Episode 15 - Sarah Garfinkel

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SPEAKERS

Caswell Barry, Steve Flemming

C Caswell Barry 00:02

Hello, and welcome to brain stories, I'm Caswell Berry, and I'm here with my co host Stephen Fleming.

S Steve Flemming 00:09

On brain stories, we aim to provide a behind the scenes profile of the latest and greatest work in neuroscience, highlighting the stories and the scientists who are making this field tick.

C Caswell Barry 00:18

We don't just ask about the science, we ask about how the scientists got to where they are today, and where they think their field is going in the future.

S Steve Flemming 00:27

And today, we're very lucky and excited to be joined by Professor Sarah Garfinkel, who is at the Institute of cognitive neuroscience at UCL. And we're lucky to have Sarah because just a few minutes ago, she almost didn't manage to get a computer game because there was ice cream in the headphones. Okay, outrageous gives you insight into Sarah's working day. I mean, it is it is a warm day. So well, we'll forgive you for that. But Sarah has done some fantastic work on emotion processing and the coupling between the body and the brain and how this may go awry in clinical conditions. She's also a relatively recent recruit to UCL. So during the pandemic, we managed to lure her away from Sussex where she was a professor before coming to UCL. So welcome, Sarah, thanks so much for joining us on brain stories.

01:19

Thank you very happy to be here.

S Steve Flemming 01:22

So perhaps we can start off by if you could say in your own words, a bit about what your research focuses on, and what you're working on at the moment.

01:34

So my research focuses largely on emotion, and understanding how we feel from a brain body perspective. So our emotion or feeling states are informed by changes in bodily signals, and these interact dynamically with the brain. And I'm particularly interested in how these brain body interactions and these mechanisms of emotion may go awry in different clinical and neurodevelopmental conditions. So I do a lot of work with individuals who are autistic who also have very, very high anxiety. And I work also a little bit with schizophrenia, post traumatic stress disorder, a little bit on depression. Basically, I'm interested in emotions and how some individuals process emotions differently and what the brain blood, the interactions underlying that might be.

S Steve Flemming 02:27

Fantastic. So basically, the whole clinical spectrum. Every

02:33

so many, I know, I really Frenchie out, I am going to be shy about it. So it's really a mechanistic perspective. Like I really love the heart is actually the heart when I talk about being with the interactions, it's the heart that I love more than anything, I really I find it fascinating. I slightly shake. It's it's like brain stories, and, but really, it's the heart that's my biggest passion. And then the heart, of course, dynamically interacts with the brain. But you can then look at this particular pathway mechanism in all of these different chemical and neurodevelopmental conditions. And then you can really see how it's how it's changed. And by understanding it in detail,

C Caswell Barry 03:10

that sounds amazing and slightly intimidating from the perspective of I don't know, I just do stuff with rats. So I guess, I mean, I think I'm gonna be the one asking the, the naive questions here, I suspect given this is like, right at the edge of sort of my field knowledge. I mean, to what extent are we able to understand what the sort of the normal set of emotions and brain interactions are? I mean, it sounds like you're, what would you mentioned, they're sort of people with autism who might be anxious. How these things change in schizophrenia? Are we do we have a particularly well characterised, normal, like set of relations so that we can compare the sort of disease states to that, like, what's the status quo.

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So we're trying to map it out, because actually, you can tackle the heart from all different perspectives, you can look at the afferent signals themselves. And I think these are getting much more popular as people monitor their heart rate and heart rate variability. And so we can just look at the signals and how they may be faster in some populations are less variable than other populations, we can also look at how the signals themselves change the way that stimuli are processed. And we can look at the precision with which people have access to these signals, we can look at the neural markers of the signals. And we can also look at higher order measures relating to how people interpret the signals. And so when I say at the heart and brain body interactions, it's really all of these different hierarchical levels, from the very signals themselves to then your own mapping to their people's precision. And yes, we are starting to get at somewhat normative understanding, or I'd say normative. I mean, not really like there's massive variation, but we are seeing that these are the types of variation depending What we're talking about seems to be shifted in these different populations. And could you

S Steve Flemming 05:05

unpack a little the core hypothesis, you mentioned emotions. So is the unifying idea here is that these afferent signals the way the heart communicates the brain, the way that we subjectively interpret that those signals is that that is what you're hypothesising may underpin a range of different emotional states.

