

## “Meet the Canine Imaging Guru” with Gregory S. Berns

### Transcript of Cerebrum Podcast



**Guest: Gregory Berns, M.D., Ph.D.,** is the Distinguished Professor of Neuroeconomics at Emory University, where he directs the Center for Neuropolicy and Facility for Education & Research in Neuroscience. He is also a professor in the psychology department and a founding member of the Society for Neuroeconomics. He has penned two books about canine cognition, *What It's Like to Be a Dog* (Basic Books, 2017), and *How Dogs Love Us* (New Harvest, 2013), a *New York Times* bestseller. [Berns](#) specializes in the use of brain imaging technologies to understand human and canine motivation and decision-making. He is co-founder of [Dog Star Technologies](#), a company using neuroscience to enhance the dog-human partnership.

**Host: Bill Glovin** serves as editor of *Cerebrum* and as executive editor of the Dana Foundation. He was formerly senior editor of *Rutgers Magazine*, managing editor of *New Jersey Success*, editor of *New Jersey Business* magazine, and a staff writer at *The Record* newspaper in Hackensack, NJ. Glovin has won 20 writing awards from the Society of Professional Journalists of New Jersey and the Council for Advancement and Support of Education. He has a B.A. in Journalism from George Washington University.

Bill Glovin: Did you ever wonder about what your dog was really thinking? Why do some dogs seem smarter than others? Can a dog experience emotions like humans do? What's the difference between certain breeds and how much does gender make a difference in how dogs think and behave? Hi, and welcome to the *Cerebrum* podcast. I'm Dana Foundation, executive editor, Bill Glovin, and today on the phone with us to help answer some of those questions is Greg Berns, author of “Decoding the Canine Mind,” our cover story in the spring issue of *Cerebrum* magazine, which you can find at [dana.org](http://dana.org).

First, a little about Dr. Berns, who is the distinguished professor of neuro economics at Emory University where he also directs the center for neuro policy and facility for education research and neuroscience. He's also a professor in the psychology department and has authored two books about canine cognition, *What It's Like to be a Dog* and *How Dogs Loves U*, a *New York Times* bestseller. Dr. Berns specializes in the use of brain imaging technologies to understand neuron and canine motivation and decision making. He is also a co-founder of Dog Star Technologies, a company using neuroscience to enhance the dog human partnership. Welcome to the *Cerebrum* podcast, Greg, and thanks for your wonderful article.

Greg Berns: Hey, it's great to be here Bill.

Bill Glovin: How are you coping in the days of COVID-19?

Greg Berns: Well, it's rough here; same as for everyone, although at least I can say I have four dogs to keep me company.

Bill Glovin: I was going to ask that. How many dogs do you have and what kind?

Greg Berns: Yeah, we have four dogs here at the household. They're all box dogs. They have all come from various humane societies, and they range from a little 25-pound terrier who was the first dog trained for MRI up to a 90-pound German Shepherd.

Bill Glovin: Wow. One of the few positives we hear coming out of the struggle too was self-isolate is how great it is for dogs since their masters have an infinite amount of time to spend with them. What's going to happen when we get back to normalcy?

Greg Berns: Yeah, I guess the dogs will feel quite lonely, although maybe we'll all start taking them to work.

Bill Glovin: People have always loved and been devoted to their dogs, that seems that in the past five years there has been an explosion in academic centers around the globe in terms of studying dog cognition. Why is that?

Greg Berns: Well, it's really funny because I mean if you go way back to Pavlov where experimental psychology had its origins, he studied dogs and so it's kind of strange then for a long time after that that dogs were not really the object of research. I guess scientists thought that they were somehow corrupted by the fact that we domesticated them and they live with us. But that has really changed, I would say in the last 10 or 20 years when scientists such as myself realize it's like these animals are special and they can tell us a lot, not only about animal behavior and animal psychology, but they also are kind of in my opinion, a window into our past because they give us some insight into what happened when humans became humans. Because as far as we know, as long as we've been humans, dogs have been there with us and so lots of groups have gotten interested in what is going on in the dog mind and what's different about them from even wolves or any other animals.

