Ways the Brain Can Break

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Robert J. Marks:

Welcome to Mind Matters News. I am your brainy host, Robert J. Marks. The brain is a marvelous organ, still not totally understood. Artificial neural networks, my field, or devices, artificial intelligence that are supposed to be a simulation to the human brain, but comparing the brain to artificial neural networks is like comparing the human heart to a pump handle; we're just not even close. We are far from any sort of duplication of the human brain, and the gap is wide, and we might never get there. I also know that as I get older, I feel my brain, or my mind, I'm not sure which, slowing down, but the brain also breaks, and there is depression, autism, epilepsy, and a number of other things. Neurologists and neurosurgeons can sometimes fix the human brain, and that's what we want to talk about today on Mind Matters News. Our guess is Dr. Andrew Knox. Dr. Knox is a neurologist at the University of Wisconsin School of Medicine and Public Health who specializes in childhood epilepsy, intractable epilepsy, and evaluation for epilepsy surgery. Andrew, welcome.

Andrew Knox:

Thanks so much.

Robert J. Marks:

I got to ask you kind of a personal question; you work with kids whose brains are broken?

Andrew Knox:

Yep.

Robert J. Marks:

Man, I would find this tough. You see little kids, and you see them having epileptic seizures, and you see kids with brain damage, and I don't know, I would have a hard time just leaving this at work and not taking it home, but I suspect people in your profession have to develop kind of rhino skin, and separate the medical aspects from your personal feelings. Do your experiences bother you after your work sometimes?

Andrew Knox:

Well, sometimes they do. Actually, one of the wonderful things about doing epilepsy is that there's a wide spectrum of what epilepsy looks like. So there are some kids who have frequent daily seizures that cause all sorts of problems. They have a lot of other cognitive problems, too, and those cases are hard, but there are plenty of other kids who have a few seizures over the course of their life, and they go away after a few years. So you see kids in lots of different places, which I think is helpful just with dealing with fatigue and caring for patients, and even in the difficult cases, it is gratifying to work with those families. I've met some amazing people that way, and so there's good that comes out of it.

Robert J. Marks:

I guess that is the positive side. Every once in a while when you see a positive result, it must give you a warm feeling that you are part of achieving that result. That's really kind of cool.

Andrew Knox:

Yeah, and one of the big things, I think, that is part of being a doctor, or part of medicine, is just being with people in cases when they're sick or when things are difficult and helping them through those times. So that's an important thing we can do for patients, even if there's not a cure that we can offer to them for their specific medical problem.

Robert J. Marks:

So in a way, it's kind of like a ministry for you in a way, right?

Andrew Knox:

Yeah.

Robert J. Marks:

Okay.

Andrew Knox:

Yeah.

Robert J. Marks:

Andrew, you got to help me here, and I'm going to start by confessing my ignorance. I don't have a clear idea of the difference between the professions that deal with the brain. There's neurologists, there's neuroscientist, there's psychiatrists, and psychologists, and each, I suspect, looks at the brain from a different angle. Now, you're a neurologist. How does a neurologist think about the brain? Do you have a special way to look at the brain?

Andrew Knox:

Yeah, so neurologists are usually primarily concerned with thinking about the hardware of the brain, so disorders where you can see some part of the brain is broken, either looking with imaging studies, or by looking with pathology under a microscope, or looking with EEG, a study that looks at brainwave activity. So we're sort of more concerned with low-level brain problems. Psychiatry and psychology usually approach the brain from the standpoint of the mind, so thinking about not what's happening with the physical substrate of the brain, but what is happening in people's thought processes, and what sort of dysfunction is there in thought processes. Now, obviously, there's overlap between the two.

Robert J. Marks:

Yeah, that's what I was going to ask. There has to be an overlap between the two, so what is that?

Andrew Knox:

Right, right. Well, that overlap, in some ways, is still not totally well understood, right? It can come out in different ways. So if you think about depression, say, there are certain brain structures that are implicated in depression. There are things like neurotransmitters that are implicated in depression.

There's certainly cases of depression where treating with a particular medication that addresses a neurotransmitter will improve a person's depression or help get rid of the problem.

Robert J. Marks:

Okay, let's drill down a little bit. Could you define and talk about neurotransmitters? What is that, and why are you concerned with them?

