WESTERN SCIENCE SPEAKS PODCAST
SEASON 3, EPISODE 13

EPISODE TITLE

X Marks the Spot: Understanding Social Behavior Through the Brain

PODCAST SUMMARY

About 1% of the Canadian population is affected by Autism Spectrum Disorder; 100,000 Ontarians alone currently live with ASD, which presents with a number of symptoms including difficulty with social interaction. On this episode of Western Science Speaks, graduate student Wes Robinson from the Department of Biology shares his insights the how the brain deciphers social cues, what has happened when it can't, and how his research may contribute to a better understanding of how to treat autism.

INTERVIEW

You're listening to the Western science speaks podcast. Presented by Henry Standage.

I'm Henry Standage, and you're listening to the Western Science Speaks podcast. The Three Minute Thesis (3MT) competition in Canada gives graduate students a chance to pitch their research in a condensed manner. In the next few weeks, I'll be sitting down with a couple of the participants from Westerns field. Today, we talked to Wes Robinson, about his talk "X marks the spot" that focuses on how our brains understand social cues. Here it is.

Henry: Tell us about your work.

Wes: So, I'm studying a specific protein in the brain that we use to control information flow. So to take a step back let's see your imagine yourself standing in a line or standing at the bus stop, and you can feel people that are getting a little too close to you, and you can actually feel them in your personal space. So that is essentially what I'm looking at in my master's program. So, in that feeling, you're using your eyes, your ears, or your smell, or you're receiving input of what's around you. And so when your brain that takes that in and then deciding what you want to do, and so that's, that's that feeling you get of somebody being too close from you. So I'm actually looking to study this in the fruit fly, which seems like a large jump - from the human-feeling personal space to fruit-fly-feeling personal space. And so what's interesting is we can study in the fruit fly because we have set up an experiment that allows us to test what the fruit fly's preferred social spaces is. So we set them up in the chamber and we let the fruit flies explore and then they actually settle at our preferred distance, which is about half a centimeter. And we do it over and over and over again, we see that they were repeatedly settling at half a centimeter. So you know, that's their preferred social space.

Henry: Do you work with Anne Simon?

Wes: Yeah she's my supervisor.

Henry: A regular podcast listeners quite familiar with the fruit fly. Taking it back a bit - where did this idea come from? Is it a natural thing that's inherent that we're born with it's a space or is that something we learn and developed?

Wes: The short answer is both. So it's an innate behavior that we have to want to be a certain distance to other people but the environment can influence whether we want to be closer or further. So a colleague of mine studies flies in isolation versus flies that are enriched and they actually they have different personal spaces that they prefer depending on how they were raised but it's actually already innately encoded the behavior of a preferred distance. So looking back into my project specifically, I'm looking at a protein in the brain that helps to control the information flow through to the brain and then helps you to decide what you want to do with that and so why this protein is interesting for me is because mutations in this protein in humans are people with a predisposition for autism. So that's where I'm looking at that angle. It's really cool because we can study this protein in fruit fly. And this specific gene and protein is very, very similar to humans, as well as the neurons, which are the basic units of the brain. They're very similar between flies and humans. So not many people would think about that, but flies have a nervous system, they have neurons. And if you were to have a neuron in a microscope of a human and the fly side by side, you almost couldn't tell the difference. You can study one and have impact on us as humans.

Henry: To me it feels like something that's not just related to sight, because if I go behind someone really close just to their back, they're going to notice there's going to they're going to know something's up. And is that brain related? Is there another sensor that goes past site?

Wes: Yeah, for sure. Your brain actually takes all your sensory modalities, combines them, decides what to do, and then goes from there. So you're right. And even in the fly specifically, we have a way of doing it, we basically do it where they can't see. And they still have their preferred social space of centimeters. So even with out sight, they do go to that preferred space. So it's just taking all of your feelings - so like your sense of touch, your sense of smell, people getting too close you can even smell them. And so that's what's contributing to that space.

Henry: What are the signals you look for in the flies? How do you know that one is uncomfortable with how close another is?

Wes: You can't really tell how comfortable they are. That's sort of putting a human feeling to it. I specifically just look at the distance. So one fly, how close is it to another fly? But we actually recently expanded to look at when you're looking at one fly, how many other flies are within for body lengths of that fly? So we're trying to see as a group as a whole, are they getting close together? Are they getting further apart? And so our recent experiment of mine where we mutated this protein that I was talking about - that's a candidate for autism - we mutated this protein and we're seeing that flies in females actually getting closer together, and flies and males actually get further apart. So we're getting a sexually dimorphic response from the fly. Which is really cool.

