BRAIN SCIENCE PODCAST

With Ginger Campbell, MD

Episode #80

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Fifth Annual Review

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INTRODUCTION

Welcome back to the *Brain Science Podcast*. I'm your host Dr. Ginger Campbell, and this is Episode 80. Earlier this month, December 2011, the *Brain Science Podcast* celebrated its fifth anniversary.

Today I will be doing my Annual Review Episode, but before I get started, I want to thank a few people. First of all, I want to thank Lori Wolfson, because she has been doing the transcripts for the last three years, and she does a great job.

I also want to thank you for listening, and I want to thank the many guests that have appeared on the show. There have actually been 49 different guests on the *Brain Science Podcast*. It actually goes over 50, if you include crossover episodes of *Books and Ideas*. So, I can't thank each guest individually, but I do want to give a shout out to all these guests, because I think when I started doing interviews, the show became a much better show.

As I mentioned, I want to thank the listeners. I especially want to thank those of you who have donated to support my work, and those of you who have sent me emails telling me how much the *Brain Science Podcast* means to you. You got me through the period when I wasn't sure whether I wanted to continue the show, so it's really thanks to you that I'm looking ahead to 2012 and Year Six of the *Brain Science Podcast*.

Now, today's episode is going to be organized as follows: I'm going to hit the highlights of the episodes that we had this year—some of the main ideas—and then I'm going to do something I haven't really done before, which is talk a little bit about what neuroscience has to tell us about brain health. Then I will tell you a little bit about next year, and I will end up with a few announcements.

As always, you can find the podcast transcripts, show notes, and links at brainsciencepodcast.com, and you can send me email at docartemis@gmail.com.

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FIFTH ANNUAL REVIEW

So, I mentioned Lori Wolfson before. Thanks to her, there are transcripts for all the episodes, and this makes it a lot easier for me to go back and look at this year's episodes. So, I took a few hours to reread the transcripts for Year Five of the *Brain Science Podcast*. Naturally, I can only share a few highlights with you today. If you're a regular listener, I hope these highlights will jog your memory; but if you're a new listener, I hope that this will encourage you to go back and listen to any episodes you've missed.

As times goes on, there seem to be more and more interconnections between the episodes, so it can be interesting to go back and listen from a new perspective. For example, if you just listened to the interview with Miguel Nicolelis, it will give you a different perspective on the interview with Olaf Sporns. But, as I said,

today's episode is intended just to hit the highlights, so I hope it will encourage you to go back and learn more.

The first episode in 2011 was BSP 72 on the neuroscience of magic. We talked to Stephen Macknik and Susana Martinez-Conde, who are authors of *Sleights of Mind*. You may have heard that magicians are masters of illusion. Well, this is not only true, but it is the reason that Macknik and Martinez-Conde have spent the last several years exploring the neuroscience of magic. It turns out that examining the ability of magicians to trick us is a great way to learn something about how the brain works. As Susana said, visual illusions can help us understand how vision works, and cognitive illusions may reveal the neural basis of some of our cognitive processes.

One of the key ideas that they brought out was that when we pay attention to something, our brain automatically suppresses other inputs. This is one reason why we really can't multitask, and why we can miss something as obvious as a gorilla walking in front of us, if we're really focused on something else. A few months ago, I got to see Stephen and Susana do their presentation at the National Association of Science Writers meeting in Flagstaff, Arizona. It was really nice to see the presentation live, because they showed several good videos that illustrated their points.

But one of the take-home points that they had at the end really stayed with me. It was that, because of the way our mind suppresses things when it's focused on a certain thing, when you're making a difficult decision, you ought to make a list of your factors and reasons and stuff, and focus on each one of them individually—not necessarily for a long time, but at least for a few minutes—because, let's say you're focusing on the logical reasons for a decision; you're not going to be thinking about the emotional reasons, and vice versa. And all those reasons are valid, but if you only look at one, you may ignore something that turns out to be really important to your choice.

So, that's a good take-home message. And it's kind of funny, because it reminds me of the advice way back in the days of Benjamin Franklin, when he said you should make a list of pros and cons before making a choice. Well, it's not a mathematical—you know, add up the pros and add up the cons—type of advice. What it is, is the advice to actually look at each reason, pro or con, individually. And then maybe you want to sleep on it, and wake up the next day and make your choice.