Andrew Knox:

Yes. So the brain, at its base level, is comprised of neurons, these cells that use electrical signals to sort of integrate information, then communicate with each other, and then there's other supportive tissues or glial tissues. So the point of neurons is sort of to communicate with each other, and the way they communicate with each other is by neurotransmitters. You have structures called synapses, which are the connections between the output coming from one neuron and the input to another neuron. So they communicate via little chemical messengers, and that's what I'm referring to when I say neurotransmitters; substances that neurons use to communicate with each other.

Robert J. Marks:

As I age, I mentioned I felt my brain slowing down. Are my neurotransmitters kind of being turned down with a little knob as a function of age?

Andrew Knox:

Yeah, you could potentially say that. Certainly in kids, if you look at how brains develop over the first 18 years of life, you can see that kids' brains are actually building more synapses, so more of those connections between different neuron over the first 10 years of life. A kid may have actually as many as twice as many neurons as a typical adult.

Robert J. Marks:

Really?

Andrew Knox:

Yeah, and then part of maturing is actually getting rid of extra synapses.

Robert J. Marks:

Now, are these synapses that you're not using in some sense?

Andrew Knox:

Yeah, your brain is sort of developing its structure in real time, or pathways, or communication that makes sense between neurons. There's probably a nice analogy to how you think about neural networks as you start out with a neural network, and then you train it, and as you train it, some connections become stronger, some become weaker. The brain goes further to actually remove some of those connections entirely, and that probably improves cognitive function when you are in the childhood-age range.

Robert J. Marks:

That's interesting. In artificial neural networks, there used to be a process, I haven't heard about this for years, called pruning, and if you have some neurons that are kind of sitting there and not doing anything, they will eventually be removed algorithmically from what's happening. Say, for example, even inputs; maybe you're trying to classify a dog from a cat, or something, and one of your inputs is the weather in Wisconsin, okay? And that is going to have nothing to do with whether what you're talking about is a cat or a dog, so that weather in Wisconsin note is going to be totally removed.

Andrew Knox:

Yeah.

Robert J. Marks:

So that does happen in artificial neural networks. So interesting. So that happens in kids as we age.

Andrew Knox:

It does, yeah, and that's part of normal brain development, and probably for the exact same reasons you said. Some of those initial connections that you make probably are not useful, so as you get older, as you get experience, the brain prunes down to the connections that are most beneficial.

Robert J. Marks:

Now, does the getting rid of the neurons continue, or does it level off at some place? I'm hoping you say it levels off, but I don't know.

Andrew Knox:

It does level off.

Robert J. Marks:

Okay, good, good.

Andrew Knox:

And we're not talking about getting rid of the neurons, either; we're just talking about getting rid of some of the connections between different neurons. So by and large, the number of neurons stays about the same.

Robert J. Marks:

I see. Interesting. So, okay, we've talked about the difference between neurology and psychology, and I guess this, you characterized it as hardware versus software, right?

Andrew Knox:

Yeah.

Robert J. Marks:

You deal with the hardware and the psychologists deal with the software of the mind. So let's get now into some of the work that you do, and talk about how the brain breaks. That's a pretty strong statement. Breaks is different than slows down. So how does a brain break?

Andrew Knox:

Right. I mean, that is fundamentally what neurology studies. So there are many different ways the brain can break, and we can go through some of the typical examples, and I think it gives some good insight into how neurologists think about the connection between brains and minds, too.

Robert J. Marks:

Okay, good. Good.

Andrew Knox:

So most people think of neurology as having come out of the study of strokes; a typical problem that comes up usually old later on in life, but there are kids who have strokes as well. The basic idea of a stroke is that you have something that blocks blood flow to a particular part of the brain, and when that happens, then the brain tissue in a particular area dies. So neurologists who cared for patients with strokes noticed that many patients come in with the same set of symptoms, and so then early on, they would do pathology. So they would look at the brain after the patient had died, and found that the brain tissue is lost in a particular area, and they noticed that there was a good correlation between losing brain tissue in a particular area and the symptoms the patient might have.

Robert J. Marks:

Okay.

Andrew Knox:

For example, if you had a stroke in what we would call a primary motor area, an area with the connections to motor pathways through the rest of the body, all of those patients might lose the ability to move their arm on one side of the body, or their leg, or their face, or all three of those things.

