

# BRAIN SCIENCE PODCAST

*With Ginger Campbell, MD*

## Episode #55

**Interview with Neurophilosopher and Author, Patricia Churchland**

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## INTRODUCTION

Welcome to year three of the *Brain Science Podcast*, the show for everyone who has a brain. I'm your host, Dr. Ginger Campbell. On the *Brain Science Podcast* we discuss some of the latest books in neuroscience and I interview scientists, philosophers, and other leading thinkers. Our goal is to explore how neuroscience is unraveling the mystery of how our brains make us who we are. Please visit our website at [brainsciencepodcast.com](http://brainsciencepodcast.com), and feel free to send me email at [docartemis@gmail.com](mailto:docartemis@gmail.com).

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This is Episode 55 of the *Brain Science Podcast*. Today's episode is an interview with Patricia Churchland. Churchland may be best known among neuroscientists for her 1986 book, *Neurophilosophy: Toward a Unified Science of the Mind-Brain*, because she was one of the first philosophers of mind to argue for incorporation of scientific discoveries into the field of philosophy of mind. I am tempted to give you a really long-winded introduction to tell you about all the

great things that are in this interview, but I know you'd rather just get into the interview. The only thing I want to say is that if you haven't listened to Episode 53 yet, don't worry; even though we refer to it in the conversation, this episode can be listened to even if it's the first episode that you have ever heard.

Please stay tuned after the interview for a few closing announcements. Let's get on in to the interview.

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### INTERVIEW

**GC:** My guest today is Patricia Churchland from the University of California at San Diego. Pat, it's great to have you on the *Brain Science Podcast* today.

**PC:** Lovely to be here. Thank you.

**GC:** When I saw you at Neuroscience 2008 I really didn't know that I was going to do the episode about *Did My Neurons Make Me Do It?* I just was inspired by the fact that I had read your book, *Neurophilosophy*, several years ago and it was one of the things that really got me interested in neuroscience again. I'm really glad that you're on the show today. I had three things I wanted to try to touch on today. I wanted to talk about the relationship between philosophy and neuroscience, and to talk about neuroscience and moral decision making since I know that's an area you're actively involved in. And then if we had a chance I wanted to get your feedback on the episode about *Did My Neurons Make Me Do It?*, since you're a philosopher and you can give me professional feedback.

**PC:** Well, we'll see.

**GC:** But I wanted to put that at the end so that anybody that hadn't had a chance to hear that episode yet would be able to get the first part without worrying about that.

**PC:** Sure.

**GC:** I thought if you don't mind maybe you could start out by telling us a little bit about yourself: maybe why you became a philosopher and how you got interested in philosophy of mind.

**PC:** Well, I was interested in philosophy of mind for many of the same reasons that I think many neuroscientists are interested in the brain, and that is I really wanted to understand the nature of how we perceive, what it is to have a self, what it is to be conscious, what the nature of learning and memory is, and so forth. And at the time that I was an undergraduate there was, of course, some work done in psychology, but at that point neuroscience was still at the stage where it was uncovering the fundamentals about the nature of what a neuron is, and how neurons communicate, and so on. So, I went into philosophy.

But then of course I became very disappointed in many respects, because although I learned some useful things in philosophy I didn't really learn very much about the nature of the mind. So, when I finally realized that I had to understand as much about the brain as I possibly could, I then went to the medical school where we were currently working—and that was in Winnipeg, Manitoba—so that was where I learned my anatomy and my physiology.

I eventually saw patients during neurology rounds. The clinicians at Manitoba were really very, very welcoming and helpful. And then I also worked for awhile in a physiology lab. It was the lab of Larry Jordan, and his interest was in the spinal cord, and in particular in the circuitry that regulates walking, so we studied walking in the cat. So, that gave me a real sort of grounding and a feel for how to

go about thinking about questions about so-called higher functions. But by the time I got to San Diego then of course neuroscience had developed enormously. So, we got here in 1984, and by that time it was really clear that the relationship between neuroscience and philosophy could only get richer and richer.

I think you wanted to ask me also a little bit about the relationship between philosophy and neuroscience, so let me give you my general two-minute take on that. Philosophy has always been the discipline that addresses questions where science has not yet got to the point of being able to have a well-grounded theory or established explanations. And so, we see with the Greeks that they were interested in everything, including the nature of motion, and what the sun was, and the shape of the earth, as well as, of course, being interested in the nature of the mind and what it is to think, and reason, and learn, and remember.

Now, as time went on specialized disciplines began to be able to be formed as experiment and theory co-evolved to provide established explanations. And the first discipline to separate really was astronomy. But this was then followed by physics; mainly as a result of the extraordinary developments with Newton, but of course he had important people that came before. And then that was followed by extraordinary developments in chemistry and in biology, both at the cellular level and at the level of physiology of organs like the heart, and the liver, and the kidney, and so forth.