I want to remind you that their website, sleightsofmind.com, has a lot of great videos illustrating some of the various kinds of illusions, and what they tell us about the brain.

BSP 73 was Lawrence Shapiro, author of *Embodied Cognition*. He defined embodied cognition as an approach to cognition that regards cognition as something that involves, not just the brain, but also the body and its environment. Now, embodied cognition is a subject that I have featured in several episodes; probably at least one episode every year of the podcast. I refer you back to the show notes for Episode 73 for the links to these earlier episodes.

The reason that I care about this question is that the question of how the mind and the body are related is one that deeply affects how we see ourselves, as well as our attitudes towards other species—especially our attitudes about whether or not they have minds. Embodied cognition challenges the standard approach of cognitive neuroscience, which is to view what the brain does as if it is totally isolated from the body. This is what Shapiro describes as the "sense, think, act cycle."

In contrast, according to Shapiro, embodied cognition thinks of the body as in some sense shaping or constraining, or actually being involved in the very processing of the kinds of information that an organism needs to interact successfully in the world. Relating this back to the work of Macknik and

Martinez-Conde, we know that what we see is definitely influenced by what we're expecting to see; so that would be an example of that interaction.

A key idea here is that sensory input requires active exploration. It changes us from a view of passive reception to active. This matters a lot if you're going to design an experiment. If you take the viewpoint that sensation is a passive process, then it doesn't matter if the animal is restrained, or maybe it doesn't even matter if the animal is awake. But if you think of it as an active process, both of these things matter a lot.

Another key idea is the introduction of feedback, which we now know is a huge factor in the sensory system, as opposed to the traditional picture, which was that 'sense, think, act cycle,' which doesn't allow for feedback. Now, the real issue facing embodied cognition is whether it represents something that can't be subsumed within traditional cognitive science. After all, no one in cognitive science, now, denies that the body is important.

This issue partly revolves around the role of computation, which the most extreme forms of embodied cognition want to reject completely. But this is certainly beyond the scope of today's discussion. The key take-home point is that, from the standpoint of embodied cognition, the brain is a part of a process or system that produces cognition; it is not the whole process.

So, this brings us to BSP 74 with Olaf Sporns, author of *Networks of the Brain*. This book was probably the most technical one that I've covered since back when we talked to the author of *Rhythms of the Brain*, in BSP 31. Dr. Sporns said that his goal was to give an account of how neuroscience and network theory relate to each other.

Network theory is a mathematical approach that provides a tool for dealing with the brain's complexity; specifically with dealing with the large amount of data

that's now being generated. Just to mention a few key ideas here, one of the things that network theory allows us to do is to deal with the fact that the brain is what Sporns calls, "a multiscale system." That means you can't just look at it at the level of the neurons; you have to look at it at different levels to really understand how it works.

Also, it's been determined that the brain has something called a "small world architecture." This means that there are a lot of local connections between neurons, and fewer connections that go over large areas. This is important for a lot of reasons, one of which is that if all the neurons in the brain were randomly connected, our brains would take up a whole room, and they definitely wouldn't fit into our skulls.

Now, even though there are, you might say, modules of neurons that have a lot of local connections, from a functional standpoint, function is distributed. Dr. Sporns said, "No mental function we can think of right now is carried out exclusively by one piece of the brain." And I will be coming back to this idea shortly.

Now, one of the roles of network theory is as a tool for generating models. So, what they do is they take the data that, say, comes from an MRI study or some other kind of study, and they use that to construct a model. The purpose of this is to generate new experiments to test the model. And then it's an iterative process because, as he says, there's no final model of the brain; because you test the model, you determine parts of it do not lead to accurate predictions, and then you have to re-do.

An example of the value of this approach is in the work of Eve Marder, who I interviewed way back in Episode 56. She was doing work with circuits in the lobster—especially in the stomatogastric ganglion of the lobster—and her circuit simulations suggested that there was much more variability in the neuronal

behavior than you would have expected. Then they went in and they tested this, and they determined that it really was true. This increased recognition of the variability is one of the reasons why just having a wiring diagram is not enough.

So, the approach that Dr. Sporns is involved in—which includes the Human Connectome Project, which would be making a wiring diagram for the human brain, so to speak—one of the limits of this is the recognition that, since there's so much variability, and even an individual person's wiring is going to be changing, that we can't just have a final wiring diagram that tells us everything. It's kind of like what we thought we would get out of the human genome. Once we got the human genome, we found out that it was just the beginning of the puzzle.

