# When Science Finds a Way

## Season 2, Episode 1
## From risk to remedy – how mosquitoes could save lives

### Show notes

Episode description:

Diseases like dengue, yellow fever and Zika claim over 700,000 lives a year. But a breakthrough from the most unlikely of places could be about to change all that.

Travel to Colombia to see how Professor Scott O'Neill, founder of the World Mosquito Program, is using mosquitoes infected with a naturally occurring bacterium as part of a game changing approach that's revolutionising disease prevention.

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Mentioned in this episode:

World Mosquito Program – a not-for-profit group of companies owned by Monash University that works to protect the global community from mosquito-borne diseases such as dengue, Zika, yellow fever and chikungunya.

Entomology – a branch of zoology that deals with the specific study of insects.

Zika virus – an infectious disease transmitted to humans through mosquito bites, primarily through the bite of infected *Aedes* mosquitoes.

Chikungunya – an infectious disease transmitted to humans through mosquito bites, primarily through the bite of *Aedes* mosquitoes.

Clinical trial in the city of Yogyakarta – A randomised controlled trial of the *Wolbachia* method commenced in Yogyakarta City in 2017 in order to rigorously evaluate the impact of *Wolbachia* on the transmission of dengue and other mosquito-borne diseases.

## Transcript

**Alisha Wainwright -** 00:00
This is When Science Finds a Way, a podcast about the science changing the world. I'm Alisha Wainwright, and I'm really excited to welcome you back for season two, where I'll be meeting a whole host of global experts who are making a difference, as well as the people who have inspired and

contributed to their work. And, just a reminder, you can find more information about all the episodes at wellcome.org/podcast. Let's get into it!

***(Music starts)*** 00:27

**SCOTT CLIP – 00:32** *"Community engagement and making the connection between science, and community and being willing to communicate and talk and listen - in particular, to people - is fundamental to rebuilding trust in science, which I think, you know, is sorely needed at the moment."*

**Alisha Wainwright** 00:49
Welcome to When Science Finds a Way - a podcast about the science changing the world. I'm Alisha Wainwright. And on this series, I'm talking to the global experts who are making a difference, as well as the people who have inspired and contributed to their work. And today's guest is someone whose work really is making a difference on the ground at scale around the world - Professor Scott O'Neill. He's a renowned scientist who leads a large international research collaboration called the World Mosquito Program.
Since the 1980s, Scott has been exploring how a naturally occurring bacterium called Wolbachia could be the key to stopping mosquitoes from transmitting infectious diseases such as dengue.
His work has led to the creation of a global non-profit initiative, which has demonstrated that not only does the theory work, but it can have a huge impact. So much so, that he has been named one of Time Magazine's 100 Most Influential People in Global Health.
The answer to preventing these mosquito-borne diseases from being transmitted is not to try to get rid of the mosquitoes, but to make more of them. The World Mosquito Program breeds colonies of them, infected with Wolbachia bacterium, and then releases them into the local communities. And in trial after trial, from Australia to Indonesia to Colombia, levels of dengue have been dramatically reduced, with potential for other diseases as well.
Welcome, Scott, to When Science Finds a Way.

***(Music ends)***

**Scott O'Neill** 02:21
Hi, Alisha. It's lovely to be here, today.

**Alisha Wainwright** 02:24
So - let's just jump right in. Tell me, how did you find yourself in this field, full of mosquitoes?

**Scott O'Neill** 02:31
Um, well, weirdly enough, I've been working on mosquitoes nearly my whole career. So, I started, when I was, had a lot - much fewer grey hair on my head. I was working on Wolbachia as a PhD student, and then I've continued.
You know, I started working on the basic biology and then much more interested in how we could apply the unusual properties of Wolbachia for stopping diseases transmitted by mosquitoes.

**Alisha Wainwright** 02:54

When we're talking about vector-borne diseases - so that's diseases transmitted by mosquitoes, fleas, and ticks - what's the global picture? Where do we tend to find outbreaks concentrated and is that changing?

