

Transcript for The Infinite Mind: Habit

Dr. FRED GOODWIN, host:

I am Dr. Fred Goodwin, and this is THE INFINITE MIND.

This week, we look at habit. Why do we do the things we do over and over and over again?

Dr. KURT FISCHER (Harvard University Graduate School of Education):

Habits are closely tied to instincts. They tend to relate to particular needs that we have. Things like sex and food.

GOODWIN: Plus, what causes habits like nail-biting in children.

Dr. BRUCE MASEK (Massachusetts General Hospital): The one consistent driver of their habit has been boredom. They're bored in school, they're bored on the playground, they're bored watching TV.

GOODWIN: And does acquiring a habit change the brain?

Dr. ANN GRAYBIEL (Massachusetts Institute of Technology): When we learn a habit, you know, a lot goes on in the brain, a lot that changes the whole way the brain codes the action.

GOODWIN: All this and standup comic Sean Conroy and commentator John Hockenberry today as we look at habit on THE INFINITE MIND.

I'm Dr. Fred Goodwin. When I'm at my desk, I often find myself arranging and organizing things; pens in this cup, pencils in this one, bills in this stack, professional papers in that stack, small paper clips in one box, larger ones in another. You get the idea. I do this a lot, so I guess it must be a habit. But is it? It depends on the context. Why? Well, there are times that my real purpose--my intention is to get my desk cleaned up and reasonably organized. I must admit that this particular state of mind does not overtake me very often. Maybe twice a year or so.

So, when I'm doing that kind of deliberate, planned, organizing, arranging of my usually chaotic desk, the term 'habit' does not apply. But at other times--and I confess, this is more like a couple of times a week, rather than a year--I slip into an organizing-arranging ritual which is a habit, and a bad one at that. Why a bad habit? Because I've come to realize that in this instance, the real purpose of my organizing behavior is to postpone or avoid doing something that's unpleasant or difficult.

The problem is that this kind of ritual habit can work all too well as an avoidance mechanism. Why? Because the activity itself is worthwhile. The desk does need arranging; things do need to be filed properly. If I had something hanging over me and I was avoiding it by goofing off, the guilt would catch up with me fast. But I'm getting better at catching myself turning a good habit into a bad one. Now when I find myself organizing the desk, I stop and ask myself why. Often I hadn't consciously acknowledged that there were negative feelings about something I had to do. Just understanding that can help enormously. It frees me up and I'm usually able then to dig in and get it done.

So I advise my patients struggling with a bad habit to stop fighting it head on. Step back, observe yourself, reflect on why you're doing something and what you feel when you stop it for a while. You may find that this sheds light on some of the more interesting corners of the mind.

We begin today with the lighter side of habit. Stand-up comic, Sean Conroy performs regularly at clubs around the country. He currently appears with the longform improv group The Swarm and he recently taped a TV spot for NBC's "Late Friday." He also has a coffee habit.

Mr. SEAN CONROY:

I love--I--I love coffee. As a matter of fact, I--I love Starbucks coffee. I hate to admit it, but I do, I love their coffee. I hate actually going into the Starbucks and buying the coffee because I always feel like I'm interrupting something that's going on behind the counter.

You know, I walk in there and the person behind the counter's like, 'Shut up, just shut up and leave me alone, would you? Come on, just--I'm not in the mood for it. I'm going to--I'll quit today. I don't--shut up. I don't care. Shut up. May I help you?'

I'm like, 'Yes. Could I get a caramel machiatto, no foam, please or--or foam, whichever you think is better. Whichever makes you happy, miss.'

Yeah, I do. I--I--I drink a lot of coffee. In fact, I drink so much coffee that sometimes I feel like I might be addicted, and that's frightening. It really is. Because I'll tell you something, addiction is no picnic, unless of course you're addicted to picnics, and then it is a picnic, but not in a good way. And good luck trying to kick that habit. There's no support groups for people addicted to picnics. They tried to have one, but at the first meeting somebody brought sandwiches, somebody else brought German-style potato salad. All of a sudden there was a three-legged race going on over in the corner, which I won, thank you. But we had to end those meetings.

