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AM: Amy Mathers

MP: Melinda Poulter

JG: Jeanine Guidry

TP: Thomas Platts-Mills

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SM From Virginia Humanities, this is With Good Reason. I'm Sarah McConnell. When it comes to coronavirus, there's a growing consensus that testing is the way out of shut down. But who do we test? Which tests are reliable? And are there enough tests?

AS The number of cases grows is a new warning tonight. The U.S. does not have enough coronavirus test kits to meet the current demand. NBC's Tom Castello takes us inside the labs to find out why they are delayed.

Health officials say that are now beginning to ramp up production of those kits, but is it too late?

Across the country, there's this urgent need for testing and contact tracing on a massive scale.

It is failing. Let's admit it. The idea of anybody getting it easily the way that people in other countries are doing it, we're not set up for that. Do I think we should be? Yes. But we're not.

SM Despite World Health Organization Director Anthony Fauci's sobering words, some states have recently reopened. Other states will stay in lockdown until tests reveal two straight weeks of declining coronavirus cases. My first guest today are two doctors who are colleagues at the University of Virginia who were at first anxious and then alarmed in early March when suspected coronavirus patients first started showing up. Dr. Amy Mathers and Dr. Melinda Poulter say the long-promised tests had not arrived from the CDC, so they decided to make their own. Amy Mathers is a professor of infectious diseases and international health, and Melinda Poulter is director of clinical microbiology and molecular infectious disease testing at UVA. Amy, when did the University of Virginia start to see its first coronavirus cases or suspected cases?

AM Well Sarah it's—it was the suspected cases at first. Towards the end of February and early March, we had people returning from China but because they didn't meet the case definition and there was so little testing available, we couldn't actually test the first cases that we potentially suspected. But then in early March we began to have people coming to the hospital quite ill that we felt we needed to isolate and treat as though they had potential coronavirus.

SM Was it scary in those early days for the medical people who would treat them and who wanted to treat them but who were also frightened?

AM Yeah I think that, all along, it's been scary for healthcare practitioners. There's been so many unknowns and the virus has evolved so fast that we can't keep up with how it's transmitted and we learn new things every week.

SM So in the early times, why did it matter whether you could test these very ill first patients for coronavirus? Why not just assume they had it and get on with it?

AM Yeah so actually, Sarah, we had to assume they had it. And so then we had to use personal protective equipment on people who we weren't sure had coronavirus and even some that we were pretty confident didn't but we didn't want to be wrong and until we could get testing, we had to use a lot of masks and gowns and goggles and face shields because we didn't know if they had it or not.

SM Mindy, early on, you got together with Amy and others and said, "Here's our plan. Everybody thought the World Health Organization was shipping a testing protocol to 60 countries but it turned out not the U.S."

MP Yeah, the CDC released their test and of course they were laboratories all over the country trying to get access to all the components of the test that were needed. Unfortunately, it doesn't come to you in a nice neat package. It requires a lot of different components. You have to have several different reagents. I know this doesn't sound like a long time but it took us a little over two weeks to really get it all here.

AM It was really really frustrating to spend you know the entire day on the phone with different vendors trying to see what they have or what they didn't have and, well, could we switch to this? And so I'd call the FDA and say, well, can we use this instead? And it was just a series of constant obstacles.

SM Amy, you've compared it to making pasta—a pasta dish. But then somebody makes you get a lot of very arcane or hard to find ingredients that make it nearly impossible.

AM Yeah, Sarah, that's—the problem with the CDC recipe is that you had to use very very specific ingredients from specific companies and you had to use a specific instrument on which to make your pasta and they were all back-ordered because everybody was trying to get access to the exact same ingredients at the same time so that everybody could have the CDC-approved recipe. And so there weren't actual kits that were sent anywhere. To do any kind of a lab test, you have to have bits of DNA from the virus. Getting that virus, there was a way to order it through the government, but we couldn't get them to register us or return the phone calls. And thus we had to reach out to multiple labs all over the country. I just reached out to people that I knew where there had been cases of coronavirus reported in the news, and asked them if they had any leftover specimen. And thankfully somebody from University of Washington reached out and sent us not only one but two bundles of virus from patients that they'd had so that we could get our test up and running.

SM How much time was lost just for that ingredient?

AM We spent about 10 days trying to get all that done, but that was actually one of the first ingredients we got.

SM What were the other ingredients that were hard to get?

