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**CHRIS DAVIS:** Hello and welcome to the *Career and Academic Resource Center Podcast*. I'm Chris Davis, the associate director of the Career and Academic Resource Center here at Harvard Extension School. And today, it is my great pleasure to be talking to Professor Ann-Christine Duhaime. Professor Duhaime is a senior pediatric neurosurgeon at Massachusetts General Hospital, where she also serves as the associate director of the Center for the Environment and Health. In addition, she is Nicholas T. Zervas distinguished professor of neurosurgery at Harvard Medical School and faculty associate of the Harvard University Center For the Environment.

She is the author of *Minding the Climate, How Neuroscience Can Help Solve our Environmental Crisis*, which was published by Harvard University press in 2022. Dr. Duhaime, thank you so much for being here today.

**ANN-CHRISTINE** Thank you so much for the conversation.

**DUHAIME:**

**CHRIS DAVIS:** So I asked you here today to speak about your book, *Minding the Climate*. There is a lot of material that is certainly covered in your book. And we can't get to it in the course of our conversation.

But I wanted this to be an enticement to our students to hopefully read it, and explore it. We have a growing sustainability and global development practice graduate degree programs. And I know that there are a lot of students who are interested in this subject.

So first of all, I wanted to hear from you very quickly, what was the genesis of the book? What prompted you to write this?

**ANN-CHRISTINE** Yeah. So a lot of people ask that. Like, what does a neurosurgeon have to do with climate change and where do

**DUHAIME:** you come off thinking that you know anything about it, and guilty on both counts. But really, it came from an increasing discomfort with the Discord between the magnitude of this problem of climate change, and environmental decline, and the way that many of us spend our time, both our personal time, but in my case, my professional time.

So I'm a pediatric neurosurgeon, as you mentioned. I spent my career taking care of children several at a time, but for that child, one at a time, and bringing families through periods of crisis, through life threatening or life altering conditions. And it's a high tech, high intensity field. It's extremely rewarding. That is -- it's very satisfying when you can bring a family and a child through that crisis and restore health.

It's intellectually interesting. There's a lot of teamwork. And so there's that element to it. And it's a very rewarding career.

But as important as it is and critical as it is for that child and that family at that moment, I was also increasingly aware, as most of us are, of this looming problem that will affect more than just the children I care for, obviously. It will affect children everywhere. And I was really somewhat distressed at the fact that most of us can go about our daily routines and feel like this is somebody else's job, somebody else's shift. And I just felt that I needed to do my part.

So that was the motivation. But why a neurosurgeon? Because it seems to me, with the perspective of somebody in the clinical neurosciences and research neuroscience, that any decisions, any activities, any behaviors, any choices that human beings make reflect the equipment that we use to make it. That's a very neuroscience point of view.

But when you work with the brain and watch it change over the life span and in relation to things that happen to it, it's not an unreasonable perspective. So it seemed to me that looking at climate change through the lens of the equipment that we have used as a species to create climate change and also the equipment that we need to rely on to reverse the problem was an exploration that would be of interest.

**CHRIS DAVIS:** Thank you. That leads me to my next point which follows from what you just said. In the book, you talk about how the human brain both constrains and frees us, talking about how through the evolution of our human history the brain has evolved and been hardwired for survival. For other needs, you talk about the rewards system that's baked into the brain's work in terms of behaviors and habits.

And you also link that to-- you tie that into setting the context for how modern human history is a millisecond of evolutionary time. You spend some time laying the groundwork for that to explain how and why the brain is wired as it is, and how it can evolve, how our thinking can evolve, and how it's also, through that evolution, that certain functions of our thinking of our brain power has been -- has grown through needing to adapt, needing to survive. Can you talk a little bit more about this and why you're talking about this in terms of how we respond to climate change?

**ANN-CHRISTINE DUHAIME:** Sure. So first, Chris, I'd like to-- I'd like to emphasize that it's common in normal language for us to talk about the brain being wired, hardwired. And I push back against that a little bit in the book. And instead, the term that I use throughout the book is that we have certain predispositions. That is our brains, first of all, are enormous.

There are 86 billion cells. That's a lot, 86 billion neurons. And they connect each on average to about 10,000 other neurons. So this is an extraordinarily complicated instrument.