One of the surprising things that has been discovered, using the network approach, is the fact that the brain is very active at rest. That is another thing that challenges the idea of the brain as a passive receiver of information.

One of the things that comes out of work like Dr. Sporns' is the fact that it's very important to be clear about what is being measured. For example, functional MRI measurements are really indirect measurements of brain activity. And this principle is going to become more important, because as we're getting more and more data being generated by these methods, we have to really be critical of what kind of information they're really generating.

Now, most of you probably won't want to read *Networks of the Brain*, but I do recommend it to those of you who are serious students of neuroscience. However, I think this interview has something for everyone, because it is full of thought-provoking ideas that will give you a glimpse into a relatively new approach to understanding how our brains make us who we are.

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In contrast, David Eagleman's book, *Incognito: The Secret Lives of the Brain*, is one that really is appropriate to readers of all levels, and a good one for new listeners. In BSP 75 I interviewed Dr. Eagleman, and this was actually one of the most popular episodes of the year, in terms of feedback from new listeners.

Dr. Eagleman's work focuses on the role of neuroscience in the legal system; but in his book he spends most of his time explaining how it is that our brain is doing lots of stuff that we are not only not aware of, but that we don't even have conscious access to. This is also a theme that we've explored several times in the past. He says that the key implication is that we are not running things. Now, when he says, 'we are not running things,' he means in the sense that our conscious self is not running things.

Why is so much of what our brain does unconscious? Well, it saves both time and energy. We can only focus our conscious attention on one thing at a time, as I mentioned before, so we need a lot of stuff to happen in the unconscious, or we wouldn't be able to function. In understanding what's going on in the unconscious, Dr. Eagleman introduced the imagery of a team of rivals; that is, various unconscious elements are vying for the attention of the conscious. And this is the reason why we can feel pulled in more than one direction, sometimes, when we're trying to make a decision. You know, like part of us wants to go exercise, and part of us wants to sit in front of the TV and eat junk food.

We did spend some time talking about the implications of this for the legal system. And I don't really want to try to get into that aspect today. If it interests you, I encourage you to go back and listen to the episode, or read *Incognito*. Like I said, it's a great book for readers of all backgrounds.

BSP 76 was an interview with Sian Beilock, who is the author of, *Choke: What the Secrets of the Brain Reveal About Getting It Right When You Have To*. This was the least technical episode of the year, but it's a great example of the practical

advantages of studying the brain. Beilock focuses on how people perform under pressure, and she has discovered that there are two basic ways that stress can impair performance. One is that if you're doing an intellectual task, like taking a big test, worry can impair your working memory, and therefore impair performance. In contrast, if you're doing a procedural task like sports, thinking about how to do it can get in the way of automatic performance. So, those are like two sides of a coin.

We also talked a little bit about a rather surprising, but well-documented phenomenon that she calls a "stereotype threat," that can impair performance. Dr. Beilock's work in this area has some important implications about how tests and similar things should be designed to avoid this problem. The thing I like about this episode is that it is something everyone can use. You should feel free to copy it and share it with your favorite student, athlete, or someone going for a job interview. It's, like I said, a real practical episode.

BSP 77 is an interview with Fabrizio Benedetti, who is one of the world's leading researchers on the neurobiology of placebo effects. He has written two books, *Placebo Effects*, and, *The Patient's Brain*. I really think that physicians and scientists ought to read both of these books, but for others I would recommend just going straight to the newest one, which is called, *The Patient's Brain*. It's got an academic style, but it's got a lot of really good information.

At the start of Dr. Benedetti's interview, and in his books he tries to make it very clear how the term, 'placebo effects,' is used differently in his work, compared to in clinical trials. Now, by definition a placebo is an inert or inactive treatment that is expected to do nothing. But we know that some people improve when they get a placebo. So, the question is why.

Well, there can be other factors, like spontaneous remission, i.e. it was going to get well anyway; regression to the mean; experimental bias on the part of the

researcher or the patient. That's the reason why we do the double blind random controlled trials. This is supposed to eliminate these problems; or, at least, they're supposed to be equal in both groups, so that they cancel out. Because in clinical trials, the treatments are considered effective only if they are significantly better than the placebo.

