Shrink Rap Radio #225, December 3, 2009, The Neuroscience of Meditation
David Van Nuys, Ph.D., aka "Dr. Dave" interviews Dr. Sara Lazar
(transcribed from www.ShrinkRapRadio.com by Jamie Johnson)

Excerpt: ...*Meditators, these guys have been practicing for years, 40 minutes a day for years. Maybe there will be some differences in their brain. Imagine how much brain matter they have. So we looked and low and behold they had more brain matter in the insula, which again is this really cool area. As well as areas involved in sensory awareness. So, for instance, the area representing the diaphragm was a little bigger. Also areas of visual cortex and auditory cortex were bigger, and finally an area in the front of the brain that's involved in a sort of an attention and working memory was also bigger.*

Introduction: That was the voice of my guest, Dr. Sara Lazar, speaking about her research on meditation and the plasticity of the brain. Sara W. Lazar, Ph.D. is a neuroscientist in the Psychiatry Department at Massachusetts General Hospital and an Instructor in Psychology at Harvard Medical School. The focus of her research is to elucidate the neural mechanisms underlying meditation, both in clinical settings and to promote and preserve health and well being in healthy individuals. One main focus of her work is determining how yoga and meditation influence brain structure and how these changes influence behavior. She's been practicing yoga and mindfulness meditation since 1994 and is a board member of the Institute for Meditation and Psychotherapy. Now let's get to the interview.

Dr. Dave: Dr. Sara Lazar, welcome to Shrink Rap Radio.

Dr. Sara Lazar: Hi! Thank you for having me on.

Dr. Dave: I'm really excited to have you on because you're one of the stars in the world of meditation research. So it's a real treat.

Dr. Sara Lazar: It's always good to be able to talk to people about it.

Dr. Dave: Ya, great. Hey, what's the weather like there in the Boston/Cambridge area right now?

Dr. Sara Lazar: Today it's beautiful! I think it's up in the 50s and maybe even the 60s and sunny and bright, no clouds, and a nice change from all the rain we had earlier this summer.

Dr. Dave: That's sounds delightful. I spent two years on exchange at the University of New Hampshire. So I got to spend time there in the Boston/Cambridge area and I miss it.

Dr. Sara Lazar: Ya, it's a wonderful place to live.

Dr. Dave: I think the fall would be a great time there, too. Well, getting on with things here. You're a meditator yourself, right?

Dr. Sara Lazar: Correct, yes, right.

Dr. Dave: Tell us about that. How you got into that?

Dr. Sara Lazar: It actually started with yoga. I was a runner back in high school and college. I had a training related injury. I was told I should stop running and instead I should do some stretching and as I left the physical therapist's office, I saw an ad for yoga and I thought, oh, that might be a fun way to stretch and stay in shape. But after about a month, I was totally hooked on yoga. I never went back to running. From the yoga, I then got interested in meditation because they always do a little bit of meditation at the end of the yoga class. So by then end of graduate school, I decided that I really wanted to understand what was going on in my yoga/meditation practice, and to better understand why and how it was working. I got very lucky, I found some people who were willing to take me in and train me. And here I am!

Dr. Dave: Now you were in graduate school, what were you specializing in?

Dr. Sara Lazar: I cloned genes out of bacteria.

Dr. Dave: Oh, my goodness. As a psychologist or in some other discipline?

Dr. Sara Lazar: No, in microbiology. That's my training, my training is in microbiology. So, I completely switched. I've no formal training whatsoever in psychology. But being in the psychiatry department surrounded by psychiatrists and psychologists, I've picked up quite a bit. Obviously, I would never be able to practice but it's my understanding of what's altered in brains of people with different diseases and it's like coming at it from a neurogical point of view.

Dr. Dave: What an interesting pathway into this work you've had. Was it a difficult area to break into? You mentioned you were in a totally different area. How hard was it for you to break into this?