05:27

That's exactly right. Like I really do think emotion is very much influenced by the body. And we get bodily changes associated with emotional states. And I'm quite William James, even in the sense that I do think I think it's embarrassing to cite someone that I'm from, like 1800s. Guys.

05:52

He's still the person they say that I do very much. Subscribe to the notion that our emotional feeling states do arise from the sensing of these bodily changes at what gives emotion the feeling Enos of it that makes it deviate from cold cognition. And I think it's the bodily reactions that come along with that. So then we can look at the extent of these bodily reactions, we can look at how people's bodies may be more reactive in some conditions than others. In some people, their brains may have more precise body brain mapping. And we can look at body brain interactions. And we can also look at the precision or accuracy with which people detect these bodily sensations. So autism is a really interesting example. Because autistic individuals will often say that overwhelmed by things that overwhelmed by maybe gut problems and body problems, they often feel like they're very aware of what's going on in their body. But if you actually test them in the lab, they don't have precision and accuracy into the signals, they're noisy, they're overwhelmed by them. So they find it hard to sort of process them with precision. And this may be contributes to feelings of anxiety, and lack of sort of precision about what they and other people are feeling because they don't have this sort of precision into the signals.

C Caswell Barry 07:11

So that's me. So relative to control group, say, an autistic group might not be able to gauge their heart rate or change in their heart rate.

07:21

That's what my research shows. Yeah. So they're not able to. And also, not only that, but their bodily responses, sometimes I even larger. So I think one of the things which is so misunderstood about autistic individuals, is that it has been said historically that they lack empathy. And actually, I think that's categorically not true. And if you watch, if you monitor the bodily response of someone who's autistic, if they see someone else in pain, they actually have a stronger bodily response, they have more bodily empathy to the pain of others. So not only do they lack the precision into the signals, they also have stronger emotional responses themselves in the body. And I think this is really fundamental to trying to understand the nature of autism.

C Caswell Barry 08:03

What's fascinating, is there. Is there an explanation that links those two things that somehow the, the fact you caught, that you're not aware of your internal state? Or at least you don't have an accurate measurement, the internal state should somehow feed back and cause larger changes? Or are these two unrelated phenomena as far as I see, I,

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I love that you've asked this question. And I felt like I want to bring in Steve. Like I said, Steve, you can't hide you're right here.

S Steve Flemming 08:35

asking me questions is

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he's, of course, and expert and metacognition. And actually, the thing that I think about all the time is the relationship between accuracy and so called awareness. Because we've we've actually finished the clinical trial to help autistic individuals feel less anxious. So we taught them to be more accurate about their heart when the heart is beating. And they we've, we've given them increased precision to this bodily signal. We've also scanned their brains before and after. And we've seen beautiful changes in brain connectivity in the insula, which is an area involved in the neural processing and sensing of internal Bobby changes, and heightened connectivity between the insula and the ventral medial prefrontal cortex, an area involved in control and also heightened connectivity between the insula and the ACC, the anterior

cingulate cortex, which is also an area that represents physiological arousal. So you're sort of now getting more alignment of physiology, and linking it to an area of growth in control. So this is what happens when you teach autistic people to be more introspectively accurate,

C Caswell Barry 09:45

how to teach them. I'm curious, what do you what does that process?

09:49

Oh, yeah, it's again, it's really simple, like basically. And so interoception is about the accuracy with which you can sense bodily sensations. And it's both a state and a trait phenomenon. So some people are really Be good, some people are bad at baseline, but actually, we're all good if we run for the bus or watch a horror film, because it's state dependent as well. So when you make the signals more strong, then there's greater accuracy for the heart. So what we did is we just got people to the star jumps or run around the room, something very simple to raise the cardiac signal. And then we did very simple tests where we played them tones in sync or out of sync with our hearts. And we got people. So it's really internal external integration. But they're very, very hard tests, to know when to tone it, and things are out of sync with your heart. Partly because the tones are always the same temporal frequency you can't get you can't be accurate, because you know, the rate of your hearts, the tones are the same that either just mildly timeshifted off or on your heartbeat. And we teach people using these things to be more accurate when their heart is beating stronger and faster. So they're having interoceptive feedback. And because of just an exercise, they're having extra sets of feedback, I'm telling them whether they're correct or incorrect, and also their heart slowly comes back to baseline, and they're able to stay within this interceptor channel. So we repeated this after six sessions. And that's when we saw the connectivity changes in the brain. Moreover, and this is a thing, so now talking far too much, but I've got excited