Robert J. Marks:

Now, some of those things I think people can recover from, and I've heard the word neuroplasticity. It's kind of like if part of the brain fails, then another part of the brain takes over. Is that right?

Andrew Knox:

Yes.

Robert J. Marks:

I'm sure that there's cases where you can't cure it, but there are cases where you can, and does neuroplasticity play a role in that?

Andrew Knox:

Yeah, it absolutely does. So there actually aren't too many areas where if you have an injury to that part of the brain, you can't have other parts of the brain take takeover.

Robert J. Marks:

Wow.

Andrew Knox:

There are a few special areas. So again, areas involved with language, to some extent, are less plastic. Visual pathways are sort of hard-coded into the brain, so strokes in primary visual areas, you wouldn't expect to recover normal vision after that. Similar for primary motor areas. Usually, if you have a stroke in a primary motor area, you would expect to sort of have long-term motor deficits.

Robert J. Marks:

Okay, in a motor area? You mean things that just affect how you move your arms and legs, and things of that sort?

Andrew Knox:

Yeah, yeah, exactly.

Robert J. Marks:

Okay.

Andrew Knox:

Yep. Those are sort of the big three. There are some sensory areas that are the same way, where if you have a stroke in a primary sensory area, you might always have problems sensing or feeling sensation in your right hand, or your right leg, or something like that, but again, those are sort of the specific exceptions to the more general rule that the brain is good at moving function between different areas.

Robert J. Marks:

I find that amazing. That's just, to me, astonishing. There are very overt cases where you see this happening. I've seen blind people, for example, that aren't using the neurons that they were supposed to use for site, and they've developed the capability of going into a room and just clicking, and hearing the echo like a bat, and actually seeing through the echo their environment, and that is an astonishing application of neuroplasticity. I think some of the other things that you're talking about a little bit more subtle, you see the recovery, but they're not as in your face as the clicking.

Andrew Knox:

Right. Well, I would say that's a different sort of way of coping. So they haven't regained an ability that they had before, but they've developed a different set of abilities they have. So like you say, if you lose the sense of vision, your sense of hearing may become more acute, it may become better, and you may develop ways to use that to sort of replace that other function, but the examples I was talking about, I was actually talking more about recovering a function that you had before. So if you have a stroke in the left motor area, and you for a while can't move your right hand, even after six months, you can have some recovery of that function, even though those neurons aren't growing back, and that's because there are connections from the other side of the brain to that hand as well. So those connections may become stronger, and you may be able to use them better.

Robert J. Marks:

I see. So there is a difference between adapting for something you haven't had since birth, and then adapting from a function that you've lost through, for example, a stroke?

Andrew Knox:

Yeah, yeah.

Robert J. Marks:

I see.

Andrew Knox:

I would make a distinction between adapting for loss of a function by developing a new function that you wouldn't have developed otherwise, versus the brain adapting to recover a function that you've lost, that same function.

Robert J. Marks:

Now, strokes in kids, what's the primary cause of that? Is it something which is genetic? Is it something that's happened to them an accident?

Andrew Knox:

Yeah, it's a spectrum of things. Infections can actually be a common cause, or an immune response to an infection. Clotting disorders can be a common cause. There's a disease called sickle cell disease, which can be a common cause for stroke in kids.

Robert J. Marks:

Yes.

Andrew Knox:

Actually, there are a number of kids now who have substantial heart malformations or congenital cardiac problems. 40 years ago, many of those kids would've just died very early in life. Now, they can actually live relatively full lives, but one of the consequence of their cardiac disease is they're more prone to developing clots, and that sort of thing, which can be a cause for stroke.

Robert J. Marks:

Okay.

Andrew Knox:

So they're a patient population where we see strokes in kids a little more often.

Robert J. Marks:

I see. Okay. Have you noticed any increase or decrease in the number of strokes the kids have, or is that kind of been something which has been constant?

Andrew Knox:

I think that's something that's been relatively constant.

Robert J. Marks:

I see.

Andrew Knox:

And again, we see it much less in kids than in adults, but we do see them from time to time.

Robert J. Marks:

One of the ways you mentioned that brains can break is dementia, and I always associate dementia with old age, but can kids have dementia?