And in a way what's happened in the 20<sup>th</sup> century is that the day of the mind has come. That neuroscience has now developed to a point where many of the traditional questions, which couldn't really be answered by the sciences, are questions which have now moved into the ambit of psychology and neuroscience: questions about the nature of consciousness, decision-making, perception, learning and memory, what it is to be a self or to have a self, and also I think the nature of morality and religious belief.

**GC:** Right. So, when you wrote your book, *Neurophilosophy*, that was published in 1986?

**PC:** That was published in 1986 by MIT Press. And at that time I think that many of us could begin to see that questions in traditional philosophy were going to shift into neuroscience. And part of what I tried to do in that book was just make the general case for it. But by the time I wrote *Brain-Wise* in 2002, so much more data had become available that it was possible to say it looked like the general idea in neurophilosophy was right: that there is a huge amount—much of it very surprising—that we can learn from the neurosciences about what makes us the way we are.

**GC:** So, do you think that the attitude of philosophers has changed? I mean wasn't there initially some resistance? After all, the philosophy of mind was kind of like the last bastion, in some ways, that philosophy had to itself. Well, I guess ethics, too; and we're sort of knocking on that door too now. Was there resistance?

**PC:** There was a tremendous amount of resistance within the philosophical community to the idea of neurophilosophy. By and large philosophers did not want to do business that way. At that time—that is in 1986 when my book was published—many philosophers felt that the empirical data were absolutely irrelevant, and that really what philosophers needed to do was to think about the concepts and provide the conceptual framework within which science could work. But they couldn't see that science might itself actually challenge that framework.

But as time went by it became clearer that in fact science always had challenged the existing frameworks, whether it was in physics, or chemistry, or cell biology, and that this was likely to happen in neuroscience too. I think that many philosophers were certainly dismayed. Some were super critical and said what I was doing was not real philosophy, and so forth. On the other hand what was

very gratifying was that people in the neuroscience community understood very well the nature of the long-term project and the likelihood that there would be an impact of neuroscience on the way we commonly think about ourselves. And, of course, that's really I think proved to be true; although we are still in the early stages and many more surprises, I'm sure, are yet to come.

**GC:** I was going to ask you about the attitude about the neuroscientists toward philosophy. You touched on that. Has that been evolving over the last 20 years also?

**PC:** I would say very definitely, because many neuroscientists got into the field because they were interested in these large-scale questions. They didn't see real prospects of progress in philosophy. Or, in some cases, they couldn't see it either in psychology. And so, they went into neuroscience with the hope that they could make some small step so that ultimately higher functions would come to be understood in neurobiological terms. I mean Eric Kandel, for example, has said that of himself. But many neuroscientists have said a similar thing. Rodolfo Linás, David Hubel has said this, and lots and lots of them.

So, I think that it in a way was not surprising to neuroscientists to see someone say, 'Look, I think we can now begin to build bridges.' And the bridges should have been very easy to build, but philosophers for one reason or another had been typically rather scoffing of neurobiologists' attempts to do that. And so, I think in lots of cases the neuroscientists were rather intimidated by the philosophers sort of stomping around the place and being very abrupt and high-handed, and saying that what they were talking about was conceptual nonsense, and this sort of thing. As it happened then I was really welcomed into the fold, and for me that was just enormously fun, of course.

**GC:** It's been awhile, but when I first started out I interviewed Christof Koch, and when I asked him about philosophy I think he said something like the

philosophers are really good at giving us the questions, but their answers aren't always all that useful.

**PC:** Well, I think that's quite right. And I think the other thing is that even the questions change over time. You know we think that certain kinds of questions are very important—and this is true of any science—we have a way of formulating a question, but we come to see after awhile that actually the question should be reformulated. So, you know you think of someone like William Harvey, who wanted to understand how animal spirits were concocted in the heart. So, when he began to work on the heart and what we now think of as the circulatory system he wasn't trying to understand the heart as a pump.

That became the new question: it was, 'Oh, it turns out the heart is a pump. It turns out the animal spirits aren't concocted in the heart at all. There are probably no animal spirits. That question I think we can just shelve.' And then people began to ask a whole lot of other new questions about why does the blood circulate? And what happens such that there is this change in color? And why does it go from large vessels to small vessels? And is blood made somewhere? And so on, and so forth. And I think the same thing actually happens in neuroscience.

**GC:** Could you think of an example that stands out in your mind from neuroscience?

**PC:** Well, I think so. I mean there is no such thing as the self. I mean there isn't a little person in there. It doesn't mean that we don't have a feeling of ourselves—of course we do—but the self is a construction of the brain. And it's a wonderful construction that allows us to know where our body is, and to plan for the future, and to know where we are in space, and to have a memory, and to have a sort of general feeling of being well or ill, or being energetic or weak, and so forth. These are things that are very important.

