

**Neuroplasticity and the Role of Sleep  
and Exercise to Improve It**  
Davis Phinney Foundation

Mel Dizon (Director of Education, Davis Phinney Foundation):

Hi everybody, my name is Melani Dizon I'm the director of education at the Davis Phinney Foundation, and today I am here with Mike Studer and I'm so excited to have you here, Mike thanks for being here.

Mike Studer, PT, FAPTA (Physical Therapist and Owner, Northwest Rehabilitation Associates)  
Oh, it's my pleasure thanks so much.

Mel Dizon:

Yeah, Mike did a lot of work with us over the years it's been a while, since we've had him on, and we've been trying to wrangle his schedule so I'm excited to finally get an hour with you Mike why don't you tell our community who you are and what you do.

Mike Studer, PT, FAPTA:

Sure, so I've been a physical therapist for a little over 31 years primarily focused in neurology and geriatrics. I have been a private practice owner for 18 years and have lectured nationally internationally and just a really an enthusiast and a neuro nerd.

I treat persons with Parkinson disease, stroke, neuropathy and balance vestibular conditions and really those persons with Parkinson disease hold a special place in my heart because there's so much untapped potential.

Mel Dizon:

Awesome, well then you're in the right place I'm excited about that. So today we're going to be talking about neuroplasticity and but before we get started, I'd love to kind of just get some foundational information on some of the terms, so what is neuroplasticity?

Mike Studer:

Well, that's a great question and a perfect one to start off with because a lot of people think that neuroplasticity is forming new neurons, when in fact it's actually just the process of learning. So, it's connecting neurons that are already there, and so we talked about making more synapses and synapses means nothing other than just the junction between neurons so that we can learn how to integrate and synthesize information that we've learned whether that's fact-based information or even movement-based information and I should also include sensory information. So, to summarize neuroplasticity is just the process by which we form new connections, we call those synapses, in learning.

Mel Dizon:

Okay, so it's not one of those things where you hear, oh, you have no more brain cells left and now, I have to recreate all these new ones, no you're just creating the new synapses between them that are there. Okay.

Mike Studer:

You know, a nice analogy, for it Melani is really the process of road construction and it doesn't matter what the injury is to the roadway system, whether it be a concussion that basically is like an earthquake that shakes the connections, but leaves everything relatively intact, a stroke that kind of washes out the roadway, or a degenerative condition that basically crumbles the roadway away and erodes it away slowly.

In all of these processes we're looking for basically an alternative route and that's neuroplasticity, connecting pathways, or roadways in the analogy that formerly had been connected, getting them connected again.

Mel Dizon:

Okay, great. Alright so I've heard there's a difference between structural and functional neuroplasticity, can you talk a little bit about that?

Mike Studer:

Yeah, so structural neuroplasticity means the underpinning, underlying connectivity that happens, certainly as we develop and as we grow, as we age, and as we have new experiences. Okay, so structural connectivity is really how many connections do we have, are we making new connections? Physically, are we growing and attracting one neuron over here to try to make another connection? Functional connectivity really is the process by how we use those, the synthesis, the integration, the proficiency, the expedience. So really is how well the machine is running, functional connectivity, how big the machine is, structural connectivity.

Mel Dizon:

Okay, that is great. When I think of the idea of neuroplasticity and I think of our community of people with Parkinson's, I'll often get, well what's the point? You know I already have Parkinson's, it's already degenerative, like I'm not really... is anything really going to be able to happen? So, what do you, somebody who believes in neuroplasticity, what are they really believing in and then, what do these people do that people who don't tend to not do?

Mike Studer:

Yeah, so that is such a lovely question and I'll make certain that I don't go on a long diatribe here. So really neuroplasticity is important for a person with Parkinson's disease, so that they can slow the disease process, preserve what they have, and make connections that were actually left off the table, because of learned non-use. So, imagine. Once you have the diagnosis of Parkinson disease there may be some self-fulfilling prophecies. Things that you stop doing,

because you think these things are unsafe or not expected or incapable, because now I've labeled myself as a person with Parkinson's disease.