AM If you think of it—the pasta and the sauce were also scares in the chemicals on which you need to run the test that can actually detect the virus in the sample, that was hard to come by and get from the company and we had to call them multiple times and they lost our first order. The oven on which you would run this test were back-ordered six weeks or longer to get one of those instruments and so that's where we pivoted and turned to researchers at UVA. Mindy Poulter reached out to the FDA and said, "can we use this research version of this oven?" And the FDA allowed us to use that so it was actually

researchers that donated their lab equipment on which we cooked the pasta if you will. Or ran the test.

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SM So at this point you have all your ingredients or are there still others?

AM Those were the key ingredients. We also needed one other last ingredient which is how do you get the virus out of the sample? And those extraction agents were also very very hard to come by.

SM Once you had all these pieces together, how long does it take to make your first test?

AM Oh my goodness, once we had the pieces together and we had everything, Dr. Poulter and the research team had it up and running within 24 hours.

MP We basically started testing and spiking samples and prepping all the reagents but with three of us working sort of around the clock, we managed to have it ready to go the next day.

AM It was mid March and I can tell you that we had multiple patients and we were able to get many of them out of that isolation especially the negative patients that we were suspecting may have had COVID but didn't and then they were able to, in some cases, reunite with families and stop us needing to use all that precious personal protective equipment.

SM Did you start doing tests for other hospitals in the state?

AM Yeah so the situation, because I had been so stressed, that we immediately pivoted and started trying to help other hospitals that were in the same desperate throughs. The personal protective equipment in the state belongs to all of us. It's a shared resource and we're going to have to all work together to take care of patients and take care of healthcare workers. And it was wonderful, it was a wonderful feeling to be able to help out colleagues that were in the same desperate situation.

SM How was this helping them? How many days was this cutting off the testing result process?

AM We had a few cases where there was an 11-day waiting period before you could get a test back. After our first day of testing, we had more results from our own University of Virginia test than we had had outstanding with all of our tests at the commercial lab.

- SM What about now? Do you still need to be using your own tests now? Or have you been given faster kits or other kits?
- AM No so we're using a commercial assays our own labs and it takes anywhere from eight hours on one testing platform to about an hour on another testing platform in our own lab, but the thing is the eight hour test, we can now run 96 at a time, whereas with the CDC platform, we could only run 23 at a time.
- SM But you know we're talking about needing to ramp up across the country to 5 million tests a day to save the economy and save humans. Can you see that happening?
- AM I think it's a really tall ask. I do agree that having testing widely available is going to be critical to how we open up the economy and being able to test symptomatic patients quickly and easily and then do contact tracing and potentially test people they were in contact with, we definitely need more testing to safely open the economy and decrease transmission. I don't know if 5 million is a realistic number. I don't think we've ever had that much of any one kind of test but I might not be the right expert. It sounds like a lot and I know we have a long ways to go just even at UVA in trying to provide more capacity for the state.
- SM Do you know whether people in the medical center are talking with some of these biomedical startups to create a test-making factory of sorts that could make as many tests as we need? A kind of World War II ramping up of industry in the biomedical field?
- AM Yeah so I've been working with a biomedical engineer at University of Virginia, Will Gilford, and he has worked to create massive amounts of swab manufacturing and so I am in the middle of trying to get those registered with FDA so that we can distribute them just like we did with the test to other people around the state and to our own patients because everybody needs swabs. The swabs are the same for all of the testing platforms so even if you have multiple different types of tests that you can run, you still need a swab.
- SM I'm really grossed out by the long q-tip swab up the nose procedure. Is there something effective that is emerging as better than that?
- AM Well I think that a lot of people feel the same way you feel Sarah, and so there are—the virus does live in the mouth, and can be detected in saliva and we've actually validated here at UVA, the throat swabs. I have not reviewed the primary data of some of the sort of spit or the mouth tongue swabs that people are talking about that they could do at home.
- SM And what about that so-called five minute test?

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AM Yeah so there is a molecular diagnostic that is a five minute test and we have not evaluated it personally but there was some concern that it may not be quite as sensitive as the test that we run in the lab ,and therefore it might not detect low levels of COVID virus even if they were there.

SM Right, so if you're using a test to say, "You're safe, get to work. You're safe, get to work," and it's not testing properly, deep trouble.

AM That's correct. That is one of my big concerns.

SM But I don't see how China and South Korea and Hong Kong and elsewhere can come up with zillions of tests per day for large swaths of the population. I mean, why can't America ramp up test availability?

AM Yeah, we are feeling some of the effects of having outsourced a lot of manufacturing in the United States.

