Science Magazine Podcast
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Promo
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Music

Interviewer – Kerry Klein
Finally today, I'm Kerry Klein and I'm speaking with David Grimm, online news editor for *Science*, about some of the recent stories from our online daily news site. So Dave, in our first story: how not to treat a disease.

Interviewee – David Grimm
Right Kerry, well this study is a little bit counterintuitive because it suggests that taking two drugs at once may actually be worse for treating the disease than better. This approach, especially taking two antibiotics at once, is called synergistic therapy. And what researchers thought the advantage was that, you know, different drugs attack different parts of a invading microorganism, like a bacterium. These drug combinations have been used in everything from treating HIV to MRSA, which is a very highly resistant pathogen that's often acquired in hospitals. But this new study suggests that maybe two drugs at once isn't such a good idea.

Interviewer – Kerry Klein
Right, because as soon as we start talking about antibiotics we have to start thinking about bacterial resistance.

Interviewee – David Grimm
Exactly, and that seems to be what happens here. What happens when bacteria evolve resistance is that they find some way to overcome, or members of their population find a way to overcome the drug, and when the drug kills all the other bacteria off, you've got these few bacteria that are left that are resistant, and they are able to multiply. And all of a sudden your drug doesn't work anymore. Well it turns out that seems to be happening even more dramatically when you use two antibiotics at once, or at least that's what these researchers have shown. What they did was they took *E. coli*, which can be a pretty nasty pathogen, and they treated it with two common antibiotics: doxycycline and erythromycin. They basically put these *E. coli* in a test tube, they added both drugs, and after a day, the drugs seemed to almost completely wipe out the *E. coli*, which is sort of expected. But what was shocking was the following day the *E coli* experienced this population explosion. All of a sudden their numbers were up to 500 % higher than they had been before. So they just really started multiplying, really out of control. And at first the researchers thought they had made some sort of mistake. They repeated the experiment, and they saw the same thing happen again.

Interviewer – Kerry Klein
And of course this new population is then much more likely to be resistant to the antibiotics that were used.

Interviewee – David Grimm
It is, and what the researchers found was that, just like what happens with one drug, with a couple drugs it still left a few bacteria left in this population that were really good at fighting these antibiotics. In fact the bacteria seemed to have multiple genes for pumping out these antibiotics. So these antibiotics, you know, get into the bacterial cell and the bacterium usually dies, but there are some bacteria that were very good at just basically pumping this antibiotic right back out again. And those were the ones that survived. And even in the presence of two antibiotics they just started to thrive after about a day because the antibiotics had wiped out all their competition. So all of a sudden they had access to all these resources, all this food that they didn't have access to before. And that they're basically growing out of control because the drugs aren't having any effect on them.

Interviewer – Kerry Klein
And so the two examples of really nasty diseases that you mentioned earlier, both HIV and MRSA, in which this synergistic method is used quite a bit, I mean they're really difficult-to-treat diseases. If we start not using this method, are there any alternative methods for treating them?

Interviewee – David Grimm
Well, one thing the researchers suggest is instead of hitting bacteria with two drugs at the same time is to alternate the drugs. So use one drug one day, wipe out most of the population, and maybe you'll have some leftovers that are resistant to that drug, but then you hit it with a different drug the next day, and maybe that will wipe out the remainder. And the idea is sort of mix things up so much that bacteria really don't have a chance to become resistant. That's certainly one possible way to go. I mean all this stuff is in test tubes right now, so it sort of remains to be seen whether this is actually happening in the human body. But it is a really powerful warning sign for a lot of these multi-drug treatments.

Interviewer – Kerry Klein
Indeed, well on to some slightly better news now, in our next story we're talking about a new spin on therapy for cancer.

Interviewee – David Grimm
That's right Kerry. This study has to do with actually using bacteria to fight disease. And the disease we're talking about here is cancer, and specifically pancreatic cancer, which is a really nasty cancer. It's really resistant to treatment. Only about 4% of patients diagnosed with pancreatic cancer survive for five years. And that's largely because the disease metastasizes, and cancer gets everywhere in the body, and you just can't treat it fast enough before it kills the patient.

Interviewer – Kerry Klein

All right, so what is this new study on pancreatic cancer involve?

Interviewee – David Grimm
It involves a cancer-treating microorganism known as *Listeria monocytogenes*, if I'm saying that correctly. This is a bacterium that's actually not a very friendly bacterium, and it can cause meningitis. But researchers have also shown that it seems to have an ability to fight cancer as well. In previous studies, researchers have used weakened forms of this bug and included bits of tumor DNA in it. And what that did was, when the body saw this bug it didn't just fight off the bug, but it started to recognize this tumor DNA. And it seemed to have an enhanced ability to prime the immune system to fight cancer. But the researchers actually also noticed that these bacteria weren't just priming the immune system to fight cancer, they actually seemed to fight the cancer itself. In another study researchers noticed that these *Listeria* microbes were actually killing cancer cells directly, and really having no impact on healthy tissues. And that's what really sparked the new study. Researchers said, you know, if these guys are going after cancer anyways, maybe we can make them even more effective cancer fighters than they were before.

Interviewer – Kerry Klein
And how did they do that?