**Scott O'Neill** 03:08
Yeah - so most insect transmitted diseases, you know, occur where the insects do well. Certainly, in temperate regions you'll have tick borne diseases like Lyme disease, etc. But really where the diseases are really killing people, it's really in the equatorial region - the tropics of the world - where you have big populations, big mega cities and huge mosquito populations. And that's where we're seeing, you know, most of the disease problems.
The reality is that as climate change kicks in and temperatures elevate and people are moving around more, these diseases are getting worse, and their geographic range is expanding. We're now seeing, you know, mosquito transmitted viruses like dengue being transmitted in southern Europe, in the southern United States, where, you know, a decade ago, it was much rarer.

**Alisha Wainwright** 03:55
It was unheard of, yeah.

**Scott O'Neill** 03:56
Yeah. So, it's changing - it's getting worse.

**Alisha Wainwright** 03:59
So, let's talk specifically about dengue as this has been a particular interest to you. Can you just briefly explain what dengue is and where it is typically found?

**Scott O'Neill** 04:10
Yeah. So, dengue is a collection of a group of viruses it's not one virus, but a family of viruses - if you like - and it's broken up into four, what we call, serotypes - dengue one, two, three, and four. It's pretty unimaginative naming but that's what we call them. And it's transmitted primarily by a single mosquito - Aedes aegypti - that also transmits a number of other human viruses. And for many people, you know, it's a bit like the COVID story that we're all very familiar with, you know, in that there's a spectrum of disease. So, for some people, they're asymptomatic - they don't have any disease at all.

**Alisha Wainwright** 04:45
Or disease symptoms, you're saying. So like, they could have dengue…

**Scott O'Neill** 04:48
Yeah.

**Alisha Wainwright** 04:49
…and you wouldn't know - you could just walk around.

**Scott O'Neill** 04:50
Exactly.

**Alisha Wainwright** 04:51
Okay.

**Scott O'Neill** 04:52
Yeah. So, they might have no impact at all from having dengue virus in their body. Whereas other people have a spectrum of disease that can be fairly mild.
I've heard people talk about it as though it's the worst hangover they've ever had in their life, to, they're so ill they can't get out of bed to go to the toilet to the point where they start internally bleeding and die. So, you know, it's - there's a large spectrum of disease. And that large body of asymptomatic people - the people that don't have any symptoms at all - makes control very difficult - to know where to target your control measures. And so, it's a very difficult disease to control.

**Alisha Wainwright** 05:28
Wow. And what countries specifically are battling dengue?

**Scott O'Neill** 05:33
Half the world - the world's population is at risk of getting dengue, so it's a lot of countries. So, it's most countries that span the tropics of the world that are having huge problems with dengue.
The biggest problems are in countries like India, throughout Southeast Asia, throughout Latin America. And, you know, it's becoming more and more apparent that it's a very big problem across equatorial Africa as well.
And it's getting worse for a few different reasons. One is people are traveling more and you're also seeing all this urbanisation occurring in the tropics of the world with mega cities developing and often developing without great infrastructure - don't have piped water, don't have trash collection, don't - makes perfect situation for mosquitoes to breed. And then finally the icing on the cake is, you know, climate change where it's getting warmer. And so, you know, the disease problem is just getting worse and worse.

**Alisha Wainwright** 06:25
Yeah, and 2024 turned out to be a record year for dengue - with over 14 million cases reported globally. And despite the increasingly international spread you mention, the vast majority of these were in the Americas - over 12 million to be precise. So, let's hear what this is like for people on the ground.

Joanny Rendon lives in Bello, a city in the northwest of Colombia – a country where dengue is a nationwide year-round threat. Joanny lived through a previous outbreak in 2016 and told us what it was like.

**Joanny Rendon** 07:02
Spanish, fading to
Voiceover

The peak in that time was in 2016. It was very strong in the municipality of Bello. In the area where we were, practically several neighbourhoods were affected by this epidemic.

Practically there wasn't a house where there was not a patient with that problem, and people were very anxious. We had to see many cases - many cases - where there were many sick people, and they needed to go urgently to the doctor. People start with a very high fever, their bones hurt, their eyes hurt a lot, a rash seems to appear on the body. And when it is tricky, the haemorrhagic fever comes. Then it is now something very serious.
People really were getting sick at the time. There were even people who died from dengue. I remember there were boys of 10, 7 years old, who died from dengue. And many people who were also seriously ill due to that disease.
The person who suffers from dengue and suffers a serious infection, that can actually cause death in a short time - in a week. There was practically little knowledge of what the transmission process was like, what the disease was like. Many people would mention dengue, but they did not identify it with the virus or with the disease, but rather they thought of dengue as the mosquito.