So Melani what's left on the table is learned non-use, because you stopped taking 5000 steps per day, stopped trying to climb the stairs, stopped trying to balance without relying on a walker. Now all those things may be necessary for you to stay safe but if you don't challenge those facets and in constant or actually in order, I just mentioned, endurance 5000 steps a day, strength, trying to ascend stairs, and balance, keeping your faculties negotiated. If you now become a person that stays inactive, because you have the label, you've left neuroplasticity on the table for me to still, as a healthcare professional to tap into. So that's why neuroplasticity is important for those three reasons, slow disease process, maintain what you've got, and actually tap into things that you left off the table that you didn't even know you had the potential to access, those three.

Mel Dizon:

Ok, so now, I picture it, let's say I've been recently diagnosed with Parkinson's, I've been active, you know I'm in relatively good health. And I think hmm, like I'm fine, I don't need to see a doctor, I definitely don't need to see a physical therapist, I'm still moving around, what would you say to that person, why is it important for them to see a physical therapist in terms of this whole thing you were just talking about?

Mike Studer:

Okay, so now I'm going to back up and give you the two analogies that are going to lead me to that answer. First analogy, high level gymnast who has been active in gymnastics since she was age six and all the way through her Olympic career at age, let's say 26. How proficient is that person's balance going to be when she turns 56? Do you think that person's balance is going to be better than someone else who didn't have a high-level athletic career that depended on balance, who's also 56? Maybe her twin sister that didn't do all those things, and they have the same genetics? All right, if you believe that, then you know that you can build what's called a redundancy, right? So, you can build a reserve so that if any process in this example, I'm talking about aging, but in any process, including a stroke takes something away from you, you have neuropathy, you have Parkinson's disease, the higher level that you start your water table, the longer it takes before you get to drought. Alright, so that's the gymnast. Now I'm going to make it even more specific and get toward Parkinson disease.

Think about Alzheimer's disease, a very related condition with regard to degeneration, plaque development, amyloid, etc, what if I was a Harvard professor for 51 years from age 31 to age 82 and I suddenly began to have some mild cognitive impairment. And was later diagnosed with Alzheimer's disease. If I was well educated, maybe even multilingual, a professor, instructor, for 31 years, again my level of redundancy, if I'm going to a road down with a condition such as Alzheimer's it's actually going to be a higher level, harder to detect, later detected in life, and it's probably not going to impair my function, because I had so much of redundancy.

Now you already see the analogy of where I'm going with Parkinson's disease right? You want to go to see a physical therapist so that even though you're high level right now you want to invest. You think about the bank account, is it going to be easier for me to invest in strength training right now, when I'm 72 and I don't have many symptoms of Parkinson's disease so that I have redundancy, reserve in the bank, so strength training, which is different than power training, which is different than high speed reaction training, which is different than dual task training, which is different than high speed walking.

So, you could work on those five facets of fitness now and actually benefit from the return on investment easier than investing just before you get to withdraw some of those things, I need them from the bank. Right? Hopefully, the gymnastics analogy, the Harvard analogy, banking analogy, all those help to meet one of our listeners today to make that an impactful consideration.

Mel Dizon:

Yeah, and you know it's interesting because falls are one of the biggest issues, right, for people with Parkinson's. They have postural instability, they have balance problems, they have all of those things and I remember talking to somebody once and I was like well how much weight training, do you do? And, I was talking about falls and it's like you don't really think about it, but you can catch yourself if you have some muscle, you're able to catch yourself in a different way, and, for some reason you know it's one of those things that you hear things a million times and, for some reason that clicks. And that person was like oh my gosh, yes like, of course, it makes sense, and I think the analogy of investment you're putting it in the bank, you're going to get the return, you are not doing this for nothing, you are not just going to the PT for nothing and getting out and getting outside for nothing, this is going to pay off.

Mike Studer:

Yeah I love the fact that you tied that in today, with that analogy of the investment because you know you're making a quick withdraw of a decent amount of money or resources or reaction speed or power from the bank, and if you never deposited that in, when you need to sidestep and put a right leg out really fast to stop yourself from falling, you better have the reaction speed, the cognitive processing ability, the flexibility to get out there, the pain free range of motion to get there, the strength to generate enough force to stop your body's momentum and then what we call power, so generating force fast is different than just the ability to generate force. So yeah, you're exactly right on point to draw those two stories together.