But it is designed by nature to be flexible. And if it weren't flexible, we couldn't learn, we couldn't adapt to circumstances in our own lives that change from being a dependent infant to being an active toddler to being all of various stages of life old age, changes in abilities, and so on. And that flexibility allows us to adapt to changes within our lives. But also, the human species is adaptable to different circumstances. And that adaptability is part and parcel of the way our brains have -- have been able to accomplish all the things that we've been able to accomplish.

There is also dramatic variability from one person to the next. And that has to do with genetic traits. But it also has to do with the experiences that each of us have.

So we are -- the brain is not a fixed thing. It is constantly in motion and changing based on all the things we encounter, all the things we have ever encountered. And the number of events going on in your brain at any given instant is in the multiple millions.

And so we do have certain predispositions of the way we are weighted to make decisions based on survival pressures. I was thinking about this today. I was walking by the water. And you always know where the food is because that's where the goals are concentrated.

They know to go and find where the food is. And there's a whole bunch of them there. And you know that they're there for a reason.

And likewise, humans, like all other creatures from whom we evolved and whose nervous systems we share elements of, we know we are very good at finding food. We are very good at certain things that help us in sensation. For example, we have good color vision. We hear pretty well, well enough to survive.

We have extraordinary skills of memory. And for example, we can, with no effort, tell a familiar face from an unfamiliar face. Although, there are ranges of abilities in each of these traits. Some people are more empathetic, some people are more decisive, some people are more mechanical, and so on.

So our brains are flexible, variable from one to the other, changeable over time, and adaptable and responsive to the circumstances in which we find ourselves. And we're good at learning. We're good at making associations.

So the idea that we are hardwired is an idea I'd like to give the readers a chance to understand. And one of the big questions about climate change is while we have certain predispositions that helped us survive and some of those predispositions are acquisition, we, by and large, like to get more money. By and large, we like to have safety, and shelter, and material goods that give us security.

But there are other things we like as well. And by like, I mean these are rewarding to us. So for example, social rewards are very powerful for human beings. And some of the other rewards that I mentioned in my career for neurosurgery, the reward of agency, being able to make something happen, being able to be successful at something. All of these are parts of the way our nervous system is attuned by evolution for things that helped us survive, and thrive, and outcompete other forms of pre-humans and even other groups of humans.

And so we're less hardwired than we are predisposed. But one of the big questions of the book was how do these predispositions influence our ability to understand, cope with, and find solutions to this pressing problem of climate change? And as you can imagine, things that predispose us to having more, consuming more, and also discovering more, sometimes are contradictory to the kinds of changes we need to make to solve this particular problem.

So this is a difficult problem for us to proceed. And it's a difficult problem for most of us to change our behavior in alignment with those things that need to happen for climate change to be mitigated. And so that's what I mean when I talk about a mismatch.

**CHRIS DAVIS:** Yeah. And related to that, you talk about in the book-- and I wonder if you would elaborate on how this all links to the fact that climate change, although there's a growing cacophony of information and voices talking about it, is not necessarily a visible -- it is certainly-- it is more and more so now. But for a lot of people, including-- especially in high income countries, you're talking about hiding in plain sight and the fact that the immediate reward for changing behavior in many cases isn't apparent. So you talk in the book about how -- you make the distinction between habits and behaviors in some sense.

And you also talking about changing behaviors, in this case to individually respond more effectively to climate change requires a change in rewards. The old ways of our thinking that old rewards must become less rewarding, and the new ways must offer more potent rewards. I was wondering if you could talk a little bit about that in terms of how people are responding to or can respond to climate change going forward.

**ANN-CHRISTINE** Sure. So one of the things I had to explore-- this was an exploration for me, and the book is the result of my own exploration -- was, a, how changeable are we? Are we doomed because we're always going to want more, do more, get more. And that more, more, more is going to tip us over the edge. Or are we changeable enough?

And so to try to answer that question, Chris, what I did was looked at some of the principles that have been used for difficult behavior change in other contexts. And what are some of the ones that are best studied because they are problematic and really difficult, one is addiction and things like overeating, and so forth. And there are others. But that one gives a lot of data, because there's a lot of modeling. And what has been shown is that there are some general principles for behavior change that is difficult for problems like addiction and similar difficult changes that people need to make for health, or well-being, or public health, and so forth.

