

FOUNDER Q&A

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Interviewer

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DR. ETIENNE DE VILLERS-SIDANI, INNODEM NEUROSCIENCES FOUNDER & CEO

So what is Innodem Neurosciences in a nutshell?

Innodem works with the pharmaceutical industry, leading medical professionals, and artificial intelligence experts to develop and promote Eye Movement Biomarkers (EMBs) & Gaze Mapping Biomarkers (GMBs) as important clinical assessment tools in the field of neurology. It is building a series of disease-specific tests embodied in an intuitive App that captures EMB & GMB data, just using the visible light camera embedded in commercially available mobile devices.

The vision is that over time, while leveraging the latest advances in machine and deep learning, this EMB/GMB platform will assist users to accurately diagnose and monitor neurological disorders affecting eye-movements or cognition such as multiple sclerosis, Alzheimer's, Parkinson's or related disorders, Frontotemporal dementia, Cancer-related cognitive impairment (Chemo Brain) and many others.

(cont'd)



What's the origin story here? What led you to founding it?

So you know ALS? Patients with this terrible disease can't speak because of a paralysis of most of their muscles. But although these patients can't speak, their eye movements are preserved, and that's how they can communicate. By glancing at words and letters on a communication board. Stephen Hawking had ALS and had this device to communicate using the eyes with a special eye-tracking device. But most such devices on the market cost something like twenty thousand bucks. As a neurologist caring for ALS patients on the neurology ward, I knew that most of these patients did not have access to good eye-trackers because of their price or complexity.

Wouldn't it be nice to track someone's gaze, but just using the camera of an iPad?

And I hired a programmer with my pocket money and did a proof of concepts. This ultimately led to a fully functional communication App available on the Apple App store called Pigio™. This App has been used by thousands already. But eye-tracking can be used for much more than communication as there is a very large body of scientific literature out there demonstrating that eye-movements can be reliably used to track various aspects of brain health including speed of processing, planning and memory. My clinical specialty is in neurodegenerative disorders and my research lab is focusing on understanding brain circuits through the senses. Given the precision of our eye-tracking technology, I saw an opportunity here to develop an affordable and highly scalable solution to track brain health and help with diagnosis in a large number of neurological disorders. The possibilities are almost endless.

How are eye movements used to look at brain & mental health disorders?

For example, in Parkinson's disease, eye movements get slower and more limited as the disease progresses. Most neurological disorders have "signature" anomalies in eye movements. What is really interesting is that one can get a sense of how someone's think with eye movements. For example, I could test your memory with a simple eye-tracking task. That can be done by presenting you with an image, modify it slightly and present it to you again 10 minutes later. If your memory is good, even without giving you any special instructions, you're spontaneously going to pay more attention to that area of the image that was modified. But if your short-term memory is impaired, then you're going to look at the picture exactly the same way you looked at it, the first time around. By repeating this test with a few different images and tracking the gaze pattern it is possible to get a very accurate determination of someone's short-term memory.

We can even determine a person's emotional state using eye-tracking. If you're depressed, science has shown that you are more likely to spend time looking at a sad face than a happy face. We look more at what



resonates with us. This is all stuff that's been shown over and over again in the literature. Eye movements tell a lot about brain function, it is literally a window into the brain.

But before now, there was no device that was practical to implement in real life clinics. You had to use infrared based research eye tracker that cost \$15,000 hooked to a computer and that requires multiple calibration steps. Imagine doing all this with iPad? Pure software piggy backing on readily available and ever improving electronic tablets or phones. Patients can even self-test at home! So that's what we did and we collected preliminary data in multiple sclerosis, Parkinson's, and Alzheimer's disease to demonstrate feasibility.

Tell us a bit about Innodem's progress regarding studies, regulatory approval, and commercialization.

Currently, we are pursuing FDA and Health Canada approval for our tool to help for the detection of disease status and progression in MS, PD, Alzheimer's and Cancer-related cognitive impairment, also known as chemotherapy-induced "brain fog".

