

## **Transcript of RELIEF Podcast With Howard Fields**

**RELIEF:** Hello, this is Stephani Sutherland with Relief.News, and I am in Boston at the World Congress on Pain, the meeting of the International Association for the Study of Pain. And with me today is Dr. Howard Fields, Professor Emeritus at the University of California, San Francisco. Dr. Fields is a neuroscientist whose work has really helped shape our understanding of what's happening, what's actually going on in the brain during pain. So, welcome Dr. Fields.

**Howard Fields (HF):** Thanks, Steph. It's good to be here.

**RELIEF:** So today we'll be talking about how expectations, or what we think will happen, actually influence our experience separately from what's actually happening in reality, right? And so it turns out that expectation influences us pretty profoundly. And particularly, for people with chronic pain, past experiences especially around treatment might set the tone for future experiences. So, we'll talk about that. And I want to start with a basic question for you, why do we do the things that we do all day? What is driving our behaviors? What makes us make our decisions?

**HF:** Well, there's one phrase that I really love, and it was by Theodosius Dobzhansky, who was a biologist. And he said that nothing in biology makes sense except in the light of evolution. So you really have to understand that human behavior is a product of hundreds of millions of years of evolution. And there's some very basic things that all animals have to do, including humans. We have to find energy, which is food. We have to keep our body temperature regulated, which means we need clothes when it's cold, and we need to have air conditioning when it's too hot. We get thirsty, we need to drink. We need to protect our body. The major function of pain is to protect your body from damage, and it does this in different ways.

One way it does it, it to say, look, what you're doing is potentially threatening. You've got to stop. You have to get away. You have to escape. The other possibility is that what you just did was good. You stopped the pain, right? So, these changes, these immediate motivations, are critical. And the thing to remember, I think, about all humans and all animals, is that nothing ever happens in a vacuum. When you have pain, it occurs in the setting of multiple other motivations that you have in life. Most typically, it might be, you wake up in the morning, and you have this pounding headache, and you have a job, and you like your job, right? So, you have a problem. You have to make a decision. Am I going to be able to go to work, or do I need to stay home and take care of myself? That's the kind of decision that we're all making all the time, and that's where your brain comes in. The pain is not simply a result of something that's going to damage your tissues. It's a decision that you make about how important the pain is in your life right now.

**RELIEF:** And the thing about pain, when we have it, is that it comes to the forefront of our attention. It really kind of grabs our attention, right? And so, it also becomes a very powerful tool

to teach us, right, so, we learn very quickly. So can you explain how we learn so quickly from pain?

**HF:** Sure. So, there're two things that are teaching signals in our life, and, in some ways, it's very simple. I like things that are simple. The thing that's simple about this is, if you do something, and it's beneficial to you, then the likelihood is, in the future, when you encounter a similar situation you'll do the same thing. However, there are things you do, you made a mistake. It wasn't what you thought was going to happen, and the outcome was worse than you predicted, then you're going to learn to not do that again

So, one of the major functions of pain, in addition to the immediate urge and the call to attention, is to instruct you that what you did was probably not a good thing. So these two things occur at different time scales. The outcome – the teaching signal, the learning function of pain – really affects future behaviors. The immediate urgency – the motivational side – is what determines your behavior right now. So these two things will be in conflict as well.

**RELIEF:** If we're learning all the time, and pain is one of the teaching tools, but as you say, we have things that are coming into conflict all the time. So, how does our brain take all this conflicting information and make decisions about what to do next?

**HF:** That is exactly what I'll be talking about today. How do we make decisions? This is one of the big current problems in neuroscience. It's called decision neuroscience. We don't know all the details, obviously. We're still doing research, but we do know that there are two parts of the brain that are very critical for this process.

One is the prefrontal cortex. The thing that distinguishes humans from all other animals is the size of their prefrontal cortex, by far. And it's almost a third of your total brain is involved in this decision-making process. It involves using memories as well as current information to make a cost-benefit computation. And then once you've done that for all the different possibilities, you choose one. You choose a possibility. Your cortex informs your motor system about what's going to be the best thing for you to do. You're not always right, but the fact that human beings are here with this big brain means that a lot of our ancestry made good decisions in the past.

It gets back to, it's all about evolution. The thing that makes us good relative to other species is our ability to weigh different possibilities and choose the best one. It's our flexibility of behavior that confers an evolutionary benefit. So, it's one of the things that's peculiarly human is that we're almost always conflicted whenever we're in a situation where we're called upon to make a decision.