And so the principles that came out that have been shown repeatedly are some of the following. One, positive tends to work better than negative. And any student listening knows that a little bit of praise from your mentor, or your teacher, or somebody you look up to, makes you work doubly hard, whereas a criticism sometimes makes you be angry or give up. Now, that isn't to say that negative -- negative reinforcement isn't effective at changing behavior. It can be. But by and large, on average, the studies have shown in a variety of contexts using a variety of models with humans and even other animals that positive tends to be stronger reward and change behavior more effectively than negative.

So that's one of the principles. And we'll get back to how this could affect climate change in a moment. But another is that if you are giving up a difficult behavior or as you call a habit, something that you do-- you've done it the same way, works well for you, and now you have to change it. The strategy that works best for changing those kinds of things are strategies that substitute one reward for another.

So I had a conversation with a writer the other day who said that she really likes her gas stove. She had learned about gas stoves being the best for cooking. And she had taken cooking classes. And she belonged to a cooking club. And she'd done all this stuff with her gas stove.

And then she read that gas stoves, a, they're methane. They're not good for climate change. They degrade your indoor air quality. I recognize this is a controversial area in some circles right now. But the evidence is pretty strong that gas stoves are, both climate-wise and health-wise, probably suboptimal compared to alternatives.

And she had to change her behavior. And she said that even the smell of the gas, which when she first got her gas stove and was doing the cooking, was a positive thing. Now, it really turned her off. And it's not that the gas stove changed. It's that her attitude about the gas stove changed.

And she decided to -- now, this, again, we're talking high income. This is, as some people say, a first-world problem. But she was able to get a new -- I can't remember what it's called, convection stove top, something, something very fancy, electromagnetic or something. And the thought of substituting that and getting rid of the guilt about indoor air quality and asthma for the family and contributing to climate change, that became more rewarding. And learning how to cook on this new stove became an exciting adventure.

So that's a somewhat high end example of a change in behavior where something that was positive becomes negative because of the learned associations. Now, the book goes into one of the -- there are several reasons that climate change is a really tough problem for us. One is because it's a really, really complicated problem. Two is because we have no history of it.

This is brand new to us. So there's no -- we are used to, as humans, looking to things in our past experience. And we're in uncharted territory. That makes it unsettling and difficult to deal with.

And three, one of the important things is we can't perceive it. We did not need in the pre-history of humans to develop carbon dioxide sensors. You can, as I said, you can sense color. You can smell ammonia. You can touch a rough surface and feel that it's rough.

We don't have carbon dioxide sensors. Evolution didn't need to equip us with that. So while we can perceive storms, and we can watch videos of floods, and so on, much of it, unless you're in it, it's indirect. And you hear it from people you don't oftentimes. These are not the way our brain is best at processing new information and understanding it.

So the behavior change is challenging. It requires substituting different rewards for the ones you're giving up. And sometimes, for no good reason other than that cognitively, you know that you should. And that's not the strongest motivator in many instances.

And it's difficult to even come up with motivation based on personal experience, because we can't perceive climate change directly. We can perceive some of its effects. But those effects, as you mentioned, are touching more and more of us, which is why the movements are gaining steam to do something about this big problem.

**CHRIS DAVIS:** Yeah. Thank you so much. One of the things I wanted to ask you about that I -- at least to me as a layperson, I found really revelatory about your book is when we read in the popular media, there's a lot of talk about individual actions. And there are other activists, journalists, people working in this space, writing about this space that say, these are structural issues and individual action, in some cases, may be pointless. That's how it's sometimes framed.

And I wanted to hear from you a little bit more about how you present this in the book. You talk about how whose behavior needs to change and actions by individuals at the micro level when they add up to the aggregate can be very powerful. And you also talk about individuals, institutions, economies, governments around the world, we are also talking about individuals. As you say, all of us are working with the same basic neural equipment.

So it's not a binary. It's not just individuals. And it's not just the corporate world or the petrochemical industries. But you break it down into talking about a lot of these things as being individual things which in the aggregate add up to very meaningful responses. Could you talk a little bit more about that?

