

Airing Pain – Programme 37: What is pain?

What pain is, and why understanding your pain is important

In this programme Dr Lorimer Moseley, Professor of Clinical Neurosciences and Chair in Physiotherapy at the University of South Australia, explains the relationship between chronic pain and the brain, incorporating personal stories that illuminate this relationship. The importance of providing good explanations of pain to those living with it is also looked at. According to Moseley, the evidence shows that learning about your chronic pain can lead to a reduction in the pain you experience.

Paul Evans: Hello, I'm Paul Evans, and welcome to ***Airing Pain***, a programme brought to you by Pain Concern; the UK charity that provides information and support for those who live with pain. This edition is supported by the Scottish Government.

Dr Lorimer Moseley: Good experiments have been undertaken by several research groups around the world, in several languages, all of which show that if you can teach people with chronic pain about their pain, in a way that they understand it, their pain reduces.

Evans: That's a very powerful claim for what must be one of the most cost effective forms of treatment for chronic pain. And it's in line with what we hope to achieve on these ***Airing Pain*** programmes. So, today's edition is devoted entirely to that most fundamental question: what is pain?

In August of 2012, I went to the International Association for the Study of Pain's 14th World Congress on Pain in Milan, where I met Dr Lorimer

Moseley. He's co-author of *Explain Pain*, an outstanding and very readable book, which I thoroughly recommend to you all. He's Professor of Clinical Neurosciences and Chair in Physiotherapy at the University of South Australia, and he leads a research group looking to understand the role of the brain and the mind in chronic pain. So, my first question had to be: when I hurt my leg, the pain is in my leg: what does that have to do with my brain?

Moseley: [laughs] That is a fabulous question, Paul, because it's got everything to do with your brain. The only reason it hurts in your leg is because your brain decides that's the best place to make it hurt. And that's because that's where danger messages are probably coming from.

Or perhaps, and this is very possible, they might be generated within the corridor between your leg and your brain. Just like: if you catch a train from London to, you'll have to forgive my bad geography, but let's say London to Edinburgh. Everyone in Edinburgh thinks it's the London train, so they're Londoners that are on it, but maybe they got it [at] on Milton Keynes. Did I get my geography right? Can you go through Milton Keynes on the way to Edinburgh?

Evans: You're speaking to a Welshman who would ...

Moseley: [Laughs] Oh I apologise!

Evans: Who would never go from London to Edinburgh, so let's assume you're right.

Moseley: Do you have trains in Wales?

Evans: We have trains into Wales!

Moseley: That's right [laughs]!

So, look, one of the beautiful things about the human brain is how precisely it can construct an experience that serves to protect you, and it would be ridiculously stupid for your brain to make your shoulder hurt when there was danger in your leg. Ah, but you're completely right, that it hurts in your leg, and I would say: 'The pain is in your leg.' But the pain is constructed by your brain.

Evans: What's the point of pain, then?

Moseley: Well, a true Darwinian would say 'There's no point of anything, it's just a fluke.' But, I guess, the effect of pain is protection. One hundred per cent of the time it serves to protect body tissue. And that's where it's quite unique. There's no other experience that we have that serves to protect the tissues of your body. You have fear but that protects your whole body. You have anxiety, again quite general, but pain protects a particular part of your body.

Evans: But, I hurt all over. What has gone on there?

Moseley: Well, your brain is trying to protect you all over. You can be as complex as you like, I guess. If you go to a pain congress and try to learn about all the molecules involved in this and that; that's very noble and very important. I sometimes like to sit on the other end, the simple end, and that is to say that 'Pain is about protection.' If your whole body hurts, it's because your brain is trying to protect your whole body.

Evans: But, with people with neuropathic pain, or people like me with fibromyalgia, there is nothing wrong with my body, I am told. But, we still hurt.

Moseley: Yeah. What does it feel like being told that?

Evans: That there's nothing wrong with me? It makes me feel very small.

Moseley: Yeah, right. Yeah, and I think that's a very common experience: when one gets half of the message, if you like. And the half of the message that you tend to remember is that people are trying to tell me: 'There's nothing wrong', and I'm trying to tell them: 'But it hurts', and I think that the modern neuroscience, or biology of pain, embraces both of those experiences and both of those facts.