SM So what about the antibody test? Is there a fool-proof anybody test yet?

AM Sarah, the short answer to the fool-proof antibody test is no but I think it's early days and I think that we don't know how well the antibody test will perform. Ultimately, I think everybody has this vision of having a "I had COVID" kind of passport so that you could say well if I have the antibodies then I'm going to go back to work. But we are far from that. Right now, we're just struggling with whether or not the tests are going to accurately point to who actually had a coronavirus infection and who did not. And because there's multiple different kinds of coronaviruses like the seasonal coronavirus, we need to make sure that when it's saying you had a coronavirus, it's actually COVID-19 that you had and not one of the other seasonal coronaviruses and we also need to understand, do they antibodies stay around for a long period of time? And we're not going to know that for quite some time. And then most importantly, we don't really know what the antibodies mean. Do they protect you from the second infection? I certainly think they may, but we don't have that data yet.

SM So, we don't have vaccines for colds, but we have them for pneumonia and flu. Is coronavirus more like a cold or more like the other?

AM So, when I think about a vaccine for coronavirus, I think of it a little closer to influenza. And hopefully it works like the measles vaccine which, you get a few times in your life and you're protected.

SM Right, because if it works like the flu vaccine, you have to get it every year and it doesn't always work.

AM Correct.

SM Pure speculation for the two of you closer to this than a lot of us, do you picture you are working from home or that a mass portion of the population is working from home even in the fall, winter, or next spring?

AM Well, I think that we are going to continue to need to do universal masking. I think we're going to need to do social distancing, enhanced environmental and hand hygiene. I think that we're going to—things are going to look different than they've looked for the last 5 to 6 weeks and I think we will begin to open up the country but I think we're gonna have to do it slowly and in stage fashions and probably walk some things back after things have opened up. I think it's gonna be a long six months.

MP I'll throw out how critical it is that we listen to the experts. You know as we are trying to reopen the country, will there be a resurgence and how are we going to manage that? And I think the planning is critical. We've got epidemiologists across the country working on this and thinking about how we do this and I just think it's important that we listen.

SM Well, Amy Mathers and Melinda Poulter, thank you for sharing your insights on With Good Reason.

AM Thank you, Sarah.

MP Thank you, thank you, Sarah.

00:16:28

SM Dr. Amy Mathers is a professor of infectious diseases and international health at the University of Virginia, and Dr. Melinda Poulter is UVA's director of clinical microbiology and molecular infectious disease testing. Coming up next, what if we make a vaccine and people are afraid to get it? We're all concerned about the spread of coronavirus, but there's a new problem: the viral spread of misinformation about vaccines. Jeanine Guidry is a media professor at Virginia Commonwealth University and she's part of a research project trying to stay on top of messaging for a new vaccine. Jeanine, you were part of a research group dedicated to figuring out how people respond to messages. And you and your colleagues have recently of course pivoted to how people are responding especially on the internet and through the news media to messages about COVID-19. Tell me a little bit about what you're looking at.

- JG What are people saying about COVID-19? How are they expressing their concerns, their fears? Is there misinformation that's present in these messages? The things that people talk about? And what are people for example saying about things like 'flatten the curve' like the things that we're hearing about, social distancing, how is that being perceived? Because if we know that, in a greater way, we're also going to be able to better communicate why this matters so much and how as a society we can better address this.
- SM It must be exciting especially now during the shutdown to be collaborating with people in such far-flung places.
- JG When all this started, and we were starting to work from home, most of us, what we said was, "we are in the midst of this. We're in a unique opportunity where we're in the midst of a pandemic. We're living through this. Let's learn as much as we can." Just as people are working incredibly hard to develop a vaccine, what can we do to make sure that, for example, when that vaccine comes out, people are more likely to accept it? What can we do to make sure that people are less scared, that they have more information? I'm very grateful that we can do this.
- SM It's so interesting because we've talked so much about how soon can we develop a vaccine? And which one is gonna work? We've talked less about whether the public would be willing to get vaccinated once one is out. What's the thinking on it?
- JG We know that there is a fairly large group of people who are concerned about vaccines in general, before we ever got to COVID, who think that vaccines may be harming people or harming their children and we were really interested to see, "how's this gonna work with COVID?" Because one of the reasons it's so hard to communicate with people about vaccines is we haven't seen the diseases. When is the last time we saw a polio patient? Here now, we have a situation where we see the horrific effects of COVID-19 on TV and on social media in front of us. And so that is different and where we're hoping this is going to make a difference is because people see how serious this disease can be that there also may be more willing to say, "Okay, I'm gonna get the COVID-19 vaccine." And that's what we're gonna need to see happen. The first trouble is getting the vaccine developed and approved and working, but then we need to see sufficient numbers of people getting the vaccine or we're still not going to be in the clear so to speak.
- SM How long do you think it will be before we have something even if we bypassed certain safety protocols because of how dire our situation is?