Henry: What are the limits with using flies for this research? Because you said with neurons, there's really astounding similarity with humans. What can humans offer in research that would go past the flies?

Wes: When we're looking at flies, there's always only so much you can extrapolate to humans. So the behaviors we have to look at to be very simple. The behavior of just how close is it? How much does it move locomotion? When in humans, there's conscious thought, there is deciding things, there's higher thinking. So we can only extrapolate so much to humans. But that being said, when you're looking at people with autism, the clinical definition of autism is having an abnormal social behaviors. So when we're trying to quantify that in the fruit fly, we're just going to look for abnormal social behaviors, not necessarily whether we want to hang out and play video games as humans, but whether they're doing social things like they're getting closer together.

Henry: Do you see an impact? If one flies getting closer to the others does it affect, say two days later how the other flies interact with this one fly?

Wes: We hadn't looked at that specifically. But what I was telling you earlier about with my colleague who's looking at what we do is right from birth, or we call it eclosion. As soon as a fly ecloses, we separated from everyone else. And we find that those flies are generally less social. So they want to be further from other flies and when we actually sort of force them in closer spaces, closer places, they become more aggressive to other flies.

Henry: About this protein, I want to know a little bit more about that. Run me through what exactly it is again.

Wes: So the proteins called neuroligin and the simple explanation of what the protein does is it helps two neurons connect to each other. And it's allows the two neurons to talk to each other. So a neuron can go from your brain to your leg, and it can tell you: "hey, I want to walk", so you lose your legs. So for them to be able to communicate from the brain to the leg, they have to be able to talk. And so this protein, while you're developing while you're growing as a human, you have to form these connections. So the protein forms the connections, and then helps facilitate the communication across.

Henry: Do people, you say it's directly related to autism, is that they have a smaller one or mutated one.?

Wes: So they actually found this mutation in a family. I think it was a Swedish family that they saw had hereditary autism. So there was multiple people in the family that had autism and they were trying to look at what might be the link in the family. They found a mutation in this gene, and that's where they saw that in each of the people affected with autism, they have this mutation. And one other thing about autism is it isn't a one-gene disorder. It's a multi-gene disorder. And so I like to think of it as a puzzle pieces. So, the more puzzle pieces or the more genes that are mutated, the more severe autism. And that's why you've heard of autism spectrum disorders. So there's the more mild version of autism, which has Asperger's, and the more severe version of autism, which is autism. And so the more puzzle pieces or the more mutations in these genes that come together can lead to a more severe, or if you have less mutations, it's more of an Asperger's disorder.

Henry: So it's not something like Down Syndrome where there's a difference in the amount of chromosomes? So they're not lacking this protein, it's just different?

Wes: Correct. You said it, right. It's a mutation in this protein.

Henry: Okay, let's talk solution because you're doing the Three Minute Thesis. Ambitious as possible, 10 years down the line, what do you want to be able to say about this research?

Wes: As much money as I can have (laughs). So what would be the ideal solution, and this is what I'm pushing for and I'm going to start my PhD and continue to look at this, is I've mapped in the fruit fly brain where this protein is. So I've actually found a specific structure in the brain called the mushroom bodies. And that can be translated loosely to the human hippocampus. And so I've located that this protein is in the mushroom bodies. Now I'm trying to follow the flow of the information. So the sensory information, so how close to somebody standing to you goes into the brain, and then it goes to the rest of the body and you decide something, like if somebody's standing too close, you move. So I'm trying to figure out what downstream of this protein is going to the rest of the body or is it going somewhere else in the brain? So I'm trying to map it, maybe even down to single neurons or single clusters of neurons, where is this information going? And the ideal solution for humans is if we can find a downstream very succinct target of where this information is flowing. This could be a possible therapeutic. So people that have autism, the current treatment they have uses medicine to either recover impaired signals or to repress overactive singling from the brain. The issue arises with these complex networks, but there's often a widespread effect of the drugs - you often get unwanted side effects like sleeplessness, nausea, depression. So if we can find a more succinct target downstream that we can manipulate with some sort of drug or some sort of chemical, then we may be able to reduce some of these unwanted side effects.

Henry: By understanding where exactly fly's brains and human brains or similar, Wes hopes to provide a solution for people with autism who may lack the awareness of social norms. You can check out more three-minute theses on the Western University YouTube page. I'm Henry Standage, signing out. Thanks for listening.