Transcript: Discover Healthier: Episode 5 Part 2

Speaker	Start time	Dialogue	End time
Azania	0:00	Welcome to Discover Healthier everything you need to know about health brought to you by discovery health. I'm Azania Mosaka. You can join the conversation as we explore some of the most pressing matters in the healthcare environment today. A wide variety of topics and specialist guests will empower you to care for your health, now and in the future. Welcome to part two of our episode on antimicrobial resistance. Experts warn that if we don't stop and rethink how we use antibiotics, the death toll from superbugs could increase. Probably the best-known voice on antimicrobial resistance in the world is Lord Jim O'Neill. He's an economist that was tasked with investigating just how big the challenge is when it comes to antimicrobial resistance. I spoke to him about his work.	0:58
Azania	0:58	Welcome to Discover Healthier and thank you for joining us.	1:00
Jim	1:00	My pleasure.	1:01
Azania	1:01	Please explain what antimicrobial resistance is.	1:05
Jim	1:05	So, antimicrobial resistance is about the very clever ability of microbes to evolve. And there's of course millions of them, including inside all of our bodies, but also in animals and other forms of life. And they become more and more adaptable as they go through their own lives, and crucially become resistant to the treatments that we've used for the past generation, going to the 50s really, based around penicillin and antibiotics in particular, to treat infection. And the more we overuse antimicrobials, particularly antibiotics, and the longer we struggle to find new ones, the greater the anti-microbial resistance problem comes, resulting some stage in the future would be a catastrophic possibility that we will have no antimicrobials for humans or animals to treat infection.	2:07
Azania	2:07	Can you give us an overview on the study you did on antimicrobial resistance?	2:12

Jim	2:12	So, in 2014, the then British Prime Minister, David Cameron, kindly and actually out of the blue, because I have no past experience in it, invited me to lead an independent review, although it was reporting to him, about the scale of the problem on a global basis, and to come up with some solutions about how to minimize and ultimately get rid of the threat of anti-microbial resistance.	2:39
Azania	2:39	Help us understand why exactly this is something that the world needs to pay attention to.	2:45
Jim	2:45	So, during the AMR review, linked to I guess why I was asked, I tried to develop that economic and financial overview of the world over the next 35 years or so, up to 2050, deliberately choosing that period because it was comparable to a world where the so called BRICS countries, China, Brazil, India, Russia and South Africa would become so big that they would become bigger than the major Western economies in the world. But I looked at that, again, with the growth of antimicrobial resistance. And we showed and these numbers have become used so frequently all over the world that if nothing is done, actually, the previous world of the BRICS becoming important wouldn't happen. And very worryingly, we could have up to 10 million, I emphasize that's 10 million people are dying from anti-microbial resistance. And linked to that, and also because of all the fears of travel and lost productivity, the accumulated loss of global economic activity, from the time of their view to 2050, could be a staggering $100 trillion potentially a colossal cost of Human life and economic life.	4:02
Azania	4:02	That's frightening. You refer to the 10 commandments of antimicrobial resistance, can you elaborate on these commandments.	4:09
Jim	4:09	So, one of the reasons why conducting this review is so interesting but also difficult. It is a multi-faceted problem. And you can't just deal with one part of it. So, we realized once we established what the consequences would be of no action, that you had to deal with solutions for 10 different broad areas, and I sometimes, during the process, labelled it as the 10 commandments, as a part of trying to get the tower of the messaging over to various audiences about what was needed. And this ranges from simple public awareness growing to various other things which I would describe as	5:46

