Announcer: ... science. He'll be presenting the recent and accumulating evidence that supports the involvement of the cerebellum in cognition, social, and emotional behaviors. Please welcome Dr. Denis Alemi.

Dr. Denis Alemi: All right. So happy to be here, it's stress to come after all these guys who are brilliant and those who are going to come tomorrow and it was stress to prepare this whole thing. So why is this important to us to talk about cerebellum, to talk about behavior, to talk about cognition? Because we are agents of change. As chiropractors, we bring back movement.

We bring back movement to the body, we bring back movement to the joints and we think that this movement does something to the brain. Just few weeks ago, I had a patient to come in, she's a head of project at a big company. And she came in for some headaches, migraines, and neck pain. And two weeks after I was asking her, "So how's it going?"

And she was like, "Oh, it's great. The pain is much less, I don't have much, any of those headaches that I had literally almost every day." And the other thing, and they always say, "I don't know if it's you," is, "I'm feeling much more zen, I'm cool. Things that used to get on my nerves are not bothering me as much anymore. So at the office, I'm just like really more relaxed."

She was also saying that, "It's not such a good thing because I'm head of projects so I need to put pressure on the team, but I'm just being more relaxed." So we want to know more about it. We used to talk about ... because I did the neurology program years ago with pros at Carrick and I still continue doing a lot of these things in US.

And we used to talk about what we do to the brain function, to the cortical functioning, to the prefrontal cortex. And we are starting to realize that actually it might not just be the cortex, but there's probably more to that. So we're going to talk about cerebellum, cognition, motor control, because that's what we know it does.

Cognitive control, implications in psychiatric disorders, and maybe implications for us as as practitioners. This year marks the 500 year anniversary of death of Leonardo da Vinci in France. And actually, for those who want to see some stuff from him, there's a great expo at Louvre right now, you have to get tickets beforehand.

But it's actually definitely worth it, the paintings, to go and see that. So the legend is that in 1504, Leonardo da Vinci made a wax casting of the inside the cranium and discovered two small brain hemispheres. And this was interesting for him because they seemed symmetrical and interconnected with both hemispheres and he called them cerebellum or the little brain.

So that's probably where, the name, it comes from that which means little brain in Latin. This little brain which accounts for 10% of the whole brain actually contains some people say 50, more people are now saying probably 80% of brain cells. So it's actually probably something very important that in that small piece, there's so much brain cells.

In 19th century, [inaudible 00:04:14] observed that damage to the vestibular system and its connections to the cerebellum resulted in lack of coordination and fine tuned muscle movements which are called ataxia and also dysmetria which was the impairment of the timing, that's when you do the overshoot or undershoot.

When you do some of the movements with their hand, with your legs or even with your eyes or even language, so they saw that removing the cerebellum doesn't stop the movement but reduces, alters the coordination of the movement. So til recently, this is what we knew about cerebellum which is cerebellum is motor control, motor fine tuning.

For some of those who come from US, maybe they had to go through some of these tests, I've done it when I was there. We don't have that in France, they just make you go over the small tests for the breath analyzer. So this is what we knew about cerebellum, which is do they have good motor control?

And it was known that cerebellum received lots of inputs from different cortical regions, but we thought that the projections from the cerebellum was mainly to the motor cortex via the thalamus. New imagery techniques are showing us that the cerebellum actually sends projections to many different regions of the cortex.

We'll talk it a little bit later, but what's most interest of us is prefrontal and parietal cortex. So the thought that the cerebellum was only motor function actually started to change in 1998 which some might call Schmahmann, from Harvard Medical School, who started talking the first about cerebellar cognitive affective syndrome or CCIS.

Because of him actually they call it also Schmahmann's syndrome. So I said that cerebral damage can result in series of deficits in cognitive control, cognitive domains of executive function, we'll come a little bit more over that which is multitasking, planning, organizing, the spatial cognition, language behavior and abstract reasoning and regulation of the emotion.