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- JG In what I can see, what I hear we're looking at 2021 and if we get one in 2021, it will be fantastic speed. The ebola vaccine I believe took 5-6 years to develop and that was incredibly fast.
- SM It's interesting how you first got into studying the public response to vaccines. You did your dissertation on a study of Pinterest posts and vaccines. I think of Pinterest as a place for pretty pictures. How did you discover Pinterest was relevant to vaccine messaging?
- JG I was a PhD student and I thought, "Huh, Pinterest, that's interesting. I use it for recipes and decorating ideas. I wonder if there's health information on there. And I typed in vaccine and vaccination and lo and behold there were a lot of conversations that you would not really see if you don't search for it. And so I studied that. I looked at, I believe, 700 pins, 75% were strongly anti-vaccine where people were saying, "this is a hoax. Vaccines are population control. Vaccines will kill your child."
- SM Did you get the impression most people posting meant well?
- JG Yes, from what we can see, there's two main groups that posted this in Pinterest. Number one is the group you just described. It's parents who are truly concerned for the children who are truly thinking that these vaccines are not good for us, for our children, and who wanna share that because of their deep concern. And then there's a group of people who try to sell certain things like supplements and who really play into it. And in a lot of ways, the fear that we see.
- SM And what were the predominant claims against vaccines?
- JG Vaccines causing autism, vaccines containing elements that are harmful for us as human beings, vaccines being used as population control.
- SM And what about pharmaceutical companies or the government?
- JG Those fall under conspiracy theories, yes. For example, pharmaceutical companies make vaccines so they don't work so that you will need more treatment. Or doctors want to give your child all these vaccines because they get paid more money. Listen, nobody's perfect and their issues in a pharmaceutical world, in our government, and even in the medical world. And I say that and I am the sister of a doctor and two nurses. There are no perfect entities in this universe. But those things, they're just not true. I believe that is preying on people's fears. If you are concerned already, and you read "I can't trust my doctor. I cannot trust that this is something that's going to be safe, that's actually meant for good." That is heartbreaking to me because vaccines are public health's greatest triumph. If we could go back in time and see what polio did, lots of these infectious diseases that we now don't even think about anymore, and how we are

able to protect people right now, I can't wait till there's a vaccine. I want the vaccine for myself, for my elderly mom, for my friends who have chronic diseases, and right now it just doesn't exist. But we have that for HPV, we have that for measles, we have that for all these other diseases, and yes, there are side effects with everything. But autism isn't one of them.

SM So you looked at the vaccine misinformation being spread on Pinterest about five years ago. Is it still there?

JG It technically hasn't been removed but Pinterest, about a year ago, took action and said, "wait a second, if there's that much misinformation regarding this topic on our platform, we're going to do something about it." And so at first what they did is they blocked searches for the word vaccine. If you would type that in, you would get a message that said, "there's a lot of misinformation about this topic on our platform. We recommend that you go to this source for correct information. And then about three or four months later, last summer, they started populating those searches with posts from reliable entities—the World Health Organization, the CDC, the Department of Health and Human Services, things like that, to stop the spread of misinformation related to vaccines. They're also doing the same thing with COVID-19 right now. A lot of other platforms have followed suit and do a lot of similar things right now.

SM A friend of yours said the internet is flat. What does that mean?

JG What that means is there's not a lot of difference in how a claim that is true and claim that is misinformation gets presented. There's so much information and it all comes at us and we can't automatically say, "well this comes from, and therefore it's trustworthy." And that flat-ness that everything is accessible to us, and then having to decide, well, what's truth here? What do I trust? Who do I trust? That, I think, is one of the biggest challenges that we have right now.

SM And of course the problem for all of us is we're all on the same boat. Even the experts don't have one single answer.

JG No that's the problem because we're, we're dealing with a moving target—we're dealing with a virus that we just at all didn't know in January. There is this uncertainty and then things change and recommendations change and that, I think, is hard for us. We want to see black-and-white. We want to see definitive statements but we can't make definitive statements, not yet, not right now.