In contrast, Dr. Benedetti is interested in understanding why some people improve when all these biases have been removed; that is, what is the psychobiological mechanism. So, I want to emphasize the difference. In clinical trials, the term, 'placebo response,' includes all the responses in the group that got the inert placebo. In Dr. Benedetti's work, the goal is to study the psychobiological responses to treatment, which is what is left after you take out the various biases. And one of the things we talked about during his interview was how his experiments are designed differently than clinical experiments, so as to be able to isolate this psychobiological element.

It's also important to understand that this psychobiological element is present even when the patient gets active treatment. In fact, to me, that's what makes it interesting. An example is the fact that when you give somebody real pain medicine—it doesn't matter if it's a narcotic or a non-narcotic—it will be less effective if you give it to them secretly, as opposed to them knowing they're getting it. As I said before, this is a complex subject, but I think it's one that we all have a stake in understanding.

What are the implications of Dr. Benedetti's work? Well, first of all, I want to emphasize that his work does not imply that ineffective treatments should be encouraged if they have a high placebo effect. I got some email that gave me the impression that that's what some people thought he was saying.

More importantly, I think that this work should influence how we deliver medical care. His work clearly shows that the role of anxiety is powerful. If a person is

less anxious, medications, including pain medicine, work better; so, it emphasizes that things like the caring attitude of medical personnel makes a difference.

And little things matter. I keep telling my nurses, "Be sure you tell the patient when they're getting their pain shot." If you take care of patients, be aware that how you act can either help your treatment or undermine it. Bedside manner *does* matter. In *The Patient's Brain*, Dr. Benedetti reminds us that medicine is a social practice that involves a personal interaction between the patient and the people around them, including their family, doctors, nurses, and everybody else.

Of course, right now, at least in the United States, there are a lot of things that interfere with this relationship; things like the insurance company, and government regulations. I don't know how we can get this information across to the politicians; and it seems like the people who run insurance companies never stop to think that they might have to be a patient someday.

I know that many of you listening are physicians. Even those of you who aren't, are aware of these problems. But I want to emphasize how we can use Dr. Benedetti's research in a positive way. These ideas affect everyone, even if you're not a doctor or a nurse, because you or a loved one are likely to be a patient at some point. So, I hope you will go back and listen to this episode, and share it with others.

And remember that you can get free transcripts for every episode of the *Brain Science Podcast* at brainsciencepodcast.com.

Now, if you subscribe to the *Brain Science Podcast*, you will usually get one or two episodes every year from my other podcast, *Books and Ideas*. This past year I had a return visit from Dr. Paul Offit. We talked about his book, *Deadly Choices: How the Anti-Vaccine Movement Threatens Us All*. This is one I

definitely would encourage you to share with others, because I think, even though it has nothing to do with neuroscience, that it's a very important topic.

The other *Books and Ideas* episode that was in this year's feed was the interview with Carol Tavris, who is the co-author of a book called, *Mistakes Were Made (But Not by Me)*. Besides talking about her book—which I'll get to in just a second—Dr. Tavris and I talked about the branch of psychology she works in, which is called 'social psychology,' which is a branch of experimental psychology that studies the individual in a social context. This seems to be a very growing field of psychology.

Also, we talked about what she calls, "the scientist-practitioner gap," which is reflected by the fact that many clinical psychologists ignore research and, unfortunately, sometimes tend to cling to disproven therapies. We also talked a little bit about how MRIs are misused. But our focus was cognitive dissonance. Cognitive dissonance is the discomfort that we feel when we are faced with evidence that contradicts our beliefs. And since it's uncomfortable, we naturally strive to get rid of it. In fact, this drive to get rid of cognitive dissonance is so strong that it occurs even at the unconscious level.

Work in this area has led to some surprising results. An example of an important consequence of cognitive dissonance is that as soon as we make a choice, even if it's about something minor, we start almost immediately to begin justifying that choice. That's why, if you're trying to choose something like a new car, the person who just bought a certain model is probably not the best person to ask.

Now, I want to emphasize that this is a theory that has a great deal of experimental support. And because it has consequences for our daily lives, I encourage you to listen to this episode, and to read *Mistakes Were Made (But Not by Me)*.

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Mistakes Were Made (But Not By Me) is an example of one of the many books that are available from Audible.com. Audible has been sponsoring the *Brain Science Podcast* for, I think about four years; and I know many of you enjoy listening to the featured books on Audible.com. If you are not already a member of Audible.com, you can get a free audiobook download by going to audiblepodast.com/brainscience.