		demand reducing interventions, including improved sanitation, much better surveillance, the growth of the use of diagnostics, significant reduction of antimicrobials in agriculture. And then in addition, various what I'd call supply boosting interventions, which would be more researchers being employed to discover new drugs with that new early stage money and then new vaccines. And then, as is highly focused on, some way of trying to improve the economic model and incentives for pharmaceutical companies to produce new antibiotics. And on top of all of them, we need a whole new degree of international cooperation involving the so called developed and developing countries. And all of those are the so called 10 commandments.	
Azania	5:46	So, there is clearly much that governments need to do to stop this global threat. And what can ordinary people do if we had to ask them to start doing it today? What would that be?	5:59
Jim	5:59	So, one of the most simple things ordinary human beings can do, and all your audience I hope will follow this after listening to this discussionm is to make sure they wash their hands as frequently as possible. And certainly, when they've been using their hands for anything that would involve the risk of infection. There's a famous story from the British Chief Medical Officer Sammy Davis, that if you wash your hands in warm, soapy water while singing the Happy Birthday song, that in itself is a very powerful tool, every single individual all over the world can do to minimize the risk of infection. And I think that would be the single most important. A second thing I might suggest, due to the fact that not many people are aware of it, whenever an individual hears, perhaps in particular parents or grown up saying they don't feel very well and they want to go and see a doctor to get an antibiotic, they should say to them, are you sure is not a virus because I antibiotics don't work unless it's an anti-viral requirement. And far, far too many people think that antibiotics are miracle sweets, and they're nor and a lot of the problem is the overuse of them. So, I would suggest those two things, amongst others.	7:17

Azania	7:17	So, has there been any progress since the findings of your review have been made public?	7:23
Jim	7:23	So, we're just over three years since we published our final recommendations. And I have to say, I can often have a different view depending on my mood and the week I'm asked this question, but by and large, I would say there's been some progress in most of the 10 areas. We did make 29 specific recommendations across the 10 areas. And there have been some progress, but unfortunately, not across the board and in some areas, there's been a lot of talk, but very little progress and most worryingly, I would say in the area of new vaccines, new models to encourage pharmaceutical companies to start becoming more serious about this. And in the role of diagnostics, those three areas in particular, there has been, I would say close to no progress, even though in some cases considerable talk, and that is very troubling because the scale of the problem is as big as the one way described and, if anything, three years later, the acuteness of the problem is becoming bigger.	8:29
Azania	8:29	So, that begs the question of whether your recommendations and the recommendations you made in your review are being taken seriously enough.	8:36
Jim	8:36	So, I have contradictory opinions about that, really, I'm the one hand, I've become known as quite a figure around the world in talking about this problem. And let me emphasize in that regard, six years ago, you know, all the people knew me for was to do with economics and the rise of the BRICs and things to do with financial markets. And I'm now known in many parts of the world… I'm a voice about this problem, so that makes me often think that there is some gnosis being made of our recommendations in addition linked to that, and something I'm very pleased about. Of course, there was a high level of UN agreements, six months later now close to very, very close to three years ago, in which my team played a role along with me. And it features on the annual G20 Leaders statements and did do again, the very latest one in Osaka. However, when I… when I look at the lack of progress in some of the big areas where it's needed, I sometimes think people like to talk about	10:00

		the problem, but they don't want to actually do something. So, I do get very frustrated particularly because now being so aware of the problem, being connected to so many different specialists in the medical and health part of it, I think the scalar the problems getting bigger	
Azania	10:00	So, it's really important for all of us then to stop talking and start doing. Do you have any practical tips that you can share with our listeners on how they can make a difference or take care against antimicrobial resistance/	10:14
Jim	10:14	So, the absolute single biggest thing I often like to say to people in this regard, or maybe two things… one is don't treat antibiotics as though they are sweets or candy. In my generation, these things have been regarded as a miracle cure, but they only are miraculous when you have a proper infection. And so many people and in some cases, many doctors too, think they are just basically something to use to shut people up and get them out of a doctor's surgery or so they can get on with something else. And we have to stop thinking of them as some kind of candy or sweets. And in that regard, this is a big thing I want to encourage people to do that. But in line with that and, amongst the areas where I'm so disappointed about lack of progress is, I would highlight is perhaps diagnostics. I'm occasionally asked, of the 10 areas, which is the single most important and my general answer is well there isn't, they're all equally important. But if then I'm asked well, if you only have one area where you could do something, I would say it would be state of the art affordable diagnostics. We live in an era where mobile telephones and social media completely dominates our lives with technology and yet in this area, there is no relevance and if we could introduce affordable state of the art diagnostics, where medical practitioners, both in hospitals and in surgeries, and in doctors' offices, if they were formally controlled by not being allowed to prescribe or given antibiotic without it going through a diagnostic test to prove it, that would have a huge influence on solving the problem going forward.	12:07
Azania	12:07	Right, right. So, some countries, say like South Africa, where we have many people living in rural areas who might not have access to this kind of information. How do you think that information can get to them, to people in such communities who trust their doctors, you know, everything that they	12:24