Dr. Sara Lazar: Not mostly hard, just long. There's just a lot to learn. You know you go to grad school, you spend five, six years learning all this information and you know, it took me a couple years to learn it as well. It's all fairly straight forward. It just takes time to learn it all.

Dr. Dave: So I noticed that a lot of your work so far has been with Dr. Herbert Benson who's well known for the Relaxation Response. How did that come about?

Dr. Sara Lazar: Right, so he was interested in adding neurology. He contacted someone named George Bush, who is a resident and no relation whatsoever to the

President and who he knew through various contacts was a neuroimager and I also knew George, so I was talking to George one day, mentioned my interest in meditation and he's like, "oh, well, we're starting a study on meditation". And I got involved on that project and it just sort of took off from there.

Dr. Dave: You were kind of in the right place at the right time

Dr. Sara Lazar: Completely

Dr. Dave: With a lot of the right background. Now, I'm thinking back to the early days of computing when people had to sign up for time on the mainframe and they had to have significant grant money to pay for that time. Was it had to get access to the fMRI for brain imaging?

Dr. Sara Lazar: ahhh

Dr. Dave: Is it a similar kind of dynamic or is it different?

Dr. Sara Lazar: A little bit. The center's good. It knows that it's hard to get funding so it provides quite a bit of development time so if you have a good idea and a decent track record, you can often get, you know, some scan time pro bono. But obviously, some of the time you definitely need grant money. But also for that first study Dr. Benson had some seed money to do that project and so that's how we were able to do that first study.

Dr. Dave: And you know, this is all way over my head, how technical is it to learn to use the fMRI device? Does that have a long and steep learning curve?

Dr. Sara Lazar: Yeah, that's pretty much as hard to learn as the psychology. You begin by just little bit by little bit. Luckily, here at the center there's a ton of people who do MRI research. There's a lot of people who I could learn from and just slow and steady.

Dr. Dave: ok you published a study with others in 2000 on functional brain mapping of the Relaxation Response in meditation. I guess you already had your PhD at that point, right?

Dr. Sara Lazar: Correct.

Dr. Dave: But you'd been in this long apprenticeship. Tell us about the design and the findings of that study if you would.

Dr. Sara Lazar: Right. The first study, we …there was this study of six people who practiced Kundalini yoga and meditation. So Kundalini yoga, it's a mantra based meditation and as such, it's a little bit different than Buddhist mindfulness meditation which is very popular right now, in that it uses a mantra. Again, that was through my work with Dr. Benson. He had a collaboration with the Kundalini group. So he very much wanted to study them. I also practice yoga, not kundalini yoga, but a different yoga.

So, I thought, sure let's try it. So they went to scanner. First they sat there and did nothing. Then they did their mantra meditation, then they …we wanted a task that was kinda sorta like meditation but not meditation. So we wanted a sustained attention task that they could do verbally, silently to themselves. So we had them randomly generate the names of animals so dog, pig, cat

Dr. Dave: ok.

Dr. Sara Lazar: So they did that for a few minutes. So they would just alternate doing that task with the meditations. And that way we were able to compare periods of rest, periods of this random animal names task, and periods of meditation and what was found was that numerous brain regions lit up and in particular we found that the cingulate was one of the regions we found and also various regions involved in attention and awareness were involved so that was the main point of that study, I'd say, was just showing YES you could do it in the scanner, that it was possible to see something in the scanner. Because I think a lot of people thought you'd never be able to meditate in the scanner or that they're going to space out and that meditation is just lying there doing nothing, you know, this is all the critics. So they didn't think we'd ever see anything but low and behold we found a very nice pattern of activity.

Dr. Dave: Is this machine like MRIs? I've had MRIs where you have to lay in this white tube on a bed and it's very small and some people get claustrophobic and there are these loud clicking sounds?