But once you realize there isn't a single thing in there that's somehow sort of tucked in between the folds of the anterior insulate, then a whole new range of questions can be asked. And these are questions about how does something like body image—how is that represented in the brain—and how is it updated, and how do we know the position of our limbs, and how is it that aspects of the self can dissociate under pathological conditions, as for example in schizophrenia or in hemineglect? So, I think that in neuroscience important new questions are being asked.

And, of course, notoriously and wonderfully this is true in the case of memory. Before Brenda Milner and her co-workers I think by and large people kind of thought there was just memory. And then it turned out there were very different memory systems, and that they could dissociate, and that they had anatomically separate substrates; and suddenly you began to ask a whole lot of different questions. You weren't just saying where are memories stored, you were asking very specific questions about the declarative system, or questions about conditioning, or about priming, or about skill learning, and so forth. And then things began to really move forward in a very dramatic way.

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**GC:** Pat, I was skimming over *Neurophilosophy* today, mainly because I wanted to look at what you had written about reductionism, but I noticed that one of the things that you were challenging when you were arguing for the scientific approach to philosophy of mind, you were arguing against—well, I guess 'against' is the wrong word—but you talked about folk psychology. And I was wondering if you might talk a little bit about where that fits in?

**PC:** Folk psychology very loosely just means that framework of concepts that we deploy in a regular kind of way in order to understand the behavior of others and ourselves. And the idea was that just as folk physics—as articulated, for example,



by Aristotle and people up until Newton—just as folk physics turned out to be quite useful in certain limited domains, it also turned out to be really improvable. And so whereas Aristotle, for example, thought that an object continued to move only so long as a force was applied, as you know in Newton’s understanding of things it’s quite different. It’s that an object will continue to move unless a force intervenes to change its direction or slow it down. In Aristotelian physics there’s the notion of impetus, which is kind of a real stuff that moving objects acquire. In Newtonian physics there is no such thing.

So, our idea was that, although folk psychology is very useful in many ways, we could predict—but this of course is only a prediction—that as neuroscience reveals more about the mechanisms and the organization in the brain, that we would actually come to think of ourselves in quite different ways. Memory is an excellent case in point. The folk psychology I was familiar with in growing up didn’t have recognition of there being different memory systems, some of which you would have conscious access to but not others. So, it’s an idea that changes the folk psychology circa, let’s say, 1920. And it becomes consonant with what we understand in greater detail from neuroscience.

And I think we’re going to see that throughout. We think, for example, of depression in a very different way. When I was growing up, women—men too, but particularly women—used to have what people called nervous breakdowns. And it was thought to be in part a characterological defect that someone would be weak enough to not be able to deal with tough times, and they would have a nervous breakdown. But you know you could feel sorry for them as well.

But then as the biological underpinning of chronic depression came to be understood, the folk psychological understanding of people who we now call chronically depressed, I think that completely changed. It’s not seen as a defective character. It is seen as perhaps being triggered by environmental features but definitely as having a biological basis, and that some people with

certain serotonin transporters are more likely to be depressed than others, and so forth.

So, the whole understanding of depression, in my lifetime has changed enormously. That was part of folk psychology, this idea of nervous breakdowns. And by the way, of course, nervous breakdowns when I was growing up didn't distinguish really between bipolar disorder, schizophrenia, and chronic depression. It was all just, 'Well, you know, they're having a nervous breakdown.'

And the understanding of Down syndrome, that too was kind of considered, well you know maybe there's something wrong with the parents, etc. Once we understood what trisomy 21 was and we understood more about neural development, the whole approach to understanding retardation and Down syndrome completely changed; and I think for the better, both in the case of psychiatric diseases but also in the case of developmental disorders. It's one of those wonderful cases where science is truly liberating. You know?

So, there is that aspect to it as well. But your main question really did have to do with what is folk psychology, and is it changing. And the answer is, like anything else, our folk understanding is always very sensitive to developments in science. But I think this is particularly true with regard to psychology and neuroscience because this is about us. And people want to know, and they want to learn, and they care very much about it.

**GC:** Right now it seems like there's a very strong trend in folk psychology to overestimate the value of intuition.

**PC:** Oh, very much so. Very much so. Yes. I mean these things have their fads, and particular authors manage to write something very engaging that says you should just trust your gut feelings, and so forth. So, these fads come and they go. And we all know that decision making is a very complex process and that, yes, the

emotions play some sort of role, but often the emotions conflict, and problem solving plays some sort of role. And we're beginning to learn a little bit about the circuitry that is the substrate for executive control, but I think that we're clearly at the very, very early stages of understanding the nature of executive control.

**GC:** Twenty years ago you were fighting for the basic principles of neurophilosophy, but your work has really shifted. Would you call what you do now neuroethics?

**PC:** No. I mean I think I would still say that what I do now is neurophilosophy. What I'm interested particularly in right now is morality and the social brain. Aristotle knew very well that humans are, as he would say, by nature social animals. But we didn't really know what that actually meant except on a phenomenological level. We know that people like to hang out together, they like to be together, that they bond, that parents typically like their children and make great sacrifices for their children, and so forth.