Bill Glovin: I happen to have a daughter who is a dog care professional, and I pose that question to her and she said that I should ask you about the social media aspect because she believes that has a lot to do with it.

Greg Berns: That may have a lot to do with it because I see on Instagram a lot of people posting pictures of their dogs where in times past you might have seen pictures of children and so there's certainly something to this idea of social media just kind of transmitting new research, but also the fact that there has been a shift in how people treat dogs and their pets in general more towards being family members and I think at any time in the past. So of course, there's going to be a lot of interest in research into what makes them tick.

Bill Glovin: What got you interested in this line of research?

Greg Berns: Well, prior to studying dogs, I was a ... I still am a human neuroscientist. I had spent most of my career studying human decision making in particular using brain imaging technology to try to understand how people make decisions over risk and reward. And for me it was very clearly a type of epiphany and I trace it back to the day that bin Laden was killed. And I say I'm probably the only person who has this thought on that day because if you remember, there was a lot of publicity around that mission and the fact that there was a dog on this mission and the dog's name was Cairo and I saw these pictures of this dog or other military dogs jumping out of helicopters and doing all this wild stuff that I didn't really know about and my thought on that day was, "Wow. If they can train dogs to jump out of helicopters, we could train dogs to go an MRI scanner so we could see what they were thinking." From that moment on, I mean literally my life changed and I switched from doing human research to studying dogs.

Bill Glovin: What is the reaction of your colleagues to canine cognition research? Or do you care even?

Greg Berns: Well, kind of, it runs the spectrum. I would say it's more respectable now than when I started. So when I started doing this, it really was just my crazy side project and it was really kind of in the vein of David Letterman's stupid pet tricks. See what I can do. I can train my dog to go in an MRI scanner. It was a side project initially. It was a project in search of a question because I didn't even know what I was looking for at the time. And so my colleagues kind of, I think looked at this with amusement. It's like here's Greg with his dog at work again. But as time has gone on, I think folks have come around a bit for two reasons. One is that dogs are no longer kind of viewed as these oddball animals that humans somehow corrupted and not previously worthy of study. But now people realize, scientists included that in fact they are worthy of study.

The other aspect I think that has gained some respect is the way in which we're doing it, which is that when I started the project, I always viewed the dogs as family members, as most people in this country do. And so I wanted to treat the dogs as voluntary participants and actually partners in the research that we were doing. And so we made it completely voluntary for them and instead we changed in some way the ethics of doing animal research in a way that was much more collaborative with the animals themselves. And I think if anything beyond the scientific results, that alone is probably the thing that I'm most proud of.

Bill Glovin: Can you tell me what the process is? A little bit about training a dog to do a proper MRI?

Greg Berns: Yeah, it's really interesting because the first step, like every type of skill is you want to identify your best candidates first off. So I'll say straight away that not all dogs are going to enjoy doing an MRI and most probably won't like it at all. So we learned this the hard way early on when we had lots of volunteers coming to us with their dogs who wanted to teach them

how to get an MRI. And we very quickly found out that it was not a great idea to take all commerce because not all the dogs were particularly happy with that.

So, the first thing we did was we developed a tryout process. We still do this; we still hold tryouts usually once or twice a year when we want to start a new training class. And so, the things that we look for in the tryouts are, first off, the dog should already know basic obedience because we don't want to spend our time teaching a dog to just to do basic sit or down. Hopefully they already know that. Ideally, they should be able to do a down without their owner standing right in front of them because that's the basic behavior that we're going to want them to do in an MRI.

Assuming they can do that, then we look to see if they have particular noise sensitivities. So, folks who have had an MRI know that the scanner is really quite loud and that's probably the most difficult aspect to get dogs used to more than anything. So we try to identify dogs who might already have some sensitivities there, but then we also look to make sure that they're willing to crawl in the tube or that they're willing to walk up steps onto what we call a dog walk, because the patient table of MRI is quite narrow.