GOODWIN: Stand-up comic Sean Conroy lives in New York City and performs in clubs around the country.

We all make and break habits, but what's going on in the brain when we do? Dr. Ann Graybiel is professor of neuroanatomy in the Department of Brain and Cognitive Sciences at the Massachusetts Institute of Technology. She's regarded as a world leader in her field. In their current work, the Graybiel group at MIT is studying the electrical activity of neurons in the brain as animals learn habits. Dr. Graybiel, welcome to THE INFINITE MIND.

Dr. GRAYBIEL: Thank you very much.

GOODWIN: What's going on in the brain when--when an animal, or for that matter, a human learns a habit? And how do you go about studying that?

Dr. GRAYBIEL: What we've been doing is to take animals like rats and mice and teach them how to run mazes. And so we have a very simple maze constructed like a T, and they start in the long arm of the maze and they run down the maze. And as they're running, they hear one of two sounds. And that sound tells them whether they can get chocolate by turning right or chocolate by turning left.

So they run to the end of the maze, they get their reward and, it's funny, these animals love chocolate just the way we do. But anyway, as they're learning this--this little maze, and it takes them several weeks to really get it down pat, we're recording the whole time from brain cells--we're recording their electrical activity. And we do that with lots and lots of wires that are very tiny that we can put into the brain called electrodes.

And the absolutely dramatic thing we've found is that as these animals learn, the activity in the brain, especially in the parts of the brain that we are analyzing; the activity undergoes really very, very remarkable large-scale changes. So that's impressed us enormously with the plasticity of the brain, and the fact that when we learn a habit, you know, a lot goes on in the brain--a lot that changes the whole way the brain codes the action.

GOODWIN: Now you're recording electrical impulses, or nerve activity as reflected in electrical activity. Are you also able to measure changes in either the biochemistry or the structure of the brain as animals learn habits?

Dr. GRAYBIEL: We don't do that in the maze study, although we have some ideas about how to get at that by using genetically engineered mice and see whether they can learn the mazes. And they would have one or another molecules changed in their brains, and we could see whether the electrical activity differs in them.

For example, we work on the basal ganglia, which is thought to have a lot to do with habit learning. And so that kind of approach lets us at least begin to look at whether--when we do build a habit, whether certain key molecules are changed. And that's, of course, incredibly interesting if you think about the range that habits take in--in our lives, all the way from very simple things we do, like, you know, chewing gum or clearing your throat or fiddling with your hair when you're thinking or reading, something like that--all the way from that to something like the habits that involve taking drugs. So if it were possible to find molecules that were tracking this learning mechanism and kind of changing with it, then we might be way ahead of the game in trying to come up with therapies.

So we do things like give animals drugs that, in people, are habit forming; for example, amphetamine or cocaine. And what we find, and many other researchers in this field are working on this and have found this too--what we find is that if you give even one dose of one of those drugs, just one dose to a rat or a mouse, then the genes in the brain of that mouse or rat are changed. So what happens is these genes turn on, and when they do turn on, they start turning out the proteins that they're designed to make.

GOODWIN: Mm-hmm.

Dr. GRAYBIEL: And if an animal is given, not just one dose of cocaine, but he's given repeated doses the way an addict might take cocaine, then these changes become very, very pronounced, and the whole pattern of turning on of these genes changes, so some brain regions that used to turn on, the genes don't; some regions that used not to, do. So the whole kind of biochemical anatomy and mo-

lecular anatomy of the brain begins to change. And these changes can last for a long, long time.

GOODWIN: Now do you think of addiction as a separate issue here, or is this more a kind of extreme, or more clear-cut form of habit learning?