SM Once a vaccine does come out, and we really need to ramp up, what are best practices for communicating, like what are we gonna need to do to persuade the population, come and get it?

JG I think our communication starts now. We need to use credible sources and we need to release accurate messages as soon as possible. People are likely to believe, and this goes for all of us, we are likely to believe the first message we hear about something. So the messaging about a future COVID vaccine needs to happen now, not when we're almost ready to get it out because there's so much misinformation already going around that the COVID-19 vaccine will have a microchip in it, that it will be used to track people. Those kind of things, we need to have a lot of reliable information already kind of setting the stage and saying, "when this comes out here is why we need it. Here's what herd immunity means and this is how the vaccine works in helping us reach that."

SM Do you think we're forever going to see our world as pre-coronavirus and after coronavirus?

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JG Yes. I think this is such a global event. I heard a friend say that, at the end of this, we're all going to walk out with a level of PTSD. And I think there's some truth in that. This is so impacting and we're in the middle of it so we don't quite know what the ultimate impact will be but yes I think there will be a before and after. At the same time, we will get through this. There will be a vaccine. There will be treatment. We just don't know when. And once we have a vaccine, and once there is treatment that has been tested, and that has been proven to be safe and effective, the environment is going to change. That's when we're going to be in a post COVID-19 environment. That doesn't mean the disease is gone. The general understanding is that COVID-19 is something we're going to deal with for a long time. But once we have a vaccine and medication to treat it, it's not gonna be this big unknown. We have a way to prevent you from getting it and if you do get it we have a way to treat you and keep you safe.

SM Jeanine Guidry is director of the media and health lab at Virginia Commonwealth University. Welcome back to With Good Reason from Virginia Humanities. In 2007, Dr. Thomas Platts-Mills started looking into a mysterious allergic reaction patients were having to a new cancer drug. The strange thing? These allergies are clustered geographically. One of his lab technicians started comparing a map of the allergic reactions to other medical maps.

TP And the map that matched it much the best was the map of Rocky Mountain spotted fever. Then we started asking all the patients questions about ticks, which I'd never done before. I was never interested and tick bites. That was an infectious disease problem.

SM Since uncovering the tick borne meat allergy, Thomas Platts-Mills has continued to look into how it works. He's chief of the University of Virginia's division of allergy and clinical immunology. Thomas, you have been an allergist for decades now. Do you remember

the first time someone came to you presenting with symptoms that you now know probably were meat allergies?

TP I don't think I can remember the first time but I do remember one of the patients. We'll call her Ruby. Ruby said clearly that, "if I eat pork, four hours later, I get hives." And so we smiled sweetly and said, "you avoid that pork. It doesn't—it's not good for you," thinking that the story didn't make any sense. I know now that there were at least four or five others who I had seen at some time where they told me the story pretty clearly but I didn't understand it.

SM And like Ruby, most of them didn't realize it was associated with having eaten meat hours earlier.

TP Some of them did. Patients would come in and say, "it's beef or pork or lamb, but it's not chicken and it's not fish, and it's not turkey." That was unusual in food allergy because patients are often very confused.

SM This allergy isn't like peanuts or bee stings. It's not sudden.

TP It's not sudden at all. And that was another thing that was very hard to get our heads around. That someone could eat beef and four hours later, having nothing happened in the meanwhile, have a severe attack which started quite fast. Because one of the rules about immediate food allergy is if they're going to be severe, they usually start fast.

SM When did you have an aha moment and think, "oh my gosh, this is real! People are developing, sometimes late in life, allergies to meat!"

TP In 2007, we were looking into this cancer drug which caused reactions with hives and a fall in blood pressure and people could get very sick and developing a test which would help us identify those patients and then we realized that the patients who had been telling us this story about a reaction four hours after eating red meat had the same antibody. In fact, the cardinal case was a gentleman with cancer in Arkansas who died in 20 minutes after the first exposure to the drug. And that was a clue that he must've had the antibody before he ever saw the drug. He wasn't becoming allergic to the drug. He was allergic before he was exposed.

SM What was the thing in both meat and in this cancer drug that they were reacting to?

TP This was a kind of sugar on fat or protein in any mammal and mammals everything that has fur and breasts—rabbits, squirrels, beef, pork, lamb. Any of those things carry these—sugar, and can give rise to reactions.

SM How did you start to think, this is a geographical problem and it has to do with tick spread?

