KAREN FOLEY: Hello and welcome back to The Student Hub Live. Well, that was a very interesting session. Thank you for telling us all of your thoughts and experiences. Well, now onto something completely different, as we often are at The Student Hub. And look what I've got here. I have some very, very brainy people in the studio. And I am welcoming Connor and Sara, who are both PhD Students, who are doing something really, really worthwhile. You guys are looking at BDNF, brain drive neurotropic factor as a possible cure for Alzheimer's, which is phenomenal. I'm sure that people don't know that we have students like you doing PhD's at the Open University, with all your paraphernalia and this, that and the other, doing such important work. So briefly, can you tell us what you're actually doing?

CONNOR: Yes, so I work with a drugs company that actually make little nanoparticles because the brain has this fantastic barrier that protects itself. And the problem with this is, it protects it, but also stops lots of drugs and treatments actually getting in there. So what our group found were these tiny bits of gold, two million of them together only make one centimetre, so I can't really make much money off them. We attached something useful to it, and we can actually get it into the brain. So our hope is something like BDNF, attached on to that and actually get it into the brain and treat something.

KAREN FOLEY: Wow. And Sara, what about you?

SARA: Something completely different. I work on a protein aggregation disorder. So, when we talk about proteins in a cellular aspect, they're more the workhorses of the cell. They make things happen in the body. And the structure is really important to their function. And during disease states like Alzheimer's and Huntington's, some proteins aren't able to fold correctly. And they form big chunks called aggregates, in the body. And this is basically what causes cell death. So -

CONNOR: So we go from that there with my aspect and we think that the BDNF might be able to not only repair some of those damaged cells because of these protein aggregates, but also help regrow some damage, some new cells as well in the brain.

KAREN FOLEY: Wow, so the protein is obviously the eggs, is it? Are we going to -

SARA: Yes.

KAREN FOLEY: And does this help, eating eggs?

CONNOR: Yeah, it could.

[LAUGHTER]

KAREN FOLEY: Because, I don't know, there's so much stuff as well, in particular around Alzheimer's about certain foods to eat and certain things. And this idea, I guess, about things happening that are bad and are having an impact in terms of brain function. And also this idea of plasticity and repair is such a hopeful, you've definitely got the better story, I think, Connor, in terms of hope for the human race. Tell us what you've got going on with these eggs, though.

SARA: So, I'm actually just going to demonstrate how protein aggregates form. So. This is probably something you've all seen before.

KAREN FOLEY: PhD students.

SARA: This is what we do in the lab.

KAREN FOLEY: OK. Really?

SARA: Well, we're not allowed to eat them afterwards.

KAREN FOLEY: OK. Are we gonna eat them?

SARA: I mean, you can if you want. I don't think it'll be that appetising.

CONNOR: Low carb, high protein diet. We all know that's the thing to do.

KAREN FOLEY: OK.

SARA: So you, basically, at the moment, the egg is full of protein.

KAREN FOLEY: Right.

SARA: And it's all in the right shape.

KAREN FOLEY: OK.

SARA: So proteins are strings of amino acids, and they're folded together to have their 3D structure. And when we apply heat and stir it up, that was disgusting.

KAREN FOLEY: We're not allowed microwaves in the studio anymore. We've been told.

CONNOR: Yeah, it's not quite Gordon Ramsay, but you know.

[LAUGHTER]

SARA: I'm not eating that.

[LAUGHTER]

SARA: Now that I've stirred it.

KAREN FOLEY: OK, so what's this about?

SARA: So, when the proteins are in the correct shape, they're nice and clear. When we apply heat, we unravel the 3D structure of the protein. And that can then bump into other unravelled proteins. And bonds can form between them. And you can form these horrible white protein aggregates. And that's essentially what protein aggregates in the body are, proteins that don't have their correct shape that have joined other proteins that don't have their correct shape. And this can cause cell death.

KAREN FOLEY: And you mentioned before that this was applicable to, oh dear, Huntington's and Alzheimer's. where you've got these aggregates. So, can you tell us a bit about the impact that they have, in terms of brain function?

CONNOR: Yeah, so in Alzheimer's disease the one that we most know of is a thing called amyloid beta, and that's in the brain naturally. And it's normally pumped out in a healthy respect. But as you get older, there is some natural build up. Now, in Alzheimer's, the case is that we're not 100% sure why this happens, but these proteins stay in the brain, aren't getting cleaned out, they become denatured and they start to stick together. This causes the cells around that area to die. They start misfolding inside themselves, themselves. And the regions of the brain that it targets are areas located to memory. And so that's why it's one of the first things that we notice with Alzheimer's is that memory starts to go.

KAREN FOLEY: So you've see these packs being formed, and the idea is that if you could stop something natural that all of a sudden goes wrong, that the proteins are all of a sudden folding and I guess layering on top of each other. And causing something to die by almost suffocating it, isn't it?

CONNOR: Yes.

KAREN FOLEY: So if we could stop that, then we would have a cure.