Dr. Sara Lazar: Exactly, in fact it's a little bit louder. It's the exact same machine. They have to put on a special…it's sort of like a catcher's mask that comes down over the head and that's a special, it's call a head coil, which collects a little bit different data then you would collect then if you were just taking a picture of say, your knee or something like that. So it is very, very high resolution pictures of the brain but yet it's the same machine.

Dr. Dave: Yea, interesting. Let me ask what might be a naïve question, but why would focusing on a mantra be better than, be different than focusing on animal names?

Dr. Sara Lazar: Well, that was the question. And in fact, we found some regions the same but there was more activity in those regions during meditation. And also there were some regions that were unique to the meditation. It's been almost 10 years so I don't remember exactly what those regions were, but I should know that, but definitely all the regions were more active during the meditation than during the animal names. And the reason why it should be different? Partly because when you do the mantra or at least the way they're taught to do the manta, it's in conjunction with the breath. So as you say the mantra, you always inhale and exhale to various parts of the mantra. So as you inhale you say wahe and as you exhale you say gurunam and also they place significance on those words. They know what those words mean and it means something to them. And they try to engender certain mind states and qualities as they say those mantra words. I think the main thing was also that they use the mantra as a way to extend the breathing especially

in the yogic meditation techniques, there's a strong emphasis on slowing down the breathing rate because as you slow down that breathing rate you calm your autonomic nervous system. You calm the mind. And so there's a lot of emphasis on that and so that's probably the main reason. Whereas when they're doing animal names; dog, pig, cat no awareness of the breath whatsoever attention goes out to these extra elements.

Dr. Dave: You know, in a certain way you and I have followed a similar trajectory in as much as when I was in graduate school, my doctoral program, I got injured doing sport judo. And I ended up taking up yoga. And for my doctoral dissertation I wanted to do something, I wanted to do a study on meditation and of course this is all before the imaging was available and reading from the conclusion section of that paper you write, "the results indicate that the practice of meditation activates neural structures involved in attention and control of the autonomic nervous system". This was so exciting to me to read because my doctoral dissertation back in 1970, I hypothesized that the focus of attention is of major importance in meditation and hypnosis but as I say we didn't have access to any kind of brain imaging tools and so what I did was very primitive by today's standards. But it's exciting to me to see that neurologically, there is this emerging understanding of and focus on attention and its importance.

Dr. Sara Lazar: yes, attention, actually we found, not published yet, but there have been now several studies that really nicely document that attention increases as a result of meditation practice. And so they both looked at long term meditators verses controls and also they've taken novices who've never meditated and tested them before and after learning how to meditate. And they've also taken long term meditators before and after retreats. And all those cases you find that there is increases in attention on well validated tests of attention. There have been studies published in journals. I think the effect on attention is pretty well established now.

Dr. Dave: Yes, yes. I notice that your study had only five subjects and I recall being brainwashed in graduate school to believe that "real research", and maybe because you come out of a different field, maybe you didn't get the same brainwashing, but "real research" required large numbers of subjects. Can you explain to our listeners why a small number of subjects should be taken seriously in this sort of research?

Dr. Sara Lazar: Right, that first study, I don't think it was meant to be definitive about what happens in the brain when you meditate. It was more, it was definitely meant to be a pilot study not a full blow study. It was agreed that it was much too small but the main purpose was to say that yeah, it is possible have people to meditate in the scanner and get meaningful data and some initial ideas of where the brain might be active. And now in our new study, which we hope to publish soon, we have 20 people per group. Which again is still small by some standards but for imaging that's actually pretty good. Most imaging studies have about 15. So we have 15-20, so 20 is pretty nice. So there, this is with the Buddhist meditators are doing insight meditation which is sometimes referred to as mindfulness meditation which is just an awareness of the breath and there we're finding the insula being active. And it's interesting what we're finding that, and this is again relative to breath and to a control task, and this time… in the first study with the