Dr. GRAYBIEL: I think a lot of people who are, you know, kind of absolute experts in this field feel that maybe there's a switch. Allen Lechner (unintelligible) calls it a switch that--something that was a kind of simple habit suddenly becomes so urgent, so compelling that it isn't simple and it isn't innocent anymore, it becomes some kind of compulsive behavior, and that's when the addict becomes an addict.

GOODWIN: Because the habit, of course, involves a substance which then has all these chemical consequences of its own.

Dr. GRAYBIEL: Exactly. So, one way to think about it--you know, once we learn a habit, some behavior, then that h--habit can be triggered--like it's almost the definition of a habit--that you learn a little chunk of behavior and then just a certain stimulus will turn it on and you do the whole thing.

GOODWIN: Then it's on automatic pilot. Once it's turned on, it's on automatic pilot.

Dr. GRAYBIEL: That's right. So then, you go on auto pilot and you can do this whole, in some cases, very complicated behavior, with--without--without really thinking about it.

GOODWIN: Like driving a car.

Dr. GRAYBIEL: Exactly. So, when we drive a car and we see the light turn red, almost before we think, and probably before we think, our leg goes out or our foot gets on the brake, we step on the brake, we slow the car. So, that's--that's a good example of auto pilot. But it probably is the case that a lot of this process was built in evolutionarily as a very good thing.

It's a wonderful thing not to have to think about every single thing we do. It frees up the rest of our brain to--to think, for example, and to--to be alert to new stimulin. So that's really great. The trouble is, if one of these triggers, triggers some behavior like taking a drug, that produces a huge reward to the cells in the brain, then it's thought that that kind of rush of what turns out to be a chemical reward signal in the brain--that rush may be the thing that flips the switch so that then one just simply can't resist going after it, getting it again.

GOODWIN: And then of course, it no longer serves the survival of the animal, of the species.

Dr. GRAYBIEL: Right. So, one way to think about something like drug addiction is that, it's the dark side of what otherwise is a--is a wonderful process.

GOODWIN: Is there a--a reward circuit involved in the acquisition of a regular habit?

Dr. GRAYBIEL: Some people think yes. I myself really wonder about that, and we're actually trying to study that very issue in another experiment because it seems to me we can come a--across or develop habits in part just by accident. We have so many habits--you know, some of them come about when kids or adults copy other people. A professor you like nods his head a lot, then pretty soon you start nodding your head a lot, or doing things like that. And, of course, we can teach our own selves habits and that actually is trying to get, you know, the nervous system to do be our ally.

For example, a lot of people try to teach themselves the habit of getting up and exercising in the morning, or exercising at night. And--and they learn that it takes a long time to get this down to the automatic level. And, at first, they have to really think about it, really want to do it, really push themselves to do it. But after a while, the brain and probably the physiology of the whole body change so that, then it becomes a routine. You just get up and do it.

GOODWIN: In fact, they wouldn't be comfortable at that point if they didn't.

Dr. GRAYBIEL: There's so many things like that, so many instances where some routine, let alone ritual, if it is changed becomes--that event becomes very alerting and sometimes very, very frustrating or--or just confusing to people.

Some people, you know, read before going to sleep. And I've had many people tell me that if they don't do that, for example, they just don't fall asleep. Some have that s--beco--they've built a habit. They've built new tracks in their own brains.

GOODWIN: What are you finding is actually happening at the cellular level, either regionally or within the cells when these habits are being acquired?

Dr. GRAYBIEL: Sure--let's go back to the T maze 'cause that actually is--is kind of interesting. So when animals don't yet know the maze, they run down the maze and there's a lot of electrical activity--neural activity when they're making the turn--they have to decide to turn and then they turn and whip down and get the chocolate. But what we've found is that as the animals learn, that activity decreases radically. I mean, it goes way, way down, and at the same time, there's more and more activity right at the start of running the maze, and then finally when they reach the goal, which got us actually quite excited because it reinforced the idea that maybe one of the things that happens when we develop a habit, and it's--it would be a very useful thing to happen, is that we sort of chunk the whole behavior.