Mel Dizon:

And then, one of the things that I tell people is you know, especially people that struggle that say like gosh I don't want to work out, I don't feel like it, I'm tired, what's the point, I will, have you ever heard of the 10 10 10 rule? So, I always say like okay well if you say no to this, how will you feel in 10 minutes? And they're like pretty good, yeah, you're gonna feel great, you can get

on the couch, you can watch your favorite show. How are you gonna feel about this in 10 months? I hope I did it. How will you feel about in 10 years? Well, you could be really strong, right?

Mike Studer:  
Yeah.

Mel Dizon:  
I think sometimes we just have to frame things in different ways. So, let's talk a little about learning, you talked about learn non-use. All learning is not created equal, right, when we're thinking about neuroplasticity, so what types of learning actually allows people to take advantage of neuroplasticity?

Mike Studer:  
Yeah, that's great, so we try to make this very person specific and very presentation specific. So, we understand that it's inarguable that there's at least two different subtypes or phenotypes of Parkinson disease, right? Some would argue that there's three types, we would say there's tremor dominant, postural impairment, gait dysfunction, and then also some would consider really a person with young onset Parkinson's disease who's more likely to have some dystonia and dyskinesia may be to be a third subtype.

So, we try to actually make our dosage very person specific and condition specific, what type of learning do you need and what we've become more proficient at learning is in these categories or columns of the different phenotypes is that there are some associated losses so that a person with tremor dominant has a greater amount of dopaminergic connections and pathways lost, which actually means they tend to be less capable in dual tasking and attention.

So, we look at the movement condition, the presentation, and we say, we probably need to get some learning done that loads this individual up, exposes them to some dual tasking so we can help those associated pathways. Now we move over into postural impairment, gait dysfunction, indeed a difference phenotype of Parkinson disease, and we understand that these individuals have a little bit more difficulties in kind of the cholinergic pathways. Yes, they're missing dopamine, yes, the substantia nigra is impaired, but they lose more in the cholinergic pathways which means their executive functions, impulse control, decision making, those types of things, and visuo spatial perception, so if I have a blanket, everyone with Parkinson's disease gets this, then I am maybe only make it correct 40% of the time for these people that have tremor dominant, 40 to 50% of the time for these people that have the and then maybe I missed completely the persons with dyskinesia. who need a little bit more of a management and learning that is repetition based, that is core strength based, that is try to deal with this perturbation and that perturbation, so they we do our learning with them more in blocked training, in high repetitions, and in motor based learning.

In the middle group, maybe we do a little bit more of a visuospatial perceptual and then remember in that first group of tremor dominant we try to do a little bit more of the attention-based efforts. Everyone with Parkinson's disease, asterisk, nearly everyone right because there are individuals out there, we see they benefit from that higher volume procedural memory learning. Give me something to do that has ultimate relationship to functional tasks, give me an opportunity to expose to it repeatedly repetitions and give me some intensity as much as my personality is willing to endure.

Mel Dizon:

All right, love it. I love it. I think everyone in our community needs to say, light bulb, I might be learning things that are not specific to my type right? How does neuroplasticity change over time and is it something that you know as your people with Parkinson's age, their ability to do it lessens as they get older, or is it lessening because their Parkinson's is progressing?

Mike Studer:

Yeah, that's a good question. So, we don't believe at this point that there are any limitations, temporally based, to a person's ability to learn. So, we have the ability to learn throughout our lifetimes. Now we talked early on that, you know, really, persons that are before or earlier younger than age nine, they're still developing a lot of new neurons, neurogenesis. We don't know for sure exactly at what age and there's some variability in there across genders and persons, we don't know what age people stop developing new neurons massively, but remember neuroplasticity or learning does not depend on new neurons, that should be time resistant, so you should have the ability to continue to make new connections, no matter whether you've had three strokes or Parkinson's disease for 22 years, it's not age dependent on that.