C Caswell Barry 11:29

what we're trying to do,

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but we found drops in anxiety. And we've published this significant drops relative to a control group who are also at tip autistic, you also underwent a different type of intervention. And we found we've now unblinded the one year follow up data, and the drops in anxiety remain after one year, which I'm so excited about. But then the link with awareness, which is the question I really wanted to ask Steve, is that we then notice that their accuracy increases that anxiety decreases. But whereas initially, before they underwent the training, they said they're very aware of bodily sensations. After the training, they then report that they're less aware of bodily sensations, there's something about the increase accuracy, that seems to decrease this awareness measure. And I don't know what's

S Steve Flemming 12:26

super interesting. Yeah. I mean, it just, it got me thinking, while you're talking there about these predictive processing models of metacognition, where, essentially, awareness is like some unexplained prediction, or you're just aggregating over over time. And that just feels like, Okay, I'm aware of something. I don't know what it is. But it's so unexplained. So I guess your one model of your findings could be that people tune into that some metacognitive level. And then they their system explains away the prediction, or they, they expect to have their heart beating at the next time step. And then that noise gets dumped down. I mean, that's quite hand wavy. But that's pretty exciting evidence that that could be the case, right?

13:10

That sounds plausible. To me, I was thinking about it in terms of sensory surprise, which you then reduce with this enhanced precision training

C Caswell Barry 13:20

is presumably a sort of, I mean, there are very powerful drugs out there that used to affect sort of heart rates, etc. I mean, I guess I'm thinking of beat the obvious things like beta blockers, etc. Interestingly, I think that because simple, short segue, I've quite got asked asthma and I take an inhaler that is a beta agonist. So I have anti beta blockers. And you really noticed your heart rate goes up and stays up for about half an hour afterwards. Doesn't make you feel quite anxious. It's quite noticeable. Yeah, it's like, unless, well, this is gonna go well off topic unless you do unless I do exercise. So if I'm riding my bike, you don't notice it, presumably, because it's masked by the normal rise in heart rate or something. But um, but presumably, going back to you not, not me and my bike and asthma, but presumably, this is very strong sort of body brain relationship in terms of sort of emotion, it sort of suggests, or at least, confirms why some of these sorts of relatively sort of simple blunt instrument treatments actually have useful effects. Like I guess I'm thinking of beta blockers again. Is there anything else to be said about that? Or is that all already a sort of well worn story?

14:34

Well, it's, it's, it was a story that sort of been known but then neglected. I think, like, we knew that dampening down these peripheral signals, could help anxiety. But it's i And again, maybe I'm biassed because I'm so interested in the body now, but I do wonder if we're in some sort of, sort of revolution of revisiting the body signals and their interaction with brain tissue We understand mental health. Because if so much about mental health is about changes in emotion, you can see that really across all the different conditions in different ways. And if we all do accept that the body is a main driver of emotion, then it's exciting to think that these peripheral signals in the body which of course, do dynamically interact to the brain, and maybe less invasive or alternate routes to help make people feel better

S Steve Flemming 15:32

on those along those lines. Cash question, I guess a broader question about causality here. So

and how you think about this, and how you unpack it. So I'm thinking like, say, I got anxious about, imagine I'm very fearful of flying. And I know, I've got to get on a plane and a couple of days, and I'm sitting at my desk, and then suddenly reminds me of about the plane journey. So that, that seems like it seems like to start with a relatively cognitive level thing about thinking about the future, and then I get anxious about that. But under your model that would then involve some bodily inputs. So how do you like how that interacts?

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I mean, I get embarrassed within like, something really radical. So

S Steve Flemming 16:20

that's being radical.

16:22

What? What makes you suddenly think about the plane in the first place? And maybe it's a strong heartbeat? Or maybe it's a skip in a heartbeat? Like, I do wonder how much negative you know, because you know, how things just jump into your mind, don't they? Why is that? And actually, you get these fascinating patterns in the heart, the heart does not beat regularly. And maybe those cognitions are elicited through changes in bodily signals in the first instance, so they may 1 of all elicit the thoughts, I would always flip the causality. And then yes, the cognition may be accompanied by a racing heart as a result, but it's the racing heart, which then drives the fear.