First we have to learn every little detail of some thing, like opening a door. But once we've learned it, got it down, got it to the level of a habit, maybe we'd just stick all of that into a neural representation that's just one thing, one package, one chunk, then the brain can very readily elicit it when the proper trigger stimulus comes. And that, as you well know, is an old idea from William James and others that one of the glorious thing about a habit, if you can get yourself to learn one, is that just a little trigger just makes the whole behavior come out.

So if we get the trick--if we can study the brain enough and figure out how this thing works, we--we might be able to mimic that set of triggers to make our own brains malleable and, you know, change them to--to get some good habits.

GOODWIN: In--in relation to people, like if you--if you work hard to unlearn a bad habit--let's say a bad habit that was triggered by a particular circumstance, not--staying away from addiction for a minute--if you worked hard to unlearn it, if indeed it turns out that the animal in the second time can learn it faster that maybe you have to be careful and--and stay vigilant to not be in the situation that may trigger the habit again?

Dr. GRAYBIEL: Absolutely. So I mean, I really--I'm really getting impressed with the power of these triggers to set off the whole behavior. Let's put it this way: If we're going to make a habit, it may be good to make up, even artificial triggers for ourselves. For example--I like to use the--the example of trying to get--get oneself to jog in the morning or something like--like that. And a lot of people find that it--it helps them if they put out all the jogging gear the night before, so when they get out of bed and stumble out of bed and they go for their--they--they find all this stuff and they--they're triggered. They say, oh yeah, you know, I can do this, I can go out and I can run a little farther than yesterday. So even such very artificial things as that can help.

And if we have a habit and we want to break it, then I--I agree with you, I mean, it's terribly important to try to avoid the trigger or--or adapt to the trigger.

GOODWIN: Do the environmental circumstances--let's stick with humans for a moment, but do the environmental circumstances under which humans first learn something or are first exposed to something have something to do with how deeply implanted it gets? I'm thinking of, if you learn something under stress, for example, is that learning that much more embedded?

Dr. GRAYBIEL: Right. So there's a fair amount of evidence that that is true. We--we talk about habits--habit learning as being so special because it's kind of slowly acquires a habit and you need to do repetition of--of it, as you've said, just over and over, but under extreme circumstances, it looks like the learning can really be accelerated to the point where it's very, very fast indeed.

GOODWIN: Yeah. I remember in--in--in my internship I learned certain emergency procedures under tremendous pressure. You had about two minutes to learn it...

Dr. GRAYBIEL: Yep. Yep.

GOODWIN: ...and--and then 30 years later, I'm on an airplane and somebody gets sick and they call for the doctor, and--and all that stuff comes back as if I had learned it the day before.

Dr. GRAYBIEL: It's absolutely amazing, isn't it? So--I mean, that's a very good example.

GOODWIN: Ann, why don't you summarize the importance of this work briefly for our listeners.

Dr. GRAYBIEL: Well, I think habits make up a phenomenally large part of our lives; doing things kind of automatically or semi-automatically is the way we do most things, in fact. So, understanding that process is important for a large part of our behavior, but also in

thinking of people who have problems because of their habits, I honestly believe that understanding the neural mechanisms, underlying how habits are formed and how habits can be broken--understanding those mechanisms will let us help people. And so that is the ultimate goal of what we're doing.

GOODWIN: Dr. Ann Graybiel is professor of neuroanatomy in the Department of Brain and Cognitive Sciences at MIT. Thank you for joining us on THE INFINITE MIND, Dr. Graybiel.

Dr. GRAYBIEL: Thank you.

I'm Dr. Fred Goodwin. Each week we explore the new frontiers of THE INFINITE MIND right here on this public radio station. Thank you for joining me on this journey.

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