DANNY LENNON: Welcome Dr. Barbara Oakley to the podcast thank you so much for taking the time out to join us today.

BARBARA OAKLEY: Thank you so much for having me Danny; it's a pleasure to be here.

DANNY LENNON: This is a conversation that I'm particularly looking forward to because the whole concept of learning particularly how we learn is the topic that I have been fascinated by for quite a long period of time in fact before if it wasn't Sigma nutrition I was actually a science teacher myself teaching physics, biology and math High School level students level students. So thinking up from that perspective of how people learn and just in general the science behind how humans learn and how we acquire new Knowledge and Skills is something that I'm particular interested in which is of course why I found your work so particular yeah fascinating so maybe just to get people listening up to speed with some of your background and a bit about what kind of got you into this whole topic. Could you may be` explain what made you to start thinking about this question of how we learn and the science behind learning.

BARBARA OAKLEY: Oh what a good question. I think it was because a student ask me a question once and he found out that I had been terrible at math and science when I was

growing up, just I float my way through elementary, middle and high school math and science. I guess what was strange to him was I was his professor in teaching his engineering courses and he asked me how did you change your brain and I thought about it you know because yeah how did I change my brain I mean here was this person who was profound math's and science loather to someone who really likes math's and science and is pretty good at it I think that's what kicked me off to start thinking about how do we really learn and can we reprogram our brains so that we can learn more effectively more effectively and more easily so when I begin trying to answer that students question that was what about 5 years ago I started working on a book about it looking at what neuroscience have to say about it, cognitive psychology, educational literature I myself have taught and done research as an engineering professor not only in engineering but in how we learn effectively in stem kind of topics like science, technology , engineering.
So it just came about because of that one students intriguing question and that's why I kind of turned to looking at how we learn.

DANNY LENNON: Yeah and I think there's a lot for us to get through and for those people listening I'm going to link up to a doctor Oakley's books in the show at the end of this episode, I really do recommend checking out so much information in them, and in one of those books Dr. Oakley a mind for numbers which I read as some really fascinating stuff in there and I think one of the big things around learning that first caught my mind and really drew me into trying to think of a best process supposed to go through on to learn something was when you were discussing these two different modes that we can go into, the focus mode versus diffuse mode so could you maybe get people listening up to speed on what are we talking about with this Focus mode and diffuse mode and how does that relate to learning?

BARBARA OAKLEY: Oh I will be glad to, so when I was trying to retrain my brain as an adult so that I can begin to learn math and

science I started at a rock bottom low I went back to remedial High School math algebra and started there and I remember being so frustrated look at new ideas new concepts I couldn't figure out them out I get really more and more frustrated, slam the book, walk away and later when I came back it made more sense but I kept thinking I was really stupid and then whenever I gave up and walked away that I was not showing persistence and that meant I was a terrible student and so it was all very frustrating for me because I kept continuing with the moral lies that I was just an idiot and there was no way I could learn new stuff but if I know then what I know now about how the brain learns I would have no hey it's perfectly normal to sit down the first time you look at something focus on it, not understand it and after going away from it, let your mind regroup mentally so to speak and then you can tackle come back and it makes more sense which really go on behind the scenes is this idea of the two different ways the brain works, different modes of learning as it were. The first one is what I call focus mode and that is when your brain sits down and starts focusing intently on something this activates what psychologist call task positive network but it really means you are using a little area of your brain in order to solve a problem or understand a concept that you may be kind of familiar with for example of you are trying to work at a multiplication problem and you have already learned how to do multiplication. Your brain kind of moves along in these pathways that is already laid when you first learned multiplication. So what if you're trying to learn something completely new but you have never encountered before let's say you know multiplication but you don't know division.