Mel Dizon:

Okay, great. What are some of the most common, let's say somebody is new, they're going to go into their PT, they're going to go through some assessments, they've got this benchmark and they've got a plan going forward, and maybe they you know they didn't do this beforehand, so they're really kind of getting on a new plan, what are some of the types of changes that they might see as a result of neuroplasticity?

Mike Studer:

Number one, I would say is response time which is involved with kind of cognitive processing and reaction speed. So, number one is response time, how quickly did I identify that I'm losing my balance and effect a change, create a strategy to do something about it, so number one I'll say response time, number two I'm going to say power. The ability to generate force quickly, and that's something that can be easily measured and what we like to talk about is gamified, both of those things, because I can measure balance now using technology, better than I ever could in the history of rehabilitation, and I can measure power better. So those would be my

top two that I would expect anyone with any subtype of Parkinson's disease to be able to gamify, measure, and expect change to be effective.

Mel Dizon:

Okay, so can you give me a few examples of somebody in their 60s with Parkinson's that's going to increase power, like where are they seeing this in their life?

Mike Studer:

Yeah so your ability to actually stand up quickly from a seated surface is power, so if I look at, and this is a really nice thing to contrast, what's the lowest chair height that I can get up from without using my hands, without time being a factor, that's strength. I can get up from a 15-inch chair and I don't have to push up or have somebody pull me up, that's strength. My ability to stand up and sit back down rapidly as many times as I can, from a reasonable height of surface, not a very low surface in 15 seconds, how many can I do, that's power. OK, so now power is what helps me quickly put a stop to my loss of balance, I have enough power in my arms or enough power in my hips, trunk, legs, right, so that's where it functionally plays out, but if I wanted to test power, I'd say okay I'm going to start a stopwatch, I want you to stand up and sit down as fast as you can, as many times as you can in 15 seconds, go. That'd be an easy test for anybody to actually conduct professionally in a clinic or at home.

Mel Dizon:

Yeah, that's good, we just for Parkinson's Awareness Day, we just did the sit to stand challenge, the minute sit to stand challenge right. That's something you can do on your own every month, you could give yourself a little test right, you can just measure it over time. That's great. Let's see, what are some of the ways that a Parkinson's brain can benefit from adaptation?

Mike Studer:

Well, this is a pretty long list, it's really exciting though. So, you think about adaptation, that means okay, I know I have a condition, and I still want to function optimally right. So, some of the easiest low hanging fruit would be okay I'm going to use an assistive device and still keep my long walks going, so rather than stopping walking, because I don't think it's safe for me to walk a mile I'm going to use an assistive device. Alright, so that would be one. I can modify how I approach a task. Number two could be adapt to the environment that you function in. Alright, so, I get some hesitation and walking as I walk through the open door, okay, and I began to get freezing of gait. So, adaptation would be, all right I'm going to change how I approach this task. And rather than allowing myself to look at the doorway, I'm going to stare at something through that room and identify that as my destination, so that I don't get visually or cognitively distracted into freezing of gait. A third way for adaptation is another way of modifying the environment, that means making my caregivers think about the cues that they give me, okay take a big step, alright, or count out your steps as you turn, or I change what's happening in my environment, and I might actually even place lines that are perpendicular to the direction of my pathway, so I can step over something visually, maybe I even change the carpeting in my home



from an ornate busy carpet pattern to something that has more geometry, so that's adaptation too.

Now all of those things involved adaptation that caused me to change how I maneuver in the environment or what I'm doing potentially even using an assistive device, however, adaptation might actually be in a positive spin where I say okay, I'm retired, I enjoy a relatively sedentary life of retirement, uh oh, my physician thinks I have Parkinson disease, my neurologist has now confirmed it.

Adaptation. I'm going to become active, I'm going to change my lifestyle, I'm going to adapt to the condition I've been told I have so that I can manage the condition best. Similar to a person with diabetes, who's told exercise is a must for you now, I'm going to adapt to my medical information, and change my life for the positive, so adaptation doesn't always have to be a takeaway.

Mel Dizon:

Right, okay that's great. So, for those initial ones that you talked about, it made me go back to what you said earlier around learned non-use, so, in what scenario is an adaptation actually triggering learned non-use that actually can be a problem, so what is that, first of all?