animals people kept going back to cat and dog and farm animals and they couldn't think of different ones so we switched to do random number generation because we figured there was infinite number of numbers and they can pick any and they don't have to go back and repeat. Anyway we have them do random number generation while they're doing nothing and breath awareness meditation. And relative to both breath and random number generation, we're finding the insula specifically being activated. And also that the activity in the insula is corresponding with the changes in breathing rates. So we're showing that… the insula is very much aware and involved in awareness and attention and control of awareness and control sort of the awareness of the body and ultimately involved in regulating the autonomic nervous system…so it's really nice we're finding the insula because it really explains a lot of the effects of meditation, both in that it's attention, it's awareness, it's also control of the autonomic nervous system, also integration of emotion and thoughts. So it does a lot and that's exactly what we're seeing, that during meditation it gets ramped up and it's actually controlling breathing while you're paying attention to the breath.

Dr. Dave: Now, where in the heck is the insula because back when I took physiological psychology nobody mentioned anything called the insula?

Dr. Sara Lazar: It's really interesting. It's very old in terms of evolution, part of it is. If you look, it's cortex but it's not on the visible surface. If you call looking at a brain, …looks sort of like a catcher's mit. The hand and then the thumb kind of comes down toward the bottom and sort of that webbing, like where the thumb, between the thumb and the forefinger like that in there, it's called the temporal lobe of the brain. And the rest of the brain, it's sort of up above it. If you stick your finger in the crease, back in there is the insula cortex.

Dr. Dave: Is it an actual structure or is it something more functionally defined?

Dr. Sara Lazar: Well, it's cortex. The cortex is everything on the outer surface of the brain. Then down below the cortex, it's mostly white matter and it's also the limbic system, the hippocampus, amygdala, the caudate nucleus, it's below the brain stem, cerebellum and the thalamus. Those are all sub-cortex structures. The cortex is really thought to be the thinking part, computation part of the brain in terms of higher order prosthesis'. What's nice about the insula is it's actually, because it's biogenetically very old, it has characteristics of both. It's thought to really integrate most of the cortex with the limbic system. It integrates the limbic system with the rest of the cortex.

Dr. Dave: So it's sort of a mediator between those two systems.

Dr. Sara Lazar: Exactly

Dr. Dave: Now in 2005, you published a second study, "meditation experiences associated with increased cortical thickness" and I think it was this paper that caught the attention of the popular press because as you say, "it was the first research to provide

structural evidence for experience dependent cortical plasticity associated with meditation practice." Tell us a bit about that.

Dr. Sara Lazar: Right. So that study again had 20 people, 20 long term meditators and 15 controls. So the controls were people with little, if any, not more than 4 yoga or meditation classes in their life that were watched demographically for age, education, race, gender. We just put them in the scanners and we took…I should back up. There's two ways to use the MRI scanners in the brain. One is functional MRI. In functional MRI, you're looking at activity in the brain. What happens in the brain during task A verses task B. The other way is looking at the structure. So that is not activity but actually how much gray matter you have. And again gray matter is the part of the brain that is actually doing all the computation. That's where the action is, in the gray matter. Other people have shown, for instance, that musicians have more gray matter in areas related to music than non musicians. Athletes have more gray matter in their motor cortex compared to non-athletes. There is one study that actually showed over time that if you take people who've never juggled before, you scan them. You teach them how to juggle and then you scan them again. The part of the brain involved in detecting motion grows in just three months. You actually see growth in that region. It is consistent with that idea that your brain grows when it learns something new. So we thought ok, three months of juggling, meditators…these guys have been practicing for years, 40 minutes a day for years.
Maybe there will be some differences in their brain, how much gray matter they have. So we looked and low and behold, they had more gray matter in the insula, this really cool area, as well as areas involved in sensory awareness. For instance, the area representing the diaphragm was a little bit bigger. Also areas of visual cortex and auditory cortex were bigger. And finally an area in the front of the brain that's involved in a sort of attention and working memory was also bigger. That region was, what was cool about that spot which got a lot of press, is that it's well known that the entire brain shrinks with age. So it's as big as it's going to get is in our early 20s after that it starts to shrink. That's why as it shrinks, that's why as we get a little older, this is completely normal shrinkage, normal aging, this is why it gets harder to remember where we left our keys and what someone's name is, sort of a normal loss of our functions as we get older is due in part to this loss of gray matter and this is throughout our entire brain. What we found is that one spot in the meditators was as big in the 50 year olds as it was in the 25 yr olds, suggesting that the meditation helped slow or reverse this gradual loss of gray matter due to age.