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The last two episodes of this year's *Brain Science Podcast* focus on the work of Miguel Nicolelis, author of *Beyond Boundaries: The New Neuroscience of Connecting Brains with Machines—and How it Will Change Our Lives*. BSP 78 was a discussion of the book, and I focused on how his work challenges two long-standing assumptions.

One is strict localization, and the other is the idea that time doesn't matter when we're trying to determine the receptivity of specific neurons. The development of small flexible electrodes has allowed two important changes in the way experiments are done. It has made it possible to sample many more neurons simultaneously, and it has also made it possible to allow animals to move around and behave normally. And remember, I spoke earlier about the implications of this, when I was talking about embodied cognition.

Initial work by Nicolelis and his colleagues shows that in an awake moving rat the receptive field of the rat's whiskers was dynamically changing; it was not static, as had been assumed. Not only that, some neurons responded to almost every whisker on the face. The key idea is that, instead of visualizing a relatively fixed map, where each neuron responds maximally to one whisker, it turns out that the

response is constantly changing, depending upon what the rat's doing; and many neurons respond to multiple whiskers, and some to all whiskers.

Moving from working with sensory neurons, Dr. Nicolelis and his colleagues went on to develop what he calls a "brain-machine interface," using motor neurons; and he has shown that the more neurons you sample, the more precisely the signal can be used to predict the motor activity that the animal will do, and to send that signal to an external device, which can then be essentially controlled by the animal's brain.

Even more surprisingly, animals, including rats, can learn to control external devices directly with their brains, without moving their limbs. Now, in the podcast, I focused on how this work should affect how we see brain function, but it also has huge implications for the development of devices to help disabled people. Of course, the big obstacle right now is the need to have the electrodes implanted in the brain, because the signals that can be derived non-invasively just don't have enough resolution.

In BSP 79 I spoke with Miguel Nicolelis; and I was glad that I could talk to him about his work in more detail, because I think that it represents a significant shift in the way we look at brain function. In fact, he said that he doesn't even use the term, 'map,' anymore, because it doesn't represent how dynamic the brain really is. Any given neuron is constantly changing its responsiveness; and it can participate in multiple ensembles, which means that it can be part of different brain functions simultaneously. So, we can no longer point at any place in the brain and say it does only one thing. I should also mention that this work is totally consistent with the work of Dr. Olaf Sporns, who I talked about a few minutes ago.

Now, my impression is that the issue of localization vs. distributed function is going to turn out similar to the 'nature vs. nurture' argument; that is, that the

answer is usually *both*. Clearly, there are parts of the brain that perform unique functions, but our most complex behavior, both unconscious and conscious, is highly dependent on the many interconnections that make up our brain. Remember that our neurons aren't that different from those of simple invertebrates—though we might turn out to have more proteins in our synapses. So, it makes sense that who talks to who is critical.

Reflecting back on this year's episodes, and especially on the work of Dr. Benedetti and Dr. Nicolelis, brings up an idea that I want to emphasize; and that is that the questions we ask influence what we measure; and, vice versa, what we can measure influences the questions that we can ask. But, as the work of Dr. Nicolelis shows, questions also can derive the technology, so that we can make better measurements.

I think that it is very important not to mistake data for answers. I was really rubbed the wrong way last year, when I read an article in *Wired*, that suggested that data could replace theories. This is not true, because correlation does not equal causation. This important principle gets ignored so often, especially in this new world, where data mining has become popular.

As Dr. Sporns explained, we should use the data to develop theories which can lead to experiments to test those theories, and then the theories are constantly revised. Remember that a good theory is going to predict something beyond the data. That's how you test it. So, just keep this in mind when you hear another news report about a study that shows such-and-such is associated with such-and-such; and realize that we're talking usually there about a correlation that has been discovered by going back and looking at the data. And, especially if the correlation is one that the experiment was not designed to study, we need to be wary.

Again, as I wrap up this summary of this year's episodes, I want to remind you that you can get transcripts for all the episodes at brainsciencepodcast.com. So, if you want to review any of these ideas, and don't want to take the time to listen to the episode again, the transcripts are the way to go.

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Every year I get requests in emails to do topics that I think of as being in the area of self-help. I resist these, because the *Brain Science Podcast* is not a self-help podcast. My focus is on choosing topics that are relevant to how neuroscience is helping us understand how our brains make us who we are. I also want the information to be useful to you, as a listener.