S Steve Flemming 17:09

Interesting. So so that provides a link then, because you have these other beautiful studies where you mentioned it very briefly earlier where you can rather than just looking at average heart rate over time, or average accuracy over time, you can time lock the presentation of stimuli to be so does that link those two lines?

17:28

Yeah, it does. I do this with experiments, where your time locking is actually stimulates you when the heart is beating, or in between heartbeats. So what you can do is you can access this heart brain channel, because when your heartbeats, T wave then activates baroreceptors, it sends signals to the brain, and then your brain activates in time with each heartbeat. And then it's this particular channel is quiet in between heartbeats. So you can present a stimulus exactly when the heartbeats and when the heart and brain are in active communication. And you can present a stimulus in between heartbeats when that channel is quiet. And you can see the My Work shows that when you present something on the heartbeat, then you can boost fear. And you can boost fear and people who are more anxious, there's something about that

channels, hyperactive and anxiety people. And I've also shown, I don't know whether I can whether a podcast is the right time to go into a complex fear conditioning experiment. I really, it's like a multi stage one, and

S Steve Flemming 18:33

you've come to the right point.

18:39

So, so I so we I can present two we present two stimuli. At systole, when the heartbeat channel is active, and two stimuli a diastole, in between heartbeats. And one of those will be accompanied by electric shock when the heartbeats and one of them will not be and to then assess plus, I honestly don't think I can. Well, there's the CSBs and a C is minus. And you can also have a CS plus and a six minus in between the heartbeats. But essentially, what we can show is that initially, well, what would happen typically is that people's fear response would be driven by the stimulus that's accompanied by electric shock, of course, it would be for what we can show that initially, before people learn these contingencies, actually, what's driving the fear response is a stimuli that's happening on the heartbeat that that has a bigger fear response. And not only that, when you bring people back the next day, after you've conditioned them and extinguish them, the fear response is highest to stimuli that wish that were presented on the heartbeat irrespective of whether they were accompanied by an electric shock or not. So it turns into a fear stimulus by virtue is associated with the heartbeat itself. And it drives memory.

C Caswell Barry 20:03

It is. I mean, that's fascinating is is, is there something special about the timing of fear evoking stimuli? Or is it? Is this even more general? Are you? You know, it is? Do you perceive any stimuli that comes on the heartbeat as being more potent or more, you know, is it just more, I can't remember psychological terms,

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normally you dampen down, it's the opposite. It's like giving you electric shock. So make it sound like I give loads of electric shocks, I'm gonna give some electric shocks. But it's not the only thing I do that if we give you electric shocks on your heartbeat, then actually you'll have less of a muscle in EMG response to a shock on your heartbeat, you actually get a dampening down of processing. And so typically, also somatosensory perception. So thresholds for how sensitive you are to touch on the skin, you're actually less sensitive when your heart and brain are in active communication. So I sort of think about it about what's being prioritised. So when internal inflammation is being prioritised, the, the brain is registering the heart, then you get this dampening down of extra sensitive processing. And fear seems to be an potential exception to that.

S Steve Flemming 21:19

So just just to go back to the plain example.

C Caswell Barry 21:22

It feels I feel like I should add something here, I want to know, are you really afraid to fly? Because it's just not actually your desk and make like noises.

S Steve Flemming 21:35

I feel very conflicted about flight because I actually love flying, but then I conflicted about it with carbon footprint. So I actually get very excited like a kid going out to play. So this is not me talking here. I'm using it as a potential example. But I guess the content, you can see, the content must come from somewhere so that sorry, I'm just wondering what your mechanistic model is here. So is the idea that they're kind of ascending input could push you down a particular channel, like it's relatively content free, but it kind of pushes the brain into a mode where it will sample from more negative stuff? Or how do you think about that? The mechanistic influence

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that drives this Sunday sending? Okay, so the afferent signals and so so why do I think it occurs, so I think they we know, the root site, they are, they're mapped out and by people other than me who do sort of animal work, but you can track the pathways. So you have bearer receptors, which are activated, and you get signals up the NTS and lamina. One, and you get ultimate projections in a variety of brain areas, from the LC, to the thalamus, to the vmpfc to the insula, T, the amygdala. And so these activate in time with these cardiovascular signals. And I sort of see the brain acting as like carrier waves. So when you have fear processing that sort of matches those types of signals, then you get this boost. Or you can get the sort of suppression effects, I sort of see them. So we know that they're the dynamic effects. That's how the heart communicates the brain. They're the types of signals which then manifest and then processing either in accordance with that, or they dominate