But there's much about the nature of social behavior that is very puzzling and we are beginning to see that there is a neurobiological component to the story of morality. Now, obviously there's a strong cultural component as well, and the cultural component is also going to be quite sensitive to particular ecological conditions. But that humans have a social nature now seems quite probable. Although, bear in mind that like all other animals we have variability in the population, and so some of us are going to be intensely social, some moderately so, and some probably not so much.

**GC:** Do you think that what we're learning about neuroscience requires that we rethink some of the traditional ethical questions?

**PC:** Well, I'm not sure about that. I mean I think that there are certain kinds of behaviors that will continue to be recognized as absolutely unacceptable—

unprovoked violence for example. But I think there are other respects in which understanding ourselves, at least in part, as biological organisms with a certain kind of disposition that can be shaped and molded perhaps by culture, but the fundamental disposition is there; I think it might make us more tolerant of each other.

In my more optimistic moments I like to imagine that it might make us realize that when we have certain intuitions about something being absolutely right or absolutely wrong—for example, that our group is the only one who has it correct, and that everybody else who doesn't conform to it is absolutely wrong—these are very powerful feelings. And we see this kind of conviction within groups, and the hostility to other groups. We see it throughout history and we see it in our own time. And I think we can't afford it. We absolutely can't afford it anymore. I think it's terribly dangerous. And as I said, in my more optimistic moments I like to imagine that if people understand that this is fundamentally a biological phenomenon their conviction might be tempered a little bit. So, they might say, 'Well, maybe we're not the only ones that are right. Maybe there are different ways of doing this.'

Now, one place where I think there has been an absolutely phenomenal shift in opinion is with regard to homosexuality. I'm 65 now, so, we're talking about not a huge long time ago, but when I was a child certainly the idea of someone being homosexual was thought to be shameful. It was kind of sick, pathological, you wouldn't want to have anything to do with them, and so on and so forth. That's completely changed, and the younger generation now doesn't think like that at all.

Of course, certain evangelical preachers who for one reason or another find that line still quite congenial may espouse it. But as we know from poll data, by and large people are much, much more tolerant than they were. They don't see it as a moral failing, they don't see it as something that should be legislated against, or

as criminal behavior, God forbid. And I think that's tremendously interesting because some people's intuitions about homosexuality have been powerful and unwavering. Their conviction has been absolutely solid. And yet, you know their kids don't think of it like that. They're like, 'Come on, Dad, loosen up. It's not like that.' And people are changing. And that's an amazing thing.

**GC:** Yes, one of my guests was Dr. Robert Burton. He wrote a wonderful book about the fact that that feeling of certainty doesn't come from the part of our brain that we have any conscious access to.

**PC:** Oh, no, I think not. I've even wondered whether there might be an evolutionary reason why the conventions of the group you're born into are internalized with such absolute conviction. I mean that may be the way it best serves the group. You don't want too many members in the group questioning these things; or at least in the ancestral condition that may have worked quite well. Now I think we have to get beyond that. And maybe we can, maybe we can't. I don't know.

**GC:** Yes, I was thinking about the example of unconsciously imitating someone when –

**PC:** Oh, yes.

**GC:** That's something that causes a lot of cultural misunderstandings in this day and time when we have to interact with people from so many other cultures.

**PC:** Yes. Yes, I know; this unconscious mimicry that we do when we—especially for the first time—engage someone in conversation. And I do it all the time; I can catch myself now. I didn't used to even know that I did it. But I don't try to stop it because it's part of what greases the social wheels. It's not like one oughtn't imitate the gestures, or the eye movements, or the smiles, or the whatever. It's a perfectly acceptable thing to do. So, perhaps that's one of those unconscious

behaviors that we're disposed to that, thank goodness, it isn't causing us too much in the way of problems. Whereas certain other kinds of behaviors like hostility to the out-group—which is very common and hard to get rid of, often—that's a little more intransigent.

**GC:** Are there any examples from animals that you think are relevant to our conversation?

**PC:** I have disagreed with some of my colleagues about this who feel that there's nothing in the animal kingdom that we see that is even a precursor for human moral or social behavior. And I tend to disagree, actually. I think there is a lot that we see. I think you have to know what to look for. And I think really good primatologists like Duvall and Duvall's students are finding that, for example, there is a kind of sense of fairness that the animals will display. You just have to tap into it in the right sort of way.

But you know I really did get interested in human social behavior for the first time—I mean I was interested in it, but I couldn't see how the neural story was going to go—the first time that I heard the story of long-term social bonding in voles. I thought, this is going to be the story: it's social attachment, bonding, and the trust that comes with that that's going to constitute the platform for sociability. And once you've got the platform for sociability, then problem solving comes into play. That is, problem solving in a social context—how do we deal with this person, how do we share resources, how do we prevent ourselves from being attacked by the neighbors, how do we reconcile after conflict—all that problem solving can then kick in. But it's got nowhere to kick into if you don't have a platform of attachment and trust.