Mike Studer:

Okay yeah, so then we start talking about a compensation. So, it is similar to an adaptation, but now it's I'm compensating. Now in a compensatory manner, I might actually cause myself learned non-use per your question, meaning if I, every time I need to stand up, I say honey honey, come over here and help me lift up. Right, rather than making the attempt myself now I am changing my entire approach to the task and I'm compensating and I'm having somebody pull me up to standing and now I'm using my arms and my trunk as my stand up muscles and my wife or husband's assistance and I'm not using my leg so over time I'm going to experience learned non-use.

From a body standpoint, not engaging those legs powerfully, from a neuronal standpoint, not actually sending a message, down to the legs, to be a part of the motor program, so that'd be one example, for what you're talking about it.

Mel Dizon:

Okay, I would say that's got to have very big implications for care partners, because you know there's that balance between I want to be helpful, but maybe learning about what this is and actually that its physiological, of what's happening to that person when you help and getting a sense of like oh, this is where I can, and this is where I might push you a little bit.

Mike Studer:



And there's a balance there, there is a fine balance, because you can say, honey I recognize during some times of the day, evening, or sometimes of your dopamine replacement therapy cycle, OFF cycle, you might need my help, okay, but we know it's not all the time, so let's make certain I'm only helping you during the times you need me and every time I come over, I'm going to help you if you need it, but let's always give you the opportunity to try to make it up one or two times on your own, because that will be healthy for us to both know that you're doing as much as you can for yourself every time, because there's variability.

Mel Dizon:

Yeah and also a lot of times you know our people with Parkinson's, people in our community will get up, and they'll take a couple of hours and they are feeling great, they go exercise, right, they could go on a four hour bike ride, or whatever they're going to do right, but then come later in the day they have trouble getting up from the chair, and you want to say, I know that you are doing so many things, and now you're just pooped out, right, you're beat. I can help you I know you actually did the work and now it's just taking a toll, so there's no reason for me to have you do that right now.

Mike Studer:

Yeah, that's a nice positive spin on that too. Let's logically rationalize when you do need help and get it then rather than feeling like it's a loss or a failure or that you need it all the time.

Mel Dizon:

Right right, great. Let's see, a lot, a lot of talk on BDNF. What is BDNF and what role does it play in people with Parkinson's?

Mike Studer:

Yeah so, brain derived neurotrophic factor. I'm going to say that one more time. Brain derived, it comes from the brain, neurotrophic, means that it actually feeds the brain, feeds neuro, remember, when we have the word atrophy, it means without stimulus or without being fed, a is the prefix, meaning without, okay, but when we have neurotrophY we actually have brain being fed, factor means it's a catalyst, it's an essential part of a process. So BDNF, just means it's a protein substrate that's absolutely necessary, you can think of it as a fertilizer for the brain. That your grass will still grow to some extent, without fertilizer, but if you don't have good soil, enough rain, it will steadily decay. Well, BDNF helps to enrich the soil, and if you still have experiences that are neurologically stimulating, then your grass, i.e. your brain will be fed and be more likely to grow. People have different amounts of BDNF available to them and that's on a personal level, that is more genetically based and is not Parkinson disease based. So not everybody has a ton of BDNF viable, however, we maximize our BDNF viability through high intensity exercise. So, you can actually fill your tank up more rapidly with high intensity exercise, and we can maximize your capacity for learning, i.e. neuroplasticity therein.

Mel Dizon:

Okay, great, so let's move on to high intensity exercise. Very important for everybody, not just people with Parkinson's, but no matter how much we talk about it, we always get the question how intense is intense enough? Let's start there, I have a million questions about this, but how intense is intense enough?

Mike Studer:

Yeah, so typically the research tells us something in the neighborhood of 70 to 80% of your maximum and we can talk about that in terms of heart rate, okay, my age predicts maximum of heart rate is something in the neighborhood of 220, subtract away my age, I'm 70 years old, it's 150. Multiply that by 70 or 80% and now you're basically talking about 120 beats per minute for 80% of an individual's age predicted maximum heart rate, if you're 70 years old, 120 beats per minute to give you some hard facts.