Today I want to take a few minutes to talk about what do we know about brain health. Is there anything that we've learned from five years of the *Brain Science Podcast* that can be relevant to our day-to-day health? Well, there are a few key ideas.

The first one—probably most obvious—is the importance of exercise. This is something that we did explicitly discuss with Dr. John Ratey back in Episode 33. Exercise is very important to brain health. We got into all the reasons why this is so in that episode.

Now, when it comes to diet, the first thing I want to emphasize is that there are no magical foods for brain health. But a good principle to follow is that if it's good for your heart, it's good for the brain—just like exercise is good for the heart and good for the brain. As far as alcohol goes, the current evidence favors moderation. Alcohol is a brain poison, so it makes sense that excessive alcohol would not necessarily be good for your brain. However, there does not seem to be any convincing evidence that total abstinence has any particular benefits to the brain.

I generally recommend avoiding drugs. I think that that's just a prudent approach, even if you ignore the evidence for the problems that addicting drugs can create in the brain. Now, you might wonder, well what about the so-called 'brain enhancing drugs?' There are drugs that now have medical uses that people are using to help their attention, when they don't have a medical problem. These can be very enticing. Personally, I don't want to take any of this stuff. I am more concerned about the risk of side effects than I am any questionable marginal benefits I might gain. But I guess this is a decision each person needs to make for themselves—with their own personal physician.

The other topic that comes up is the question of brain exercises. It's pretty well documented that learning new things is good for your brain—things like foreign languages and playing musical instruments have been well-studied—and that lifelong learning is very, very important. It's never too late to learn something new. That's an important take-home message.

Now, as far as these computer programs for doing brain exercises, I will tell you that I have used the Posit Science program, myself, but I don't really have an opinion one way or another about its effectiveness. It is expensive, so I wouldn't put it at the top of my list, unless I had that kind of expendable money. As far as I know, none of the other programs have been particularly validated.

If a program advertises that it's been scientifically tested, you need to ask what those tests were. And if they're just internal tests, and they don't represent anything that's been done by an objective source, then I would take them with a grain of salt. A good place to look for information on this topic is sharpbrains.com.

Now, videogames: there really does seem to be some evidence that some videogames—the ones that are designed for fun—can be beneficial, in moderation. It looks like the shooting-type games, which require quick reflexes,

help people, as they're getting older, to maintain some of their ability to take in more information, and that sort of thing.

I would just emphasize on the issue of the videogames, two things: You probably don't want very, very small children trying to play videogames. There does seem to be evidence that children under the age of two do not need to even be watching television, let alone playing videogames. And then, your older children, the best thing to do is to limit the time to one or two hours a day. That's just like what my parents would have done, which was only allow us to watch television one or two hours a day. The main reason for this is we really do want kids doing other things, including exercising.

The thing that has the most implications for us, in terms of brain health right now, is our growing discoveries of brain plasticity; which means that it's never too late. It means that whatever you do use your brain for, that's what it's going to get wired for. So, you care about that if it's your kids, or your teenagers. And once it's wired, it's harder to change; like getting ruts that are hard to get out of. But, because the brain is plastic, it is possible to learn new skills, learn a new language, take up an instrument, even take up a sport that allows you to combine exercise and mental activity. Whatever age you are, you want to build up your brain reserves for the future, so that if you do have the misfortune of getting something like dementia later on, you have more reserves to work from.

That's enough of my free doctor's advice for today.

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What about next year? The first thing is I'm definitely going to be returning to a monthly schedule, and my goal is going to be to put the *Brain Science Podcast* out around the last Friday of every month, and *Books and Ideas* out in the middle

of the month—although I'm not making a firm commitment to putting out *Books and Ideas* every month; I am for the *Brain Science Podcast*.

I have a lot of good prospective guests lined up; some great books that I'm reading now. You can see some of these if you go to the Brain Science Podcast Group on Goodreads.com. I've already recorded next month's interview, which is with Patricia Churchland. Dr. Churchland was interviewed back in Episode 55, but she did publish a new book, and I'm happy to be able to get her back on the show. She's always a great guest.

I'm still trying to get Antonio Damasio. He keeps sending me emails saying he will do it, but then he never gives me a firm date, so I'm not sure if that's ever going to happen. It's actually much more difficult to get some of these more well-known writers. And to be honest, some of the most original work and most interesting guests are the ones who aren't so well-known, so I'm happy to focus on those.