C Caswell Barry 23:32

us. So we talked a lot about the heart. Would this also be true? Would you expect these phenomena are true things like breathing and other any any other? Like cyclical body phenomena? Basically? Oh, well, this

23:45

is a no, I love that. Yes. So I think so. So just after I published a paper showing that they're processing changes at different parts in the cardiac cycle. And so when else a Chicago Group published, I think it was Chicago published the respiratory cycle and showing that fear changes

with different parts of the respiratory cycle. So very complementary. And we know so I loved that, because it was sort of supporting each other's work using these different systems. And we know that one of the main causes of heart rate variability at rest is respiratory cycle, because their spiritual systems and the cardiac system are very much interlinked. So yeah, it does, and it also seems to be dependent on the type of processing so yeah, Camilla Nord. He's done really cool work in Cambridge has given people drugs to dampen down rhythms in the stomach. And she shows changes in how people process disgust. When you change, I think probably everything you have all of these beautiful oscillations in the body, and depending on the organ, and then how they're interacting with the brain that they'll then shape different types of processing in accordance with the organ in question.

S Steve Flemming 24:58

So cool, and do you Do you think this is a broadly speaking? Do you think? Do you view this as a bug or a feature? Intensive? Why would evolution have set it up this way? Because I can imagine, it would be evolutionarily better to just always be, kind of have a baseline high level of responsiveness to things that might kill you. But if, if like I get a dip when my heart isn't beating, then that seems suboptimal. So I'm just wondering, why why is it set up

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like that? Because I think it's, I think the on enough, the heartbeat is mechanistic insights into a more genuine system. So when you're running from a bear in the woods, and your heart is beating strong and fast, and it puts the brain into a state, where you then are prioritising the processing of fear, you're hypersensitive to it. But also, you can run over broken twigs and making your foot bleed because your pain sensitivity thresholds are low. And so it's really about a chronic system that you can also check at a moment to moment basis, but it also biases the body for different types of processing at a more chronic level as well.

S Steve Flemming 26:13

Awesome, I have so many questions, but I feel like we're gonna run out of time, unless we ask you some questions that we also like to ask on brain stories about how you got into this in the first place. So when did you? Well, I guess two questions. One is, when did you first get interested in psychology and neuroscience more broadly? And the second question would be, when did you first get interested in the heart and the body?

26:39

So I think I was always well, actually, not always. So unlike a levels for art history, and physics, and, and I really didn't, and I went to a really, really bad school, like an inner London school where it was really tough. Like, it wasn't we None of us did that well, and Phys. And I actually love physics, and most I'm so obsessed with physics. But we didn't do much physics in class. And, and I actually got a you in my practical. The first time I ever did a practical exam was in the actual exam, like we didn't have any marks. And I was like rolling little cars down. And I just had no idea what I was doing. So physics didn't go to plan. And I really loved history. And I

really loved art. And I thought I was like, I just don't know. But I also love people. And so I said, so I made a side switch to psychology, and thinking that I might want to be a clinical psychologist, ultimately. And then I found out that while I do, I didn't know that I'm not what I do desperately want to help people I'll and probably to emotion, I just being too honest now, like, I'm very emotional. So I'll feel other people's pain and sadness, very deeply. And I thought, crying and being distressed, I think I could make more of an impact from a research perspective than a clinical perspective. So my way of helping people instead of doing clinical psychology is the clinical research one step removed. But actually, my PhD wasn't, although I would have been very happy to do it in a clinical topic, my PhD was actually looking at the effects of alcohol and memory. So it was very, very fun. But it just involves getting students drunk and looking at their memories, which, which was an amazing three years, but then I really then did want to make it have a clinical focus. So after that, I did a first postdoc, which is really retraining looking at memory and post traumatic stress disorder. In Detroit, in America, like people with PTSD, and there, I was just focusing on the brain to try and understand fear in the brain for memories in the brain. And it was working with those individuals where I also noticed all these hyper reactivity signals in the body, racing hearts, autonomic sweat responses, and I just thought you can't study fear, just looking at the brain that you have to look at the body as well. And that's when I retrained in autonomic neuroscience with the amazing keto critically access six,

