourselves in a particular context and have more awareness about how we relate to the environment? And then meta-awareness, which is I think the key mechanism by which many of these practices work therapeutically, allowing us to have distance from our thoughts. I think Zindel Segal talks about this too. When people are able to say, "Thoughts are not facts. I am Dave having a thought." And that distance of decentering and allowing one to have awareness of our own cognitive processes are key. So that self-awareness.

[\(32:08\)](#) And then self-regulation (R) is this ability to regulate, or inhibit. Inhibitory control is I think one of the biggest mechanisms that I focused on. I tried to articulate, what are the cognitive and neurobiological mechanisms by which the self is transforming? And inhibition is probably one of the biggest ones, where it can regulate our destructive thoughts and emotions.

**Wendy Hasenkamp (32:32):** Let's nuance that a little bit, just because I think it could come across like... just the word inhibition could sound like, oh, you're stopping something that would naturally be



happening. But I suppose you want to have some discernment around that, like you don't want to just completely inhibit yourself. So could you unpack that a little bit more? What would you be inhibiting?

**Dave Vago (32:54):** Well, sure. Again, it goes back to increasing our temporal resolution and decreasing the stickiness—getting more time, so to speak, to look at a stimulus that presents itself, and responding appropriately. It's the wedge of insight that mindfulness provides between stimulus and response.

**Wendy Hasenkamp (33:16):** Oh, so what you're inhibiting is the unfolding of the automatic process?

**Dave Vago (33:20):** And the response, right? So from sensory perception to motor behavior, there's a process. And so how do we slow that down enough that we're not being impulsive, we're not just responding automatically. We're using our awareness to slow our response down—without being too slow, like, "Let me... uh, I'll respond later." *[laughter]* It's actually interesting, if you look at reaction times of mindfulness practitioners, there are varied changes. Sometimes you'll see response times [get longer] in mindfulness practitioners because they just are slowing things down so much that they respond slower. But that's because they're responding more purposely.

**Wendy Hasenkamp (34:04):** Yes. It takes more time to have an intentional response.

**Dave Vago (34:09):** Intentional response, right. So that's what I mean by inhibition or inhibitory control. That's the way it's sort of described in neurosciences. And then there's of course, self-transcendence (T), which I think is probably the most critical piece to self-transformation. It's not only increasing pro-social dispositions of compassion, empathy, forgiveness.

**Wendy Hasenkamp (34:30):** Moving beyond just a self-focus?

**Dave Vago (34:32):** Moving beyond self-focus. So most people are motivated to practice mindfulness... I think there's a study that looked at what people are motivated by. It's like 84% of people are motivated to decrease stress and improve concentration.

**Wendy Hasenkamp (34:49):** Yeah. And interestingly, that's how it's been marketed... in Western culture, which is not surprising.

**Dave Vago (34:55):** Yeah. Well, it's not surprising because we all feel like we're stressed out and need to help us start there. That's a great place to start, and that's where Jon Kabat-Zinn's genius was to think about stress, which is a good place. But it's not the fundamental goal of practice, it's not just for self-regulation or stress reduction. It's for this sort of transcendent experience where you dissolve the boundaries between self and other. And that is profound. When you think about how it's described in the Visuddhimagga, like an object of compassion, of thinking about your mother as a metaphor, the love that a mother has for their child is unconditional.

**Wendy Hasenkamp (35:40):** Which sometimes has to be nuanced I think also, when that metaphor is brought into the West. But in the Buddhist context...

**Dave Vago (35:48):** Yes, well, it doesn't always work out that way, but in many regards, that is the ultimate sort of non-conditional sense of love and kindness that a person can have for another, is the mother and their child. If you could have that same amount of love that is often talked about in the benefactor practice by John Makransky, showering yourself in that kind of love. If we were all, as one humanity, to cultivate that non-dual sense of love and kindness for everyone around us, including the

people on the bus, your neighbors who are noisy, to you know, Palestinian and Israelis, that kind of love would dissolve our problems if we could truly do it. But it's a big tall order for humanity. We're not quite there, but it would certainly help. So that's the transcendent piece.

