Promo
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Music

Interviewer – Sarah Crespi
Finally today, David Grimm, editor for our daily news site, is here to talk about some recent stories. I'm Sarah Crespi. First up we have a story on tracking our moods. Many people use check-in apps on their smart phones to let their friends and followers know that they've frequented a hot nightspot, or a popular restaurant. But a new study has people checking in with their emotions. So Dave, why might we need to check in with ourselves a few times a day?

Interviewee – David Grimm
Well Sarah, this study is all about depression. One of the problems with depression is, is that it's hard to combat unless you get an advance sense it's going to happen. So researchers are trying to find a way to anticipate when people are going to not just be depressed, but really have these major depressive episodes that can lead to long-term depression.

Interviewer – Sarah Crespi
So why might collecting the emotions from someone multiple times a day help with that?

Interviewee – David Grimm
Well one idea is that there may be a tipping point for depression. In other words there may be a lot of little things that happen during the day that push us over the edge to depression. But researchers weren't really sure what that was, and hence the idea of checking in with people many times a day.

Interviewer – Sarah Crespi
So how many people did they have checking in on themselves?

Interviewee – David Grimm
Well they recruited 600 people, some were healthy, some had a diagnosis of depression. And they asked them to track their emotions for about five or six days. And what they did was 10 times a day, at random intervals, these people were wearing a watch that would beep, and whenever it would beep the subjects had to write down what their mood was—was it cheerful, content, sad, anxious, you get the idea. Six to eight weeks later, the participants filled out a more detailed questionnaire that rated their levels of clinical depression.

Interviewer – Sarah Crespi
And so was there a correlation between those measurements on the day and then months later?

Interviewee – David Grimm
There was. So what the researchers found was that after the end of the follow-up period, about 13% of the subjects had experienced a shift toward being more depressed, which is about what you'd see in the general population. But what was more interesting was that this shift from a healthy state to a depressed state resembled tipping points that had been seen with other phenomena such as changes to Earth's climate, or even social trends— things that go viral for example.

Interviewer – Sarah Crespi
So they would actually be able to see the accumulation of these hits, like these states of anxiety, these states of sadness, building up over time. And then could actually say we can make a prediction off that data?

Interviewee – David Grimm
Exactly. And the example they give is if a healthy person has an unpleasant call with their employer, they'll be unhappy about it, and they'll maybe dwell on it for 10 or 20 minutes, then they'll get over it. But people that experience these longer term episodes of depression, would dwell on these very negative experiences, and these were things that the researchers picked up on during the study was that these negative moods persisted when the people kept on checking in on themselves several times a day, they had a much harder time shaking these negative moods. And that would ultimately push them over this tipping point into a much more major depressive episode.

Interviewer – Sarah Crespi
Is there a use for this outside of the laboratory? Is this something people might actually turn into an app?

Interviewee – David Grimm
Well exactly, and you might actually see that, because again the problem with treating depression is really anticipating it. And so if this research leads to a better way to anticipate these depressive episodes, then people might be able to seek therapy, or take drugs before the depression actually sets in, which would make it easier to treat.

Interviewer – Sarah Crespi
Next up we have a story on how our diet influences our gut microbes. We talk a lot about our microbial friends on this podcast—what they help us with, and how many there are all over our skin, inside of our bodies. In fact they almost seem, at times, to be in charge. So this latest study actually turns the tables. Dave, why did these researchers wrest control from these tiny tyrants?

Interviewee – David Grimm

Well right. So this study actually shows that there may be a way for us to control our microbes—our gut microbes—rather than vice versa. As you mentioned Sarah, gut microbes have been linked to everything from autism, to obesity. So they clearly play a very important role in our body. Although most of those links have been done in mice, and they haven't been tested as well in humans. One of the reasons is because researchers have long thought that it's very hard for us to change the composition of our gut microbes. There is not just one type of bacteria in our guts; there's tons of different types of bacteria in our guts. And it was thought that it would take weeks or even months to change the composition of these bacteria, and that would be hard to do a study with. But this new study suggests that it's actually fairly easy for us to changes these populations of microbes in our guts, and exactly what these microbes are doing as well.

Interviewer – Sarah Crespi
Basically they had to get people to change their diets, right?

Interviewee – David Grimm
They did. They did. They did. And they actually took 10 people and they put half of them on really hardcore carnivore diet. They had to eat basically only pork, cheese, ribs, brisket, salami, pork rinds.

Interviewer – Sarah Crespi
Did they have to pay for that? That's a lot of meat.

Interviewee – David Grimm
And the vegetarians were, comprised the other half of the group. And they were put on a very veggie high-fiber diet—beans, rice, things like that. And the scientists were amazed to find that just in the course of just four days the microbial populations in the guts of these two groups were very different.

Interviewer – Sarah Crespi
Well what kind of difference did they notice? Did they see an influx of a new type of bacteria in their guts?