		say?	
Jim	12:24	So, I'm glad you asked me specifically about South Africa, because part of the way you get to 10 million deaths is because of the inter linkage with things like malaria and particular TB, and one third, as the 10 million deaths by 2050 if we don't solve this problem, are because of the risk of TB infection, in particular, the growth of drug resistant TB, so it is very important for many developing countries and those that unfortunately suffer from TB infection, which obviously includes South Africa. And when it comes to rural areas, I think I have two related, very powerful things for people to think about and for policymakers to help. One is to increase the scale of the public awareness about this issue, very simple forms of using some form of advertising or information provision, evolving either the radio or television from public policy. As we've learned in many parts of the world about trying to reduce the risk of driving accidents and excessive consumption of alcohol or, as we've found, particularly in many parts of the Western world are dramatically reducing smoking cigarettes. Same thing needs to happen with… with this issue. And secondly, and maybe applicable to anybody that can get some kind of access to technology, even on public awareness, let's grow the role of social media platforms to being at the forefront of information provision about these kind of things. As we see all over the world, whether it's Facebook or Google or Twitter, or other forms of social media, these things have a huge impact on so many of our lives. And I would love to see them being used more productively for public information provision about the fight against anti-microbial resistance.	14:21
Azania	14:21	That's a lot of food for thought for our policymakers, that we need to start acting and treat this in a similar fashion to non-smoking campaigns to safe driving campaigns. But Lord Jim O'Niell, if our listeners want to get a hold of additional material on the study that you did on the 10 commandments, where can we turn?	14:39
Jim	14:39	So, if they have access to technology in the internet, the simple thing is to Google my name and anti-microbial resistance or AMR and it will lead them to our overall final review	15:17

		recommendations and many of the research pieces that have gone with it. There is also indeed a book that I published with two of my colleagues now about 18 months ago, it's entitled Superbug: An Arms Race Against Bacteria, and it was published by Harvard University Press, under the name of William Hall, Anthony McDonald and Jim O'Neill. And it would be fabulous if people could buy that, too.	
Azania	15:17	I know what I'll be reading Lord Jim O'Niell, thank you so much for speaking to us about this very important global phenomena. Thank you.	15:25
Jim	15:25	Thank you very much for having me on.	15:27
Azania	15:27	So, if you want to read more about Lord Jim O'Neill's research you can buy the book. It's called Superbugs: An Arms Race Against Bacteria. Or you can find more information on amr-review.org.	15:46
Azania	15:46	Very few people infected with the superbug may live to tell their story, and this next story is absolutely gripping. I spoke to Professor Steffanie Strathdee whose husband Dr. Tom Patterson got infected by one the deadliest superbugs known to man. This is the journey of a life and death battle to save Tom's life.	16:14
Azania	16:14	So, what a pleasure to talk to both of you this afternoon. I want to take you back because it was during a holiday in Egypt, when Tom got sick and the nine-month long battle to save your life began. And it wasn't initially clear what Tom was suffering from. What was going on at the time? Why was it so difficult to diagnose?	16:33
Steffanie	16:33	Well, at first Tom got sick after a meal and it was seafood on top of a cruise ship on the Nile. And, you know, we just assumed that he had food poisoning and, you know, he was vomiting uncontrollably for about 24 hours. And then he started complaining about back pain, and I realized, wow, that doesn't sound like food poisoning at all. Maybe this is more serious.	16:58
Azania	16:58	Then you got admitted where you were, of course. In Egypt.	17:01
Steffanie	17:01	Yes, but there was no hospital in Luxor. So, this was a community clinic. It was actually a temporary clinic as well. And they did the best they could. They were wonderful doctors and nurses but they	17:14