So, that was why I was absolutely blown away by this work that's been done by Sue Carter, and Larry Young, and Tom Insel, and others on the social behavior of the voles. So, I think that's tremendously important. I think the differences that

we're beginning to see between, for example, marmosets—which do also bond for life and do have the same pattern of receptor density that you see in voles—that we see differences between their behavior and that of chimpanzees. And I think that's very significant.

The differences in behavior between bonobos and chimps is very interesting and important. We're not exactly like either of them. Bonobos, you don't see infanticide and you don't see out-group hostility or the killing of the neighbors, whereas you do in chimps and you do in humans. On the other hand, you do see long-term pair bonding—not always, but quite often—in human communities. We're like the bonobos in some ways, we're like the chimps in some ways, but we're not exactly like either of them. And that in and of itself I think is very revealing and very useful as we sort of chew on the nature of our own sociability.

Now, of course there's so much culture that intervenes. It would have been different if we were able to have a look at what people were doing 100,000 years ago, but of course we can't. They may have been quite similar to chimps. Because they wouldn't have had the cultural framework, we would have been able to have a clearer view of what simple social problem solving looks like. And that would have been very, very interesting.

**GC:** Because now we have the constant interaction between culture and whatever.

**PC:** Yes. Yes. Now, you see even some conventional ways of doing things in other animals, and probably early humans—early hominids—had various kinds of conventions for problem solving just like they had various kinds of tools for doing this and doing that. You know if it works, well, you keep doing it. I imagine that certain kinds of conventions grew up in that way and if the conventions didn't work, then there was instability, things changed, and new conventions came into play.

But we do also see that in other animals. I mean famously Sapolsky showed that the baboon troupe that he was studying changed quite a lot in its competitiveness and its sort of rough behavior, shall we say. When the alpha males all died of TB and the females became the dominant members of the troupe a different level of cooperation emerged. There was much less in the way of fighting and competitiveness. And that remained over several generations. Now, we don't know how much to make of that particular example, but I think it is quite instructive.

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**GC:** I need to take a moment to thank our sponsor, Audible.com. I just recently listened to a book that was recommended to me by Dr. John Ratey, who I interviewed back in Episode 33 and Episode 45, and that is *The Power of Full Engagement* by Jim Loehr and Tony Schwartz. You can get a free audiobook download as a part of a trial membership by going to [audiblepodcast.com/brainscience](http://audiblepodcast.com/brainscience). Now let's get back to our interview with Patricia Churchland.

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**GC:** I'm going to switch gears. I want to get on to the issue of free will before we talk directly about the discussion of *Did My Neurons Make Me Do It?* You have written quite a bit yourself on this subject, and I thought that we might just start by talking about the whole idea of contra-causal free will and why you and many others reject it—I along with you—why we would reject this whole thesis of contra-causal free will.

**PC:** The idea that there could be choices made independently of causes really came from Descartes, so it's actually not that old an idea. And Descartes was moved to think of that for several reasons, but one had to do with the idea that he couldn't see how you would be held responsible for things unless that was the



way it worked. But he thought, well all this happens in the soul and the soul doesn't have the same sorts of causal laws that a material mechanism does, so maybe what happens is that individuals just create a choice, and that's by exercise of the will.

Now, this had seemed very implausible to philosophers even in the 18<sup>th</sup> century; so that David Hume said this doesn't look very plausible because surely choices have to be caused by desires, motives, and tangent background knowledge, and so forth. And Hume disputed the idea that there could be this freedom from causality. Now, it's very interesting to realize that of course Aristotle didn't have any such notion of freedom from causality. And when Aristotle in the *Nicomachean Ethics* wrote about responsibility—and incidentally it's the framework for the criminal justice system in our country and most Western countries—when Aristotle wrote about that he thought about responsibility in the following way.

He said the way it works is that basically everybody is held responsible—that's the default—unless certain conditions obtain. He didn't know about insanity in quite the way we do, but he did know that insanity was a problem. And he said, so for example, if a person does not know who he is; and that was his description of insanity. So, he recognized that there were various conditions under which you would excuse somebody, or under which you would mitigate penalty. But there was nothing that you needed to say about contra-causal free will. And the Greeks perfectly well understood how the system was supposed to work.

So, this kind of crazy idea of contra-causal choice really doesn't come about until Descartes. Now, a number of philosophers, but particularly those who tend to think that there is a non-physical soul independently of the physical brain, and some who have a particular religious agenda, have felt that there is a place for choice that has no causal antecedents. Now, the problem with that has been that the evidence for the non-physical soul is really at the vanishing point. It really

does look like it's the brain that sees, and feels, and thinks; it's the brain that remembers, and falls asleep; it's the brain that's conscious, or under anesthesia, or in coma, and so forth.