And people vary in their ability. Some people are impulsive. They make decisions without weighing all the alternatives. Some people are very deliberative. They take a very long time to make a decision. Maybe they take too long, and the predator eats them.

**RELIEF:** Right, and that doesn't work either.

**HF:** So there are pros and cons of being highly deliberative or being very impulsive. And it turns out that we have great variability in the human population in terms of our ability to make, either wait for a future reward, or impulsively select what's immediately available.

**RELIEF:** So, as I think about going through my day, and you're talking about we're making these decisions all the time, but I don't feel like I have to make decisions every single second. How is that happening without me knowing about it?

**HF:** Stephani, you are asking great questions, and they're also incredibly profound. The last question you asked is very profound. And I think people, hopefully, they'll enjoy my answer. The main thing you've got to understand – and I think most people should understand – is 99.99% of all your brain activity is unconscious. You're just not aware of what's going on. You don't really know when the part of your brain that's making this decision has started to work. It probably started to work long before you had this feeling of, oh, I'm going to do this.

So, there's this wonderful book by a psychologist, Dan Wegner. The title of the book was "The Illusion of Conscious Will." And his idea was that most of our decision making goes on before we're aware. Once we make the decision, our brain becomes aware of it, not the deliberation, but the actual decision. And then you think, oh, I picked up that glass of water because I was thirsty. That's the little story that you make.

**RELIEF:** Right, and we give ourselves credit for it, don't we?

**HF:** As we should. I have a little phrase that I like: It's not my fault, my neurons made me do it.

**RELIEF:** All right, so let's shift and talk a little bit about how these elements of predicting what might happen and expecting a certain outcome and making these decisions, how do these relate to pain and, particularly, chronic pain, and specifically in the realm of treatment for chronic pain?

**HF:** Really, I believe that it's absolutely critical to understanding many patients who have chronic pain. Chronic pain is much different than acute pain. With chronic pain, you've gone through many days, weeks, months, often years of not being able to escape the pain. It's always there. And, if you think about it, the fact that it's there is telling you you need to do something about it. It's calling your attention. And it's disabling because it's calling your attention. If you could ignore it, you'd be okay. But you can't, or it takes a lot of effort, or you don't always succeed. It's almost as if it's constantly telling you that whatever you did was wrong, and you've got to stop. So, gradually, first you experience a loss of pleasure in the things that ordinarily, or in the past, you'd enjoy doing, so you're less likely to do them. You do less and less. You stay at home. You become isolated from all your friends, and it's kind of a downward spiral. And that, I would say, is the result of the motivational side to pain.

Its influence on decisions really are, you've got to always do things to address the problem of pain. Some of the things that you do to address that problem actually make it worse. But the key thing to understand is that if the decision you make, if your brain's decision is to respond to the pain, it's actually going to turn up the volume on your pain transmission system. So the very fact that you're trying to deal with it makes the pain intensity worse.

So this is the critical understanding, right. If the decision is no, I want to get up, I need to go to work, I need to go to my job, because I'm the support for my family, once you make that decision that you're going to go, and you're going to get up, and you're going to go to work, the brain actually turns down the volume on your pain. So it makes it actually better than it otherwise would be. It doesn't completely get rid of it. It's not like you get up, and you go off to work, and all of a sudden your back pain disappears. It's just that you're able to do better, and your attention is focused elsewhere. And that also is helpful.

**RELIEF:** And how does the brain do that, turn our pain signals up or down depending on where we put our attention?

**HF:** That part we actually do know quite a bit about. We know that there's a top-down circuit that runs from the cortex through the brainstem and down to the spinal cord and actually controls the neurons that are sending the pain message back to your brain. So, a lot of your brain is involved in a control system that, basically, controls the volume knob on your pain transmission system. And there're two sets of cells. One cell that's in this top-down system turns the pain up – we call those the ON cells. And another group that turns the pain down – we call them the OFF cells.

So, the OFF cells will be activated if the decision is, I'm going to go to work. The ON cells are turned on when the decision is, no, I need to go to the bathroom and get an Advil or an ibuprofen.

**RELIEF:** And head back to bed.

**HF:** Yes, and head back to bed. So, you've constantly got this decision process affecting pain through this top-down system.