Dr. Dave: I was vey excited to read that by the way, as an older person…

Dr. Sara Lazar: We're excited about that actually so…

Dr. Dave: Now, you're observing the structural differences via this machine. I'm just wondering, has there been any sort of confirmation by looking at actual brains to see that in fact there is a kind of thickening? I'm sure, maybe not with these particular meditators but somewhere along the line has anybody established that in fact there is that relationship?

Dr. Sara Lazar: The first few studies was Huntington's, Huntington's….Chorea.

Dr. Dave: Ya, Huntington's Chorea?

Dr. Sara Lazar: Exactly, what they did is they had families who were willing to donate their brains to science. They would scan those brains of people very shortly after, or maybe it was actually after they were very old and ill, they'd scan them and after they passed away they were able to do autopsies. They were actually able to show very good correspondence between the thickness of the gray matter measured by hand on a real brain and what was observed in the MRI.

Dr. Dave: Ok. Good. I thought that might be important to establish. Are there any skeptics by the way? My experience in psychology is that for any study that's ever been done, it seemed like there were people who were critical of it. What do skeptics say about this research?

Dr. Sara Lazar: There's tons of them. A lot of people think meditation, you're just lying there doing nothing. Of course, the critics are saying, well this is cross sectional, taking long term meditators, people who have been practicing 10, 20 years. Maybe people with thicker cortexes in those regions would for some reason be drawn to meditation. Yeah, that's reasonable. Or that some of them were vegetarian or they obviously took a lot of time out of their life to rest, relax. So the critics would always say it was just those things. It had nothing to do with meditation. It had to do with who they were as people, they're different, they're …that's just who they are. It has nothing to do with the practice of meditation. In the paper though, we make the point that the thickness of the insula was tightly correlated to the total number of hours the person spent actually meditating. It also correlated to number of years of practice, but it is more tightly correlated with number of hours. That's important because some people just practice 40 minutes a day, maybe 40 minutes a day every day. Some people practice only 4 or 5 times a week. Some people, though, go on retreats. They've been on many, many retreats where you're practicing 10-15 hours a day. If you go on enough of those retreats, that certainly adds up over time. We had several people who all had 10-15 years of practice but huge variations in total number of hours of practice because of variations in how much they practiced daily and how many retreats they'd been on. That's where we saw this nice correlation in amount of practice, actual practice verses years of practice. If it was something that had to do with say diet or exercise or these sorts of things, you'd expect it to be the other way around, tightly correlated to number of years as opposed to number of hours. But now, we have brand new data, which is not yet published, but we're hoping to get published soon, where we actually have taken people who have never meditated before, we scan them, taught them to meditate for two months, scan them again and we're finding, and this is actually the MBSR course started by Jon Cabut Zinn, we're finding from before to after that the insula actually grows. Now we know for sure that it is the insula growing and not just people are weird and different and strange.

Dr. Dave: YEAH!!! For our side! That's really fascinating. It reminds me of Malcolm Gladwell. I think it was in his most recent book. I think he was citing research, I'm not sure but there was the claim that in general is seems to take 10,000 hours to achieve mastery of….whether it's a musical instrument or some other kind of discipline. Somehow that seems to be related to what you're talking about.