**Alisha Wainwright** 08:29
It's clearly an illness that can quickly become very serious, and in some cases, especially where there's a lack of information about it as Joanny describes. I mean, what did you feel when you heard her take of her experience?

**Scott O'Neill** 08:43
Yeah, I think it's very typical of what we hear.

Do you remember in COVID when the Chinese were building hospitals with 48 machines in a weekend?

**Alisha Wainwright** 08:53
Yeah

**Scott O'Neill** 08:54
And in America, they brought Navy ship, hospital ships up to New York City. All of that was because there was a fear the hospital system was going to collapse under the weight of the COVID cases. That's what happens with dengue regularly, but we just don't hear about it. And so, when you get swamped with dengue cases, hospitals go to two patients to a bed, then patients in the corridors, and then right on the verge of, you know, creating a major crisis for the hospital system when we get big outbreaks. So, it's a really, really big problem.

**Alisha Wainwright** 09:26
Dengue is normally spread by a particular breed of mosquito, isn't it? So, tell me about Aedes aegypti - I hope I said that right - or the yellow fever mosquito. Where do they live? How do they breed? And what diseases do they transmit? And why are they so good at it?

**Scott O'Neill** 09:46
Yeah, so I have an entomologist friend who I used to listen to referring to them as the cockroach of the mosquito world. I think it's a great description.

**Alisha Wainwright** 09:54
Yeah!

**Scott O'Neil**l 09:55
Because, you know, cockroaches like to live with people in their kitchens, in their houses. And this mosquito - Aedes aegypti - is the same. It doesn't live out in, you know, parks or mangroves or…it lives in urban jungles with people because it wants to bite people.

**Alisha Wainwright** 10:12
Yeah, I was gonna say, that's where the blood is.

**Scott O'Neill** 10:13
Yeah. It's like a buffet of people there to bite and to, to feed on. And then so because of that, they're biting people all the time. And so, they're perfect vectors to transmit viruses between people.
And interestingly, you know, biting is a very hazardous thing for a mosquito. And these mosquitoes have become very adept at being good biters. And so, they want to live inside with you and, well, rather than come and have a gorge on you and drink so much blood they can hardly fly - which some mosquitoes do - these ones are very good at just coming and giving a little sip, taking a little bit of blood and then getting out of there before you even notice.
And, you know, quite often you don't even know that you've been bitten. You know, you're sitting there having breakfast in your house or whatever and while you're eating your eggs on toast or whatever you're eating, they're there quietly biting you, taking a small amount. And because they only take a small amount, they come and do it frequently. So, they'll bite you every day and that makes them fantastic disease transmitters or virus transmitters, because every time they bite, it's an opportunity to transmit virus or acquire virus from someone that has it in their body already. So that's what makes this mosquito such a problem.

**Alisha Wainwright** 11:24
And what has been done historically to control mosquito populations and why hasn't that worked?

**Scott O'Neill** 11:30
Well, ever since we've known that mosquitoes were heavily involved in transmitting these viruses, the obvious next step is, well, let's kill the mosquito. And that's what we've been trying to do for the last hundred years - kill mosquitoes. But mosquitoes are very difficult to kill.

**Alisha Wainwright** 11:45
As I know, just in my own apartment.

**Scott O'Neill** 11:48
Yeah. You know, I was living in Ho Chi Minh City the last few years. I'm a mosquito expert and I couldn't control the mosquitoes around my house in Ho Chi Minh City. I was spraying insecticides, I was doing everything - and they were indestructible.

**Alisha Wainwright** 12:04

Oh gosh.

**Scott O'Neill** 12:04
And when you go into cities - like Ho Chi Minh, Bangkok, you name your big tropical city - there's so many places for the mosquitoes to breed - underground, on your roof gutters, everywhere that, actually controlling them - just finding them to control them - is overwhelming. And so, while we've been trying for many years to control them - the main tool has been chemical insecticides - those insecticides have become less effective over time and really largely ineffective, now, at being able to control mosquito populations.