(36:42) Lastly, I actually started creating a new component to the SART model, which is a little "i" called integration, where the idea is to start integrating the insight and wisdom into a holistic, unified experience. So everything, all the insights that you gain from mental training contributes to your sense of purpose and meaning, and that holistic kind of unified experience is what we would call integration. In fact, in psychedelic assisted psychotherapy, integration is a key piece of how the clinical impact can be a positive experience. We're just starting to see how meditation is being used in the integration process for people who go through that psychedelic experience.

**Wendy Hasenkamp (37:31):** Yeah, it's so healing to have this, like you said, a more holistic perspective on all the things maybe that you've learned or that have happened to you. And that's making me think about predictive models too, of mind, and how from that lens or that theory, our minds are continually constructing this model of the world based on all our experiences, and then using that model to make inferences about everything that we're then experiencing, and then what's coming next. I feel like it's such a benefit if you're holding a model of the world, that it be synthesized like that, right? That it all hang together in some way. Is that kind of part of that integration, the way you're thinking about it?

**Dave Vago (38:17):** I would think so. We should write it together. *[laughter]* Yeah, I think that there's this sort of natural reframing that happens through mindfulness practice too, the reappraisal piece. It's controversial, but Eric Garland has used this idea of reappraisal to better integrate all the wisdom that you learn from the practice. There could be some bottom-up kind of sensory embodied experience that you get from sitting on a cushion, or from psychedelics, and how you reframe or shift your mental habits or behavioral patterns... Behavioral change is really predicated on how you integrate all that wisdom into a new self. If the self is changing all the time, there's always an opportunity to shift your mental habits and your behaviors in a positive way. How you can take all the information that's coming in and shift how you respond to that.

(39:24) The automatic part is the hard part to change. The strategic level of processing is a little easier. We can constantly remind ourselves to do something differently, but our patterns that are ingrained into those biases that happened before there's awareness, is much harder to shift. But at the same time, we now see there's evidence that mindfulness can do this. After Harvard, I was at Vanderbilt and we did this. We just tried to reproduce the findings that we saw behaviorally using EEG and ERP. So event related potentials (ERP) is just another way to look at the electrical signature of responsivity of the brain to a stimulus. We can look at 100 milliseconds, we were looking even at... We saw larger C1, which is like 35 milliseconds after showing a happy or an angry face pair. At 35 milliseconds, we saw that there was a difference in amplitude in the visual cortex responding to happy versus angry face cues, suggesting that at 35 milliseconds, your brain is already making some sort of evaluation.

**Wendy Hasenkamp (40:38):** Like a filter.

**Dave Vago (40:39):** A filter that's based on emotional differences. It's not just lines and edges and dark and white contrast in the visual cortex. There's emotional aspects of a stimulus being processed. And that's also profound because we don't typically think that the visual cortex does that, but there's so much feedback happening in such rapid amount of time that we have to think about the temporal nature of all these events that are happening so early.

**Wendy Hasenkamp (41:06):** I love that—it really hammers home that in thinking of the brain as such an interconnected system, you can't really think about one part of the brain on its own, without having influence from all the other parts. That's a great example.

**Dave Vago (41:22):** Yeah, we used to think [about] functional brain activity, we would correlate function with one brain area, like "the amygdala does fear" or "the prefrontal cortex does higher-order thinking." But we now know that you can't really separate these individual components from their networks that they function in. In some of the models that we've created beyond the SART now, we actually just wrote a paper, I just wrote a paper, and it's a new model called the SPACER model. It's proposed to integrate the temporal components of experience that happens at the body-brain-mind interactions, each with neurological substrates supporting the dynamic processes moment by moment (moment by moment meaning 500 milliseconds by 500 milliseconds), what's happening in each system? And that's where we can start teasing apart different neural systems as it relates to self-reification, how do we reify ourself into a pattern of behaviors and thoughts and perceptions, to a feeling of self-agency of I am, to how we relate to others, self-other relations, and then non-duality. So all of that was in the SPACER model.