Dr. Sara Lazar: Definitely. It does take many, many hours. Anyone who practices will tell you, the more you practice the more it develops and deepens and you're constantly discovering new things and reaching a new level of practice. So we saw that in the brain that there was-and another thing we actually looked at was breathing rate. And what we found people who had than less than 5000 hours, yeah, there was some change in their breathing rate but not much, maybe just one breath a minute, two breaths per minute. But then once it got past that 5000 hour limit, you then saw a really nice decrease and that was very tightly correlated with number of hours of practice again. And so once you past five, 6000 hours, you really start to decrease back down to say 4 to 5, 8 breaths per minute change during meditation relative to baseline. It really does suggest that there is a continuing process due to meditation.

Dr. Dave: That's really interesting. Whether it's meditation or learning music or painting, we're in a sense growing our brains. We're growing a new brain or an augmented brain.

Dr. Sara Lazar: Exactly

Dr. Dave: Wow! On your website, I see also that you conducted a 2006 study on association between oxygen consumption and nitric oxide production during the Relaxation Response. Is that kind of what you were just speaking about or is that something different?

Dr. Sara Lazar: That's something different. Actually I wasn't only personally involved in that one. Jeffery Dusek was the lead on that one. What that was, that was with the Relaxation Response, Herbert Benson's intervention and so we should probably say something about that at the moment. There's been two stress reduction courses that have been developed that are based on meditation. One is Herbert Benson, developed one called the Relaxation Response.
It incorporates a sort of a mantra but they don't call it a mantra. They call it a focus word but it's the same idea as a mantra where again you say one word over and over again on the breath. It also incorporates breath awareness meditation. But it also incorporates several other techniques that they have developed themselves; guided imagery, just deep relaxation like progressive muscle relaxation techniques to elicit the Relaxation Response. They feel like meditation is just one method of focusing on relaxation. The relaxation is the key component to health that meditation benefits.
In the other camp, you have Jon Cabat Zinn who developed Mindfulness Based Stress Reduction which is based pretty closely just on insight, vipasana meditation, mindfulness meditation. That has a little bit of yoga but it's a very slow gentle yoga and all the meditation is breath awareness, mindful breath awareness meditation. So the nitric oxide

paper that you mentioned, that's with Herbert Benson's Relaxation Response. One idea they have, they've done a lot of work showing different markers of relaxation increase when you practice these techniques. Nitric oxide, like laughing gas, right?, your cells actually produce tiny amounts of it and it's involved in physical relaxation. So for instance, it causes your blood vessels to dilate when you relax. When you relax, that's one thing that happens. It does various things inside cells to, that's consistent with relaxation and producing physiological states that are consistent with say healing and relaxation. What they found was that at the pre time point before anyone had any practice, they would listen to these tapes and elicit the relaxation response. They would produce a little bit of nitric oxide but there wasn't any correlation between how much they produced and it's sort of all over the place. Whereas after 8 weeks of practice, they then found nice shift. So when they went from sitting there doing nothing to relaxation response they got a nice burst of nitric oxide. It sort of continued over the course of the next few minutes that they were practicing it. That's really a marker of relaxation more than anything.

Dr. Dave: Ok, that's fascinating. So do you think your research suggests that everyone would benefit from meditation?

Dr. Sara Lazar: I don't like making grand sweeping statements like that. In theory, probably most people could benefit from it. I think there needs to be some caveats and I think that's important. So for instance, you could say that everyone could benefit from physical exercise but in reality if you have serious heart disease you want to be very careful. If someone has serious heart disease and goes into the doctor, the doctor's not going to say, "Oh, go start running". You start with walking. You start with…you do it very carefully. You're closely monitored by a doctor. You're very careful about how you begin. So I think for people who are more or less healthy, psychologically healthy, I think meditation is great. For people with really serious psychological conditions, for instance, schizophrenia or problems with psychotic breaks, you want to be really, really careful and it may actually be counter indicated for people like that. It certainly just as the heart patient would only do it under close doctors' supervision, I think those patients should only do it under very, very, very close supervision of a mental health professional. Just because there is this potential for… it's fairly well known that when people meditate there is a possibility for psychotic breaks. So you do want to be very careful. And also anyone who has had any serious trauma, you want to proceed with great, great caution.