Well what's your brain do I mean the first thing it does is it tries to default the pattern you are already familiar with you know like you are trying to work a division problem but you kind of start using some of the approaches from multiplication and of course that

doesn't work and then you get a little bit more frustrated but when you have kind of try to load something new like starting to work on a division problem then what happens is you loaded it in and then as you start to feel frustrated you stop and what that does is when you stop thinking about it and I mean you really have to stop your thinking about it so you have to get your mind off of it you have to put your focus completely on something else or go for a walk take a nap or go to sleep or ride on a bus or anything else that really gets your mind off of it as soon as your mind stop focusing on it these are the networks what we most often refer to the default mode network opens up and this network kind of it does two things it makes new connections and helps you start to lay the patterns but it also kind of makes sense of it all it consolidates what you thinking about so that later on you can come back and access it easily and it really is compacted and it makes sense and it is easily accessible and so learning as it turns out involves these two completely different networks in the brain one of them is the focused task positive network and the other one is much broader diffused mode network and you often go back and forth between these two different modes us you are learning you can't be in both different modes at the same time unless you are taking different forms of mushrooms and I'm not advocating that you do that but that's often what's behind good learning.

DANNY LENNON: Very interesting and there's a couple things I wanted to ask when we talk about with these two modes Focus mode and then this diffuse mode that were able to switch between and it seems like it's not that one is better but it's that switching process that allows us to go between allowing our brain to go to this new areas the diffuse mode and then to be able to focus on the problem or in this Focus mode blocks.

So when we're talking about switching between these if we were to try and think of how this might play out in practice, is there a best way for people to think

about how to make this happen as in is there one of them should come first so wake up in the morning and I want to do some work on my best going on going through a period of some real focus work until I can't ready focus anymore and then maybe going for a walk to try and get it to diffuse mode or is it better to go to the way around and try and just go for a walk clear my head not be to focus on something and then come back something like a that or how does this all work out in practice of how should we even think about switching between these modes?

BARBARA OAKLEY: Oh interesting, that brings up some interesting ideas. Fast of when you go through the day your neurons the cells in your brain kind of put up these metabolites and those are like toxins and this is why as the day goes by you can get a little bit kind of a bit of mental fatigue so most people not everyone but most people find that the mind is clearest at the morning that they can think with less fatigue so one approach that productivity experts recommend is to do what is called EQ frogs first. So that means do a little bit not all a little bit off something you find really difficult first of when you begin walking in the morning because that's when your brain is freshest so for me for example what do I find most difficult I find you know for me staring at a blank page and trying to write part of a book it's kind of difficult for me it's like wow! where do those words come from, what am I thinking, what's the main idea here, getting it down like throwing this mental depth in the air and capturing those words is not the easiest thing for me to do So sometimes I find that working on it in the morning it's best for me because I'm sharpest at that time.

Now, when spectacularly useful sort of approach that the people find and I should give you a little background, so I teach with the principal professor of the Salk Institute I teach a very large course called learning how to plan, it's a massive open online course and we have almost 2 million students so it's actually

the largest such course in the world and people really love it they get a lot out of it but one of the things I love the most is this technique that I'm going to tell you about and this is called the Pomodoro technique it was invented by an Italian, Francesco Cirillo in 1980s and what this technique consist of is like so simple that I think's people sometimes don't hear about it because it's not this complicated thing that somebody can make a whole bunch of money out of it it's a really straightforward technique all you do is that fast you turn off all distractions and then so that means no little ringy thingy's on your phone, your cellphone and no little pop ups on your computer and nothing like that you turn them all of you set the timer for like 25 minutes and I'll use a little timer I have on my computer and Francesco Cirillo sold I think he continues to sell a beautiful little tomato shaped timer you can set for 25 minutes some people will get Pomodoro apps that you can use anyway you set a timer for 25 minutes and then you focus as intently as you can for 25 minutes on whatever you are trying to complete and I mean if you are like me I look away and I'm just doing great and I look up at the clock and I'm just done 2 minutes of the Pomodoro and my mind goes no! I can't do 23 more minutes and I just let that thought go right on by and I just returned my attention to what I was working or I'm working on and as it turns out when I do this and you know anybody can focus on 25 minutes and that includes me and I get a lot done but the main thing of these is that when that 25 minutes is done you reward yourself you can listen to a song you like, you talk to a friend, go out for a walk as you had mentioned you know kind of get something physical You don't want like let's say you've been writing and then for your reward you go up to Twitter well you're not resting that part of the brain that is doing the writing you are kind of doing similar tasks so you want to do something that is sort of dissimilar and if it's physically active all the better because when you do a Pomodoro what's that doing is that allowing you to focus for 25 minutes and then you

are going to diffuse mode for a little while so you are able to consolidate and refresh yourself a little bit and it works really well.