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TP Yeah. The first breakthrough for us was my technician in the lab who was very smart and he was looking at maps to try and see what map matched this. And the map that matched it much the best was the map of Rocky Mountain spotted fever. It turns out that that wasn't correct but it was correct that it was a tick borne illness. Then we started asking all the patients questions about ticks, which I'd never done before. Was never interested in tick bites. That was an infectious disease problem. Suddenly we had an allergy related to tick bites and that was absolutely baffling when we first saw it. Didn't believe it.

SM Had they all been bitten by a tick?

TP We assume so. They all come from an area where there are these ticks.

SM Which ticks are they? Are they the same ones that cause Lyme disease?

TP Almost certainly not. The Lyme disease ticks don't itch. The tick we're dealing with is called the lone star tick because it has a white—the adult female has a white spot on her back which, at one point, was thought to look like the state of Texas.

SM Where are these ticks? Primarily breeding on deer. And that's our primary hypothesis about why it's increased is the massive increase in deer population on the east coast and I think very few people understand that. In 1950, there were virtually no deer all the way down to Piedmont. None in the county around Chapel Hill where I met a local hunter who remembered the first date in the 70s when a deer was shot that had grown locally. So from 1950 to today, they've expanded enormously and, in addition, we now have them around our houses, so that at least half the patients we see have received tick bites from their own property.

SM You were bitten by a tick in 2007 on a hike along the Appalachian Trail.

TP Part of it was on the Appalachian Trail. I was off trail most of the time, happily going up the side of the mountain and presumably somewhere during that five hour hike, I went through a nest of larvae and got 200 on me. But you don't feel them until you stop, and when you stop, you realize, "oh my god. My feet are itchy," covered with these tiny little black things. And you can't actually see they're a tick without glasses or a magnifying glass. They're very small. Some had bitten me and some were still crawling. I scraped them off, went back home, scraped the rest off with a knife, hundreds. And luckily my wife was away because, that night, odd larvae were turning up all over me and you'd

take them off with scotch tape. And then we took them to the lab and they were actually identified as lone star larvae.

SM Did you say to yourself, "oh no, I'm going to get the meat allergy."

TP Well actually, I said, "well we've got a great opportunity to take my blood once a week and watch what happens to my antibodies." And they went up and up and up, and in November, following the August bites, I got my first attack.

SM Where were you?

TP I was in London and I had a lovely dinner. We ate lamb chops and fine French wine and, six hours later, I was covered in hives, itching like crazy. Not anaphylactic, not feeling sick, just feeling stupid.

SM Would you say that a lot of the people that you have seen develop this are the outdoorsy type?

TP Lots of them are. Lots of them are hikers or hunters but now gardeners. This guy got his bites between his cabin and where his well is because he has to go and fetch the water.

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SM It's interesting. You had this first tick experience yourself where you contracted this allergy to meat in 2007. Then it happened again.

TP Yeah. In 2013, we were hiking on top of a mountain close to where we live. We sat down for a picnic and they were four of us there. And two people got no ticks on them and two of us got a bunch of these larvae again. And I got about 10 or 20 of them this time and my antibodies went up again, got very high.

SM So did your allergic reactions to red meat worsen after the second bite?

TP I never challenged it enough to know. I'm pretty careful about red meat. And, my wife, we don't have red meat in the house. Don't have anything which could have either meat or innards. Innards is a real problem because many chicken sausages are covered with the intestine of a pig, so the outer casing is pig, and those can cause bad reactions. What the tick does is to change that immune response to an allergy response and does it incredibly effectively. It is dramatically, big response, that the patients get to this tick bite.

SM What's the solution? What is the cure when someone presents with a meat allergy, horrible allergic reaction?

TP There are very few gasping for breath, covered in hives, blood pressure down, clearly dangerous. Bad abdominal pain because, if you go into the emergency room with abdominal pain, and you're asked, "when did you last eat?" And you say, "six hours ago," no one thinks of allergy. You've got to say itching or hives for allergy to come up. And that's been a problem with a lot of patients. If you get diagnosed, the correct treatment is to avoid mammalian meat. One of the shingles vaccines had too much gelatin in it which carried this sugar because it comes from a mammal. And the new vaccine has very little.

SM Do you give people an antidote to the itching and hives?

TP Very important. All the patients who have this should carry Benadryl for sure because they should take Benadryl immediately. Many of them have to carry an EpiPen.

SM Where in the U.S. are we finding people presenting with this allergy to meat who've been bitten by ticks? Is it just east coast?