**Alisha Wainwright** 12:35
Because they've become immune or?

**Scott O'Neill** 12:38
That's right. They're resistant to them.

**Alisha Wainwright** 12:39
Well, this is, uh, where you come in because your research on Wolbachia could prove to have a better solution. So, tell me, what is Wolbachia? How did you find it? Where do you find it? And what do you do with it?

**Scott O'Neill** 12:53
Yeah, so Wolbachia is an intracellular bacteria that lives naturally in insects. So, you know, there's many, many, many insects on the planet - many insect species on the planet. And about half of them are naturally infected with Wolbachia. But not this mosquito that does all of this virus transmission to people.
What we found in our research group was that if we were able to introduce Wolbachia into the mosquito so that it carried it and actually passed it on through its eggs to its children, once the mosquitoes had the Wolbachia in their bodies, the viruses couldn't grow in the bodies with the Wolbachia there and so that couldn't be transmitted.
So, we found, like, a quite a natural way to block transmission of the viruses that didn't require any human intervention - it could be done just within the mosquito - and that's what we're working on now. When we put it in, you know, it's intracellular. So, it lives across many tissues of the insect's body, but particularly, you know, heavily in the ovaries. And so, it gets packaged into eggs and then transmitted when the eggs get laid. And so, it goes from generation to generation through the female mosquitoes' ovaries.
But it has these incredible tricks it uses to enhance its transmission, Wolbachia. So, you know, it manipulates the reproduction so that females that have Wolbachia are able to mate successfully with both males and females that don't have it and ones that do. But females that don't have Wolbachia, if they mate with a male that has Wolbachia, all of their eggs die. And this provides a way for Wolbachia to spread itself into the insect population by itself.
So how we go about using this knowledge is that we grow mosquitoes that contain Wolbachia, release them into the environment, they mate with the wild mosquitoes, and Wolbachia spreads itself into the mosquito population, and once the mosquitoes have it, they're unable to transmit these viruses.

**Alisha Wainwright** 14:43
I'm just imagining the injecting a mosquito - we'll get to that in a second. But are you primarily injecting the females, the males?

**Scott O'Neill** 14:51
A common misconception is that we're having to inject all these mosquitoes that we release, but actually we only had to do it once and to do it successfully to get it in. And then we can grow colonies of mosquitoes and they maintain the bacteria in the colony. And then we just have to release the members of the colony. But that one time of getting it successfully in, we had to inject it into embryos that were less than 90 minutes after being laid and, uh, it took years…it took years to do it.

**Alisha Wainwright** 15:20
When I – I did a summer internship at Notre Dame where I had to inject fly larvae with, uh - I don't even remember what it was at the time – but, like, I spent the entire summer learning how to do that.

**Scott O'Neill** 15:33
Mmm.
**Alisha Wainwright** 15:33
And I can say it is very hard, and you have to have such a steady hand and a keen eye.

**Scott O'Neill** 15:39
Yeah, mosquito eggs are much smaller than fly larvae to be honest…
**Alisha Wainwright** 15:42
No, okay, so I, I would fail out of your, your lab easily.

**Scott O'Neil**l 15:47
Yeah, it's – yeah…yeah - it's like torture.

**Alisha Wainwright** 15:47
Uh, but once they leave the factory, Scott, how are they released into the community and…and for how long?

**Scott O'Neill** 15:57
We do it in different ways, in different cities, and based on a number of different factors. But our two main ways are to have a small, like, a noodle box - you know, like if you were going to get take out Chinese food, you get it in this little paper container - we would use those.

**Alisha Wainwright** 16:14
How many mosquitoes fit in there?

**Scott O'Neill** 16:15
Well, 200 eggs. We drop some water and a little bit of mosquito food in a gelatine capsule with 200 eggs and just drop it in. And then they hatch and grow through and release themselves - so that's one

approach. The other approach is that we take mosquitoes in tubes and we release the adult mosquitoes and tubes every 50 meters or so, as we go along the roads in a community.