DANNY LENNON: Perfect, so again if we think of some of that the practicalities here for that Focus mode and had to explain perfectly there it makes sense that during this time you want to have a distraction free environment and mitigate as many potential distractions we can and set up an environment where we can focus on the task at hand as intently as possible I think that's easily relatable for most people but then on the flip side when we then swap into that diffuse mode a couple of things that you mention there about having the task number one being quite distinctly different from what you're actually working on during the focus mode as something maybe that's Physically Active could be a nice little bonus, is there anything else to be aware of in terms of types of activities that could be best here for example do we find that certain things are its completely individual that depending on the person they'll find things that are better for the diffuse mode or does it even matter what the task is as long as it's just simply doing something that's not focusing.

BARBARA OAKLEY: Well to some extent it doesn't matter I mean if you are drawing your attention to something that is different you may be focusing right so if that happens then you know just try to make sure that it's not something when you are taking that little bit of rest you don't want to be working hard on something else you want to be relaxing just a little bit and this is more like it got sense that nickname of the research is telling us except that when you take that little bit of rest when you are not focusing on something we do know that that helps the brain to organize things and consolidate what you have just been learning and that can help you be more creative later on with what you have learnt. It does seem to me that if you are like always focusing let's say you focus and then you take a brain and you decide to do like some focused meditation during that break well you are still kind of focusing so

well that can be you are not giving your brain a chance to do that diffuse consolidation and it makes it harder for your brain to organize that material so that you can think about it more creatively about it later on.

DANNY LENNON: Sure I'm and so if someone now is going through those blocks in and they're trying to learn or the trend of study for example and these Focus time blocks one of the probably common things the come up like you mentioned is someone doing it for short amount of time and then suddenly breaking out without Focus mindset and feeling the need to try and get away from it like classic case of procrastination that we all face and so we see the Pomodoro Technique is one method you've talked about I'm trying to have these Focus chunks of time that make it may be more like that we can stick them is there anything else from research that shows how we can kind of mitigate the suppose downsides of procrastination during time box that we're trying to learn or trying to study?

BARBARA OAKLEY: Well I think the best thing we know of now is when you are doing something like a Pomodoro and you clam in a reward for yourself, anticipating a reward helps you to enjoy the process of focusing so as much as getting the reward anticipating the reward help the activity prior to getting the reward to be more pleasurable. So by planning in that you get a little reward you get to do something you like it can help you learn to like focusing better and that of course will allow you to focus a little bit more intently with a little bit less destruction and that's one of the way that we find out that it can help you build your abilities or to focus on and learn a little bit more effectively.

DANNY LENNON: Yeah and so when we think about this kind of larger concept of learning in trying to acquire more knowledge and I think one of the big maybe distinctions of where we go from just simply learning something to actually effective learning is where rather than just be able to cram something in and learn something in a short space of time and then

soon after that be able to talk a bit about it versus the long-term retention of knowledge which is why most people listening are probably after how do we take in information from whatever source and be able to learn that in an effective enough manner that we can retain it for long enough so when it comes to the only learning something new but once we learn something and trying to maintain that learned knowledge ordering skill it is right thing to guide us there in the best way to retain knowledge or to relearn a recap over something to stop at regression of that complex that we have just built.

BARBARA OAKLEY: Well as they say practice helps make prominence and that's really quite true practice does help us you know kind of reinforcing, sometimes it sort of amazes me because people will learn something and they will let's say they will do homework, so they do homework and they will they just do the problem and turn it in but would you ever sing a song one time and say you knew that song.

Absolutely not, you would never do that So you practice things in order to get it so a good thing to do is to like if you are learning problems you do the problem and see if you can work it cold if you can't try to work it cold take a pic and then the next day try to work it again and maybe a couple of times again and do it for several days and what you will find is that sooner or later no only will you be able to work that problem cold but you will be able to kind of remember it. It will stick to your mind and even when you look at it you will know the steps that you will take in order to solve it and it's kind of like when you learning anything let's say like you're learning a language in Chinese it's like when you write it forty times it would stick with you but you often not necessarily need to do it forty times if you can come up with a good mnemonic or trick to help you stick that word in your memory.