TP No, it goes a long way into the Midwest. We are very interested in the area called three corners which is eastern Oklahoma, northwestern Arkansas, and southern Missouri, and that is a real hotspot. All the clinics there have seen cases and many of them have seen 100.

SM What are some other hotspots?

TP Lynchburg. Lynchburg, Virginia is a real hotspot. Warrenton has plenty of cases. We have a lot of lone star ticks and lots of larvae so there are plenty here. And we have an incredible amount of deer. So if you ask what we could do, obviously we could decrease the deer population. The alternative is to stop the leash laws because one of the reasons the deer have got really into the suburban areas is because we don't have a pack of dogs anymore. So for the first time in 10,000 years, the human race is running villages without a pack of dogs.

SM Do you think now all allergists are testing for this as part of the big test that one does for everything that's causing allergies in someone?

TP No. The prick test doesn't work very well for the red meat allergy and so the primary thing is history and then a blood test. There's still certainly doctors who are not fully aware of it.

SM Thomas Platts-Mills, thank you for sharing your insights on this on With Good Reason.

TP My pleasure.

SM Thomas Platts Mills is chief of the division of allergy and clinical immunology at the University of Virginia Health System. Coming up next, does stopping the spread of tick borne disease begin in the lab? As genetic engineering technology like crispr advances, it's more and more important to ask tough questions about when to use it. How do we balance the reward between eradicating malaria with the risk of throwing off the entire region's ecosystem? Jesse Kirkpatrick is assistant director of the Institute for Philosophy and Public Policy at George Mason University. He studies gene editing technology and he says we don't need to be afraid of what it can do but we should be careful. Jesse, before we get into the tough ethical questions raised by gene editing, give me a quick primer on crispr—what it is, how it's used.

00:42:02

JK Sure. So, in 2012, scientists discovered that there's this obscure bacterial defense mechanism called crispr. It allows scientists to insert, delete, and modify elements of that gene in ways that are now faster, cheaper, and easier than ever before.

SM So what does this concept of gene drive have to do with crisper?

JK Yeah so a gene drive allows scientists to use crispr to basically push a desired modification through a gene. One of the most promising lines of research is using gene drives to eradicate malaria. They could edit the gene of a mosquito that conferred sterility to males, okay? Crispr would be used to modify and insert a gene that conferred sterility, right? Made it impossible for males to breed. And subsequent generations would inherit this, right? Not all of them. But, eventually, if the drive works successfully, 100% of those of subsequent generations of mosquitoes would be born sterile, therefore, crashing the population and making them unable to breed.

SM So how could this be controversial? This seems like such a good idea, either making a certain population of malaria-carrying mosquitos sterile or making them resistant?

JK Right, so, as a basic proposition, it seems as if it would be a no-brainer and that we ought to be eradicating malaria. The problem is that gene drives are very aggressive so there could be consequences to the ecosystem. There could be consequences to other animals that feed on these mosquitoes. We just don't know what the consequences are, and, until we get that sorted out, it's really risky business to go and push ahead.

SM But crispr is so easy. It's hard to imagine that scientists aren't using crispr to edit genes and experiment various ways.

JK Well they certainly are. Lots and lots of really excellent research going on in the lab. The real kind of rub comes when we think about when we move these, these organisms out

of the lab into field trials and into the wild population. That's where it really starts to get tricky and potentially worrisome.

SM And are there any gene drive field trials going on?

JK There are not.

SM And what are we doing at a global level to police it?

JK There are a few things. There's a convention under the auspices of the United Nations called that convention on biological diversity. What the convention is supposed is just simply ensure that state parties are conserving and protecting the environment and biodiversity. And one of the concerns with gene drives is that because we don't know what those effects are is that they could have really deleterious outcomes for biodiversity. And there was a coalition of actors, NGOs, international organizations, scholars, indigenous groups and so on and so forth, lots of stakeholders, that wanted to draw a red line and put forward a proposal to have a moratorium on field trials of gene drives. The proposal was eventually rejected. Primarily the rationale for scientists was, they said, "we're not gonna be able to know the risks unless we be able to run trials with this."

SM Well, so, give me some other examples of what seem like no-brainers to us as far as doing gene editing to solve a intractable problem that seems like a good idea but maybe we shouldn't.