All right, that means I count on my wrist or someone else counts for me my heart rate for 30 seconds and they count it to be 60 That means for a minute it's 120, I'm there. So that's one way to do it, and that means I wrote and I'm actually on a stationary bike right now right, so I rode the bike and I'm pedaling it away and I'm 70 years old and I made it to 120 and there's your answer. But additionally, we can also use 70 to 80% as our indicator of intensity when we're talking about strength and power.

Okay I'm able to lift a 20-pound barbell with both of my arms, and I can only do that one repetition, that's my one repetition maximum. Well 70 to 80% means I want to be able to exercise and actually conduct, something that is of sufficient intensity, so I'm going to do 15 pounds, we all know that's 75% of 20 pounds and I'm going to actually see if I can use that weight for eight to 12 repetitions, I'm operating at 75% of my maximum, therefore I've hit intensity again. Now I'm going to give you one more way and hopefully those will kind of fulfill the questions that are out there. All right, what is that lowest surface that I can get up from is 20 inches and lower than 20 inches I have to use my hands or I have to get physical help. Now, what is, this is going to be a tricky math question for you, are you ready? What is my age, well what's my predicted 75% if 20 inches is as low as I can possibly go, what height, should I operate at, so that I'm at about 80%. Well you say wait a second you just gave us this because you did 20 pounds, so it'd be 15 inches right? No. You gotta go the reverse, because if 20 inches is as low as I can go, I need to be a little bit higher to actually make it a little bit easier. So, let's do the simple math, if 10% of 20 inches is two inches then I'm at 90% if I'm operating right at 22 inches, so another 10% at 24 inches puts me at 80% because that's 20% easier than 20 inches. So now do a collection of sit to stands from 20% easier than your maximum height and you hit it again.

Mel Dizon:

I love that, I have never heard that, that is great. Love it. I want to talk a little bit more about this, first of all, what about, so very common, we talk to somebody, we give them that recommendation, and maybe they have never exercised, and A, they either can't get to that

point, like if they do the math, it's just like I can't get there or, B, they get there and it's scary because they're really not somebody who's pushed themselves ever physically that's just not their thing, how do you work with that?

Mike Studer:

Okay, so I love that so much that's that hits a wheelhouse for me, I like to actually take each person for what their preferences are, their personality is, and some people are very competitive and some people completely resist any type of stress challenge competition, etc, so the things that we have to think about is when we take each person at who they are, a lot of times, we have to think about how we're going to frame their expression of wellness. So I actually have to resist using the term exercise for some people and I'll talk about it in terms of physical activity.

Because exercise, especially for the generation of people that for currently, have been diagnosed or are living with Parkinson disease, exercise can seem like a little bit of a misuse of time. So for that generation, an absolutely exceptional generation, the baby boomers, and some of that greatest generation that are still alive right before them, they think well if I'm going to be moving I need to do something that's purposeful, exercise is a waste of time, so I need to actually change my mindset, rather than trying to change their mindset, so that means okay, I want to actually consider how to frame your physical activity and wellness around what you like to do, all right, well, I like to walk with friends, all right we'll get your endurance exercise, I need to walk my dog, we'll do some of your high speed interval walking there. I play pickup ball with friends, we'll get your reaction speed and your balance there. I love my grandchildren, we're going to get your weightlifting there. Okay, and I love to garden, okay we're going to eat your flexibility and your ability to get up from the ground there. So I'm going to frame what types of fitness attributes I need to get for you around your preferences, rather than around my preferences.

Mel Dizon:

Great I love it. Now let's say we have a gardener and they, gardening is hard work, you're up and down, you're on your knees, you're pulling, you're doing all of this kind of stuff. But, are you getting to that level of intensity that's actually going to create more BDNF, that's going to help you with your Parkinson's and that kind of thing?

Mike Studer:

Absolutely alright so let's think about this. So, we know that several different authorities including the World Health Organization, including the American College of Sports Medicine, including the Centers for Disease Control all are in agreement that a weekly total of physical activity should be something along the lines of 150 minutes per week of moderate intensity exercise or 75 minutes per week of high intensity exercise, and we know that that works very well within the realms of persons with Parkinson disease. Now I'm talking seven and a half minutes per day, 75 minutes per week, okay, well actually I should say 10 minutes per day,

right? 10 minutes per day of something that is of high intensity. Here's the nice thing So when I grew up C. Everett Koop was the surgeon general and we thought okay that people need 30 minutes of endurance exercise and we used to think it had to be done all at once.