Andrew Knox:

So there are some disorders where kids can have dementia. So dementia is a little different from strokes. Strokes, the idea is you have an injury to a particular part of the brain, and then you wind up losing the function that goes with that particular area of the brain. Dementia, usually, you have a problem that affects the whole brain at the same time, or at least the brain more diffusely, so it's not one particular area of the brain; it's the brain as a whole. You don't lose all of the neurons in the brain at the same time, but you start to progressively have injury to more and more neurons throughout the whole brain. So that causes a different sort of change, where you see loss of cognitive function over time.

Robert J. Marks:

So you can say that dementia is kind of distributed, whereas stroke are localized?

Andrew Knox:

Yeah, exactly. Right, and less focal.

Robert J. Marks:

Okay.

Andrew Knox:

Now, there are exceptions to everything in neurology, but yeah, I think that's a good way to think about dementia. So kids can have sometimes particular kinds of genetic or problems with cellular processes that lead to something like dementia. So in adults, it's much more likely to be a part of the natural aging process.

Robert J. Marks:

Yes.

Andrew Knox:

In children, usually it would take a specific disorder that they have that would cause earlier onset dementia.

Robert J. Marks:

So it is something which is gradual, then?

Andrew Knox:

It is gradual, yeah. You think of strokes being something that you see the effects of the stroke over minutes to hours. Dementia, usually, you think of seeing the effects over months to years.

Robert J. Marks:

Okay.

Andrew Knox:

Yeah, and adults, again, usually you don't necessarily lose one particular function on one side of the body, but you see the effects of that sort of diffuse loss of neurons. You see that with more global cognitive functions, so problems paying attention to things, problems with memory, problems with just understanding the world around you, and some of those symptoms can follow really interesting progressions that maybe give some insights into how brains work.

Robert J. Marks:

For example, I would like to hear about this. What would be a progression that would give you an insight into the way the brain works?

Andrew Knox:

Well, so I've thought at times, "How does the brain store memories?"

Robert J. Marks:

Yes.

Andrew Knox:

There are different schemes for storing memories, but patients with Alzheimer's seem to have this progression where as you get further down the disease, more of their early memories seem to come back to the surface, or it often seems like they're convinced they're living in the world they lived in when they were a child. Yeah, and it's made me wonder if the way the brain stores memories, it's an associative sort of scheme, where it uses the previous memories you have to build up into new memories, and then as you have injury to the brain, perhaps you lose those most recent memories first, and then sort of go backwards through that scheme.

Robert J. Marks:

Okay. So Alzheimer is the type of dementia.

Andrew Knox:

Mm-hmm.

Robert J. Marks:

Do kids get Alzheimer's?

Andrew Knox:

Kids generally do not get Alzheimer's. Many of the dementias can look similar with different sorts of emphases. There are certain language processes that are a particular problem with Alzheimer's. There's another kind of dementia called frontotemporal dementia, where decision-making and controlling appropriate behaviors tends to be the bigger problem. Those, again, are all sort of adult onset dementias.

Robert J. Marks:

Yes, okay.

Andrew Knox:

The pediatric dementias are more specific to specific genetic disorders, and usually, they have other associated symptoms, too. One example might be juvenile Huntington's Disease.

Robert J. Marks:

Ooh. Okay, that's not good.

Andrew Knox:

Yeah, it's not. So those children would have dementia, and along with it, they would usually have other motor disorders, too; problems like dystonia, where muscles are stiff in ways they aren't supposed to be.

Robert J. Marks:

I see. I learned a new word from our conversation before, and I practiced pronouncing it, but I'm probably going to screw it up. Paroxysmal.

Andrew Knox:

Paroxysmal.

Robert J. Marks:

Paroxysmal, okay. I had it right, but I screwed it up there. What is that? I'm not going to try to say it again.

Andrew Knox:

Yeah.

Robert J. Marks:

What is that?

Andrew Knox:

What is a paroxysmal disorder?

Robert J. Marks:

Yeah.

Andrew Knox:

So that's sort of a blanket term for any kind of problem that suddenly comes and then goes.

Robert J. Marks:

Ooh.

Andrew Knox:

So epilepsy or seizures would be an example of a paroxysmal disorder. Everything's working fine, and then the seizure happens, something's dramatically different, it ends, and then things go back to normal.

Robert J. Marks:

So a seizure would be an example of that?

Andrew Knox:

Yep, a seizure would be an example.

Robert J. Marks:

Another word I learned from you is syncope.