So you said: 'What is going on there? Why do people tell you that?' I guess, I think, we have to concede that every single pain we ever have is ultimately decided by the brain. I mean neuropathic pain, the danger messages that are being produced, either in the peripheral nerve – so in the nerve that supplies the body tissue – or within the spinal cord. That message is being generated in error. So, because of a problem with the nerves within the spinal cord – and when I say 'problem', I mean: it's not functioning correctly; it's not broken; it's not chopped in two or anything – it's not functioning properly, therefore your brain might receive messages of danger when there is, in fact, no danger. So, it's an error message.

Fibromyalgia's a bit different. My understanding is that the community doesn't understand where in the system the error is being generated. It could be being generated, I think, in the spinal cord, it could be generating in the brain, and it could relate to all of the other protective mechanisms we've got – like your immune system; like your endocrine system; your autonomic nervous system.

Evans: If my brain were a telephone exchange, like in the old days, my leg has phoned a number which communicates with a part in my brain that will send pain back down there. But with somebody whose brain has gone wrong, if you like, in this way, the number gets transmitted to all the wrong numbers round the brain.

Moseley: I love the metaphor. I don't agree with the metaphor; I think it's wrong. Can I tell you why? [laughs]

Evans: Go, please.

Moseley: It's very attractive for us to think about the biology and the nervous system like hardwired telephone exchanges. So, I completely get that. I think it's reasonably acceptable to adopt that model until you get to the brain. Can I shift your metaphor slightly? I'm going to try and play with the metaphor.

Evans: Please do.

Moseley: The 'telephone exchange' will never send pain down to a body area because pain doesn't travel in anything. Pain is a conscious experience and this is the mystery, and it's a fantastic mystery!

We don't know how consciousness emerges from the human brain. We know it does. People will say: 'Oh it's this and that', and we don't know, yet. But it does. So, pain is this thing that is constructed in the consciousness, it doesn't get 'sent'. But if I work with that metaphor, the phone number might be dialled up into the telephone exchange; I would prefer it if you said that it's not a typical telephone exchange, it's a room completely full of, let's say, people, to take that metaphor, who are listening to a whole lot of other telephone exchanges. And whenever they get a message they have to try to interact with that room full of

talking people, until eventually – and in reality this happens in milliseconds – eventually that room full of people decides what to do. And one of the things they decide to do may very well be: ‘make your leg hurt.’ Because that will make you behave in this way, protect your leg and your leg will get better. They might also say ‘and turn on the immune system; reduce blood flow,’ or ‘Increase blood flow; change muscle control.’

So, when pain persists, one of the effects of that is that, the people in that room who have been most influential in getting the pain message out become better and better and they become sensitive. So they get a little hint from somewhere and *bang*, they say: ‘Produce pain!’ So, it’s not really this mechanistic thing. I like to think of it as a mixture of chemicals and pathways; not of simply pathways. The idea of it simply being about wires downplays its complexity. And, you talked about a ‘malfunction’; in neuropathic pain there can be an injury to the nerve which causes it to malfunction, an error. I would argue that if the brain is producing pain, that’s a functional, sensible, survival-promoting response, all the time. The problem is that it’s because of an unhelpful set of inputs, whatever those inputs may be. So, I would say: ‘All pain is normal and physiological but the causes of it are not.’

Evans: You’re listening to *Airing Pain* by Pain Concern, the UK charity that provides information and support for those of us who live with pain. And in this programme, we’re looking at the fundamental principles of what pain is. But before we continue, let me just remind you of our usual words of caution, that: whilst we believe the information and opinions on *Airing Pain* are accurate and sound based on the best judgments available, you should always consult your health professional on any

matter relating to your health and well-being. He or she is the only person who knows you and your circumstances and therefore the appropriate action to take on your behalf.

Dr Lorimer Moseley said, at the beginning of this programme, that 'If you can teach people with chronic pain about their pain, in a way that they understand it, their pain reduces.' Now, people with the most knowledge, that is the 'experts', aren't always the best communicators. Or, at least, some fail to communicate on a level that mere mortals like me can understand. Lorimer doesn't fall into that category – when I was talking to him, he illustrated a complex brain–pain response by telling a personal story that even I could understand.