**RELIEF:** And that decision-making process, that goes back to what you were saying in the beginning about evolution. So, we have these needs. We need to eat. We need to work. But as soon as pain is in the picture, it can throw off your decision making, right? It can hijack the decision.

**HF:** Well, I don't know if it throws off your decision making. For most people who don't have chronic pain, the pain system works pretty well. I mean, that's the thing to remember, that we needed our pain pathways, both for tissue protection and to make good decisions in the future, to

avoid damage. So, never lose sight of the fact that there is a beneficial side to having a pain transmission system.

There comes a point, where the information that you're getting is no longer tissue-protective, but it's still sending the message. And that's when the pain signal becomes counterproductive, right? It's not helpful. It's sort of the opposite of what happens when you get addicted to a drug. Take a drug, it makes you feel better. But it doesn't actually do anything to benefit your body. But it feels like it does, so then you do it again. So, I would say that drug addiction and chronic pain are sort of opposite poles. They're taking you in two different directions through two different sets of cells.

**RELIEF:** Can you talk a little bit too, then, about how pain is a learning tool? So, say for example someone has chronic pain. They're learning, constantly, and maybe if they are active, it makes their pain worse, and that becomes a learning signal to keep them from being active in the future. Is that right?

**HF:** That's a good point. It's a good point. That's right. That's why I say the pain signal, when it's chronic, is dysfunctional. It's no longer acting to protect your body. So, for example, let's say that you have sciatica, and you have low back pain. And when you get up and walk around, it hurts. And you think, gosh, if I walk around, I'm going to damage my nerve, so I better not do it. I better get back in bed and rest.

The data suggests that if you get back in bed and rest, that actually makes your pain worse, even though it feels better at the time. So, that's why I say it's a dysfunctional learning signal. It's teaching you something that's actually inaccurate.

**RELIEF:** Interesting. So, then again, let's talk a little bit more about expectation, and especially how it relates to treatments. So, if a patient has an expectation that something will work, does that give it a better chance of working?

**HF:** Yes, there's very good evidence on that. This evidence comes from very simple, straightforward experiments. They started an intravenous line, and they could give people medication at times when they didn't know they were getting it. And so, what they did was, they compared the effect of the drug given blind versus given in open, so now you know that you're getting the drug versus you got the drug, but you didn't know it.

Consistently, a drug is consistently more effective when you know that you're getting it. So, every time you get any kind of treatment, there is an effect of the treatment on the body, but there's also an effect of your expectation of how the treatment's going to work that adds to any biological effect directly on the body.

The reverse is true, if you're expecting that it's not going to work, it subtracts from the efficacy of a treatment that may actually be beneficial to you. So, expectation can work both to make pain better and to make pain worse.

**RELIEF:** So, that sounds suspiciously like you might be talking about the placebo effect. Is that true?

**HF:** Yes. There's a thing called the placebo effect, which is, you give somebody a pill that's, say, a sugar pill. It has no medicinal value. They're in pain at the time. You give them the pill, and they get relief. The relief, in that case, is a 100% due to expectation. The other thing that can happen that's very important is what's called the nocebo effect. So, you give somebody a medication that you know is effective, but you tell them it's going to make their pain worse. So, now, this drug that's supposed to be an analgesic makes your pain worse due to expectation.

And that's the other key thing for everybody to know, both for the healthcare professional and for the patient in pain, is that expectation works in both directions. It can make your pain better. It can make your pain worse. So, dealing with pain, I always say, the first thing you have to do is you have to understand what the person's expectations are. If the expectations are for worse pain, then you need to work with the expectations before you initiate treatment.

**RELIEF:** I was going to ask you, what should healthcare providers do? Should they paint a rosy picture, or hedge your bets? When I say a rosy picture, of how a treatment might benefit you, but it sounds like maybe you need to get on the same page with the person and see what their expectations are to begin with. Is that right?

**HF:** Yes, so one of the cool things that now seems to be fairly well established is that a very large proportion of patients with chronic pain have an emotional condition that's been labeled "catastrophizing," what I would say catastrophizing is extreme pessimism. So, what I tell people is the first thing you should always do is ask people what their expectations are.

So, I'll have a patient come into my office with chronic pain, and I'll say, hello, blah, blah, blah, why are you here? They'll say, look, I have this chronic pain, and you're my last hope. I've been to lots and lots of doctors, nobody's helped me. The first thing I want to know is, do you really think I'm going to be able to help you? And a lot of times people will, if they're honest, they'll say no, I don't really expect it, but I'm hoping.