		had very limited resources.	
Azania	17:14	And so, what happened in the race to save his life if there was so little as far as medical provisions and know how is concerned.	17:21
Steffanie	17:21	Well, we were very fortunate that we had had the foresight to get travel insurance, which allowed us to mitigate Tom on air ambulance out of Egypt. He was first sent to Frankfurt, Germany, because he was too ill and weak to be sent home. And there they found that he had a gallstone that stuck in his bile duct and it caused a giant abscess to form that was the size of a small football. But that wasn't the least of the problems because that made a nice little apartment for a superbug to move into. And so that was ultimately what we were battling over the next several months.	17:59
Azania	17:59	Yeah. And Tom, do you remember anything at all about that period while you were sick?	18:04
Tom	18:04	Oh, yeah, I was cognisant in the beginning clearly and then I fell into really having hallucinations off and on. But that was periodic. So, I knew I was going on until I started to die. I mean, I really was dying after a couple of months, at which point I was in a deep coma. And I could hear, which is a message I'd like your listeners to know. But I wasn't hearing like you and I speaking right now was like, uh, I can hear voices in the distance and I was confused. So, I was making wonderful tales out of them about wandering through the desert or being on a spit being roasted, that type of thing.	18:54
Azania	18:54	And meanwhile, people around you in the most desperate state and you weaving stories on the other side. What a contrast.	19:05
Steffanie	19:05	You wouldn't believe it. In fact, that's one of the reasons we decided to write our book The Perfect Predator: A Scientist's Race to Save Her Husband from a Deadly Superbug. Because after Tom got home from the hospital, we started to compare notes because we realized that even though we'd been beside each other for the last nine months in the hospital, that we had totally different experiences. And at one point, you know, he thought he was the snake when I asked him if he wanted to live, and if he did to squeeze my hand, and it took him about a minute, but he said that he	19:46

		had to learn how to wrap his tail around my arm to squeeze it. And of course, I just looked at him like he had two heads when he told me this after he recovered.	
Tom	19:46	Snakes only have one head, dear.	19:49
Azania	19:49	Precisely, precisely. So that's quite a question to ask someone. So, why did you ask that Steffanie, ‘Do you want to live?’?	19:58
Steffanie	19:58	Well, the doctors had been basically told me that this superbug, which is a bacteria that's resistant to multiple antibiotics, in his case, it was resistant to all the antibiotics and modern medicines arsenal, that they didn't have anything left and he was slowly slipping away. And even though you know, we as a couple, we've been married 11 years at that point, and we had had a will. And he had told me, hey, if I'm ever on life support, my brain is dead, please pull the plug. I don't want to live like that. But this was the opposite. His brain was alive and his body was dying. And I didn't know what he would want and I was just overcome with this dilemma. Should I try these alternative treatments, I'm going to try to research something on my own. And I asked him, even though I wasn't sure if he could hear me, I asked him to squeeze my hand if he wanted to live because if he didn't, I would have had to let him go.	20:52
Azania	20:52	That must have been the longest minute of your life, because he was deciding how to do that as a snake. So, help us understand what Acinetobacter is, this particular superbug and its multidrug resistance that it possesses.	21:09
Steffanie	21:09	So, Tom's bacterial infection was caused by Acinetobacter baumannii, and that's a real mouthful of an organism. It's… It later became number one on the World Health Organization's list of the 12 most deadly superbugs to human health. And what was a shock to me is that, you know, I have an old degree in microbiology from the 1980s from the University of Toronto, and we used to play this bacteria on our petri dishes with you know, just gloves and a lab coat that was required. It wasn't it was considered a pretty wimpy bacterium back then. But over the last couple of decades, it's acquired you know, I guess real bacterial	22:08