And so, then the question is how is choice handled in the brain? Are there places where suddenly the causal interactions break down and suddenly a neuron without any causal influences whatever makes a decision? Well, that's not how it looks. It looks like choices are part of the whole process that is in this rich causal network. Now, that doesn't mean we can't distinguish, as indeed Aristotle did, between behavior that is within the control of the agent and behavior that's not within the control of the agent. And so, we do recognize that even though behavior and choices are caused by processes in the brain, that someone who is in the florid state of schizophrenia, for example, is in a very different state vis-à-vis control than someone who is, let's say, Prime Minister of Canada.

And we recognize what those differences are, and we're beginning to understand neurobiologically the difference between control and lack of control. So, I think that it's within the general framework of neuroscience that the notion of free will as Aristotle understood it has a perfectly good and natural home. But you know at the end of the day the point is this: that we're really, really interested in free will and responsibility because we need a criminal justice system.

But the criminal justice system is wonderful in many ways. It's evolved from trial by ordeal, trial by monarch, to trial by peers or by a judge. The criminal justice system is very, very pragmatic and very practical. It's a practical solution to a practical problem. And the practical problem has to do with public safety and what to do with people who are violent, or who are a menace, or who cannot somehow control themselves. And that's really what the criminal justice system, at the end of the day, is all about. So, we can talk about responsibility, and mitigation of sentence, and so forth, quite reasonably within the framework of neuroscience. That's the basic story as I see it.

**GC:** Is there anything else you want to share before we get into the whole issue of Episode 53 and *Did My Neurons Make Me Do It?* That's where I'm going to ask you about reductionism.

**PC:** I guess the other thing is that you had mentioned something about reductionism, and reductionism is something that the meaning of which has kind of changed over time. And it's become equated with an approach which seeks to somehow declare as not meaningful anything that isn't at the level of the molecule. And, of course, I don't think that at all. I don't know a single neuroscientist who thinks that.

What we do recognize is that we want explanations of behavior in terms of systems, and of systems in terms of neural networks, and networks in terms of micro-networks, and micro-networks in terms of neurons. So, we recognize that there are levels of organization in the nervous system, and that you don't really have a satisfying or complete explanation of anything unless you know what the mechanisms are on a lower level that explain what's going on on the higher level.

And I think of that as reductionism. But people have attributed to me certain terrible things when I talk about reductionism. So, I think probably we just have to bury the word and talk about, you know, integration across explanatory levels or something. So, I suppose that's something that I should just have out there.

**GC:** Well, I guess that in a way the flip side of that problem is all the baggage that's connected to the idea of emergence. Pseudoscience, and mysticism, and stuff has been tacked onto the idea of emergence so that people who are trying to write about that from a truly scientific standpoint, again, run into the same kind of misunderstandings.

**PC:** Yes. And you know it's funny how there are these little sort of simple catch phrases that catch people's attention. And so, they say, 'Well, you know the

whole is more than the sum of its parts.’ Sum of its parts? I mean nobody thinks that the properties of a network, for example, are the sum of the properties of the individual neurons. Of course not. It’s a much more complicated mathematical process than summing. I mean what we think is that there’s a very complex relationship between the individual neurons and the way they interact which gives you the property of the network.

So, for example, our president of the Society for Neuroscience last year, Eve Marder, studied a circuit which controlled the rhythmic behavior of grinding in the stomach of the lobster. And what she was really interested in was not so much the lobster as such, but she wanted to know how rhythmic behavior of the circuit as a whole comes about as a result of the way the neurons individually are, and the way they interact. And that turns out to be quite a hard problem. And it’s an emergent property, but only in the non-spooky sense that it’s the effect that you get as a result of the way the neurons are put together and the intrinsic properties of the individual neurons themselves. So, there’s nothing spooky about it.

Now, there is this tendency to think that because there are levels of organization in the nervous system, that somehow at some level something spookily emerges. And some people want to think about that as consciousness, or they want to think about it as uncaused free will, or something. And when you think about it in a serious scientific way you see that even though the explanations are going to be hard to come by, the spooky part of emergence doesn’t actually make any sense.

**GC:** Yes. So, as I said, I was going back over what you had written, and you were specifically attacking in neurophilosophy two strains of antireductionism: dualism and functionalism. And Murphy and Brown in the book, *Did My Neurons Make Me Do It?*, specifically reject both of those. That’s not even what they’re talking about. Do you have a problem with that? Have you read their book?

**PC:** I haven't read the book, but I heard part of your discussion of it. And I've always been very puzzled by this idea that there's bottom-up causation and there's top-down causation. I have no idea what that means.

**GC:** Fair enough. Fair enough.

**PC:** I just have no idea what that means. I mean we know that there are complex properties: for example the water is wet, shall we say, but oxygen itself isn't. Well, all right. So what? I just don't quite know what their story is. It could be very legitimate and it could make perfectly good explanatory sense, but it sounds to me like it's a way of grafting on certain concepts because you antecedently want to defend a certain position. So, they want to defend the idea that there really is free will. I don't quite know what that means for them, but I guess they think it's consistent with causality but somehow it's the person as a whole that causes it. I just don't know what that means.