Moseley: So, the story, part one, involves me camping in the bush. And I got up early in the morning and no one else was awake. I put on my sarong – which was very fashionable, I'm sure you would appreciate – and I walked towards the river. And I remember, what I thought at the time was scraping my leg against a twig or something like that; I remember a sharp prick on the outside of the leg but that was it. And I jumped in the river; it was very cold, I remember. I felt like I had the mumps afterwards, I had these two lumps up in my throat, but, it was so cold. Got out of the river, and then I don't remember much after that. I was quite sick and it turns out that the scratch from a twig was actually a bite from an Eastern Brown snake. To give that the purchase that it requires, I have to say it like this: [deep, ominous tone] 'Easter Brown snake.' You know, that's a big, nasty snake; second deadliest land snake in the world.

And what that actually does is activates danger fibres. The danger fibres were telling my brain: 'Danger! Danger!' And my brain thought: 'where

are you? You're in the bush. What are you doing? Walking. What are you wearing? A sarong...you idiot.' You know: 'what does this message mean?' And my brain evaluates it. The spinal cord is saying 'It's danger.' But my brain knows: 'well, for the first 10 years of my life, I was always walking in the bush. Got scratches on my legs. This is not dangerous; we've been here a million times.' So, my brain constructed an experience that should have promoted my survival: kick off the twig, continue on your way. So, it made a mistake and I had no pain, really, but severe danger.

Eight months later, I was walking in the bush – not wearing a sarong, in fact – and scratched my leg. Same thing: danger messages activated, sent a message up my spinal cord, says to the brain: 'Brain, there's a bit of danger on the outside of your left leg, in the skin.' So, my brain evaluates all this again. So, that room full of people – the telephone exchange idea – full of people, someone saying 'Okay, it's a foot off the ground, on the left hand side.' Someone else is saying 'It's on the outside of your leg halfway between your ankle and your knee'. Someone else is saying 'You're walking.' Someone else is saying 'You're in the bush.' Someone else is saying 'You're halfway through your walking stride.' Together they conclude: 'My goodness! This is highly dangerous, because last time we were here, you almost died.' So, my brain, together, says: 'Protect!' Pain is the thing that emerges out of that. And I had severe leg pain. Severe, white-hot poker pain screaming up my leg. And I was looking for the snake; the people I was walking with were looking for the snake; and eventually we saw a nice little scratch on my leg from a twig or something like that.

So, in that scenario: excruciating, distressing, panicking pain.

Completely real, I can assure you – I hope you can tell by the look on my face – it was horrible. No significant danger in the tissues. The first scenario: severe danger in the tissues; no pain. And that, for me, captures the complexity of pain. Pain is all about protection. It's not about stating the facts; it's not about a transmission of information from body to brain; it's not about that. If it was about that, our life would be crap all the time because, right now, you and I both have got danger messages coming but because the brain knows: 'That's not dangerous. Shift in your seat. Cross your legs over.' So, pain is always about making you behave in a way that protects your body.

Evans: So, the pain from the scratch from the twig was purely a learned response to something that had happened before?

Moseley: [sighs] That's a great question, Paul. And it makes me slightly nervous, as someone who has been charged with or has taken on the challenge of trying to express science. I think, strictly speaking, you're correct. But, what that question or that phrasing suggests or implies is incorrect. And what I mean by that is, if we were to say: 'The pain I had from the twig was a learned response', it implies that it's not a real response. That it's illegitimate, and that it implies that it might be learned in the same way that I might learn my times tables. I have some intent or objective. And it's not like that at all.

The molecular mechanisms that happen are consistent with learning on a single cell, you know, and network level. So, although your statement, I believe, is true; I'd never use that language because it implies some illegitimacy or something like that. You know, we only talk about learning when we're talking in this, sort of, psychological realm, which I think –

because pain is so physical, so physical, it's about your body – then any implication that it's not, I think, is not helpful.

Evans: I understand what you're saying and I agree with you, that learning implies that it's something that you have deliberately put into your brain, if you like. But is there something that's implanted into the chemistry of the brain that has switched something off, or switched one of the junctions somewhere else, that has given you that response? Which, to many people, might sound like an idiotic response; that you hurt from scratching yourself on a twig.