So, it's a kind of a probabilistic thing. I'm really hoping there'll be a miracle, and my pain will get better, but I really don't expect that it will. So, then you have to kind of get people's expectations back to neutral.

**RELIEF:** And how do you do that?

**HF:** Well, then you can talk about just what you and I have been talking about for the last few minutes is, expectations are a really important part of your probability of improvement. And it's been my experience that many people who have a condition similar to yours actually do get better. Here are the things that I've done. Now, that doesn't mean that you'll be one of those people, but you have to keep in mind that there's a good chance you'll get better.

My approach has generally been to say – I'm never dishonest with a patient, but I can be somewhat hyperbolic, and I might say, you know, I've had four or five patients that I've given this medication to, or I've done this procedure on, and they've done remarkably well. They've recovered and gone back to work, and their pain levels have been markedly reduced. I don't talk about the eight or nine patients for whom there was no effect. So, I'd say I more tell them the truth, but I don't tell them the whole truth.

**RELIEF:** Because you don't want to get their expectations overly high, right?

**HF:** No, I don't want to lie to anybody. I don't want to lie to them, but I want to emphasize the possibility that they'll get better.

**RELIEF:** I think most people don't realize how – I didn't realize – how profoundly, as we've been talking about, our expectations influence the outcome of something like a drug – something that we think, this is a drug, it works on these cells, it's going to work the same because that's how they work. But our brains really shape our experience separately from that. It's pretty amazing.

**HF:** Yes. Well, I mean the fact that you can have such powerful effects from expectation alone. Studies of placebo have been very important in demonstrating that. There're studies from Italy looking at patients who've had chest surgery, thoracotomy, which is – the pain following a thoracotomy is really strong. If you laugh or if you cough, it's just excruciating pain. And they've shown that placebos can be effective even for that type of severe pain.

So, it isn't that placebos only work for mild pain. They work for severe pain as well. In fact, there's some evidence that they may work better for severe pain. Now, the problem with placebos is, they don't continue to work. Over time, your brain figures out that nothing biological has happened, and the placebos tend to lose their effectiveness, not in everybody, but in some people.

**RELIEF:** What would be your advice, then, to someone who's living with chronic pain, and maybe they have had these experiences of treatments that haven't worked for them, and they have been to a lot of different providers. Maybe they're feeling a little pessimistic about, as you said, even if they're not catastrophizing quote-unquote. But what would be your advice, with everything we've been talking about how the brain works with chronic pain, what would you tell them?

**HF:** What I would say is that we know so much more now about how to manage pain that even if their experience in the past has been largely negative, that doesn't mean that they won't get relief from something that they haven't tried in the past. There are new medications. There are new procedures. There are new stimulation tools, interventional things. And the key thing in my mind is, they need to find a group or a physician that will spend the time to really find out everything that's going on with them to try to make a diagnosis, and then address that.

I would say that, for most patients out there, even with chronic pain, there's probably something that's going to help them.

**RELIEF:** Even if it doesn't completely get rid of pain.

**HF:** That's right. To get them back to a point where there are things they can do that they'll enjoy.

**RELIEF:** I think that's an important point, too, because sometimes people have an expectation that their pain will be gone after a treatment, and that may not be realistic.

**HF:** And that may not even be a good thing.

**RELIEF:** Sure, sure.

**HF:** Sometimes your body can tell you things you need to hear. At times, your body can tell you things that are not helpful to you. And that's going to be the difficult decision. And I think there are a lot of programs now that are beginning to understand that. So, they'll include things like mindfulness or cognitive behavioral therapies that could get you back to the point where your expectations are more in line with reality, in which case, the things that didn't work in the past may begin to work now, that, in which case, your ability to tolerate activity goes up even if the pain levels don't go down. So, there are multiple paths to a better life.

**RELIEF:** Sounds like some reason for optimism, then.

**HF:** Yes. I'm definitely an optimist, and all my experience over the years taking care of pain patients has not dampened my optimism. And the other thing that makes me very optimistic is, just to be at a meeting like this, where there's so many new things that people are talking about. And our understanding of all aspects of the pain – how pain affects the nervous system – is advancing by leaps and bounds. I'm very optimistic.