Once we identify the good candidates, we'll constitute a training class. And then as we've done since the start a project, we usually hold MRI training class every other Sunday afternoon. So, we give people mockups of the things that the dog has to put their head into and they take it home to practice with. And then we just slowly start shaping the dog's behavior by first having them put their head in a little chin rest we make for them and we give them treats for this and then we gradually lengthen how long they should hold that. And then we add in the tube, we make them walk up steps into the tube and we put their chin rest in there.

So, it's basic, basic dog training really. But the behavior is really pretty simple. Most dogs will lay down naturally. It's what we call a natural behavior. So, we're not teaching them anything complicated. Once they get used to it though, then we start adding in things like noise. So, we recorded the sounds of the scanner and we give those recordings to the people to play at home with their dogs. We try to make it a positive experience because the dog doesn't know what an MRI is. And although humans are somewhat naturally anxious about it, dogs have no knowledge of it.

So, what we try to do is we try to pair play time with noise. So when the dog hears these recordings, they kind of view it as, hey, it's time to play. This is going to be fun. And so that's the general process. It takes anywhere from two to four months, I would say, to get dogs to the point where they're ready for a real scanning.

Bill Glovin: And how long is a dog in the scanner?

Greg Berns: Initially, we're aiming to have a dog perfectly still in the scanner while the scanners were running for at least 30 seconds at a time, and the 30 seconds is the time it takes for us to do a standard anatomical brain scan. The dog's brain is not terribly big, so we can do it fairly quickly. If they can do that, they can usually do the more complicated tasks where we might want to study some type of cognitive function because we can break those into chunks less than 30 seconds and where the dog gets periodically rewarded.

Once the dogs have that down and we essentially do just kind of a very simple first experiment where we just give them treats in the scanner and see how they respond to that. Once they get that down, then they typically will start doing more complicated experiments. So we've done all the easy things we can think of. And so nowadays what we're doing is adapting human experiments, human fMRI experiments for the dogs, and those can sometimes run up to half an hour in the scanner. Now, we don't ask the dogs to stay in there for half an hour. Usually we do it in chunks of about five or 10 minutes and we give them a break and then they go back in. But that's typically how long they're there.

Bill Glovin: I noticed in the photos that you sent along that are in our article, which people can find at [dana.org](http://dana.org) that many of the dogs look similar or similar breed. Is that the case?

Greg Berns: Initially it was. The folks who volunteered for this when we started the project, a lot of them tended to already be involved in various other things with dogs. So a lot of them, for example, we're involved with Happy Tails, which is a program where the dogs go into hospitals and nursing homes, are just the emotional support animals that they bring in. And other folks were involved in training service dogs or acting as puppy raisers as they say, so there tends to be a lot of retrievers in that cohort. Most of the service dogs tend to be the golden retrievers or labs or crosses between the two. So initially we had a lot of those dogs and as time has gone on though, we've actually pulled in folks from the community who just like me just have dogs from the humane society or the pound. And so we have just a lot of mixes now.

Bill Glovin: Does gender or age make a difference?

Greg Berns: We don't really know. I get asked the gender or the sex question a lot about dogs and it's not quite the same as humans because most of the dogs, I would say 95, or 99 percent of the dogs in our project are either spayed or neutered. So their sex has been altered, literally as we say. So, what that means practically is they don't have the normal hormone circulating that they would have and so they're kind of in this intermediate or in determinant state almost. So, we have not really been able to study the sex or gender question just because we don't have many dogs that haven't been fixed in some way.

The breed question or the age question I should say is interesting. The age question is something that we've been focusing a lot on lately because we started this project back in 2011 so it's been going on nine years and that pretty much stands the lifetime of a lot of the dogs that have been in the project. We've essentially had this kind of lifetime database of the dogs that have been participating and then watching what happens to their brains. So, I don't know the answer yet, but someday soon, I hope that we'll have some data about what happens as the dog's age, in particular what happens to their brains.