But now what we know, going back to the gardener your question is that there is any effect of cumulation or an accumulation of activity that is just as proficient as if we did it all at once. So now, I'm going to take that gardener and I'm going to say okay, what I want you to do is have these bags of soil that are 30 pound bags, okay, that you know are too heavy for you to lift let's say 10 times in a row, but you've got them stacked up so that they're not all the way down at the ground, and I want you to go to your let's say your wood shed, your workshop, your gardening shed out in your yard, and I want you to three times per week pick up that 30 pound bag and bring it to your chest and set it back down and just do five repetitions, that's going to be intensity, and then what I want you to do is when you get down you've done some weeding, every 20 minutes, I want you to get up from the ground and go back down just five times that's going to accumulate. And then, what I want you to do is take your shovel and I want you to dig into your pile of bark dust and move it into a wheelbarrow and give me one half of a wheelbarrow full and I want you to do that three times a week that's going to add up and we're going to get some intensity and we're going to do it and frame it around your gardening and we never called it exercise, we made it purposeful.

Mel Dizon:

I think that you probably just made people so happy because a lot of people that start, they're like, I haven't exercised, now you want me to do it every day, and you want me to go get on a bike and go crazy and it's like you made it so accessible.

Mike Studer:

Yeah, so the thing is Melani you said it exactly right there. If we don't make it accessible for the person they won't do it. If we don't make it something that they enjoy they won't be as intense with it, so why not couple both of those, something that's practical, something you enjoy, your intensity is going to be up, your compliance or frequency is going to be up, and it's going to be a win, win.

Mel Dizon:

Great. Okay, so how can people track it? What are some of the best ways that people that are watching this right now can kind of come up with a plan and then track their progress? And then what sort of timeframe, let's say there's somebody that you know doesn't really do much, and now they implement a plan and they're tracking it, how soon might they start to feel the benefits sort of maybe cognitively, balance wise, power wise?

Mike Studer:

All right, I am going to challenge myself to give you several different ways to measure it maybe I'll come up with six or so. And I'm going to try to answer all of those questions that you

outlined there. Alright, so now one, let's say how much time does it take for me to walk around the block? All right, I can gamify that, all right, we made it 19 minutes and 38 seconds today honey, gamify that, that's a measurement. Okay, let's go back to the sit to stand example that we talked about, make it palatable, and just do 30 seconds from a very high surface, oh this low surface hurts my knees, go to your bed or your guest bedroom that has a high bed and time it from something that's going to be palatable and easy. And like you and I talked about, you suggested it, measure yourself once every two weeks or four weeks and do a 30 second sit to stand and put a clock to it. That's another measurement.

Okay, here comes number three, how many steps does it take for you to get down your hallway when you're just walking naturally. All right, it's a 30-foot hallway, today I just tried to do it, as I normally would walk, and it took me 35 steps. All right, how few of steps can you take to get that done? Oh my gosh. The same hallway I was able to do it in 28 steps, re-gamify that, measure that, and occasionally when you walk through there go ahead and do it again.

All right now, let's see, can you do a sit to stand with your eyes closed, can you gamify that? No gosh I've got to actually put my hands on the chair, or I needed help, or I staggered. Can you gamify your ability to move with your eyes closed? Now let's take a look at your ability to actually, let's time you going up the stairs, all right, that'll only take me 10 seconds, but I put a watch to it, my grandson is there with me, he enjoys interacting with me. Okay grandpa let's see what your record is today. You made it up in you know 9.87 seconds. I don't care whether you use a handrail or not, you just did intensity all right, that's number five. Let's give you one more and let's say okay, let's see how many steps you can take in a row, trying to walk with your feet lined up. Maybe you can't even stand like that, for now and maybe you get to the point in three weeks from now, where you can stand, put your left foot in front of your right, and then you got your right foot in front of your left, you made three, you can measure that and now pretty soon you can walk 10 feet.