Since then, there's been more and more research on that, still the beginning, but there's starting to be more. And actually in 2018, Marek showed that actually probably only 20% of the cerebellum is related to motor control and 80% of the function of the cerebellum activity is about abstract thinking, about planning, emotion, memory and language.

And through different researchers, we'll go over some of them, they have actually started to say that the cerebellum, the actual cerebral function, is related to addiction, to autism, to schizophrenia, to depression, obsessive compulsive disorder and ADHD.

What they found also is that the structure of the anatomy of the cerebellum is very individual so it can correlate individual differences in brain structure with individual differences in behavior, skills and capability. Most of us think that who you are is actually what's going on in your brain, in the cortex of your brain.

Again, we talked about prefrontal cortex. Now, they're saying actually it's probably a lot of involvement in the cerebellum that is making you who you are. They also said that activity in critical areas associated with higher cognitive function in the brain cortex was followed by few several hundred milliseconds in the cerebellum.

So they think that the nascent thoughts, the thoughts that you start do to think about something, are actually being relayed to the cerebellum and then comes back to the cortex ... I mean, it goes to the cerebellum for pre-approval before going back to the cortex. And what they're saying is that when we do some things when we are drinking.

And there's some things that we look back and say, "Well, that was really stupid," is because cerebellum, which is actually the area that is being targeted by alcohol, is not doing his function, is not doing the editing of the thoughts. And that's why these people would do or say things that they could regret or that could be funny later on YouTube.

So the cerebellum integrates internal, external stimuli and modulates the appropriate responses to maintain a homeostasis state without conscious awareness. So it's a dampener of how are we going to react, how are we going to bring out our output? The theory of thought implies that when the cerebellum is dysfunctional, the clinical manifestation, what we call the dysmetria, is going to be consistent across all domains.

In the same way as the cerebellum regulates the rate, the force, the rhythm, the accuracy of the movements, it would regulate the speed, capacity, consistency, and appropriateness of, again, mental or cognitive processes. So you're saying that dysmetria from lesions of cerebellum motor regions manifest in cerebellum motor syndromes like gait ataxia, limb ataxia, dysarthric speech.

And the cerebellar vestibular regions, when there's a deficit, they do the cerebellar vestibular syndrome. And we have these in the cognitive limbic regions then we have the cerebellar deficits as we call now the CCAS, the cerebellar cognitive affective syndrome. So what is it?

Well, when there is a cerebellar cognitive affective syndrome, there are deficits in executive function. Some people went over what the executive function, we're going to go a little bit more inside to understand what it is. So when there's a deficit in executive function, there's impaired working memory.

This is the short memory that you need to be able to reason, to be able to make decisions, to fortify behavior. You can test that by asking the person to just give you as many names or objects, terms, in one minute. So this is actually what we do test also for prefrontal cortex so it's actually a combination of what's going on in cerebellum and the prefrontal cortex.

The set shifting, this is the ability to shift your attention from one task to do another task and to do that change. You can see that deficit when if you have had or if you have or if you worked with ADHD, Asperger kids. Just go tell a kid who is Asperger that the plans have changed and look at their reaction.

Recently, I had a kid who was coming, it was for the first visit, I knew the grandparents who are patients. And they were late, they were like 15, 20 minutes late. And, again, I like my patients to be on time. So I'm like, "What's going on?" And they say, "Well, I'm sorry, but we had a huge fuss. He made a huge fuss."

This is his five year old kid, extremely brilliant, since I don't know when he's doing mathematics, calculus, and stuff that nobody ... I mean, it's not this age range. But what happened is that when they were taking the train, I'm close to the Eiffel tower so they have to take the subway that goes above the ground, he got panicked.

He started actually making a huge fuss because he used to do that with his grandfather to come and go to the Eiffel tower. So coming here with his mother was not normal for him, so he started making huge fuss and actually the mom was saying that, "We had to get out of the train to just sit down for 10 minutes and calm him down before we can come here."