JK Yeah so there's a thought that this technology could potentially be used to help mitigate or eradicate the effects of Lyme disease. But we're just not yet sure as to what could happen with these you know with using this technology. Another example I think maybe a better one is that, so New Zealand is sort of thought as what might be kind of a good test case for this, being that it's an island and it's relatively remote. And they also have a very aggressive invasive species—rodents, weasels, and so on and so forth—and they wanna do something to eradicate these invasive species there. The problem being is that using certain types of gene drives, and there are many, this has the capacity to spread beyond the local population and that could have really serious outcomes.

SM You mentioned earlier Lyme disease. Are you talking about scientists using the technology on ticks or are you talking about the possibility that we use gene editing in people so that future generations are immune to Lyme disease.

JK I'm referring to the possibility of gene drive being used largely in rodents or other animals which ticks bite, and then transmit the disease to humans.

SM Could we use the same technique though on people to make us immune rather than annual shots against the flu to make us immune to any number of health threats that we face otherwise?

JK It's certainly theoretically possible that a scientist could insert the gene drive into a human being. What's less likely is that it's going to be effective. Because remember that the goal of the gene drive is to be passed onto future generations through this kind of super Mendelian genetics. A way that almost ensures that 100% of future offspring are going to inherit this and that it's really unlikely with humans because our reproductive time is so short. Humans really aren't a good candidate for this technology.

SM What is the worst fear we might imagine if we allow the unbridled use of this technology for nefarious purposes. What's the worst we have imagined could happen if people were dead set on such a thing?

JK It's the ones that might be sneaking under the carpet to which were not paying attention. We could imagine that scientists are taking all protective measures, safeguarding their research, really dotting their i's and crossing their t's and making sure that their lab is safe, doing everything ethically. Well, we could imagine that, let's say Russia or China or another country started an information campaign—and actually what these scientists were doing was unethical. Or what they were doing was unsafe or that this mosquito gets out of the lab and it's been weaponized. Whatever it is, whatever false narrative that wants to be let out of Pandora's box. And my concern is that this false narrative getting out there would really really turn public sentiment against the science in a way that could very well halt it or set it back. And it could really set back you know what would be a boon for human health and well-being.

SM How quickly do you think this is all changing?

JK The pace of progress, and this is just, is just astounding...a few years ago, the national academies of both China and the U.S. had a human genome editing summit to discuss things like editing human embryos. A few years later, it had been done. That's really remarkable and astounding. The issue here is that the science is outpacing the slow pace of governance and regulation.

SM What do you recommend from the study that you recently concluded?

JK Well one obvious area is that any labs that are engaging in this type of activity have to follow the guidelines that are set out by the National Institute of Health, the NIH. Right so research entities right universities and others that are receiving NIH funding, they're required to follow certain bio-safety protocols right so they have to make sure that their labs meet certain safety standards and conditions, certain ethical requirements, security requirements, and so on and so forth. That's not the case for those research institutions

that aren't receiving federal funds. So one, I think, piece of low-hanging fruit is to make NIH regulations applicable to anyone that's conducting this research irrespective of them being public or private. The other is that I'm worried about genome editing being used in, in ways that we've seen with unregulated stem cell therapies. You know, the potential for crispr charlatans. These people that are making dubious health claims, potentially fleecing people of money, or worse yet, engaging in unregulated practices that are supposed to be "therapeutic" that could have really serious negative health outcomes for people. And we've seen this with stem cell clinics that are largely unregulated in the U.S. where people have been blinded as a result of these kind of shady doctors operating out of strip malls.

SM Did you also make recommendations that relate to biosecurity broadly, or the defense in the nation?

JK Yeah. There's a possibility that crispr could be used, genome editing in general, could be used for nefarious purposes. So an example would be to increase transmissibility or the virulence of the virus, making it nastier and worse and making people more susceptible to it. That's a serious concern. For it to be weaponized by non-state actors. There's a whole range in this study of areas of concern that we've outlined while also trying to to really drive home that we ought not lose sight of the really really important benefits that this technology can yield.

SM Jesse Kirkpatrick is a professor of philosophy and assistant director of the Institute of Philosophy and Public Policy at George Mason University. With Good Reason listeners, we want to hear from you. What are you doing to keep up your spirits and your health? Let us know at 434-253-0396. The number's on our website. Major support for With Good Reason is provided by the law firm of McGuireWoods. With Good Reason is produced in Charlottesville by Virginia Humanities. Our production team is Allison Quantz, Matt Darroch, Allison Byrne, Lauren Francis, and Jamal Millner. For the podcast, go to iTunes or to withgoodreasonradio.org. I'm Sarah McConnell. Thanks for listening and I hope you and your loved ones stay safe. [music].