**Alisha Wainwright** 16:38
Fantastic. Well, we were able to visit one of your mosquito breeding centres to see the Wolbachia method in action. The centre is in Medellin in Colombia and is currently breeding around 2 million mosquitoes, producing about 20 million eggs a week, which are planned for release in El Salvador. So, the reason your lab is in Colombia is because it's one of the key places you've been releasing mosquitoes.
For the last decade, your team has been working in the Aburra valley in the northwest of the country. They've been mapping the release of millions of mosquitoes in three cities - Medellin, Bello, and Itagui. Nelson Grisales is your Director of Implementation and Field Entomology and he's been responsible for running that trial on the ground.
We also met Marlene Salazar the scientist in charge of the facility, who gave us a tour.

**Marlene Salazar** 17:31
Here we rear the mosquitoes inside the cages. You can see small cages that we put a lot of density of mosquitoes in that cage.
All the eggs that you saw in the other room, we bring here and we put the strip in water. And after that, all the eggs were hatched, and we obtained larvae - a lot of larvae.

**Nelson Grisales** 18:00
In all these trials we have conducted, particularly here in Colombia, are focused in implementation research. We know the technology works. Now, how do we take it to the communities? How do we implement it, actually?
The technology doesn't work immediately - we need to replace a mosquito population and we need to be able to show, in an epidemic year, that dengue cases are reduced. Fortunately, Colombia has a very strong epidemiological system for dengue. So, all the hospitals report suspected and confirmed cases of dengue. So, we know where Wolbachia is, we know what are the percentage of the mosquitoes in general that have Wolbachia in a particular city, and we know what is the transmission settings.
So, we are able to do what happened before and what happened after of our intervention. Dengue has the complexity that is cyclical - it's not transmitted at the same intensity all the time. But we are able to compare peaks - and expected number of cases in peaks. I can tell you, our analysis shows that more than 90 percent reduction compared with previous years. More than 90 percent - so we're talking about 95 and 97 percent - in different municipalities compared with previous years.
So, the results are very encouraging. It doesn't mean eradication or elimination - transmission can still happen. So that's an important thing to understand. But at very low levels, very low levels. In the last peak of transmission for Medellin, there were many thousands of cases. Last year we have less than a thousand cases, while the rest of the cities in the country - or most of the cities in the country - have a really, really high incidence of dengue. So, we are able to compare the before and after but also, what is happening in other cities around the country. And we know not only the country, but all the region right now is flooded with dengue.

So, being able to understand that Medellin is not part of that city that are under a catastrophe right now, this is something that we can clearly relate with Wolbachia - at least for a mitigation of the dengue transmission.

**Alisha Wainwright** 20:03
Wow. Uh, so Nelson mentioned 95, 97 percent reduction rates for dengue. I mean, that's…that's incredible.
And is there any evidence to show that, it has helped in other diseases, spread by the same mosquito, like Zika, chikungunya or yellow fever?

**Scott O'Neill** 20:24
From Brazil we have evidence on Zika and chikungunya suggesting similar levels - a little bit less reductions - but still very significant reductions for those diseases as well.
We don't have any data on yellow fever at the moment beyond laboratory data but we're very confident that we'll see similar results for yellow fever.

**Alisha Wainwright** 20:42
How do these reduction figures compare to other countries that you've worked in like Australia and so on?

**Scott O'Neill** 20:52
So, when we started working in Australia - that was where we first worked - there'd been, you know, recorded dengue transmission occurring in Australia since 1905 - over a hundred years and nearly occurring nearly every year. And there's no dengue transmission - local transmission - anymore in Australia.

**Alisha Wainwright** 21:08
Wow.

**Scott O'Neill** 21:08
So, we've eliminated it from Australia.
In Indonesia, where you have really heavy dengue transmission pressure, we did this very large, expensive clinical trial in the city of Yogyakarta. And, we measured in that trial design, a 77 percent reduction in virologically confirmed dengue and an 86 percent reduction in hospitalisations. So, in all the places we're going, we're seeing really significant reductions in disease.

**Alisha Wainwright** 21:36
Wow. And breeding millions of insects in a lab can feel a bit dystopian, like it's part of some kind of Sci-Fi plot. How do you really know it's safe to release millions of modified mosquitoes into a local ecosystem? And do the local mosquitoes get along well with these lab mosquitoes?

**Scott O'Neil**l 21:58
They seem to be doing quite well. They're able…often they're a bit bigger - the ones we grow than the wild type mosquitoes. But they mate well and they seem to be attractive in the field, so they do well.