**ANN-CHRISTINE** Yeah. I'm so glad you brought that up, because that's a common misunderstanding of the work that I've gotten

**DUHAIME:** into here. It doesn't help anybody to say, nothing I do is going to make any difference as an individual. That's true. Nothing you do is going to make a big enough difference as an individual.

I had to explore how does that actually break down, what are the facts. And the book, as you've seen the book, has a lot of references. It was a-- I had to do a lot of reading and talk to a lot of people. But I wondered myself like, what is the breakdown of individual household behavior and things you can't control directly.

And it depends on how you define it. There's lots of different people who have drawn the circle slightly differently. But as a rough estimate, on average, about half of the problem of carbon emission amounts comes from things that individual people do in their own household lives. And the other half comes from things that, by and large, you can't do much about as an individual.

But this is the mistake people make. They think that because we're talking about individual brains, we're therefore confining our discussion to individual behavior at the household level. And that's not true at all.

If you're the CEO of a company and you need to make a decision about your company, are you going to invest in a process that is going to reduce your margin but improve the environment? That's a decision that's going to affect more than your household, household budget, and carbon output. But it's still made at the level of your brain. And the things that are going to influence that decision are the same kinds of things that influence each of us making our decisions minute to minute in the context of all the decisions we make, but in this context, in the environmental realm.

And so if you're the president of a university, if you're a middle manager at a manufacturing plant, if you are an educator, if you're a member of a family who others look to for your expertise, if you have a large friend group and you do a book club, or you have social life, each of these spheres of influence including all the way up to politicians, negotiators, people who are into policy changes, each of these -- the decisions have to change at the level of the brain. Nobody makes decisions without the brain. Well, sometimes, maybe they do. But you know what I'm saying.

So the point is that each decision at any scale of behavior that it will affect one or two people or will affect thousands or millions of people, those decisions are still made with the same equipment, using the same equations, using the same evaluative mechanism of relative weight of pros and cons, rewards versus downsides. And all of these decisions are influenced by the same kinds of inputs which is things that you hear, things that you see, things that you're exposed to, people in your life and their opinions. And one of the take home messages is that your opinions matter and have an effect on more people than you probably recognize.

And this is how culture changes. This is how widespread movements occur. But each person that gets involved has to get involved at the level of the brain. Whether you're a persuasive writer, a journalist, a person who makes movies, and artist, somebody who writes books, all of these things happen and may affect many people. But they still happen at the level of each individual brain.

**CHRIS DAVIS:** Thank you so much. As a closing thought, I wanted to hear from you if you could share one takeaway or one message that you hope readers of the book get, what would you share with our students? The message that I'm going to share with them is that it's very much worth reading this book. But as a closing thought, what would you want to share with readers?

**ANN-CHRISTINE DUHAIME:** I think the take home message is as follows. There are several, but I think the main one is this. You can't expect pro-environmental behavior and decisions to engage in pro-environmental behavior to feel the same as decisions you're used to making that have been rewarding and the cause of your success throughout your lives to date. Your brain is just not going to weigh climate change -- for most people, there may be exceptions -- in the same way that it feels to get the goal in soccer, to get the bonus at work, to get the A-plus on your exam. Those rewards, we are well designed to feel, perceive, act on, and learn from.

But pro-environmental decisions, our brains simply haven't caught up with the urgency and magnitude of this problem. So when you make a pro-environmental decision, it just won't feel as rewarding. And it will make you question whether you're making the right choice, especially if it's a difficult choice, whether that's at the scale of your personal life, or your work life, or your academic life. These decisions aren't going to feel as good and as rewarding oftentimes. They're going to feel kind of vague, and unsatisfying, and I'm not sure that it makes any difference.

Despite that, you need to persist at pro-environmental decisions. And we all collectively need to make these changes, because this is the biggest problem that we are facing. And it's a complicated unsatisfying problem to the brain. But it will be a very satisfying problem to solve for our and future generations.

**CHRIS DAVIS:** Dr. Duhaime, thank you so much for joining me today. I really appreciated it.

**ANN-CHRISTINE** Thank you. It was a great conversation. Thanks, Chris.

**DUHAIME:**

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**CHRIS DAVIS:** You can listen to the CARC podcast. This is the podcast for the Career and Academic Resource Center here at Harvard Extension School. And I hope you will join us again.

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