Andrew Knox:

Oh, yeah, right. So a syncope often looks like a seizure. A syncope is basically a brief loss of consciousness, which usually happens because, for one reason or another, you don't get enough blood flow up to your head. So probably many people have had the experience of standing up, and then suddenly feeling kind of lightheaded. Maybe you see some tunnel vision, some black blurriness on the edges of your vision.

Robert J. Marks:

Oh, I see little dots.

Andrew Knox:

Oh, yep, yep, dots can happen, too, and if that's dramatic enough, some people may have experienced that the blackness on the edges of your vision eventually absorbs your whole vision, and you have other strange feelings, and then suddenly you wake up on the floor looking up at people who are wondering what just happened to you. That would be a syncopal episode, where you totally lost consciousness, because for a short period of time, you didn't have enough blood flow to your brain.

Robert J. Marks:

And at what point should I be concerned if I'm suffering from syncope? Because I have low blood pressure; I get up too quick, "Whoa, too dizzy." I got to get up kind of slow, but there was one time when I was a teenager that I got up real quick, and I was exactly like you said. I was sitting back down, and people were looking at me saying, "Are you okay?" And I thought, "Well, I don't know what happened."

Andrew Knox:

Yep, I've done that, too. Yeah.

Robert J. Marks:

Really? Okay.

Andrew Knox:

Most people, particularly young people, don't need to worry if they have syncope. The most common cause is because your blood pressure sits sort of low, and so then your body doesn't compensate well when you stand up. The only problem that really causes for you is you tend to almost pass out sometimes. There are other patients who have what's called a vasovagal response. That's the sort of scenario where someone is coming at you with a needle to draw your blood, and all of a sudden you feel kind of sweaty and not so good, and then you might have a similar syncopal episode because of that response to that stimulus that you have. So those are the common causes of syncope. Those are pretty benign. They won't cause any long-term problems. There can be some other causes that are a little more serious. There are some kinds of heart dysfunction that can cause syncope. So there are a few rare people who have syncope who might have a more serious issue, but that is the exception rather than the rule.

Robert J. Marks:

What do they call the person that takes your blood? They have a fancy word for it.

Andrew Knox:

A phlebotomist.

Robert J. Marks:

A phlebotomist, yes. Now, I give blood regularly. I go to functional medicine, and they take my blood all the time, and I used to be scared, and then I realized that the expectation was a heck of a lot worse than the realization, so I just swallowed, and now I look at the needle going in and going, "Oh, that's interesting," but I asked these people, "Who are the people that wimp out the most?" And on more than one occasion, I think for three different phlebotomists, they said that it's the guys that come in with big muscles and tattoos, which I thought was very interesting. It's kind of like they want to put up this facade of this big tough, macho guy, but they come in, and they face a needle, and they get all sweaty and stuff. So there's something deep and psychological about that, I think. And the diagnosis of some of these things, especially dementia, let's talk about dementia again, it doesn't look like that's something which would be diagnosed by a neurologist; that's more of a psychologist diagnosis. Is that right? Or is it-

Andrew Knox:

So dementia is still something that's managed by neurologists. So yeah, some of this is just historically who's managed what, but again, dementia does come out of some change in the brain hardware, right? So for Alzheimer's disease, if you look on pathology, there are abnormalities that are not supposed to be there. They call it talk about plaques and tangles that you can see, so they're-

Robert J. Marks:

Plaques and tangles, is this in the pathology of the brain?

Andrew Knox:

Yes, this is on the pathology.

Robert J. Marks:

I see.

Andrew Knox:

So you have substance accumulating that's not supposed to be there, which causes injury to the brain, and this progressive sort of loss of function. So yeah, dementia has always sort of been owned as a neurologic disorder, and is usually something that neurologists manage. With Alzheimer's, people have been looking for a long time for treatments for this disorder, right? For medications that can slow progression.

Robert J. Marks:

Sure.

Andrew Knox:

And there are some that are available, but they work much less well than we would like, and again, the field continues to look for things that you can do to slow that process, but if you're thinking about the contrast between neurology and psychology, again, something like depression would be a more typical sort of psychology-owned disorder, where often you can identify particular thought patterns that are also associated with that disorder, and the strategies for coping with the disorder often are rooted in changing those thought processes; things like cognitive behavioral therapy.