Bill Glovin: I would think as with a human, the more one experiences, maybe the cognitive function would improve, or it would show that. So, you can't tell that yet. Like how long out are we to maybe finding that answer?

Greg Berns: I think the thing that we really want to know about is do dogs have cognitive decline, something like Alzheimer's disease similar to humans? There's this idea, certainly in veterinary circles there is a notion that that does happen in older dogs, at least some older dogs and nobody really knows what it is. So, we are starting to see that and some of the dogs that have been with us a long time, so we're looking for things like structural changes. We want to know, do they have brain atrophy, like you would see an Alzheimer's or is it something else?

We think a lot of these older dogs, for example, have sensory disturbances because maybe they get lots of smell or their hearing is not as good. Certainly, their vision goes. A lot of dogs have cataracts, so we're just not sure kind of how that affects their overall mental state, but we're trying to figure it out.

Bill Glovin: How does canine brain structure compare to humans?

Greg Berns: Well, the most obvious thing is that it's smaller. The dog's brain is really quite small. Even if you have a dog who's a large size, say like a hundred pounds, and maybe they have a big blocky, had like a big blocky retriever or a Rottweiler, most of their head is not brain unlike humans. The average dog brain is about the size of a lemon and it really doesn't matter that much on the physical size of the dog.

Once you then kind of go into more detail and start looking at the structure of their brains, you immediately see that kind of all the same basic structures are there that are in human brains, and factoring all mammalian brains. It's just that the relative size of the parts are different and probably the biggest difference that would account for dogs being dogs is they do not have a very big frontal lobe. So, whereas humans, the frontal lobe might occupy say a third of the brain or a third of the cortex. The dog's frontal lobe is maybe 10%.

Bill Glovin: I've been told that my brain is the size of an apple, which is really that much larger than a lemon. So, I guess I should be concerned. Let me get to some of the questions I asked at the top of the podcast. Why does some dogs seem smarter than others?

Greg Berns: I think that is an issue primarily of humans defining what smart means personally. Now having said that, and having lived with four dogs, I can tell you that some definitely appear smarter than others and some kind of have a pretty dim bulb going on. However, I think the issue of intelligence, when humans talk about intelligence, I think what we're generally talking about, at least in my view, is problem solving ability. It's like, can you figure something out that you haven't seen before and approach it in a new way. We're not talking about SAT scores here or anything like that. And so the question is can dogs do that? Can they adapt in the hobbler circumstances?

And I think the answer is that some do it better than others. And one of the issues that we actually see in training the dogs, and probably the one that gets in the way of dogs succeeding in the MRI is what we call nomophobia, which means they're afraid of novelty or they're afraid of new stuff. It causes them anxiety. And so I think this is more of an emotional trait that seems to interfere with some dog's ability to learn. And it may be that when we talk

about the differences in dog's intelligence than facts, what we're talking about are these emotional temperaments that either interfere or somehow augment a dog's suitability in a particular circumstance.

So maybe an example would probably be good here. Sometimes when you're training a dog to do something like fetch for example, the dog will happily go after a ball, but they don't want to bring it back. So does that mean they're not smart or they just don't understand what we're trying to get them to do? Or maybe they understand perfectly, but they just don't want to do it. And so sometimes it's difficult for us humans to make that distinction of whether the dog understands or they understand perfectly, but their motivation is elsewhere. And so this is one of the reasons why we like brain imaging is it gives us the ability in some cases, to distinguish different neural systems for those very different types of functions.

Bill Glovin: It sounds like dogs can experience emotions like humans do to a degree. Would you say?

Greg Berns: Well, that is opening the Pandora's Box for sure. Where scientists definitely disagree about that. On kind of one end of the spectrum, there are a group of scientists who believe that animals do not experience emotions at all, like humans and fact that human emotions are very unique and very dependent on our language ability to describe the feelings that we have. I don't share that opinion. I think that there are core emotional responses, common, in fact, all mammals. And so I think very much that dogs have certainly basic emotions. I don't think you need brain imaging to know that the dog can experience joy, for example, or that they can be scared or that they can be anxious.