C Caswell Barry 29:23

it's so interesting. No one has a journey straight through this is the this is the building this podcast has taught me is. You said this perception of surrounded by people who are like, I've always wanted to be neuroscientist. And that was quite off putting, but actually what we've learned is I don't think a single one of the people have been on here I've been like, that's what I want to do. It's always been an interesting and variable journey. I also must confess this thing when you were saying, Oh, I studied the dream. My PhD was on feeding people alcohol and testing the effects. You weren't a PhD student, the ICN were you by any chance? Because if you are no thank God for that time. Once did someone's experiment just come back from Glastonbury quite giving me alcohol. For some time, I thought I was like,

30:13

that's so funny wasn't me. But I had so many participants just like you. Because it was genuinely, I think word got out that if you did my experiment, not only would you get paid 20 pounds for participating that we also gave you lunch and alcohol. So it was a really popular study.

S Steve Flemming 30:36

Not hard, not hard to get participants through the door. Did you? So with that trajectory. Also, another interesting observation is that I feel like a lot of psychologists who we've had on have done a blend of Arts and Science, like you mentioned physics, and then arts and history, and you're kind of trying to chart a path through there. And I feel like psychology is often a place where people end up who are interested in the art side, the the human side of things, but then

have a scientific. You know, they want that scientific underpinning as well. So it sounds like that blend that you hit upon a level, the practical experience notwithstanding, seem like to be a natural feeder into psychology.

C Caswell Barry 31:22

You know, what, I'm gonna go further, I want to, I want to add to what Steve just said, so what while you were just saying what you said, I was thinking, you know, this is so you're so going against the sort of the Descartes, the Cartesian view of like, the duality of modern body and mind, I'm wondering whether is that do you put that down to the arts background that you like? This, this, you know, the, the emotional side of the human spirit is so much more present in art than

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I think it's probably a mixture of a few things? It was such an interesting question. Yes, I think it's maybe about to do art you create, and there is a creativity streak in that. I think it also I do think my education was helpful for me, because it made me think for myself, like, it was so rowdy in class. Sometimes you just sort of had to sit in the corner and think, and try and work it out and come up with your own excavation, explanations that might not have really necessarily made sense, I think there was, instead of just being taught how to do things, I think there was a real streak of independent thought that you had to do just to sort of survive in that school. And then I think the final thing is that I am a bit dyslexic. From age eight, I was going to Bart's hospital before dyslexia was even a big thing quite regularly, because I was just had sort of unusual patterns of different things. And I think that dyslexia thing as well, it made it hard to learn as well. And not only the school, but just, it just was a it was a real challenge. So I'd have to try to figure things out on my own, sometimes at my own speed. And I think it's probably an amalgamation of the school that dyslexia, the creativity and art side as well all sort of mash together to to be helpful in the end.

S Steve Flemming 33:11

And did you or do you remember, a decision point about academia? Did you have a point where you thought, yeah, an academic career is for me, or just something you kind of fell into.

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So the, the really honest truth is that I finished my undergraduate and I, that someone had dropped out of the PhD position. And what they did

S Steve Flemming 33:41

the alcohol PhD.

33:46

It actually dropped out the MDMA PhD. Why they dropped. It was actually my friend, Jessica, because I knew her she she got into fast track civil service. And what they did was they just happened to have marked at that point, the only thing they've marked was the presentation for the dissertations. And the only two people to get top marks were me and Jessica. So I got this phone call, which my parents didn't tease me about for ages. They used to play Ring Ring, do you want a PhD? Because I, the phone just rang one day, and they were just like, well, we've got this spare PhD place. And actually, it really was life changing, because I'd come from this background, and I was a bit dyslexic. And I didn't perform that well in exams, that actually, I don't think I ever would have had the confidence to apply for a PhD position. But it was research that I really fell in love with rather than the exam stuff. And it was the research that got me the PhD and it really probably was my biggest life changing moment.