For next year I really want to double the audience of the *Brain Science Podcast* We've just been kind of coasting for the last couple of years, and I'm really ready to kind of work on growing things again. And I'm going to be asking for you who have been listening for awhile to help me with this.

Another thing I'm looking into is the possibility of doing an eBook; and I have in mind, at this point, making a book aimed at aspiring scientists, because I have five years' worth of advice from leading scientists. There are lots of books out there for would-be writers—you know, little short-chapter books, with advice from other writers. That's the kind of thing I have in mind. I'll be letting you know more about that in the up-coming months.

As I mentioned, I want to get listeners more involved. Right now I've got two volunteers, Jeff King and J.j. LaTourelle, working on creating a new audience

survey, which I hope to unveil next month. After that, we will be actively recruiting volunteers. I'd really love somebody that could help us to create some videos, or other multimedia. If you're interested, be thinking about what *you* can do; what talent you think you could contribute, or would like to contribute. And you can email me at docartemis@gmail.com.

I also want to say something about listener suggestions. I do pay attention to all the listener suggestions, and they are very much appreciated. Even though, obviously, most of the suggestions don't make it on-air, please do keep those suggestions coming.

Before we close, I do want to just make a few announcements like I always do. One is, please do visit brainsciencepodcast.com. And if you haven't done so, go to the Guest Book and leave—I hate to use the word 'testimonial'—but what I'd really love for you to do is go to the Guest Book and leave a comment about why you like the *Brain Science Podcast*. Say something like you would on an iTunes review, so that people coming to the site can see what it is that people like about the *Brain Science Podcast*.

You know why you like it, but sometimes people don't think that they want to listen to a show about neuroscience. You can get to the Guest Book in one click, from the front page at brainsciencepodcast.com. Just look for the blue banner underneath the logo, and you'll see the word, 'Community.' If you hover your cursor over that, you'll see the Guest Book as a choice; and just click on it, and that's all there is to it.

I mentioned donations before. The show is supported by donations, and if you're interested in doing that, you can see a link for that, also on the website. I want to mention that although PayPal is the main way that people give donations, it is possible to send direct donations, and the information for that is on the website.

I want to mention T-shirts. I've never really sold very many T-shirts, but I am doing a redesign on the T-shirts, so that they will have the new logo on the front. The T-shirts are at Printfection.com, and you can find them by going to Printfection.com and then searching for 'Brain Science Podcast;' or follow the link on my website. These are not cheap T-shirts. These are well-made T-shirts, so they're not as cheap as say, CafePress; but they don't fade. I've had some for four years, and they still look almost as good as when I originally had them made. So, that's something that, if you can afford a T-shirt, it's a great way to help promote the show.

I mentioned last month that the *Brain Science Podcast* app has been doing surprisingly well. It's now available for iPhone, iPad, and Android devices. One of its best features is the fact that you can read the transcripts right on it.

A new thing is Google+. I think that's open to everyone now. I just started a Google+ page for the *Brain Science Podcast*, and I'm hoping that this is going to be a way to share good links and everything with you, in between episodes. So, be sure to go onto Google+ and add the *Brain Science Podcast* page to your circles.

We still have our Facebook Fan page, and J.j. is working on putting links on there almost every day, to make it a place where you can actually find something new every day. But it's also a place where you can go and leave comments, and interact with each other—as is our Goodreads Group. Last, but not least, don't forget that you can get the show notes automatically for every episode by signing up for the *Brain Science Podcast* newsletter at brainsciencepodcast.com.

Links to all these are in the show notes. Now, I don't expect you to go to Google+, Facebook, and Goodreads. Just pick the one you like, and support it. I'm trying to find some mechanism by which the community will be able to interact, as much with each other, as with me.

I always ask for iTunes reviews; and I happened to look in iTunes yesterday, and I noticed that there are actually 193 reviews, and our average is now five stars. And I really appreciate that. Those reviews are really important, keeping the *Brain Science Podcast* on the 'Featured' page in iTunes. So, please keep that up.

And don't forget that word of mouth is the key way that new listeners find the *Brain Science Podcast*, so keep on sharing the podcast with your friends.

Well, I guess that's it. I will be back with you in 2012. Thanks again for listening.

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Transcribed by Lori Wolfson
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