We have implemented a fully secure cloud-based pipeline in which hundreds of eye movement features are being extracted automatically using visual tasks presented on the iPad. These tasks include simply looking at a video of moving or still images. With this, we can understand how precise, how fast, how organized all the eye movements are and relate them to a number of known brain health metrics. These Eye-Movement Biomarkers or EMBs can then be correlated to validated gold standard clinical indicators of disease status or progression. Data collection is currently ongoing at multiple clinical sites and we have a strong partnership with Novartis Canada to look specifically at the progressive form multiple sclerosis (MS). MS is a relatively common disorder affecting young individuals and its progression can be very hard to track with conventional brain imaging such as MRI. They, and we, believe that we can do a much better job with our technology. That would be major for MS patients with progressive disease as it would help them access earlier existing medications to save their brain from further injury.

At the start of 2021, I saw that you closed your \$6 million Series A financing led by Morningside Ventures. That's awesome.

Yes, it's great because to be they're one of the most important investors in the health care sector. Morningside truly understands what we're trying to do and I am grateful for that. They have been great partners so far. They have in their portfolio several companies working on drugs for neurodegenerative disorders. Digital biomarkers such as the ones we are developing could improve specificity and efficacy of the drugs that are



being developed. This is what precision medicine is all about. MRIs and blood tests are not going to be telling the whole story.

What disorders can Innodem's technology be used for? What different ways can this be used?

MS, PD, Alzheimer's disease, depression, anxiety and many many other neurological or psychiatric conditions. When you have information about the status or progression of any of these disorders, we can actually inform clinicians so they can adapt their approach and change the management of their patients. That translates in improved patient outcomes.

Eventually, this model that we're using can really be applied to many disorders or conditions such as vestibular disorders, autism, schizophrenia, strokes/etc. We can help diagnose people earlier, help track the progression, and therefore efficacies of certain drugs and treatments.

Beyond healthcare system and the pharma industry, EMBs could be used in other vertical markets such as insurance(beneficiary payment/new client risk assessment) and large enterprise (HR preventative testing).. We want our technology to be prescribed in the same way a blood test or an MRI prescribed. Given that it requires only an off-the-shelf mobile device, testing can be done in a monitored setting or at home.

So is the main goal for this to be a test that's prescribed by providers? Or something used in tandem specifically with a drug?

I think a diagnostic companion tool would be something that would make a lot of sense. For these more expensive drugs to be reimbursed, for many disorders, you need to show that a patient would qualify for the drug.

With our current clinical validation pipeline, I think we are very positioned to accomplish that goal.

Our technology can also simply be used to clinician to track our patients are doing as very few practical tools exist out these to accurately, easily and repeatedly track brain function in an individual. Declining brain function can have a large impact on someone's quality of life and ability to live independently. Multiple management preventive, diagnostic and treatment measure can be applied when accurate disease tracking is possible. Most importantly I think our technology can empower the patients themselves by providing them, via their doctor, with a more accurate picture of how they are doing.



What's your plan to achieve adoption?

I am fortunate to have direct access to academic and clinical circles given my training and professor position at McGill University. Many of my colleagues have become Innodem's clinical champions, as I like to call them. As we are gathering further solid and eventually peer-reviewed evidence for the efficacy of our diagnostic Apps, I anticipate it will be quite easy to attract attention at major international conferences. The digital biomarking space is growing exponentially and is becoming the center of attention in many of these venues. At the same time, our partners, such as Novartis will likely play an important role. Their expertise in marketing and their understanding of the various existing distribution channels will help us forge key global alliances effectively.

Bottom up adoption could also play an important role as I see patient empowerment as a central aspect of Innodem's mission. This could happen through word of mouth, vlogs or patient associations.

Company Overview

Innodem is a digital health company developing software including software as medical device (SaMD) to track the presence and progression of various neurological and psychiatric disorders. It is composed of a blend of highly qualified neuroscientist, software engineers including AI specialists and physicians working with leading edge academic partners and pharmaceutical companies. Innodem currently has close to 20 employees devoted to improving the quality of care and quality of life of the many individuals living with disabling brain conditions.



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