When you are learning something mnemonics can be really powerful so when I was trying to learn how to write a script in Japanese I look at these kind of complicated scripts you know, it's a syllabary certain

syllables will have a character and so there's like I don't know, around 46 different characters and I will try to come up with a little memory trick or tool I could remember pretty easily and some of my just couldn't see the trick so I went and found a video on, by a Japanese teacher who really hot been teaching this for a long time so he knew all the different tricks and he could show on each character how there was something really memorable on each character so that you could like put it on your mind and I was like you know I have been working for weeks to remember all these characters and here is this guy who give me a bunch of little tools and I can learn much quicker sticking in my mind and they stick their. So good mnemonics that might be given to you by teachers who have collected them can help you leap forward much more quickly and then as you get much more comfortable with those mnemonics they can help you'll begin to see how to do them yourself and that can also speed your learning.

DANNY LENNON: Sure, I wanted to ask a question as specific to maybe a lot of the listeners to this particular podcast as we have quite significant proportion of the audience to our coaches and personal trainers and other people who are working with people in professional practice and who are trying to become better coaches, who are trying to become better for their clients have to help them more effectively and one of the things we talked about on this show is the value of evidence based practice and basing our approaches on sound science and while that's great for and maybe especially if it easier for those of us coming from a background in science and with that second formal education Etc. there are many coaches who are excellent in practice and trying to get better on top of that or maybe aren't coming from a scientific background or at least try to improve their ability to understand research or to improve their scientific literacy etc. So based on some of the things that you've talked about and especially in your books which kind of address the issues of Science and Mathematics is specifically for people in this scenario the scenario is running too personal advice that you can give on if they want to improve their scientific literacy your proficiency or just their own confidence in reading and understanding science is there a few things that they should be aware of.

BARBARA OAKLEY: One of the best technique to learn something new in science well I think this is answering the question that you are raising. You know let's say you don't have a background in science and you are trying to understand something scientific that you are interested in, of course you are trying to pick something that is explained in a way that you can understand and often you can understand even really in-depth scientific concept even if you don't have a background in science at all if the writer uses good metaphors in order to convey the idea so if you are able to find an explanation that has good metaphors in it you can kind of follow what the arguments are or what the main idea is even if you do not have a good scientific background But some of that let's say that you are tackling an article that's like a press release about something or a study on nutrition and you are trying to figure out whether that nutrition study in sense and whether it's something you'll be able to learn from a good thing to do is to look at the description of that study read it as quickly as you can and then look away from the page and see if you can recall what the key idea was and by doing this you can sometimes researchers show you can learn at a deeper level than by rereading, underlining or trying to do a concept map or any of these other techniques So reading it looking at away if you can recall the key idea is one of the most powerful techniques to learn.

DANNY LENNON: Amazing thank you for that and I'm sure it will be very helpful to people listening and if you could just add on to that maybe something else again going along the lines of something specific to this audience and seeing as the listeners to this particular podcast, number one, love learning about all this kind of detail stuff and the various different topics with a nutritional science discussed on this podcast that they're obviously fond of the medium out of learning through in audio format so I'm just love to hear your thoughts on and if you have any ideas on this or any thoughts on this topic of how listeners can maybe optimize how much they get from listing to episodes of this podcast or already from any podcast is there anything you'd advise that will allow them to allow them to essentially squeeze as much as they can from something like an audio podcast is their stuff they

should be doing after an episode is over for example how can they take what's in these episodes and make best use of episodes?

BARBARA OAKLEY: I think, probably a good idea is to keep a little running a journal and after listening so it would be your podcast journal and after listening to an episode you don't have to write a bunch of lines or anything like that you indicate what the episode was and who the person was and then the key idea that you got from that episode you know if it's a couple of ideas or if it is just one that resonated with you but you will be surprised if you keep a little diary it helps you to do what they call neurally encode that means come up with a pattern that's easy for you or with the key ideas of that podcast and that can be a good way to remember those key ideas and easily access them again whenever you are talking to somebody or you're trying to put together some different ideas about what you've learned

DANNY LENNON: Brilliant, thank you so much for that we're coming close to the time I know but I did want to get to one other question and topic that I'm pretty interested in because one thing that I'm messing huge on and prioritize a lot is sleep and I'm really fascinated by the research I read on how sleep affects us and I talked about how important sleep is for health than and we know things like it affects non-physical performance but the cognitive performance as well so I'm just interested to hear how does sleep exactly relate to learning in the learning process and what way should we think of it in that sense if we're trying to learn or study for example?