Robert J. Marks:

Yes. You also talked about something called non-epileptic seizures. What is a non-epileptic seizure? Every seizure that I've ever seen is epileptic, the people's eyes... I had a student, a master's student, that suffered from epilepsy, and it's not a fun thing to be in the room when they suffer a seizure. It's something which comes, they wake up, at least in this case, he was a little cloudy-minded, but eventually regained his senses, but there's a non-epileptic seizure. What would that be?

Andrew Knox:

Yeah, so this is a great example of the interface between neurology and psychiatry. So a patient who has non-epileptic seizures experiences all the symptoms of a seizure. So from their perspective, they might notice involuntary movements of their body, and then they might lose consciousness and then wake up later, similar to a patient who has an epileptic seizure. The difference is that if you were recording their brain waves, you wouldn't see any sort of change in the brain wave pattern, and so it's thought that those sorts of seizures come not out of dysfunction of particular neurons, but of certain thought processes or certain thoughts that potentially lie in the subconscious.

Robert J. Marks:

Ooh.

Andrew Knox:

Let me develop that a little further. So taking a step back and just talking about what is an epileptic seizure? So what we think happens during an epileptic seizure, usually, you have your neurons are firing off at their appropriate times, working on their particular tasks that they have. The analogy I like to use with patients is you can think of it like a city full of people. The people are all going about doing their particular jobs, or things that they're doing. During an epileptic seizure, for a variety of different reasons, neurons usually wind up firing off together all at the same time in a way that's not helpful.

I explain this to patients as you can think of it as a group of people in the city start to have a riot. They're all upset about something enough that they gathered together, they all go to the center of the town, and are yelling at people to change things. That riot goes on for a while, and then eventually, people go their separate ways, it stops, and the city goes back to functioning like normal. So you see evidence of that sort of a change in neuronal behavior if you're recording brain waves. So during an epileptic seizure, you see spikes in the brainwave patterns that happen like a couple of times a second, or even many times a second. So that's how I think of an epileptic seizure. Does that explanation make sense?

Robert J. Marks:

Yes, it does. Yes.

Andrew Knox:

Okay, yeah. So then the contrast, for a non-epileptic seizure, you don't have that same change and that the people are all coming together to the center of the city and rioting. You don't see those regular discharges on the EEG when you look at the brainwave patterns. In fact, if you look at an EEG during a non-epileptic seizure, the brainwave patterns are unchanged, so they look the same as the patient at any other time, but the patient is still experiencing all the symptoms of a seizure, and again, that happens because some part of how the brain is working to process what's happening is dysfunctional; usually in the patient's subconscious. So this can happen for a variety of different reasons. The classic illustration that I give patients is it's been described that patients who witness something that is a terrible, traumatic event that they can't process might wind up developing symptoms later that express that trauma that they just experienced.

Robert J. Marks:

I see.

Andrew Knox:

So this would be another variant of a functional neurologic disorder. Non-epileptic seizures are one example of a functional disorder. Another example might be, let's say someone witnessed the brutal murder of their spouse, and then two or three days later, suddenly, they are blind; they can no longer see. The neurologist does the exam, they see the pupils seem to respond normally, the eyes even seem to track in ways that you would expect, and yet, the person is unable to see. That would be another example of a functional disorder. The brain hardware, the pathways that process visual information, are intact, but there's something about that trauma that they witnessed that is preventing them from processing visual information and interpreting it the way they usually do. Does that make sense?

Robert J. Marks:

Yeah, interesting. Okay, so I would describe, as an engineer, I would say that an epileptic seizure, it's a difference between coherence and non-coherence; coherence and kind of chaos, if you will, in the brain.

Andrew Knox:

Yeah. Yep, you could actually absolutely distinguish things in that way.

Robert J. Marks:

Okay.

Andrew Knox:

But again, the way I like to describe this to patients or explain it to patients that comes out of my computer engineering background, is epileptic seizures are like a hardware problem. You can see a change in the way that individual neurons are firing off, whereas non-epileptic seizures are more like a software problem, that the hardware is working, but the way the brain is processing the information is not working correctly during that period of time, and patients seem to be able to identify with that pretty well. Everyone can think of when they've loaded or tried to run too many apps on their phone at the same time, and the thing eventually just locks up, and then you have to restart it, and then it goes back to normal function, and that's probably good an analogy, in some way, for what happens during non-epileptic seizures.