Interviewee – David Grimm
Well not really new types of bacteria, but they saw a rise in certain species of bacteria in the meat-eaters versus the vegetarians. And it wasn't just the relative populations of these species; it was what these bacteria were doing. For example, in the meat-eaters they saw that there were bacteria that were known to tolerate high levels of bile, which the body secretes to digest meat. There were much more of these types of bacteria. And not only that, but the gene activity in some of these bacteria reflected how the bacteria were metabolizing food. So for example in those eating meat, genes involved in the breaking down of proteins increased their activity. And similarly in the vegetarians, genes that were important for digesting carbohydrates became much more active.

Interviewer – Sarah Crespi

So is there a recommendation that can be made from these findings? Should people eat more or less of any one of these foods?

Interviewee – David Grimm
Well it's hard to say. I mean because a lot of these bacteria have been linked to disease you might think well all I have to do is start eating a lot of meat or a lot of veggies and all of a sudden counteract things like autism. And the researchers say we're not anywhere close to that yet. But what this does show us is that we do have a lot more control over this microbial population than we thought. The question is, is exerting that control, will that lead to good consequences or bad consequences? Some of these bacteria have actually linked to inflammatory bowel disease, so you certainly wouldn't want to radically change your diet based on this one study because you could actually cause more problems.

Interviewer – Sarah Crespi
Finally we have a story on how earthquakes spread. There're still many mysteries about the behavior of earthquakes. But here's a new one: how are earthquakes like forest fires, Dave?

Interviewee – David Grimm
Well the answer isn't simple, but there is an answer. And it turns out earthquakes actually do share some similarity with forest fires. This all gets back to the fact that earthquakes show a surprising statistical regularity. Larger ones occur less frequently than smaller ones. And for more than half a century scientists have known that earthquakes of magnitude two occur roughly one-tenth as often as those of magnitude one; those of magnitude three occur about one-tenth the rate as those of magnitude two; and so on. So there is this interesting mathematical relationship between the frequency and the size of earthquakes. So it seems like a fairly straightforward correlation, but the one problem with this model of earthquakes is that it leaves out aftershocks.   It doesn't really account for how often aftershocks happen, and it doesn't really account, for example, for how often aftershocks happen.

Interviewer – Sarah Crespi
Okay. So let's bring in the forest fires. How do those fit into maybe tweaking this model of earthquake frequency?

Interviewee – David Grimm
Well there was a researcher in Argentina who thinks that there is some similarity between the way forest fires spread, and the way aftershocks quote, unquote, spread after earthquakes. And what he did was he tried to see if he could apply a similar model that had been applied to earthquakes to forest fires. And he basically created this model where trees sprout at random on a square grid – it's like a vast checkerboard. And once the forest gets dense enough, lightening sets a random tree on fire and the fire spreads instantaneously among the trees that occupy the adjacent squares. This conflagration continues until there are no more neighbors to jump to. And the process starts all over again. So applying this to earthquakes, all of a sudden the forest is the plane of a fault

cutting though Earth's crust. And sprouting trees correspond to the buildup of stress along the fault. Burning areas correspond to the part of the fault that moves during a quake. Now when you apply this model, it didn't match exactly what was seen with earthquakes, so he tweaked things a little bit. He actually introduced two different types of trees. One, which he called A trees that burn instantly, and B trees that burned more slowly and only light their neighbors up after a small delay. And the fire pauses when it has to hit one of these B trees as a consequence. The result is that the forest fire breaks into a cluster of smaller fires slightly separated in time that reduces the frequency of really big fires. When he did this, the model of the spread of forest fires matched very closely the distribution of earthquake sizes.

Interviewer – Sarah Crespi
So this is something they were able to compare to real world data?

Interviewee – David Grimm
Well the researchers showed that if you looked at California quake data over the past 20 years, he did see a similar correlation to what he was seeing in his model—in his forest fire model. But earthquake researchers, though they think this is interesting, say there's been a lot of attempts to correlate the statistics in earthquakes to other things. This is just the latest, and it's unclear what impact this will have on both understanding the spread of earthquakes, and even possibly predicting them.

Interviewer – Sarah Crespi
Okay. So what else is on the site this week, Dave?

Interviewee – David Grimm
Well Sarah, for *Science*NOW we've got a story about ways to prevent birds from crashing into airplanes—called bird strike. Also a story about why the animal family tree trunk may be made of jelly. For *Science*Insider, our policy blog, we've got an item about how a new US budget deal could spare some very tough cuts for scientific research funding. Also a follow up to our story from last week about efforts to grant chimpanzees legal personhood in US courts; those efforts have failed, and we talk a little bit about what happens next. Finally for *Science*Live, our weekly chat on the hottest topics in science, this week's *Science*Live is about efforts to understand the origins of human disease by digging up the bones in a thousand-year graveyard. And we'll be taking a brief hiatus for *Science*Live for the rest of December, returning in early January. Be sure to check out all of these stories on the site.

Interviewer – Sarah Crespi
Thanks, Dave.

Interviewee – David Grimm
Thanks, Sarah.

Interviewer – Sarah Crespi
David Grimm is the editor for our online daily news site. I'm Sarah Crespi.

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