BARBARA OAKLEY: Oh sleep is so important as part of the learning process it's vitally important and it's important in two different ways. The first way is remember those metabolites the little toxins that I talked about that comes out as the days go by well we can't wash away those toxins very easily because the neurons are kind of big and they block the part of the cerebral fluids that could wash those toxins away but as it turns out when you sleep, so you just go to sleep, those brain cells shrink during sleep, that allows the cerebral fluids to easily wash the toxins away so sleep is important in one way because it's like the time when

housekeeping sets up and kind of cleans the brain so that you are fresh the next morning.

It's just amazes me I have seen people taking the doctor of qualified exams who haven't slept the night before hand and really think that they are doing well and of course the brain is frozen and not working very effectively it's didn't help them to go through in the morning the brain wasn't working because they didn't know why sleep is important that's why they fell into this but the other reason why sleep is important is because it turns out that when you land doing today it's like front cording yourself but when you go to sleep at night what happens is that when the new synoptic connections grow so the synoptic connections a sort of like the foundations of learning they are the structure of what you are learning that's why sometimes you learned something during the day and it kind of doesn't stick very well but then you sleep on it and the next day you go on again and it seems a lot easier and that's because doing tonight this new connections are formed and you go to this foundation of learning. I'm, so this is why it's important to have special learning hours over several days because each day you practice you are like building several synoptic connections which is kind of turning a little path into a big Super Highway or a much broader Road on that make it's a lot easier for you to think on the work with these new ideas so sleep is a big part of learning and am really glad you focused on it because it’s a very helpful thing.

DANNY LENNON: Yeah I'm glad you mentioned that just another reason for people to focus on getting a high-quality and sufficient amounts of sleep and this has been amazing we have gone through quite a lot of practical stuff for people to take care and know. The Sleep issue, but in terms of podcaster and laying at we look that having those kind of switching between focused and diffuse mode at techniques like the Pamadora, whole host of other things how to address or our review science if it comes up in different posts etcetera. So lots of real practical takeaways from people to take from this discussion and for the very final question that we end the podcast on Dr. Oakley where can people find more of your work online and where can they get access to

your books and course etcetera if they're interested in delving into some of these ideas in a bit more detail?

BARBARA OAKLEY: Just go to my website barbaraoakley.com or they can find my books on Amazon the first is a mind for numbers, its basic learning tools for the brain and the second is my most recent book is mind shift and that's about how to change our own perspective on learning so you can learn more effectively but it also talks about things like well if you are trying to improve the way you think and learn and so forth one of the most effective ways to do this is to use action Style video games that can help keep your brain sharp so it's a lot of little facts like that along with a lot of inspirational stories.

DANNY LENNON: Brilliant and for everyone listening I will link up to that in the show notes to doctor Oakley's website as well as all those books on Amazon I'll put those in the show notes as well as anything else that's relevant to today's discussion that will be there at sigmanutrition.com/episode188 and that brings us to the final question that we always end the show on dr. Oakley and this can be to do with anything even outside of today's topic and it's simply if you could advise people to do one thing each day that would have a positive benefit on any area of their life what would that one thing be?

BARBARA OAKLEY: One thing I try to do is just be grateful of what we have in life think about the millions of people in the past who have helped us to get to where we are every time you walk into a building the builders have built this building for you have air conditioning, think of who invented air conditioning to help make it so that you can feel a little better on a cold day on a hot day, when you go across the bridge well people who built that bridge they even figured out how to build Bridges, it was not an easy thing to do so I think sometimes we take for granted many of the miraculous things around us and hard work that our ancestors and others around us and society have put so hard to make our lives a little better so I try to remember and be grateful for the good things have happened or come along my way

DANNY LENNON: Absolutely I couldn't agree anymore. Great statement and a perfect way to round out this episode which like I said has been full of very practical takeaways for people and at least get people thinking of a deeper of how we can learn more effectively and some of the ways that we can improve at what we take and what we learn so Dr. Oakley thank you so much for taking the time out to do this and for the great information you shared on the podcast today.

BARBARA OAKLEY: Thank you so much Danny.