I think where it gets confusing; it's potentially more complicated emotions. So, when you're talking about things like love or jealousy, these are very subtle terms and very nuanced even for humans. So we can disagree about what those words even mean. And so my definition and my feelings associated with those words may be different than someone else's. As far as the basic emotions, I think they're all there.

Bill Glovin: I thought one of the really interesting things in your article is that researchers have found two genes that are associated with being hyper-social and have been identified in a rare genetic disorder in humans called Williams-Beuren syndrome. Apparently, dogs or many dogs also have those two same genes. Are there any other genetic findings or research going on that can help us understand canine cognition?

Greg Berns: Yeah. This is kind of one of the hot areas of canine research that's going on. There are a number of groups across the world that are trying to understand that the dog, and in particular these genes that are somehow associated with sociality. First off, there are several genes associated with Williams syndrome. And it turns out that dogs have a variant of a couple of them, but wolves do not. And so this is one of the first clues that suggest that the main difference or an important difference between wolves and dogs has to do with their sociality.

Where it gets confusing though I think is if you look at what those genes do, it's not clear how that relates to sociality. The genes are very kind of generic functions necessary for

nervous system function or even just physical growth. So we don't know kind of what the role of those particular genes play. We just know that there seems to be this association between hypersociality in dogs, in a syndrome of hypersociality in humans. There are probably other targets that people are looking for. But we don't really even fully understand what makes humans social at the genetic level.

Bill Glovin: You mentioned wolves. So I'll bring up the fact that another article in our spring issue involves an experiment where foxes were domesticated over about 60 years to resemble dogs right down to changes in their physical, such as their tails and wider snouts. That's more from the behavioral side of things. But does that surprise you?

Greg Berns: The thing that is surprising about that project, the Siberian Fox experiment is how quickly these supposedly wild foxes changed in form. So normally we think about evolution occurring over really long periods of time, very slow incremental change that occurs not over decades but over millennia. And so here was this experiment in Siberia that showed, well, you can selectively breed foxes based solely on a trait of how approachable they were. And then within 20, 40, 50 years, you start to see foxes that were very social, and the physical form also began to change to resemble dogs. So the thing that is really surprising about it is not that you can select animals for these traits, but the fact that the form could change so quickly, at least in canines.

Bill Glovin: I'm going to ask you to put on your anthropological hat for a second and ask you about the fact that in your article you point out that there is evidence that dogs were found buried next to humans about 11,000 years ago in the Eastern Mediterranean. But do we know how and why their relationship with people evolved?

Greg Berns: Again, another million-dollar question that everyone in this field would like to know. The difficulty in answering the question is that we have two sources of data available to us. One are the fossils, so the fossil record tells us when dogs appeared, because dogs are generally smaller, their cranium is different, their teeth spacing is different than wolves, and so we can definitively date dogs to existing at least 11,000 years ago. And that also corresponds to the time when humans started living in one place. So that is dawn of agriculture and cities. Prior to that, all humans were essentially nomadic.

Now, the genetic evidence though gives a somewhat different story. Some of the genetic data suggests that dogs started to differentiate from wolves further back than that, maybe 15,000 years, maybe as long as 30,000 years ago. We're not really sure because it depends on a lot of assumptions, like the mutation rates that we don't really know in dogs. And the other problem is that technically dogs and wolves are still the same species. They can still interbreed so they are technically the same. What really distinguishes them though is their sociality in their behavior and of course behavior doesn't have a fossil record.