Moseley: Yeah, I agree. I want to respond to the last bit of that first, because it's easier. It would seem an idiotic response if pain is only about the sensory input from the body. But, if we can think a bit more widely, and say 'Pain is about doing everything to promote your survival and part of that is to protect you before you're actually in danger,' for example. Then, if there are sufficient cues available, it's a genius response to say: 'Hang on, last time you were in this exact situation, you almost died. I'll do something to get you out of this situation before it becomes a problem.' And if we take away from that, sort of, snakebite/scratch-from-a-twig scenario and we might put it into an experiment that my research group has done.

Some time ago now we got a group of supposedly normal people; well, they volunteer for pain experiments, so they're probably not quite normal, but they say they're a healthy volunteer. And we put a very cold piece of metal on the back of their hand. Now, that might be mildly painful after a little while, or for some it will be mildly painful initially, but if we simultaneously show them a red light – and we don't do anything different – we show them a red light, then it's painful. If pain was only

about what the hand was sending, you'd say that: 'That's idiotic.' But think about it for a moment. There's a big bombardment of nerve impulses from the hand, and your visual system is saying 'red', which means 'hot' – we've learned that – then, before the brain even evaluates this message from the hand, it says 'Get your hand out of there, because we've got these two scenarios.' So, it really hurts. And some people rate exactly the same stimulus, they say: 'It doesn't hurt,' with the blue light we would show, or no light, but say: 'It's an 8 out of 10 intense pain with the red light.' And that to me is genius.

Evans: So, what you're saying is that 'We're not reacting from the stimulus, or the twig on the leg. We're reacting from all of our thoughts of the past, other signs, colours, lights, flashing lights; absolutely everything that's gone into our brain in the past.'

Moseley: Yep, absolutely everything. And one of the, I think, magnificent things is that nearly all of that, you don't know about. It's all the stuff that you know, but you don't know that you know. And it's only the last little bit that you do know, and that's where pain resides. All of this stuff happens if you were to think of your brain being like an egg. Don't really think of it like that because it says it'll break; but you've got this very thin layer at the top, and all the egg is on the inside – that's where all the thinking really happens – and your conscious bit, the stuff you know about, is on the outside. It's not much. Of everything you know, nearly all of it you don't know, that you know, you know? [laughs]

Evans: No, I don't! [laughs] That's all very well, but what happens when there are none of these stimuli there, but we continue to hurt? You've pointed out that we hurt for a reason, pain is there for a very, very good

reason: it's to keep us alive. But, some people are in pain when none of those warning signals are there to fire it off.

Moseley: How do you know there's no warning signals there?

Evans: [laughs] You tell me how I don't know.

Moseley: Well, I would argue, the reason for my question is that I would say: 'If there are no cues for your brain, there will be no pain.' The fact that many people will be sitting minding their own business and their back starts to hurt; or they have pain lying in bed at night; or they wake up at 3 o'clock in the morning and they're hurting; or they wake up at 7 o'clock in the morning, get out of bed and they're hurting; all of these things, where there's no obvious cues, what that just tells me is that there are very unobvious cues. And, I see my role, in a clinical sense, is to be the detective. Why is your brain trying to protect your body? Because, for me, if we answer that question and we can solve those cues, then you will not hurt. Now, the challenge is that it's very difficult.

The other challenge is that one of those cues might be, for example, a spinal cord neuron that's over active. So it's a lot harder to train that system. And that's what I think we have to do: we have to train the brain to not protect you unless you're truly in danger. And that's very difficult to do. But I think it's doable.

Evans: How would one do it?

Moseley: The best evidence we've got relates to people understanding the sort of stuff we're talking about. That pain – completely real, intense pain – doesn't have to reflect what's happening in your tissues. And, it's one thing to say: 'Yeah, okay, Lorimer. I get that.' But, what I want is for people to understand it in the belly of their nervous [system], or in the

marrow of their bones. To understand it so well that their language reflects that, and we've spent 15 years researching methods of teaching people that. We're better than we were 10 years ago, but we're still not super effective at it.

There must be better ways to do it; but even with the ways that we use, in science terms, we say: 'We've got level 1-A evidence.' Which means that good experiments have been undertaken by several research groups around the world, in several languages, all of which show that if you can teach people with chronic pain about their pain, in a way that they understand it, their pain reduces. In fact, the research actually comes up short of that by saying, 'If you can teach people about their pain using the best methods we've got, their pain gets better.' We don't even know if they understand it in the clinical trials, but we presume they do. So, there's very good evidence to support that. That's one thing I would always expect, or hope to see, someone in chronic pain deals with. So, the clinician they see is able to do state-of-the-art, therapeutic education.