**GC:** Well, obviously you're at a disadvantage because you've only had a small snippet of my interpretation of what they wrote—which is not fair to either you or them.

**PC:** No. So, I don't really know what they're up to.

**GC:** I just want to say, for the sake of the people that already know what the rest of the conversation on this was, it seems to me that they are trying to respond to those people who have argued—like Susan Blackmore, for instance—that we don't have free will because we don't control the lower level processes of how things happen, and therefore free will is a total illusion created by our brain. That's what they're trying to argue against by saying that top-down causation is the answer to that.

**PC:** Yes. I don't know really what Susan was on about there either. I mean I presume that she means that there isn't acausal choice. Well, fine. Nobody

believes—or almost nobody believes—in acausal choice anymore. There are one or two people at Notre Dame I think who may—philosophers, I mean. And so, fine, that’s an illusion. So, fine. Yeah, yeah, yeah. But there is still a case to be made for saying that there is a difference between someone who makes choices in a way such that we want to say they were responsible and it was within their control, and people who don’t. I mean there’s a big difference between somebody who washes their hands because they have OCD and somebody who washes their hands because they just cleaned a turkey. And she’s got to recognize that. I think that all she means is we don’t have this kind of acausal free will.

But it’s a tricky thing—and I don’t think this necessarily applies to Susan—but there are definitely people who want to sell a book by saying free will is an illusion and there is no such thing as choice. But on the other hand when you look at it a little bit more closely what they mean is actually not quite as dramatic as what they said. It’s been suggested to me that there is going to be a price that neuroscience is going to pay because people are doing that, and that is that the public is going to get really ticked off. Because many people are very practical and they say, ‘Well, what are you talking about, there’s no such thing as free choice? I’m not compelled to wash my hands, I wash my hands because I was working in the garden.’ And so forth. It is an area that’s kind of a mess actually right now, and I’m sorry I haven’t read the Nancy Murphy and the Brown book.

You know Roger Sperry used to talk about top-down vs. bottom-up causation and I couldn’t make a lick of sense of it then. I couldn’t actually at all. I mean he’s a neuroscientist for whom I have almost religious respect. But I couldn’t make any sense of that. You know not everything that a great neuroscientist says is sensible.

**GC:** But you know it seems like we just have our own certain limitations. I mean I can’t make any sense of the whole idea of qualia or why I should care about it, no matter how much I read about it.

**PC:** Well, I mean I share that. I think that there are perceptual experiences – there’s a difference between being in coma and not, and there’s a difference between paying attention and not, and there’s a difference between being in deep sleep and not—and those are the differences that are going to tell us about what the nature is of experience. But, no, I quite agree with you, there is all kinds of nonsense. And we’ve talked about qualia and I just can’t any longer give it the time of day.

[music]

**GC:** Pat, what question do you find to be the most interesting?

**PC:** I think there are so many that are incredibly interesting. At the moment, as you know, I’m very interested in the nature of the social brain. But you know there are really many fundamental things we don’t understand about the nervous system. I mean we don’t understand many aspects of the way it’s organized. For example—Ray Guillery and Murray Sherman talk about this, and it’s so important—but every part of the cortex projects back to the thalamus, and every part of the thalamus has projections somewhere to the cortex. Well, what’s that all about?

**GC:** Yes.

**PC:** I mean why don’t we have a story about that? We all know that there are top-down influences on perception—you know perceptual effects, motor effects, right into V1. How do they get there and how do they know where they’re supposed to go? And if we don’t really have, strictly speaking, a visual hierarchy, then what is actually there? What do we have by way of organization in the perceptual nervous system or in the sensorimotor nervous system? What really is problem solving? Not just humans: I mean God knows, we’re not the only ones who solve problems. What kind of a business is this? You know some people say

it's deduction. Well, it's obviously not deduction, except very rarely: it involves something else. Well, what is that something else? And what's the role of emotions in that?

For none of these questions do we have good answers at this point. But I think for all of them interesting progress is being made. You know we still have no idea really how memory is retrieved. That's a lot not to know. We don't know how memory is consolidated such that you can lose your hippocampus—or hippocampus plus—and still have access to old memories. Well, how does that work? We have no account really, that I know of, of the nature of procedural learning or skill learning in any domain, whether it's touch typing, or speaking, or learning to drive a car, or playing golf. That's a lot not to know.

**GC:** I know every week I get an email from a listener with a question I can't answer.

**PC:** Oh, yes. It's fascinating because I sometimes think—this is sort of a private thought—but I sometimes think we're really kind of like molecular biology before the discovery of the double helix. We've got a lot of bits and pieces but we're not putting it together in quite a way yet. And it's hard to, because it's so unbelievably complex. And some things we're just looking at in the wrong way. We can be reasonably sure of that, just as a lesson from the history of science. Look how long it took for people to understand that mice do not spontaneously come into existence when you throw old rags in a corner.