C Caswell Barry 34:49

That's amazing. That's really amazing. It's really good. It's also something I feel that we sort of increase increasingly, it feels like that's much less likely to happen these days. There's sort Have the channels are much more sort of strict and laid out to get like, and maybe we're missing something because the result because if if, you know if it's if someone like you feels that they maybe wouldn't be able to I wouldn't have made that decision themselves or maybe wouldn't have got to this position like the same thing wouldn't happen now then we're, we're really doing something rhyme. I really

35:19

believe that especially as dyslexic Some evidence suggests that dyslexic brains develop a bit later. And I spent a neurotypical brains developing that later as well. And actually, it's, it's in these people who think a bit different, where potentially you get magic happening. And that can take more time for it to shine and manifest. And those who do really well in the exams very early on and able to learn things which are taught to them won't necessarily be the ones the creative experimentalists that create the paradigm shifts. And I did do some mentoring for individuals I know lots of people do at UCL, it's one of the things I love about being here to help people who maybe didn't have the same advantages and starts as other people, to help them feel that they have the confidence and mentor them along the way. So they we don't, they don't drop out. Because I do feel like it's really in diversity that we can really build and understand.

S Steve Flemming 36:24

Okay, so we're almost out of time. So this has been absolutely fantastic. We'd like to finish off by just asking you what you're currently working on. Now. What do you think the fear the field holds for the next year or two of your research?

36:40

Well, I'm really excited because I've just got a major grants, and so for over 4 million from the

Wellcome Trust, to run along with Camilla noids. At Yeah, a new grant.

S Steve Flemming 36:52

Wow, fantastic. Congratulations. Can you can you tell us a bit about the

36:59

Yeah, so it's, it's really trying to understand emotion from the perspective of bodily signals. So it's looking at emotion granularity. So knowing what type of emotion you're feeling, emotional awareness, and the capacity to control your emotions. And in regard to all different bodily systems, looking at the guts, looking at the heart, looking at respiration, monitoring the signals both in the body and the brain and their interactions. And then looking at modulating different systems in the body to see if we can change the way that people process control and understand their emotions. And then the final phase is a really big clinical trial in mindfulness. Because mindfulness can be used to treat depression and anxiety, but it doesn't help everyone. It helps some people, they love it, some people, it doesn't help at all. And some people can even get worse. And it's to understand whether mindfulness may work to body based signals. So controlling the signals in your body, the precision with which you can detect them, interpret them, and whether that actually predicts whether mindfulness is efficacious or not. And we can also try augmenting mindfulness using interoceptive mechanisms to help people with depression and anxiety. So that's, that's the seven years of funding. So that's, that's the main thing. But there's lots of exciting other side projects along the way, and collaborating with a skilled cardiologist to look at heart brain interactions. I have even only joined UCL two and a bit years ago, I've amassed the exciting lab of PhD students, all working on different projects from ADHD, and emotion to computational modelling of interoceptive signals to heart brain interactions using M eg. So yeah, it's, it's a UCL really is a wonderful place to do research.

C Caswell Barry 39:02

We're not going to let you go quite yet. We are about to wrap up. But before we do, I get to ask the question that we ask everyone. And here it is. What's your favourite fact about the brain?

39:14

So I feel like I'm going to be some sort of brain traitor. Because actually, because actually, I just although I started reading my training as a neuroscientist, I think the heart may be a driver. So I'm going to give you heart facts, if that

C Caswell Barry 39:36

will give you a pass. Yeah,

39:39

so I mean, conditions that were typically only seen in regard to brain disorders such as schizophrenia. Actually huge see changes in the hearts before you see any symptoms of schizophrenia. So you can see longitudinal healthy sample cardiac changes happen first. And you can also look Look at cardiac morphology, and show that that actually serves as a risk factor for schizophrenia. And you can also look at, for example, how statins. So, drugs that act on the cardiovascular system can actually be protective for schizophrenic and bipolar episodes. And so all of this so things which would typically like schizophrenia is like a typical brain condition. Actually, there's really exciting data from the heart, saying that that could be a driver.

C Caswell Barry 40:33

Amazing. I'm glad we let the heart question through those. Those are some of the best facts. Yes, that was great.

S Steve Flemming 40:39

Excellent. Well, thanks so much, Sarah, for joining us on this episode of brain stories. It's been really excellent to have you with us. And we'd like to thank Matt Wakelin, Maya Sapir and Travis mark for their roles in taking brainstorms from an idea to a fully fledged podcast. We'd like to thank Patrick Robinson and UCL digital education for editing and mixing. Please follow us on Twitter at UCL Bray stories for updates and information about forthcoming episodes. See you next time.