		superpowers, it's learned how to be somewhat of a kleptomaniac, stealing antibiotic resistance genes from other bacteria. So, when you're, you know, giving someone very heavy-duty antibiotics, you're often killing all of the friendly bacteria in the microbiome. And this one can move in for the kill.	
Azania	22:08	Well, what a picture that you've described. So, you have to then, knowing that it's develops this kind of resistance, it's on this top 12 of deadliest superbugs, you then turn to something that you've learned early on in your career. How did you stumble upon phages therapy?	22:24
Steffanie	22:24	Well, after Tom squeezed my hand indicating that he wanted to live, I was terrified because I'm not a medical doctor. I'm an infectious disease epidemiologist, and I certainly don't know better than any of the top infectious disease physicians who were treating him at our hospital back home in San Diego where he was finally medevaced to, but I went home and I, you know, conducted a literature search. The National Library of Medicine has a open database called PubMed, which is something like Google Scholar and you can put in any keywords you want. So, I put it the name of his superbug, multidrug resistance, alternative treatments and up popped a paper that describes, you know, different new techniques to potentially kill this superbug. And one of them was phage therapy, which is short for bacteriophage therapy. And I remember learning about phages way back in the 1980s at the University of Toronto.	23:22
Azania	23:22	What's the best way to explain what phages is?	23:25
Steffanie	23:25	Well, phage are viruses that have naturally evolved to attack bacteria. They're the oldest and most ubiquitous organism on the planet. It's thought that there is 10 million trillion trillion phages on the planet. They're everywhere. They're in soil, they're in water, they're on our skin, they're inside our guts. And, so, when you have a superbug that's inside your abdomen eating you, you know the best place to actually find phages that will attack it is in sewage, believe it or not, and I was able to enlist the help of not just our colleagues here at the University of California, San Diego, but a whole global village of Phaedra researchers, who were total strangers to me. I reached out, sent emails	24:50

		and they stepped up to the plate. Researchers from Switzerland, India, the Republic of Georgia, Belgium, all over the US responded and said that they would donate phages to Texas A&M University, which volunteered to become the command centre. And they look to see whether or not any of these phages were a match for Tom's bacterial isolate. Because that's the thing of it phages, it isn't just any phage will attack any bacteria. They're very specific and finicky. And in this case, it had to be matched to Tom's specific bacteria and not just the genus and the species, but Tom's bacteria. And luckily, we found several matches,	
Azania	24:50	And we'll go into that, but I think let's understand the relationship between the phages, these viruses that are able to at least take on multidrug resistant superbugs. So how does this work then, what is happening within with how the virus, that organism is composed and how the bacteria also exists?	25:13
Steffanie	25:13	Well, phages are 100 times smaller than bacteria. So, you can't see them with the naked eye or even with the light microscope. It wasn't until the 1940s that phages were actually known to be viruses. They come in all shapes and sizes, but the one that people recognize the most is… is called a collaphage. It looks a little bit like a spider from outer space with these long spindly legs. And if it is going to infect a bacterium that it matches to, it attaches through a receptor on the outside of the of the bacterial cell, and it injects its genetic material, usually DNA, into the bacterial cell, and it turns it into a phage manufacturing plant. So, you have all of these little baby phages that are being assembled. And when given the kill signal, they burst out of the cell and what's called lysis. And so, 100 to 300 different baby phages now exist and they go on and turn to attack new bacterial cells. And that whole process repeats until there's no bacteria left that they match to. Then they're naturally excreted by the body, the liver and spleen filter them out. And they don't harm any of the other bacteria in our body or even our human tissue.	26:28
Azania	26:28	There's no health consequence to this therapy, even though you've introduced a virus into the body, its sole purpose is to activate or become activated and quite potent towards the virus, or the bacteria rather, that it's… it's designed for.	26:45