Robert J. Marks:

Understood. You mentioned things happening in the subconscious. Do we have access to measure activity in the subconscious in any way?

Andrew Knox:

The answer to that question is not straightforward, and they are probably people who could answer it better than I could, but I think there's probably not a good way to objectively access what's happening in the subconscious.

Robert J. Marks:

I see.

Andrew Knox:

Most insight into what is happening in the subconscious is going to come through the individual themselves, and it'll come over time. So that's part of the whole idea of psychotherapy, is to spend time getting more access to some of those things that are happening in the subconscious that may affect or that may cause some of the problems that you're having in a disorder, like psychogenic, non-epileptic seizures.

Robert J. Marks:

Okay. Yeah, okay, understood. So the subconscious would be more in the area of what a psychologist would deal with, is that right?

Andrew Knox:

Yeah.

Robert J. Marks:

Okay.

Andrew Knox:

Yep.

Robert J. Marks:

Wonderful. Another disorder is functional gait disorders. Now, let me tell you about an interview that I did with a neuroscientist who had kind of a potential cure for gait disorders. He would show people walking with incredible gait disorders. In other words, they could hardly walk. They needed to grab the walls or handles in order to maintain their balance, but then they did something; they put a little vibrator on their tongues, and this vibrator on the tongue, it was almost like a miracle that people could walk better. That seemed to be very strange. Have you ever heard of this?

Andrew Knox:

I have heard of things along those lines; not that, specifically.

Robert J. Marks:

Okay. Well, anyway, these guys, they tried to commercialize this. They went to the FDA, and there's a big difference between okaying a physical device that operates inside the body as opposed to external of the body, and since they put it in the mouth, they said it was internal to the body, so all of a sudden, the hoops that these guys had to jump were just too great.

Andrew Knox:

Yeah.

Robert J. Marks:

Yeah, so unfortunately, it was something that was tried to be reduced to practice, but the business plan didn't make it. I thought that some of these results were just astonishing as in terms of the recovery, at least from what I saw. You never know what's true, you never know what's false.

Andrew Knox:

Right, right.

Robert J. Marks:

It was on the web, so it must be true, I guess.

Andrew Knox:

Right. Certainly.

Robert J. Marks:

So tell me about functional gait disorders and how that relates to the way that the brain breaks.

Andrew Knox:

Yeah. Those are really just another example of a functional disorder, similar to a non-epileptic seizure or functional blindness that we talked about.

Robert J. Marks:

Sure.

Andrew Knox:

So really, any sort of functional disorders that are rooted in disordered thought processes can wind up manifesting as a whole variety of different symptoms. So there's some patients who, yeah, because of their functional disorder, wake up, and one day discover, "I can't walk normally anymore. I'm just not able to walk."

Robert J. Marks:

Right.

Andrew Knox:

There's some really interesting tricks that can help some of those patients. You mentioned the tongue vibrator thing.

Robert J. Marks:

Yes.

Andrew Knox:

Another trick that you see sometimes, if a patient is unable to walk normally forward, they may still be able to walk normally backward.

Robert J. Marks:

Really?

Andrew Knox:

Yeah, and so identifying things like that are helpful for the treatment of the disorder. Usually, those disorders, you treat sort of along two different lines. One part of the treatment is cognitive behavioral therapy, so working with a psychologist to identify what are the thought patterns that are causing this particular symptom in the first place? The other line that you approach them through is by usually doing therapies, and that needs to be targeted to what the particular problem is, but for someone who can't walk anymore, they're going to work with a physical therapist to sort of rebuild that ability to walk, and discovering something like, "Huh, I can't walk forward, but I can walk backward," gives you a good sort of jumping-off point for then relearning sort of how to walk forward again.

Robert J. Marks:

Interesting. Fascinating. We've been talking with Dr. Andrew Knox, and we've been talking about how the brain can break. Next time, we're going to be a little bit more happy, a little bit more positive, and figuring out what tools do we have to fix the brain? So we appreciate the time of Dr. Knox. He's going to return. Dr. Knox is a pediatric neurologist at the University of Wisconsin School of Medicine and Public Health. So until next time, be of good cheer.

Announcer:

This has been Mind Matters News, with your host, Robert J. Marks. Explore more at MindMatters.ai. That's MindMatters.ai. Mind Matters News is directed and edited by Austin Egbert. The opinions