Yeah. You know, all of our work gets very heavily scrutiny from regulators - we give it scrutiny ourselves. You know, the last thing we want to do is to make a situation worse. And so, there's been a lot of independent risk assessment done that's publicly available showing that the risk of adverse consequences is negligible. And, and I think the reason that you can sort of intuitively figure why that would be is that this Wolbachia is already all around us. We're eating it in our food supply - often we don't appreciate how many insects we eat when we eat processed food, but we eat a lot.

**Alisha Wainwright** 22:46
Yum.

**Scott O'Neill** 22:46
And... they don't put it on the packet though.
And, uh, so we're being exposed all the time naturally without any negative consequence. And so, putting it into this one additional mosquito - it's in many mosquitoes that bite us already that just don't transmit disease agents to us. And so, you know, intuitively, it makes sense that it's not going to be creating a big problem.
And certainly now, we've not seen any adverse consequences from doing any of those releases. And we've been looking.

**Julia Gillard:** 23:16
Hello! I'm Julia Gillard, chair of Wellcome. Thanks for listening to our podcast, When Science Finds A Way. Wellcome supports researchers around the world to make discoveries and help solve urgent health challenges. We believe in the power of science to build a healthier future, and the need for inclusive collaborative action to ensure that everyone can benefit. To get involved, visit wellcome.org, that's Wellcome with two l's. Now, back to the story.

**Alisha Wainwright** 23:49
So, this sounds fantastic but I know that you must have encountered sceptics or resistance along the way. Where do you see that from? Is it from the governmental level? Where's your resistance coming from?

**Scott O'Neill** 24:02
Things have been changing globally, you know, particularly since COVID and there's been this upsurge in this anti-science, anti-vaccine sort of mood starting to permeate from the COVID period. And one of the things we're seeing from that has been the rise of misinformation, you know, people not telling the truth - just people making stuff up and putting it out on social media. And so that's created us some problems.
I think with regards to governments, you know, governments are always cautious. They represent the people, their populations, and, and they want to do the right thing. And so, when you have anything that's very new, they want to be sure that it's going to be beneficial to people and not have unintended consequences. And so, there's some caution about anything - adoption of anything - that's quite novel. And so, we find that there are some countries and cities where you have leaders that are more willing to take that political risk, if you like, to try something new and believe in the benefit that could come from it. And so, we're seeing more and more demonstration of that; more demand building, more

people wanting it, countries now moving to doing national deployments. Brazil's now moving to national deployments of the technology. Indonesia, similarly. And so, there's a momentum building, a positive momentum, about scaling the technology globally which is great.

**Alisha Wainwright** 25:21
And the scientific community has also been on board as well?

**Scott O'Neill** 25:24
Yeah, sure. You know, the scientific community - the way science is structured is its critique based and so you've always got critique and questioning and that's how science works and that's a good thing. But yeah, the evidence - the scientific evidence - for what we do is incredibly strong. You know, it's peer reviewed, it's published in the highest quality medical research journals and so we're very proud of the quality of the work.

**Alisha Wainwright** 25:48
And I know you do a huge amount of community engagement work to ensure that local people are consulted and can actively participate in the project. Can you tell me a bit about how that works?

**Scott O'Neill** 25:59
Sure. You know, we're about listening to the community and not being arrogant about how we work, and we consider everybody's concerns and issues and questions as equally valid. And so, we spend a lot of time listening and engaged in a two-way conversation - not just a one way, 'This is good for you. You should accept it.' And if people choose not to accept it, we're okay with that and we don't try and force it onto anybody. But what we find is that when we spend time with people and we develop a trusting relationship and we're very open with people, we haven't had very many places where communities haven't wanted us to come and work. So, um, yeah, community engagement and, making the connection between science and community, and being willing to communicate and talk and listen - in particular, to people - is fundamental to rebuilding trust in science, which I think, you know, is, uh, is sorely needed at the moment, globally - unfortunately.

**Alisha Wainwright** 26:50
Well, I really appreciate that. I think, you know, the more I do this podcast, the more I learn that the relationship between science and research and community engagement, is really the kind of through line for acceptance, education, and getting people to get on board.

**Scott O'Neill** 27:09
Yeah.

**Alisha Wainwright** 27:09
Because if you just try and, you know, push your way through and, and not educate people, you probably end up having downstream negative effects for yourself. So, I'm just - I really admire, you know, if I complained about something, your program's willing to adapt.