Steffanie	26:45	Well, that's what we know so far. When this is called the litick phase of the bacteriophage. There is a different kind of life cycle that can happen… instead of turning the bacteria into a phage manufacturing plant, sometimes, for reasons that we don't necessarily understand, the phage actually integrates its genetic material into the bacterial cell DNA and hits the snooze button as we described it in our book. And you don't want that because first, it doesn't kill the bacterial cell. Second, it can actually carry toxin genes or anti-microbial resistance genes with it. And third, sometimes it even can make the bacterial cell resistant to attack by other phages. So, we really don't want that. And the reason I bring this lifecycle up is because there was a recent case after Tom was treated, it kind of revived phage therapy in the West. And the first genetically modified phage was used to treat a young girl with cystic fibrosis who had a superbug infection in England. And, because they could only find phages that were these sleepy kind of phages, they snipped out the gene that made this phages sleepy and forced it to become the lytic or phage rage kind. And that was the very first time that this this has happened. And in fact, the phages that were used in this girl's case, one of them was found on a rotting eggplant in South Africa. And I know that that's where you're based, so I wanted your readers to, to hear about that.	28:18
Azania	28:18	So, with the description that you've given, now I understand how apt your title is, The Perfect Predator, that these phages are actually just the perfect predator for bacteria. But can we start to understand a little bit more about Acinetobacter baumannii, just how big a superbug it is. As you said, it is on this top 12 of the deadliest around the world. Just give us more about its evolution in becoming the superbug that it is today to belong on this list and also a little bit about the company that it keeps on that list.	28:51
Steffanie	28:51	Well, Acinetobacter baumannii is a real formidable pathogen these days. Its nickname is Iraqibacter because so many veterans come back from the Middle East with this organism, and it was really	30:05

		clever at another level too. Due to poor infection control in the military evacuation system, it populated itself in all of these regional hospitals in Western Europe and the United States. And so the most common place to acquire it these days is actually in a hospital or clinic, believe it or not. And it's also got these other qualities that make it extremely virulent. One is the formation of what's called biofilms. And these are like slimy layers that are made up of bacterial cells and human tissue and other types of cells. And they're very impervious to antibiotics. And I liken them in our book to the microbial version of the Borg. In terms of the number of people dying from superbug infections, it's thought that right now there's about 1.5 million people per year that are dying, but by the year 2050, that's going to be one person every three seconds. Or 10 million people per year. That's more than motor vehicle accidents or cancer.	
Azania	30:05	Wow, that's just astounding. So, there's a real risk and… but before we get to that, Tom, does it feel like a miracle to be alive having heard this entire journey, the description of this warfare that was happening within your body?	30:20
Tom	30:20	Well, without a doubt, I'm very privileged to be alive today. I can't tell you how grateful I am to the global community, the medical community, the nurses, scientists, even the government officials, the Federal of Food and Drug Administration helped even, the Navy… then so without everybody coming together, I certainly would be in an urn today. I was fortunate to be in a place at the right time, or science and… and everything was coming together to make it possible for me to survive this incredible experience.	31:02
Azania	31:02	Incredible it was. But Steffanie, how long is the lifeline in fighting superbugs with phages because maybe we need to also understand how long we have with the current antibiotics that are available.	31:17
Steffanie	31:17	Well, we're really running out of antibiotics solutions to attack superbugs. You know, simple infections that used to be treatable, even a few years ago, are increasingly resistant. So, urinary tract infections are getting more complicated to treat, hip and knee replacements, those are getting to be very difficult as well, because the hardware that we put in people's body, their pacemakers or	32:48