This is actually what we see a lot of times also when we see autistic kids who come in. The first time, it's extremely difficult because it's a new thing. They cannot change their mind on what they were going to see and what they're seeing now, so this is a set shift.

The verbal fluency, manifesting as telegraphic speech, like, "Cupcake, give," or, "Daddy, here," instead of having a whole sentence. And we test that by asking how many words from one category they can do in one minute. For example, give me as many names you can of flowers that will start with an F, something like that.

The problem solving, the multitasking, the planning, so these are all the things that we do. The sequencing, which is being able to understand a story, what's

starting it, what's the middle of it was the end of it and be able to plan also things for them and organizing.

There's also deficits in visual spatial cognition which usually enables us to perceive and interact with our visual world such as the ability to recognize the food on the plate to the visual skills needed to find our favorite product at the supermarket to understand that I'll have to get down at this bus station to go to my chiropractor's office.

Do you have patients who miss that station, that stop? So when there are deficits in these problems then we get visual, what they call visual spatial disintegration which is manifesting as deficits in copying and conceptualizing drawn figures. You can see that when you ask them to draw a cube on their own and this is probably what you can get.

Or you're going to ask them to copy a drawn cube and see what they do, how they do that, or maybe some of the writings problems that we see with some of these kids. There's also simultaneous ... yeah, I don't even know what that name is, which is actually the perception is limited to one thing, one object or one site.

If you ask a person like that to explain this, they're just going to look at one part of it as, "Okay, there's water coming down from here," and they cannot conceptualize the whole thing that's going on in this kitchen. And then there's a deficits in language which for example agrammatism which is telegraphic speech.

Again, when you ask about a picture when the children playing in the park and they're not going to be able to explain and put words on it, but just going to be trees, children, running, something like that. Anomia which is type of an aphasia when they cannot find the words, usually I do that a lot.

I can describe what I'm talking about, but I cannot find that specific word in one language or the other. Dysprosody is when they don't have the melody, the intonation, the pauses when they're talking, just all monotonous and it's my geography teacher when I was I don't know what age and it was like everyone was sleeping at the end of the class.

And you have deficits in emotion affect which is seen by dis-inhibition, impulsivity, some regressive and child behavior and obsessive compulsive disorders. Sorry, did I miss something here? Oh, there's something that is not showing. Huh? No, [French 00:18:01].

Okay, well, there was a table that was on this page, I don't know where it went, which actually shows that from a neuropsychiatric perspective, we see deficits in five core features which are deficit in attentional control, in emotional control, in autism spectrum, psychosis spectrum symptoms and deficient social skills.

So basically, what they see is that there's a lot of either exaggerated hyper-metric cognitive behaviors or diminish hyper-metric responses. For example, either they react extremely violently to news or to something that didn't like or they're just apathic. They don't have much of a reaction.

They don't have that oomph to start something, to do something and to maintain attention. Vagus nerve stimulation, I definitely want to hear what we're going to talk about tomorrow, but also that has been shown to facilitate plasticity memory in animal models. It has also shown to have an effect on cerebellum, blood flow, activity and disorders.

Again, these are the things that Vagus nerve stimulation ... probably, again, someone has more information on that tomorrow, but this is something that we use at the office and we do with external Vagus stimulation, but we combine that with other things also.

Music training induced neuroplasticity, cerebella improvement of executive function and working memory so that also can have an effect. Adjustments, do they have an effect? Again, if exercise has an effect, adjustments might have an effect. Do they? I don't know. Some people from, I don't know, some far far away country, they talked about that.

They said Marek's cerebral spine manipulation in a subclinical neck pain group leads to a pattern of cerebella modulation more similar to a non-neck pain group. So when they did that adjustment, they have actually an activity that is more much of a normal activity in the cerebellum. Huh.