(42:37) It leverages Thomas Metzinger's sort of approach to how the self is updated continuously, and then Buddhist descriptions of self-transformation that happen through these practices. And the idea is you can break down experience across these perceptual, cognitive, emotional and motor types of systems and look at how mindfulness can impact all those different systems. That's what at least I was proposing in that model.

**Wendy Hasenkamp (43:08):** I love how you're emphasizing, and all the models that you've been working on, emphasize how the self is continually changing. Like you just said, it's kind of always being updated. I think that idea can run counter to the normal concepts that we have of self as like, "I am this person. I'm kind of always the same through time." Something you've also written about recently is relating the self and the patterns of self to inflexibility or rigidity in the mind and how that can have clinical impact. I don't know if there's more to say around that. It just made me think about how we were talking about stickiness, and being stuck in patterns versus being more changeable.

**Dave Vago (43:57):** Yeah, we just published a series of articles on the self that uses Sean Gallagher's Self Pattern Theory. And the idea here is looking at how these patterns of self-experience can group into ways of processing the world. So you have a narrative kind of self, you have an experiential self, that's what's happening in the present moment right now, versus how you time travel into the past or think about the future, and the narrative that you create of the reified self-identity that we all carry. And how do those different aspects of self transform through contemplative practice?

(44:42) And those papers, they've come out, and Sean is a critical part of that team. But it's a large team. In fact, it's another one of those really great initiatives where a large group of people got together—and it was sponsored by Mind & Life Institute, by a Think Tank. Marieke van Vugt was I think, who got the grant. We were in the Netherlands and we all met. It was probably 10 of us, and we all came up with different ways of bringing our expertise and different perspectives together to write a really high impact paper. I love that kind of team approach. That's like my favorite thing to do, is have that kind of think tank structure to have a large impact. So that's where I think Mind & Life has been really critical to help bring that kind of work together. I would just suggest for anyone listening to check out these series of three papers that go into this, the self pattern, describing how we can have different experiences of the self and how they can transform through contemplative practice, for sure.

(45:40) – *musical interlude* –

**Wendy Hasenkamp (46:10):** Well, I know you've been involved in so much interesting stuff. There's one other thing I know you've been up to recently that I want to touch on because I think it's so cool, and we haven't talked about it, I don't think yet on the podcast, but that's looking at the effects of mindfulness on what's called the glymphatic system in the brain. Which is a kind of revolution in our understanding of what's going on in the brain. So maybe you could share a little bit about that.

**Dave Vago (46:34):** Yes. Oh, I'm so excited about this research, actually. This was research that is being done at Vanderbilt. There's just so many great people at Vanderbilt. The imaging center is particularly good. It's run by John Gore, Bennett Landman, and Manus Donahue. Manus Donahue studies metabolism. He's a neurologist and a radiologist, and he was looking at metabolism actually in the different parts of the body, that brown fat for example. Through that sort of expertise, we paired up and said, "Hey, did you hear about the glymphatic system?" It was discovered in 2012. It's a relatively recent discovery. The glymphatic system plays a critical role in clearing metabolic waste accumulated throughout the day. It utilizes a unique system of perivascular channels formed by glial cells and how they interact with vasculature.

**Wendy Hasenkamp (47:24):** And clearing the debris specifically from the brain, right?

**Dave Vago (47:27):** From the brain, yes. From the brain. The way it works is that all the sort of waste compounds, amino acids, neurotransmitters related to just transmission, has to be cleared on a regular basis. The idea is that the cerebral spinal fluid and neurofluids that are throughout the brain are washing over tissue and helping eliminate the waste. This is similar to the lymphatic system responsible for removing waste materials in other parts of the body. And the reason it's glymphatic is the glial cells are responsible for making that bridge between the vasculature and the gray matter.