		their, you know, their artificial knee. Those often get covered with this biofilm that I mentioned, that is very impervious to antibiotics. And phage can actually be synergistic with antibiotics and in Tom's case and in several others, we've seen that it can resurrect a failing antibiotic regimen. So that is in itself a game changer. But I think to me one of the most exciting things about the case that I mentioned about this girl who had a superbug infection in the United Kingdom, and was treated with a genetically modified phage… her bacterial infection is in the same family as tuberculosis. She had a Mycobacterium abscessus infection, which is a cousin to TB. Now we know that TB is the world's biggest bacterial killer. And in fact, in South Africa, many, many people die each year from tuberculosis, which is increasingly multidrug resistant or extremely drug resistant XDRTB. And so, this case holds promise that maybe someday phage could be used to treat tuberculosis, and that would be astounding.	
Azania	32:48	Because you're now the co-director of New Phage therapy at USCD. So clearly there is a resurrected interest in phage therapy, but why was the science neglected all these years?	33:01
Steffanie	33:01	Well, yes, we have open the first dedicated Phage Therapy Center at the University of California San Diego called I path. And it really has brought phage therapy back to the west. Phage were discovered 100 years ago in 1917 by a French Canadian, and they were used for many years to treat bacterial infections in humans and in animals. But when penicillin came on the scene as the first antibiotic, the West forgot all about phage therapy, thinking it was too finicky. And because it was readily taken up in the former Soviet Union, where penicillin wasn't widely available, there was a real geopolitical bias against phage therapy, which was considered to be a pinko commie science. And that bias really persists to this day, and Felix Dirrell himself was considered to be an egotist and he was not formally trained so a lot of other scientists really looked down upon him and marginalized him and his research. So that was another reason. And of course, natural phages are difficult to patent.	34:26

		And, so, the pharmaceutical industry really didn't want to see competition with antibiotics. But with the hope that we can now genetically modify phages or even develop synthetic phages, there's hope on the horizon that we will see more interest in this from the biotech and pharmaceutical industry.	
Azania	34:26	What was fascinating is where the phages were found with the young patient who followed Tom's case, as you said, and also even with Tom's case that the phage was found in the sewer system. So is it then a game of Russian Roulette because Tom was administered a number of cocktails and the hope was that surely one of them will work and it took the second therapy for the right phage match, the second therapy that had the right phage match in the cocktail for the to be success. So, how much of a shot in the dark is it, how precise can we be in identifying and of course matching the right virus for the right bacteria?	35:07
Steffanie	35:07	Well, it's actually relatively easy to determine whether or not you have a phage that is killing a certain bacteria. What you want to do is put them together in a phage cocktail that attack different receptors of the bacterial cell. So think of it as, you know, two people, you don't want to them to go through the door at the same time you want one to go through the door, and then maybe another to go through a window. And so, if you… in Tom's case, the first phage cocktail, we didn't know it at the time, but there were four phages in that cocktail and, and they were almost identical to one another. So, they were all trying to go through the same receptor. And that made it very easy for the bacteria to evolve and to mutate and to become resistant to that phage cocktail relatively quickly. And so we've learned from this that what we need to do is to identify different types of phages that can work in combination. And, if you have phage banks that exist where you've already got phages identified, characterized, purified, ready to go, then it's much easier to put a phage cocktail together, it can be done within a couple of days as opposed to an antibiotic that takes 10 to 15 years to develop and a billion dollars or so.	36:19

Azania	36:19	That's extraordinary. How quickly, how rapidly does bacteria evolve? What you've just described, it sounds like the intelligence perhaps as they become more and more resistance improves?	36:31
Steffanie	36:31	Well, it's really a bacterial arms race, and phage and bacteria have co-evolved for millennia. And so, we're trying to take advantage of this natural process, you know, bacteria multiply every 20 to 30 minutes and phage are multiplying even faster. So, the goal really is to try to stay ahead of the evolution and if you have enough phages that can match to a bacterial pathogen, you increase the probability that the bacteria will not be able to mutate and to become fully resistant to all of the phages.	37:06
Azania	37:06	So, the lifeline that we have is only as good as our ability to understand, our ability to be able to modify or rather to understand the virus, the phage itself, and to be able to modify it as quickly as we can.	37:22
Steffanie	37:22	That's right. I mean, we're using natural phages at this point that are found in nature. But it's also possible, as we discussed with the case of the young girl in the UK, it's possible to modify the genetic material of the phage so that you can make them work better or hit a larger number of bacteria.	37:42
Azania	37:42	It's astounding. I think I'm a little bit optimistic now, considering how grave the picture seemed when it came to what we have when it comes to antibiotics. But what happened to Tom could actually happen to any of us. So, what should ordinary people know? What choices should we be making when it comes to paying our pot in preserving antibiotic medications or in enhancing, potentially enhancing drug resistant opportunities in bacteria.	38:09
Steffanie	38:09	Well, there's a number of things that the average person can do first. Only take antibiotics when they're prescribed by a doctor and take them as directed, and finish them when you're supposed to because if you don't, sometimes that promotes resistance. Wash your hands, handwashing is one	39:02