So I've given you a six there, but then you asked another question inside that. How long does it take for someone to make changes. I'm going to back up into exercise and I'm going to get right back at you. When somebody goes to a gym for the first time in a long time and they lay down and they want to work on bench press and oh my gosh the most I can lift is 40 pounds. But then next week, they come back, and they can do 45 pounds and pretty soon after that they can do 50. Well, why do people make such fast strength gains like that, when you talk about percentage you go from 40 all the way to 50 you improve by 20% right there, actually 25%, 10 pounds out of 40. Well, you make gains quickly by using several different facets. Strength gains, neuromuscular recruitment gains, coordination gains, motor control gains. So, gains that come with something that you're doing that's novel, come very quickly if it's something brand new for you, because you have all these different facets to tap into. And now here's the last part of the answer to your question, the effect of feeling domain and positive wellness influenced chemicals, neuromodulators and neuro transmitters such as right, the dopamine, the endorphins, the serotonin, and additionally oxytocin depending on whether we're exercising

with somebody else, all of those things actually can contribute to a relatively immediate sense of wellness. So, now, the answer to your question is the neurochemical benefits are nearly immediate, the physiologic and motor control benefits follow right after that, it takes 10 minutes to make neuroplasticity work. 10 minutes. So that's a very long answer, but hopefully we've covered things comprehensively.

Mel Dizon:

Yeah no that's great and I think it gives people hope that it's not something that has to, you don't have to wait months for the impact like and the faster they start to feel it, the more they all feel like I have to do this, I have to do this, this feels so great.

Mike Studer:

Yeah you get addicted to it then, yeah.

Mel Dizon:

Okay, can we talk a little bit about sleep, it is super important for everybody, especially people with Parkinson's have a lot of trouble sleeping, so what does it have to do with learning and how does it have to do with like helping them consolidate their, all of the exercise that they might be doing or physical activity?

Mike Studer:

Yeah, gosh, sleep, maybe in the next couple of years we're going to talk about that as the eighth vital sign, right? We keep adding vital signs. And I'll tell you the sleep science is not something that I'm trained in to be an expert in, but because I am considered to be an expert in motor control and thereby motor learning and neuroplasticity I will tell you that I'm fascinated by quality of sleep because we understand that sleep is a time that we do basically three things that are important for us. First and very much specific to what we're talking about today, learning becomes consolidated or actually settles as wet cement becomes hard cement, becomes permanent during sleep. So your experiences during the day today will be things that you can hold on to, but only if you get quality sleep will they be solidified as what we call episodic memories that you will hold on to in the future if you get good sleep tonight. In your procedural memories, the movements that you taught yourself how to do today, or you learned today in your golf lesson will be consolidated, also in sleep. So, there's one, consolidation. Sleep also seems to have an as yet poorly defined role for clearing away some of the negative accumulations of alpha synuclein, plaques, beta amyloid as we sleep. You think about your cerebral spinal fluid coming in as a dishwasher and basically cleaning out these negative plaques that would build up in degenerative conditions.

So, our likelihood of developing Lewy bodies would actually be reduced, with quality of sleep and then the third thing is growth hormone is released during deep rem sleep. Growth hormone helps me take advantage of the physical stimulus that I subjected my body to today, so I can turn it into more strength tomorrow. So I'm going to stop with those three attributes of



strength and again qualify I'm not pretending to be an expert in sleep, but gosh as a consumer of the literature and practitioner, I can tell you, for certain, those three attributes are solid.

Mel Dizon:

Yeah and I would bet that as a clinician, you see a lot of people and when they're not sleeping you know it.

Mike Studer:

Yeah, absolutely because you know that's going to throw out and how efficacious your dopamine replacement is, whether your deep brain stimulator is working to the level you normally expect it to be, your relative attention to participate with me in tasks and then your intensity that you can conduct with me or at home, are all going to be influenced by sleep right?

Mel Dizon:

Well, I appreciate you being here so much, Mike, there is so much practical advice and ideas and suggestions and I think it's going to be really helpful for our community, we're going to write them all down and give people a handout so they can follow all of the tips that you gave us, so I appreciate it so much, thank you for being here.

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