**Scott O'Neil**l 27:25

Yeah.

**Alisha Wainwright** 27:26
Joanny, who we heard from earlier, is a community volunteer in Bello - one of the cities involved in the Columbia trial. She's from Paris - a working class suburb of the city - and she explained how she got the community to buy into the project and the impact it's had.

**Joanny Rendon** 27:41
*Spanish, fading to*
**Voiceover**
I participated in the World Mosquito Program because it is a very nice opportunity to serve people and it is an opportunity to learn more. We were a group of ladies from the community from the Paris neighbourhood. When the program arrived, it trained us because it was a good strategy to train the same women of the community, so that they could tell the community what this program was about. Initially, the work was to bring awareness to the inhabitants of the neighbourhood about everything to do with dengue. So, we started explaining to people so they would be able to identify dengue. They knew exactly what the process was like, how it is transmitted, and that the mosquito is a vector for it. Then we told them what the process of Wolbachia released with the mosquitoes was going to be like. We went from house to house, informing people on why it was happening - why it was important that people knew and accepted the program. And it took us almost two years with this socialisation process.
We went to the supermarkets, to the churches. We were going to everything that will represent the community - health centres, community meetings and boards. We took advantage of the fact that we knew who the leaders were. We'd tell the community that they should not be scared, that they were safe, that they should go about their normal eating habits. That they were going to be bitten, but they shouldn't change anything. Simply that they were going to be living with the mosquitoes that were in the community to transmit Wolbachia and that they would turn into, let's say, inoffensive mosquitoes. This led, in the end, to a total acceptance.
The truth is that the community feels very confident that it is someone from the same neighbourhood who is telling the story of what is going to be done, how it is going to be done. And that generates a lot of confidence. And people have come to trust and believe in the program. And seeing that the cases have gone down - that we no longer see dengue cases in the neighbourhood - they knew that it was real, that these mosquitoes are harmless. The people of the community see with confidence, with great respect, with seriousness, that it was true what they did and what we told them - that it was truly for the good of the community.

**Alisha Wainwright** 29:54
It almost feels like on the ground, it's a community led project. And I'm curious how you found community volunteers like Joanny and how you've been training her and others to be able to, sort of, spread the word?

**Scott O'Neill** 30:10
Yeah, so Joanny, belonged to a women's group in Bello. It's lovely to hear that clip actually, because it's been a while since I've been there to speak to the ladies there.

And it was giving them employment, it was community action where they're involved and, I think as she explained, you know, it was people from the community doing something positive for their community. And, you know, that's great to see that, and that leads to good acceptance - they're known, they're trusted, they're there to answer questions, they're not there to put polish on something - they're there to tell it as it is. And they build trust and fundamentally it's all about trust.

**Alisha Wainwright** 30:47
Yeah, I feel like building that trust is so integral to any kind of scientific research or intervention. And are there any limitations to this method? Like, does it work in very high temperatures? And could the mosquitoes become resistant eventually?

**Scott O'Neill** 31:04
It's possible that, you know, we may see resistance develop and what looks like a very beautiful control measure at the moment, may become less so in the future - it may become less effective. But we don't know. We can predict that that might happen, but we don't know - we can't predict how long it might take for that to happen.
Certainly, we've been out in the field now for over 13 years, 14 years now, and we've seen no signs of any resistance developing. The impact is as strong today as it was on day one. Um, so I don't think it's going to happen very quickly. Maybe it'll happen in 200 years, maybe it'll happen in 2000 years. Maybe it'll happen in 10,000 years, but, um, you know, I'll be quite happy with a few decades.

**Alisha Wainwright** 31:44
Alright.
I'm trying to find what is the - what is the downside of this? Is it expensive? Uh, what's the cost? And..