CONNOR: We hope so. I mean, that's the pitch that I've been trying to sell to people to be interested in my research. But again, we need to do all the research behind that. And it's a very long time from trying this just in simple cells to actually trying to get this to humans. But that is our ultimate goal. And if this works, the general principle might be that we can not only use this for Alzheimer's, but Parkinson's and Huntington's and just slightly modify what we attach onto the nanocarrier.

KAREN FOLEY: Yeah. I mean, from what I understand, the research in this area is growing prolifically. I mean, there is such a great, I mean, and clearly, because it is one of the key conditions, especially in the elderly and ageing population now. So it's a massive issue, and the race is on to try and find a cure. This idea then of plasticity is really hopeful, as I said before. Can you tell us a little bit about that and about how the brain can repair itself?

CONNOR: Yeah, so the brain is an amazing organ. It has this ability to, depending on the stimuli that is being, from your eyes and how you're training it, it kind of acts like a muscle, and can grow and adapt to it. So one of the best examples is taxi drivers we're shown with MRIs. Parts of their brain actually changed that was to do with their spatial awareness. And if they had passed the knowledge, which is the big test that London cabbie drivers do, then the brain actually looked different than the average person, just from the MRI.

KAREN FOLEY: But is this a case of cause and effect? Maybe they were taxi drivers because they could remember things so well.

CONNOR: There is some reasons for that, that might be when you're younger and it's a bit more plastic. But there is definitely a possibility that you can see, people who had only just passed the knowledge from two years to someone who had done it 20 years and actual size difference and an increase as well.

KAREN FOLEY: Well, maybe this is why taxi drivers have won things like Mastermind then, they're clearly very intelligent and good. But obviously, the sat nav thing changes things. So this whole shape and area of research, I guess, in terms of applying this to what you guys are doing, is changing. You've mentioned as well that you're looking, you're working with drug companies. And arguably, while this is a very exciting and sexy area, you're boiling eggs and you're writing

grant papers and doing a lot of essentially quite administrative things. So tell us about life as a PhD student, and some of the sort of things that you guys get involved with.

CONNOR: Yeah, so I mean, we're part of the OU community. So we are doing fun things with the OU as well. But it's definitely a time consuming aspect. You do commit your life to this kind of area. You do spend a lot of late nights here, and occasionally stay here overnight just to do your experiments.

SARA: Well, he does. I don't.

KAREN FOLEY: You can use a saucepan.

[LAUGHTER]

CONNOR: But the OU has this unique aspect with its PhD students because in a lot of other universities, you would have a lot of teaching requirements because of undergraduate. While here, we focus a bit more on the research. But this is also why we like doing these kind of outreach things, to just actually tell the people what we're doing.

KAREN FOLEY: What's it like for you then, doing something completely different? You're not here late at night. Are you not doing so well?

SARA: Well, I'm halfway through my PhD So, please don't ask me that.

[LAUGHTER]

KAREN FOLEY: Yeah.

SARA: No, I mean, a typical day, you spend maybe six hours in the lab. I typically use cell lines to look at protein aggregates in. I mainly do sort of fluorescence microscopy, looking at single cells and what's going on in there. And possibly less writing than I should be doing. But, it's been really good.

KAREN FOLEY: But you're in a different phase, I guess. And like all PhD's have different phases of doing the stuff, writing the stuff, revising the stuff. And there is this whole fluid process. What's it like, then because clearly you're on campus. You're doing stuff. So you're saying you're part of a community. But equally, you're both doing something very, very specific and niche. Like with all PhD's you know, it is a really, really minuscule question that you're trying to feed into the wider area of knowledge. How's that for you?

CONNOR: It feels like you're doing something worthwhile. It feels like, for me personally, my grandmother had Alzheimer's. I saw what that was like through all the stages. So, seeing that I'm actually doing something towards that always just helps me move along with what I'm actually doing. And it makes staying here at night a little bit better.

KAREN FOLEY: Aw, poor Connor. Let's see. There's a lot of questions on the hot desks. Sophie and HJ, any ones that you want to put to us?

HJ: Well, we've got quite a few comments actually, haven't we?

SOPHIE: There's a lot going on. So Sylvia asks about diet and whether your diet can affect, well, she said cure Alzheimer's disease. But is there anything that you can do diet-wise that can maybe prevent it or anything like that?

CONNOR: Well, it's always put forward that basically a healthy diet, there's a lot of different things that we think cause Alzheimer's, but none of it's 100% proven. So there is a small genetic trait. There is other traits.

Basically, eat healthy, and do exercise, which again links back into BDNF that we discussed before. Have a healthy lifestyle. Don't smoke too much. Don't drink too much.

[LAUGHTER]

SARA: Don't smoke too much.

KAREN FOLEY: At all I think is the line.

CONNOR: Yeah, that might be better. But you still need to have a little bit of fun.

[LAUGHTER]

HJ: Ella has a question as well.

SOPHIE: Yes. It also links into something that Sylvia said as well.

HJ: Oh, yes. Sure, take that one.

SOPHIE: Yeah. It's just about, it's used in Alzheimer's in the moment. Can it be used for any other

memory problems or any of the brain problems, or is it specifically just for Alzheimer's, all the research that you're doing?