Dr. Dave: Ok, those are good caveats to mention. What sorts of brain meditation studies are needed in the future? In other words, what sorts of questions still remain?

Dr. Sara Lazar: Oh, many. How does it work? I think we're really just starting to scratch the surface and there's a lot to be done. Clearly, I think it's been shown that meditation reduces stress and promotes attention but that's just the beginning. So how does that then lead to emotion regulation? How is that, it's really kind of amazing, all you're doing is sitting and watching your breath and yet leads to emotion regulation and stress reduction and but also spirituality and changes in interpersonal relationships and better health, physical health, better mental health. So, ah, understanding how you go

from that really simple practice of watching your breath to all these such wide ranging benefits, I think it's not all clear how that happens. We starting to have some clues but we're really just beginning to see that. Also, again, I'd say that what you see in a course of 8 weeks of say Relaxation Response or MBSR training is really just the beginning. You know it's nice looking at the long term meditators to see what the potential is of the human mind, especially if you look at these monks. I don't look at monks. I just look at long term meditators who are just every day people but the monks, you're really seeing some really amazing things in their brains. So I think understanding the ramifications of what those changes are I think is going to be very interesting.

Dr. Dave: Speaking of the monks, I'm sure you know Dr. Richie Davidson's work. I'm going to be interviewing him soon. Do you have any advice for a penetrating question I might ask him?

Dr. Sara Lazar: I actually need to think about that one, sorry.

Dr. Dave: I guess I do too, then.
I was hoping you'd get me off the hook.

Dr. Sara Lazar: The question you just asked me, "what is there to do?", it's a "what is the potential, the maximum potential?" question. Lots of interesting questions. Another thing is that we're using slightly different tools. We're looking at the structure of the brain, whereas his lab looks a lot at EEGs which looks at brain activity in real time. That's different than fMRIs. They're both looking at activity but they're different. So they're finding slightly different things. So trying to understand how they interrelate is sort of interesting, something to do in the future, I think.
There's so much to do. There's so much to do.

Dr. Dave: What would be your advice to any students who might be listening? And who might want to get into the sort of research that you've been conducting?

Dr. Sara Lazar: Right, that's a question I get a lot. Everyone wants to do research on this and at this point I'm not aware of any programs really per se that are devoted to mindfulness. There might be now being that there is so much demand for it. But there are definitely people all over the place starting to do research on this. So I think what I would say the most important thing is to get a good education and a good training in how to do research. And then take those tools and apply them to meditation. Another thing to remember, like I said know, we know that it effects attention but it also effects emotion. I'd say find something that you're interested in and see how meditation effects that process. If you're interested in attention, you to a lab that's studying attention. Learn how to do the research on attention, then add in the meditation. Or if you're interested in emotion or some aspect of emotion regulation or vision or cognition or memory or whatever, find a lab that does that, then add the meditation in. I think that's the best way to go.

Dr. Dave: Ok, that sounds like great advice. As we wrap up here, is there anything else you'd like to say?

Dr. Sara Lazar: I'd recommend to people at least try meditation because I think it's one thing to hear about it, it's sort of…the analogy I always make is: how do you explain color to someone who is blind? There's no way to explain color. You can only experience it. And similarly with meditation, there is this subjective feeling and these experiences that you have when one meditates, it's really hard to describe. I think to a lot of people who haven't practiced, they poo poo it and don't understand it because they haven't tried it. Words just don't do it justice. If you can't understand color without seeing it, you can't really understand yoga and meditation without trying it firsthand.

Dr. Dave: That's a great close. Dr. Sara Lazar, thanks so much for being my guest today on Shrink Rap Radio.

Dr. Sara Lazar: Thank you for having me.