**Scott O'Neil**l 31:53
Yeah.

**Alisha Wainwright** 31:54
Is it sustainable? Scalable? Is this something that we can do globally?

**Scott O'Neill** 31:58
You mentioned about temperature. And so, what we have found is that certain areas that are quite seasonal - with cold winters and very hot summers, we find - that maybe they may be less suitable for this method. But in areas closer to the equator, temperatures are quite constant and that's where most of the dengue transmission is occurring and it looks quite effective there. But there could be areas where you get super-hot summers going up to 40 degrees Celsius, or whatever, that probably will prove less effective as a location to receive this sort of intervention. So, it may not work everywhere, but the areas where it will work, we think it will have a very big impact.
The other problem with it, if you like, is that it costs more to deploy it. So, it requires an upfront investment to deploy it, but then it lasts by itself without having to be reapplied. If you have a vaccine or insecticide treatment, you're having to reapply it into the population every year, whereas this is once and done. And so, while there's an upfront investment over a 10 or 15 year period, it more than pays for

itself. Actually, it becomes cost saving for governments to implement it. But there is that barrier of, you need to pull together the financing to be able to implement it in the first place and so that's a challenge for wide scale deployment.

**Alisha Wainwright** 33:11
So, there are other mosquito borne illnesses like malaria. I'm sure there are many scientists in the field studying malaria that are looking at your work, very curiously, to figure if it will impact their research. Have you found that this technology can be used for diseases like malaria?

**Scott O'Neil**l 33:32
Yeah. So, there's actually some really interesting work going on - particularly work being led out of Michigan State University.
I don't know if you can see, but I've got a real lot of grey hair on my head. You know, I'm getting to the end and, uh, there are younger

**Alisha Wainwright** 33:44
You look great.

**Scott O'Neil**l 33:47
Thank you. But there are younger scientists coming up, doing, expanding upon our work and doing really interesting stuff. And I think there's a potential possibility that this could have impact on malaria transmission as well, which would be amazing.
**Alisha Wainwright** 34:00
Gosh. Science really is slow and steady wins the race because this is essentially your life's work and you're just - it feels like we're just getting started. But why is your work so important and what else needs to happen to help us eliminate vector borne diseases?

**Scott O'Neill** 34:18
You know, half the world's population is at risk. And so, we need solutions for people that live with these problems. And I think all of the people that we work with, all of our colleagues, you know, we're all very passionate about being fortunate enough to feel like we're able to have some impact on the situation and contribute positively to this problem.
You know, I'm not sure how long it's going to take, but at least we have tools that look much more promising than what we had a few years ago. So, it's cause for optimism.

**Alisha Wainwright** 34:50
Hey, well, I'll take optimism. In this day and age, I'll take any optimism - especially from a scientist. So, thank you so much, Scott. I've learned so much - not only about mosquitoes and how they transmit diseases, but also the research, the community engagement and everything your program is doing to potentially make a better, healthier future for a lot of people around the world.
***(Music starts)***

So, thank you very much for your time.

**Scott O'Neill** 35:15
Thanks, Alisha, for talking and being interested in the topic.

**Alisha Wainwright** 35:22
Thanks for listening to this episode of When Science Finds a Way and thanks to Professor Scott O'Neill, Joanny Rendon, Nelson Grisales, and Marlene Salazar. This one was mind blowing.
It's an amazing example of science and community coming together to implement a new technology in a way that doesn't alienate anyone, and that is having incredible results. And just think how one single mosquito has led to this whole program of work.
When Science Finds a Way is brought to you by Wellcome - a charitable foundation that supports the global scientific community, working to build a healthier future for everyone.
Infectious disease is one of Wellcome's priorities, along with mental health, climate and health, and discovery research.
If you visit their website, wellcome.org/podcast - that's welcome with two L's - you'll find a whole host of information about infectious disease, as well as full transcripts of our episodes. It's also where you'll find the episodes about infectious disease from season one of our podcast. Or, just scroll through the series on your podcast app and you'll find it there too.
If you've been enjoying When Science Finds a Way, be sure to rate and review us in your podcast app. You can also tell us what you think on social media - just tag at Wellcome Trust - with two L's - to join the conversation.
Next time, we'll be talking about the health impact of wildfires, and how cultural burning practices could help mitigate these effects.
**Nicole Redvers** 37:01 *"The question has often been, how can we integrate traditional knowledge into what we already know in Western science. But what about the other way around? Why are we not, you know, thinking about how do we actually integrate or bridge western systems to Indigenous systems?"*

**Alisha Wainwright** 37:15
When Science Finds a Way is a Chalk and Blade production for Wellcome.

***(Music ends)***