**(48:12)** The discovery was this landmark paper in Science in 2012. This was Maiken Nedergaard. Her team discovered that the brain has this unique method of removing waste through this network that piggybacks on the blood vessels, pumps cerebral spinal fluid through the brain tissue, flushing away the waste, and that the system is primarily active during sleep. It makes sense, right? It emphasizes that some of the greatest restorative components of sleep is to remove metabolic waste. It has profound implications for neurological diseases, Alzheimer's, Parkinson's, ALS. We know that as people get older, they sleep less. Their sleep efficiency is less, so they're not eliminating their waste products as much. And that's where there's accumulation and we see that people who have decreased sleep are more likely to have some of these neurodegenerative disorders. So we now know there's toxic proteins, amyloid, beta, tau, all contributes to these neurodegenerative disorders if you don't get rid of some of the waste. And it's just led to an explosion of research in the last 10 years.

**(49:19)** There was also a paper in 2019 by Bob Stickgold and colleagues that showed during non-rapid eye movement sleep, so deep sleep, that there's these large oscillations in this neural fluid, we can call it glymphatic activity, that wasn't present during wakefulness. And so we wrote a grant together with Manus Donahue to essentially say, "Hey, well, meditation is a low metabolic activity. Let's see if it can compare to sleep and follow this sort of same pattern that we saw in the two Science papers." And so we now have 20 expert meditators with lifetime experience of probably around, greater than 500 hours. We wanted to look at people who had the ability to sit in a scanner or lie in a scanner and have stable attention. So we looked at focused concentration first. And then we also were wondering, what if you just do paced breathing? How would it compare?

**Wendy Hasenkamp (50:21):** Just like a regular steady breathing?

**Dave Vago (50:23):** Yes, exactly. What we found is of course, in meditation, without a lot of awareness, your breathing rate goes down—it changes, it reduces. And so we wanted to make sure that this wasn't just due to the breathing. So we had this other group come in also that does paced breathing at the same rate that the meditators were reducing their rate to. It was about 7 to 10 breaths per minute. It was like 3 or 4 breaths per minute less than their rate before they started meditating.

(50:52) So now we have about 20 meditators. We're still immersed in this study. We need more practitioners, so if people can come down to Vanderbilt in Nashville and participate, we need more. But so far, what we're finding is fascinating, that it turns out... There's different metrics by which you can measure the glymphatic system activity. You can look at CSF flow through the aqueduct.

**Wendy Hasenkamp (51:16):** Cerebral spinal fluid?

**Dave Vago (51:18):** Cerebral spinal fluid through part of the brain and the brainstem, and you can look in different sinus cavities of volume and flow rates. That's one of the indirect measures of the glymphatic system activity. And we looked at different types of brain imaging techniques and looked at functional connectivity with the salience network because that seems to be a really important network that is associated with meditation. And looked at these metrics of glymphatic system activity and how it correlates with salience network activity and expertise of the practitioner. But it turns out that the metrics for glymphatic system activation correlated significantly with change in the functional connectivity of the salience network between the resting mind wandering state of no meditation and of focused attention meditation practice, and that the activity looked similar to sleep.

**Wendy Hasenkamp (52:20):** Similar to deep sleep, when you're doing this kind of clearing?

**Dave Vago (52:22):** Similar to deep sleep, yes! So, suggesting that there's some restorative effects that you see in sleep that are also similar in meditation. Here's what's also really interesting: I really thought that breathing, the paced breathing was going to have an impact. But it turns out that those CSF flow changes that we saw with the meditators during meditation relative to mind wandering were not observed during paced breathing. So the group of people who just did the paced breathing at the same rate that the meditators were breathing did not show that same kind of glymphatic system activation.

**Wendy Hasenkamp (53:02):** Interesting!

**Dave Vago (53:03):** Really interesting.

**Wendy Hasenkamp (53:04):** I love this.

**Dave Vago (53:05):** Yeah, right? But the implications are profound because you would imagine of course, all these people who are mildly cognitively impaired or on the track to neurodegenerative disorders who are not getting proper sleep and clearing out metabolic waste could then start using meditation specifically prescribed for helping them reduce the impact or the progression of their disease.