KAREN FOLEY: That may have been something that, because the chat happens quite quickly.

SARA: It was- -

KAREN FOLEY: You touched on a variety of various neurodegenerative diseases.

CONNOR: So BDNF is nicknamed Miracle-Gro for the brain. So it can cause different areas of the brain to grow and repair itself. So technically, if we get it in there, we could do quite a lot for a number of different disorders.

But also what we're doing is a general principle. So if we can attach this and get it in, then maybe we can get another protein that does something similar but more specific to Huntington's or Parkinson's. Then we can try it.

SOPHIE: Great.

HJ: I think Ben has a quick question as well for the couch. He says, if you could have something to aid your research that you currently don't have, what would it be?

KAREN FOLEY: Oh, that's a good question, Ben.

SARA: Oh -

CONNOR: More money?

[LAUGHTER]

SARA: Yeah, that would always be good.

HJ: Do you think Alzheimer's research is underfunded then?

CONNOR: I think in recent years, it's getting better. But I think research in general is quite on underfunded.

HJ: Mm.

CONNOR: I think we could all do with a lot more money in this kind of area. People are spending too much time writing grants and proposing rather than actually getting to do their own work.

KAREN FOLEY: Yeah. No, very common. Any thoughts from you, Sara?

SARA: Well, a lot of the big neurodegenerative disorders, they're funded by a lot of charities. So you get a lot more money in for those.

KAREN FOLEY: Yeah.

SARA: But it's a difficult question to answer about funding.

KAREN FOLEY: Yeah, very difficult. And also there's so much variety in terms of the stages, I guess, of some of these neurodegenerative diseases. And some things that people talk about about diet you know, that's a massive area that people are looking at all sorts of berries, and cranberries, and various things that you can eat, and also various diets where they have higher rates of neurodegenerative diseases as well, which could possibly be related to diet.

Going back then to this idea about linking quite specifically with what you guys are doing, because you can't obviously address this whole broader picture, how do you connect with this academic community? What sort of networks are you in? As OU students, obviously, that's an important one.

But in terms of the academic community, are you going to conferences? Are you writing papers? What sorts of things are you involved with as PhD students in terms of disseminating your knowledge and also feeding into the specific areas you guys are covering?

SARA: Yeah. I mainly go to conferences. And we're actually going to one together next month. That's funded by the BBSRC and is all about protein folding and protein production in the cells. So that's kind of the main way I really get my research out there.

KAREN FOLEY: That's why you're not doing your writing.

[LAUGHTER]

SARA: Yeah, yeah. I'm making posters.

KAREN FOLEY: OK. There were a couple of other things I wanted to touch on very, very briefly. And one of them, I guess, is just the point that you talked about plasticity and this whole idea of learning, which is effectively what people are doing when they're studying. They're exercising their brain and making new connections between certain networks. So as people are learning new

subjects, they're doing a lot, which is possibly why they get hungry.

But also there are other things that we can do. And we've mentioned diet, but exercise was one that you wanted to touch on as well.

CONNOR: Yes. There has been a lot of links with BDNF and its levels being increased after exercise. It's most commonly been shown when it's been long aerobic exercise, so going for a long job or doing that rather than any weights or high intensity interval training. But yeah, we see these levels increase.

And this thing, again, the Miracle-Gro for the brain is causing the brain to change and form these new connections. So exercise is great for the brain and definitely better to help you learn.

KAREN FOLEY: Yeah. No, it's a great thing. I like the Miracle-Gro for the brain.

CONNOR: Yeah.

KAREN FOLEY: It's just because no one can brain neurotropic factor, not even me.

[LAUGHTER]

CONNOR: And calling it manure or something for the brain doesn't quite work as well.

KAREN FOLEY: No. It wouldn't appeal so much, would it? You guys are going to go back to your labs and engage in the chat, aren't you? Because there's a lot of questions.

So this is all we've got time for right now in the live session. But do get those questions coming in on the chat. And Connor and Sara are going to go back to their desks and try and answer as many of them as is possible.

Sophie and HJ, any final thoughts?

SOPHIE: No, not really. I don't think so. Everyone's still really interested in the actual neurodegenerative disease and things like that. And sort of there's still chat going on, but not many questions that we've got here.

HJ: But we have taken on board your thing about eating healthy food. So Sophie was eating so many crisps earlier, which was terrible.

SOPHIE: I had a whole plate.

HJ: So I thought I'd replace them with carrot sticks and hummus, which may be a bit better. Would you recommend that, or -

CONNOR: Yeah, but I like crisps as well. So that's OK.

[LAUGHTER]

KAREN FOLEY: Connor's the bad boy, right? I knew this would turn into a conversation about food. Sara, Connor, thank you so much for coming along. I hope you enjoy in with the chat. And thank you for doing that.

We're going to be back in a few minutes after this video break. We're going to take a look at writing our CVs. And I have Lynn and Cathy from the Careers Advisory Service. And they're going to tell us what's hot in CVs right now and what you can do to update yours. So we'll see you very soon.

[MUSIC PLAYING]