Evans: Your 15 years of research; one of the results of that is your book, *Explain Pain*. Now, that's one of the best books I've read to explain pain in a very, very clear way. Is that the sort of education you're talking about?

Moseley: Well, it's the sort, yeah. We wrote *Explain Pain* after we had done the bulk of our own randomised, controlled trials. So, we'd done eight or nine experiments that said: 'Yes, this is good material. Let's put it into a book that's like what we use clinically. That's got nice pictures.' Well, it's got pictures [laughs]. Some people don't think they're nice but they're provocative; they get your brain emotionally engaged; they

access a different method of learning, I guess. So, the book provides much of the material. But, we know, that even that book, that you're able to get a handle on, is at too high a level for many patients, many people in pain. So, it's really meant to be a resource for a clinician or a really informed family member to have – preferably a clinician – to be able to go through explaining pain. As a – it's sort of like a manual, if you like.

The more we learn about this, the more we think it's important *how* it's explained. From a couple of perspectives, one of which is: 'What's the attitude of the explainer?' And, even in pain management circles, there is a surprising number of people who actually don't respect the pain that their patient has. Almost doesn't respect the patient, therefore. Or the person in pain – 'patient' sort of puts them in a box.

But, in my clinical role, that's the role I have. People are coming to me as a patient. But, I would love to see the end, the complete annihilation of comments, even at conferences like the World Congress on Pain; conversations over coffee where people are implying there's something psychologically damaged about this person or these patients. It's astounding to me that those conversations still happen.

I've written another book that, again, is a compilation of stories that I've told patients over the years as a way to try and grasp concepts. And the stories are like the snakebite story. Or there's a story about a guy I worked with at MacDonald's who, when he got panicked, his pants would start to drop, and you could start to see the top of his bum crack. And that would be the sign of panic; so, we would know to do something. I use that story as a metaphor for an important concept of pain science, and we've done randomised, controlled trial on those stories as a method of changing the way people think, and we can see that has an

effect. The best effect we've had so far with purely material is these yarns – metaphors, stories – followed by *Explain Pain*, followed by targeted coaching from someone who knows what they're doing. And those results are top shelf, in my view.

Evans: I would say that many health professionals aren't very good at explaining pain to patients. There is a bit of a chasm between 'Us' and 'Them'. 'Us' being me, the patient; 'Them' being the doctors. You are a very good communicator and I would recommend anybody to look to your YouTube lectures, not to patients but to students, to realise how simple pain can be.

Moseley: That's great to hear that because I believe that. I know about all this research on the complex molecular biology, but at the end of the day, it seems very simple to me. If your brain has to protect you, it'll make it hurt. And that's quite intuitively sensible, I think. But, it's great to hear that feedback, Paul. I really appreciate that because I'm passionate about communication; and I'm passionate about humans; and I find humans very interesting. Not least, myself, you know, [there are] opportunities to hold up the mirror all the time in what we do. But, I'm excited to hear that from you, so thank you.

Evans: My thanks to Dr Lorimer Moseley, Professor of Clinical Neurosciences and Chair in Physiotherapy at the University of South Australia, and I do recommend his book, *Explain Pain*, written in conjunction with David Butler. It's very readable and the imaginative artwork really does add clarity to the text.

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I'll give Lorimer the last word. My question might sound flippant, but his answer illustrates that the best communicators know how to make a point stick. And it isn't always by bombarding people with facts and figures.

Why on earth would you bring a stripper to a lecture?

Moseley: [laughs] That's terrific! Well, I actually had nothing to do with that, to be honest. That was at a conference run by NOI [Neuro Orthopaedic Institute] group. David Butler is the driver of NOI group and he's the driver of that conference. A *fabulous* conference! About 3 months before the conference, they took me aside and said: 'Somewhere in the conference we want to have a stalker. Would it be okay if it was just before your talk?' So, I had nothing to do with it. But it was fabulous to watch; well, not that I was watching the stalker so much as watching the watchers. It's memorable – see, that's a fantastic example of how do you get the brain to lay down stuff? Novelty! Fun! Emotion! And all the rat studies, all the human studies, on this say: 'Emotion; novelty; exercise; is how you get the brain to change.' Maybe fish oil tablets...but that's the fourth.

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