**Wendy Hasenkamp (53:30):** Yeah, that's an exciting possibility. Obviously there would be many steps to test that out.

**Dave Vago (53:34):** Yeah, it's the beginning.

**Wendy Hasenkamp** ([53:35](#)): But I love that you're doing the beginning of this work to look at how can meditation help us clean our brains out, literally, more efficiently?

**Dave Vago** ([53:45](#)): That's the question. Can it help clean our brains out? Exactly. Literally, with actually metabolic waste, not thoughts. Not clearing our thoughts out. But maybe a little bit of both.

**Wendy Hasenkamp** ([53:55](#)): Right, right. Oh, this is so cool. Well, before we wrap, I just wanted to also mention one thing I know you've been really involved in the last several years, which is your involvement with the new academic society, professional society around contemplative sciences, called the International Society for Contemplative Research (ISCR). I know you guys have a meeting coming up in Italy, which sounds totally amazing, so if there's anything you want to share about that.

**Dave Vago** ([54:21](#)): Yes, thank you. Yes, the society is getting legs underneath it. We're just starting to become more stable, and we really want to partner with Mind & Life and other organizations with similar interests in contemplative science and contemplative research. There will be a conference in Padova, Italy, the second ISCR conference. The first one was in San Diego. And so this one will be June 19th to 23rd in beautiful Padova Italy. We have some great keynote speakers and panels all set. Franz Vollenweider, who's going to talk about meditation and psychedelics. Olga Klimecki will be there talking about empathy and compassion. Rhonda Magee, Anne Klein, Sarah Shaw, Claire Petitmengin will be talking about microphenomenology. Andreas Weber, Shirley Telles—we're really trying to bring in the yoga community, yoga science community. She's going to be talking about yoga science as well. So there's just a lot of really great stuff happening that I encourage people to still register. There's still time. If you're interested in the actual society, check out the website. It's [iscrsociety.org](http://iscrsociety.org).

**Wendy Hasenkamp** ([55:37](#)): Great. And were you saying that that meeting is taking place in a building that Galileo taught in? It's amazing.

**Dave Vago** ([55:44](#)): Yes! Yeah, right? It's like the oldest university and the space where Galileo taught human anatomy dissections. It's got this really tiered approach to these balconies that just go up and you can just peer down into this one small lectern. Fascinating. So yeah, there's going to be some really beautiful venues to have a conference and have dialogue about contemplative research. It'll be really great.

**Wendy Hasenkamp** ([56:09](#)): Well, that's going to be amazing. I know we're coming up on our time, and I'm sure there's so much more that we could talk about. Is there anything that you wanted to be sure to chat about that we haven't touched on?

**Dave Vago** ([56:20](#)): Oh, no. I think it's just so great to be here with you. And like I said in the beginning, there's a tapestry of origin stories of all your guests that I hope one day we can weave them all together and see how we all got here through this interdependent kind of experience we're all having with the Dalai Lama's intention.

**Wendy Hasenkamp** ([56:42](#)): Well, thank you so much, Dave. This has been so great to chat, and thanks for all of your work in this field, and thanks for taking the time today.

**Dave Vago** ([56:50](#)): Yeah, wonderful to be with you, Wendy. I'm a huge fan. Thank you.

**Outro – Wendy Hasenkamp (56:58):** *This episode was edited and produced by me and Phil Walker, and music on the show is from Blue Dot Sessions and Universal. Show notes and resources for this and other episodes can be found at [podcast.mindandlife.org](http://podcast.mindandlife.org). If you enjoyed this episode, please rate and review us on Apple Podcasts, and share it with a friend. If something in this conversation sparked insight for you, let us know. You can send an email or voice memo to [podcast@mindandlife.org](mailto:podcast@mindandlife.org).*

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