Interviewee – David Grimm
What they did was they actually made them radioactive. They modified these *Listeria* so that they contained a radioactive compound called rhenium-188. And over the course of 16 days they injected mice that were already infected with a highly metastatic form of pancreatic cancer with these radioactive bacteria. And they saw pretty dramatic results. The radioactive bacteria reduced the number of metastatic cells in the mice by 90% compared to controls. Even the non-radioactive bacteria decreased the metastatic cells by 50%. So it was pretty dramatic results. And, like the researchers had seen before, there was very little damage to healthy tissues.

Interviewer – Kerry Klein
So how is this targeted method different than other forms of radiation?

Interviewee – David Grimm
Well, ordinary radiation isn't terribly specific. I mean, doctors can try to sort of hone in on a particular part of the body, but they have a hard time really getting to the specific cells, so you tend to have a lot of collateral damage. And what's cool about this therapy is it's sort of like sending a heat-seeking missile into the body, because it's really only going after the cancerous cells. That being said, some of the experts consulted for this story still have concerns about putting this radiation into the body, because it has to go somewhere. And there's concerns that potentially it could build up in the kidney, for example, and that could cause problems down the line. And again, this is just a rodent study, so although it's promising, the researchers still don't know how well it would work in people and what the potential side effects would be.

Interviewer – Kerry Klein

Right. And now for something completely different: why babies like to be rocked.

Interviewee – David Grimm
Well Kerry, what's cool about this study is it shows that there's a lot of commonality between species. In fact, a mother carrying a child in her arms turns out to not be very different than a mother cat grabbing her kitten by the scruff of the neck. The impact on the small animal in both cases is actually surprisingly similar.

Interviewer – Kerry Klein
So how did a study like this get started in the first place?

Interviewee – David Grimm
Well, this study actually has sort of a fun origin. The lead researcher, who's a neuroscientist in Japan, actually had a newborn baby boy, and she was noticing that, you know, when she carried this baby around it had a rapidly calming effect on him. Now, that's not really surprising to any parents out there, but what she thought was really cool was how quickly this effect happened. You know, it happens sometimes in as little as two to three seconds. And she wondered what exactly was happening sort of to the physiology of the baby while she was doing this, and whether this was something that carried over to other animals as well.

Interviewer – Kerry Klein
So how did she set up a study to look at that?

Interviewee – David Grimm
Well, she set up a study with 12 infants from one to six months old. And each was left alone in a crib or held by its mother sitting in a chair or carried around the room as the mother walked around. And sometimes these conditions were combined, sometimes they were done separately. What the researchers found was that carried babies cried and squirmed the least, which again is not probably terribly surprising, but they also had the lowest pulse rates, which suggests this is a very calming behavior for them. Those left in the crib were the fussiest, and holding the baby while sitting sort of produced in between results. The researchers then sort of moved on to mice because they wanted to see, well, you know, is this something that happens in other species as well. Mother mice carry their pups around sort of like mother cats do by grabbing their infants by the nape of their necks in their mouths. And what they found was that, just like human babies, when they wired these pups, as they're called, with mini-electrodes to check heart rate changes, and they also recorded the ultrasonic vocalizations of these animals, which previous researchers had suggested is sort of akin to baby human cries. They found that the heart rates of these animals plunged, the vocalizations stopped. The animals became passive, just sort of like human babies do.

Interviewer – Kerry Klein
So there were two elements of what actually helped calm these baby animals. One element was carrying it, and the other one was motion.

Interviewee – David Grimm
Exactly, exactly.

Interviewer – Kerry Klein
So why do the scientists think that this in particular would have been hard wired so much in humans and in mice?

Interviewee – David Grimm
Well, what the researchers suspect is that this might have evolved as a way for mothers to get their newborns out of danger. Obviously if you've got a baby that's thrashing around when you're carrying it and trying to walk away or maybe even run away with it, it's going to be much harder for you to be able to do that. Whereas if your baby becomes very quiet and passive especially as you're in motion, that could potentially be an evolutionary advantage that helps both the mother, but also the newborn, effectively escape to safety.

Interviewer – Kerry Klein
Wow, how interesting. So what else have we had on the site this week?

Interviewee – David Grimm
Well Kerry, for *Science*NOW we've got a story about the populating of Australia. Who were the first Australians, and how many were there? Also a story about a baby turtle robot, and how that is shedding light on how baby turtles navigate very tricky beach sand. For *Science*Insider, our policy blog, we've got a story about the patenting of human genes and the controversy around that. And finally for *Science*Live, our weekly chat on the hottest topics in science, this week's chat is about the "Anthropocene," this controversial idea that we have entered a new geological age – what's known as the Age of Man – so be sure to tune in for a video chat on that. And next week's chat is going to be about the Chinese H7N9 virus that's been making the news lately. So be sure to check out all these stories on the site.

Interviewer – Kerry Klein
Great, thanks Dave.

Interviewee – David Grimm
Thanks, Kerry.

Interviewer – Kerry Klein
David Grimm is the online news editor for *Science*. You can check out all of our news at news.sciencemag.org including daily stories from *Science*NOW, science policy from *Science*Insider, and *Science*Live, live chats on the hottest science topics every Thursday at 3 p.m. U.S. Eastern time.