It was Pasteur who demonstrated that in the middle of the 19<sup>th</sup> Century. Well, my God! That's a little over 150 years ago that people still thought that mice came into existence spontaneously. So, it's a very complex set of problems. And I'm interested in all of these things, and tremendously interested in neural development. And of course now that we know that things in the uterine



environment, as well as things like phosphorylation, are affecting gene expression, then we have much more to wonder about in neural development.

**GC:** Do you have any advice for non-philosophers who are interested in learning more about philosophy of mind? Do you think it's worth getting into?

**PC:** Boy, that's a tough question. I mean I think there are some books out there that are quite useful. I think Terry Sejnowski and Steve Quartz wrote a book called, *Liars, Lovers, and Heroes*, which I think people can read and learn a lot from. I think there's quite a lot out there that's very, very in-house, I guess you'd say. It's stuff that I tend not to read myself because it drives me nuts. A person that I think does write beautifully, and clearly, and very rewardingly is Owen Flanagan. He's at Duke.

**GC:** Absolutely.

**PC:** And his book, *The Really Hard Problem*, I think is just brilliant. I think some of Dan Dennett's work is good. I think on the free will question his book, *Freedom Evolves*, is very sensible. Let me think who else. Andy Clark—you know he's the one who has this idea that the mind goes beyond the body and all that—some people find that really interesting. I don't particularly; and that's partly because I'm just so fascinated by a certain set of questions that I think we will answer in the next 10 years that I'm not being distracted by Andy's questions. But I think Andy does ask good questions and I think he has an interesting perspective. I would say that his stuff is good.

**GC:** Yes, I'm reading him now. In fact I'm hoping to be able to invite him on the show in the future.

**PC:** Yes. I think he's very smart, and very knowledgeable, and very thoughtful, and not silly.

**GC:** And very readable.

**PC:** Very, very readable.

**GC:** Well, Pat, I really appreciate you taking the time to talk with me today. Is there anything else you'd like to say before we finish?

**PC:** No, I don't think so. No, this has been fine. I hope you can get some useful stuff out of all that.

**GC:** I'm sure I will. I hope to get this out on the second Friday of March.

**PC:** OK. Well, send me an email when you do.

**GC:** I'll send you the links.

**PC:** Yes, that would be great.

**GC:** Thanks again. I really appreciate it.

[music]

I want to thank Patricia Churchland for coming on the *Brain Science Podcast*. I hope that this interview has given you a feel for the overlap between philosophy and neuroscience. I share Churchland's commitment to promoting a dialogue between the two disciplines.

I would like to encourage you to visit the *Brain Science Podcast* website at [brainsciencepodcast.com](http://brainsciencepodcast.com). If you listen to lots of podcasts you know that many podcast websites have nothing but links to audio files. This is not the case for [brainsciencepodcast.com](http://brainsciencepodcast.com). The site is full of links and other resources including episode transcripts.

When you come to the website there are two things I would like for you to do. First, I hope you will explore the site and send me feedback. Tell me what you like or dislike, and send me concrete suggestions about how you think the site could be improved. I'm hoping to update the site sometime in the next six months, so your feedback will be very valuable. Secondly, please complete the new audience survey. I just put up a link to a different survey, so even if you've done it before I hope that you will do this survey.

This brings me to the subject of money. The *Brain Science Podcast* is supported mainly by listener donations. I get a small sponsorship from Audible.com, but other than that I've had only one brief advertising campaign, and I don't anticipate much advertising in 2009. I realize that money is tight, so I really appreciate your ongoing support.

One thing I do want to mention is about the subject of transcripts. We are in the midst of getting all of the older episodes of the *Brain Science Podcast* transcribed. I am currently able to get the new episodes out within a few days, so if you'd like to get a transcript of this episode you should be able to find it on the website [brainsciencepodcast.com](http://brainsciencepodcast.com) within a few days of when this episode is posted. So, if you are one of those people who is contributing to the financial support of this podcast, know that paying for these transcripts is one of the things that your donations help to make possible

The next *Brain Science Podcast* will be out on the second Friday in April, and I'm hoping to interview Dr. Eve Marder. There will be a new episode of *Books and Ideas* out in two weeks. This is an interview with writer Jennifer Michael Hecht, who is the author of one of my favorite books, *Doubt*. If you haven't already subscribed to *Books and Ideas* you can find it in iTunes, or by going to [gingercampbellmd.com](http://gingercampbellmd.com).

As always I'd love to hear your feedback. The best place to go is the *Brain Science Podcast* Discussion Forum at [brainscienceforum.com](http://brainscienceforum.com), or you can send me email at [docartemis@gmail.com](mailto:docartemis@gmail.com).

Thanks again for listening. I look forward to talking to you again soon.

[music]

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