So, we're kind of stuck right now. My belief is that they were probably kind one off, so called domestication events occurring throughout the last ice age. You kind of have to imagine what the world looked like then. So, we're talking about the ice age. When the ice sheets were way

down in Europe all the way almost to the Mediterranean. And so certainly wolves were much more extensive in their domain and probably came into contact with humans a lot more than they do now. And so you can imagine where humans and wolves start to come in contact. There might've been skirmishes, they could have been fighting over the same resources, but there could also be these one-off events where maybe a wolf pup was taken in by a group of humans and became part of their community. There's ample evidence that wolves can be at least tamed that way.

I think it was probably happening on and off probably for a very long time. And it was only when humans settled down in one place that these kinds of dogs or these wolf dogs started to breed amongst each other. And then you kind of got this domestication effect take off.

Bill Glovin: In your article, you say that dogs can be prescribed anti-anxiety and depression drugs similar to ones we use for humans. Are they being overprescribed because owners don't want or can't invest the time or money in proper training? And how did doctors identify necessity?

Greg Berns: You could make the same argument for humans. I've heard this as well. In my prior part of my career I was a psychiatrist. I've heard that complaint as well that human doctors overprescribed for humans. So I don't think that's specific to dogs. I think the issue is that when a dog has particular problems and for us they manifest as behavioral problems because the dog can't speak to us. They can't tell us that they're feeling sad or anxious. They can only display certain behaviors that we think reflect that. And sometimes the choice with dogs and the circumstance that they live in, the human doesn't have the time to address it behaviorally.

It's very similar to this situation with psychotherapy. A lot of the human disorders like depression and anxiety do respond to various forms of psychotherapy, but they do take time as do the medications. And for many people that is just not within their reach or their ability or their pocketbook. So it's the same with dogs. The difference though is if the dog's problems are not fixed, they could very well end up dead because the owner turns them into a shelter, and they get euthanized. In that sense, I don't think that overprescribing is as much an issue because for the dog it could be a matter of life and death.

Bill Glovin: I'm just wondering if the lack of funding in this area is holding up research breakthroughs. Could you learn more if you had better funding?

Greg Berns: Totally. I mean even though these research groups are popping up, I mean money is still very hard to come by to do this research because it's not high priority. It is not something that NIH typically funds because, for example, we're studying the dog for the dog's sake almost. We're trying to understand what the dog sees and so NIH is interested only in dogs to the extent that it improves human health. Even though I clearly think that if we understand what makes dogs, dogs, eventually it will improve human health because I think we could all learn something from dogs.

Bill Glovin: With the advent of service dogs, I would think that might be an area where they would be interested in funding because it's clearly a big help to humans.

Greg Berns: Yeah, it is. Even there, the research though is not there. We all have this kind of subjective feeling that yeah, dogs kind of make us feel better when we're down or help someone who has a disability. But it's been really difficult to prove that scientifically because it's not something you can do a placebo-controlled study on even. I think a lot of the usual funders like NIH have stayed away from that because it's just viewed as crap science. I don't think so.

Bill Glovin: Last but not least, I'm going to ask you to put on your philosopher hat now, and tell us what can humans learn from dogs?

Greg Berns: I always think of the bumper sticker that I want to be the person my dog thinks I am. But seriously, the thing that amazes me about dogs is just how open they are to people. We call it love or loyalty. I don't know 100 percent what that is, but in some ways, they can teach us how to be better people because we all ... Everyone wants to be loved, everyone wants to be accepted and dogs are just the master of that. A good dog is everyone's friend. I would like to figure that out.

Bill Glovin: I can't thank you enough for taking the time to do the podcast.

Greg Berns: Oh, my pleasure.

Bill Glovin: I'm told that the podcast world recently hit a milestone. There are now 1 million podcasts, but the good news is that there are probably only 25,000 that have to do with dogs. So, we should definitely stand out. Plus, we don't accept ads or have commercials. So that helps. Anyway, for people out there who want to know more, you can find Greg's article, "Decoding The Canine Mind" at [dana.org](http://dana.org) and you can find this podcast and all our brain science content at [dana.org](http://dana.org). Meanwhile, have a great day. Stay safe and healthy. Be kind to your dog, and thanks for listening.