Same guys, again, neck pain may change cerebellum, motor cortex interaction. The change to facilitation such as the spinal manipulation may reverse inhibitory effects of neck pain. There's not ... so not the same guys anymore, 2018, [inaudible 00:20:32], they showed that the spinal manipulation therapy reduced not only patient's clinical back pain.

But also the reversing of the observed back straining exercises, meaning the fear and expected pain. So they had also saw changes in the poster insular, the superior Templar design and the cerebellum with their adjustments. So we might have actually an effect on that. Those are all 2019.

These guys actually did something, which probably is interest to Dr. Column's going to be talking tomorrow, and they saw that no significant changes within the cerebral dynamics following surgical manipulation or maximum neck rotation, so they're saying that probably there's some of these effects are not due to problems with the adjustments.

But the other thing that they saw is that there is an increased functional connectivity after adjustments to different areas of the brain, including, again, cerebellum. Mm-hmm (affirmative). Okay. Great. Oh, come on. So what can we

do in our office? Well, there's a lot of things that we can do. We do the adjustments, that's one thing.

We give them exercises, we give oxygen, breathing, we give them balance exercises, we give them rhythmic exercises, eye exercises, hand and eye coordination, complex movement, vestibular stimulation. There's a lot of things that we can do as a practitioner to be able to work with these patients who have brain or cerebellar disorders.

Again, we get a lot of kids, we have a whole program for them. And they go through different stations doing different kinds of things. And when you have done the exam and we know what areas that we want to work on and these are some of the things that we work with them.

So to finish, again, our role as a health care practitioner, what is it? I think it's to better understand what we do. I've been doing the neurology with Carrick for 20 something years, 24 years now. And we have talked about a lot of things that we do in the brain. Now, we have some people who actually are doing the research.

And they're showing, "Well, maybe what we were talking about for a long time, we are seeing the results in the office." Not only the carpet neurologist, chiropractors been this for a hundred more than a hundred years. So these people are saying, "Okay, maybe actually what the clinicians are saying are worth putting research and see if we can see how this is working."

So what we can do is try to better understand, read some of these articles and actually support the research. And then, again, offer some brain-based solutions. The adjustments could be part of it. Exercises, we do some of them inside, in the office, some of them, get them to go do it in the home.

Nutrition, I just have like two more minutes maybe I'm going to talk about that also. Nutrition at cerebellum is a huge, huge, huge thing. If you want, guys, listen to the [inaudible 00:24:01], and some of the guys who work in those fields. We talk a lot about the gluten. Today it's like a huge, huge thing, fad. What's the reality of it?

But the problem is not of gluten in itself. A lot of people eat gluten, they don't have any problems. The problem is that some of these people with neurological problems, they have also some barriers that are not functioning. When these barriers are not functioning, that gluten goes, goes through the hemo cerebral barrier and that's when it starts creating immune reaction.

And the thing is ... actually, I didn't find the article but I saw that article like few weeks ago, I can find out for you guys. Again, that is was talking about it years ago, but they again saw what's going on with the gluten, the form of the molecule and what's going on in the cerebellum.

And so what happens is that when these barriers are not tight or functioning, then when the gluten goes in the cerebellum, in the brain areas, then the immune reaction starts to attacking cerebellum. And that's why we are probably having some of these effects with these kids, ADHD, autism, all these things.

And when they take off the gluten for these kids, they start having some improvements because we started reducing that immune reaction. So again, it's a very difficult presentation to talk only about cerebellum because there's so many connections to so many other things. But we as clinicians, when we're working on them, then we are working on different things.

We are chiropractors, we are going to do adjustments. We're going to talk about about exercises, but we're going to also talk about nutrition and try to have a global view on these patients and what we can do with them. So again, just to finish, I'm really happy to be able to be here with some of these guys who do some terrific work.

And probably could help us, again, to understand a little bit more and have more applications for what we do every day in the office with our patients. Thank you.