		of the most important things you can do to stop the spread of bacteria and viruses. But also, eating meat that is free of antibiotics is important because the use and overuse of antibiotics in livestock is the most important determinant of superbugs. Let me say that again. Most antibiotics that are misused are not misused in people they're misused in livestock to make them grow fatter faster, so people can choose to eat antibiotic free meat as one of their options. Or to not eat meat at all.	
Azania	39:02	And what should governments be doing to prevent the likelihood of many others facing the situation? Tom faced. As you mentioned, we're going to get to a point by 2050, where the number of deaths is at a particularly high rate.	39:16
Steffanie	39:16	Well, certainly we need more basic research and clinical research on phage and the interaction between phage bacteria and the immune system. We need clinical trials to show that phage therapy can work on a broader scale instead of just these individual cases, because that's not enough to have health agencies like the Food and Drug Administration to license that alongside antibiotics. And so, we need a lot more research to move this field forward. And governments also need to… to have a more open mind. We can't just treat our way out of this superbug crisis. It isn't just a matter of identifying new antibiotics because resistance is always going to outpace us. So, using nature's own perfect predator to attack bacteria is a beautiful adjunct to antibiotic treatment, and really could open the door to save millions of lives around the world.	40:12
Azania	40:12	So, I want to understand actually what happened. Was there food poisoning to begin with? Or was the food poisoning episode caused by the presence of Acinetobacter to begin with, and then it grew in strength because there was the gallbladder. What came first, what precipitated the health condition that Tom was in?	40:33
Steffanie	40:33	Well, turns out Tom didn't have food poisoning at all. He was having a gallstone attack, a tiny gallstone had lodged in his biliary duct, and caused an abscess to form. And so, he was getting sick	41:07

		from this gallstone initially. But then this abscess became an apartment essentially for a superbug to move into. And while we were giving him antibiotics to try to keep this infection at bay, it killed all of the friendly bacteria in the microbiome and allowed more space for this Acinetobacter baumannii superbug to take over.	
Azania	41:07	Do we know how he contracted the bacteria?	41:11
Steffanie	41:11	We don't know, actually, we never will. We do know it was an Egyptian stream because it was sequenced. And it was resistant to 15 antibiotics right off the top. But it acquired more resistance over time and became fully resistant to all antibiotics and modern medicine.	41:27
Azania	41:27	So, Tom, how has this changed your life? Has it changed the way you take care of your health, things like washing hands, I guess, how has it modified the way you live?	41:36
Tom	41:36	Well, certainly, I'm more aware. And certainly, I do wash my hands more. But I consider myself to be evidence based hope and I spend a lot of time advocating for phage therapy and making people aware of the growing problem of superbugs. So, I'm myself enjoying life to the fullest, and what can I say but how much I thank the world for saving my life.	42:07
Azania	42:07	I think you married right as well.	42:09
Tom	42:09	I chose wisely is what I say.	42:13
Steffanie	42:13	And from my view, if we can do this for one man as a global village, we can do it for the planet.	42:22
Azania	42:22	That's a powerful note to end things off on. Incredible book, incredible journey the two of you have been on. Thank you very much.	42:36

Azania	42:36	As Tom said, the global healthcare community came together to save his life. And it seems antibiotics resistance is something that we'll all have to fight together, starting with regular hand washing and greater awareness of when you really don't need an antibiotic. Thank you for listening to this episode of Discover Healthier, brought to you by Discovery Health. Join the conversation on social media with the hashtag discover healthier and tag @discovery_SA. You can subscribe to our podcast channel, Discovery South Africa, on your favourite podcast app or visit discovery.co.za to listen to our shows.	43:18