

TPWKY

This is Exactly Right.

Peter Hotez

After I did my MD and PhD I was a pediatric house officer, a resident in Boston, and I was admitting a child to the hospital every couple of weeks with a horrific disease called homofluous influenza type B meningitis, it has the word influenza in it because during the 1918 flu pandemic it was erroneously thought this was a bacteria that caused influenza, not the virus we know today. But it turns out it causes a terrible disease and I would have to do the spinal tap on those kids, the lumbar punctures, you would see the pus coming out where cerebrospinal fluid should be. And these children had terrible outcomes, they were either deaf or permanent intellectual injuries and some of the kids didn't make it. And this took a tremendous emotional toll on the pediatric house staff as well. And that was in 1987/1988.

By the time I finished my residency a new vaccine had come on line that was developed in parallel with the NIH, National Institutes of Health, and in Rochester by another group. And within 3 years that disease had vanished from the United States, it was a disease that I talked about to the next generation of house staff purely for historic interest. So like the old-timers would talk to me about diphtheria and tetanus. It just goes to show you the power of vaccines, you know admitting a child every 2 weeks with meningitis from this disease and now gone.

TPWKY

(This Podcast Will Kill You intro theme)

Erin Welsh

So that was Dr. Hotez sharing with us one of his stories about vaccines and you are going to hear more from him later in the episode. Hi, I'm Erin Welsh.

Erin Allmann Updyke

And I'm Erin Allmann Updyke.

Erin Welsh

And this is This Podcast Will Kill You. This is the second episode in our two episode series on vaccines. In the first episode we covered vaccine basics, how they work, the history of vaccine development, and where we stand with various vaccination programs and vaccine-preventable diseases today. So if you haven't already listened to that episode, you should pause right now and check it out before listening to this one.

Erin Allmann Updyke

Definitely. On today's episode we're going to discuss the opposition to vaccination that has really taken hold in a lot of places around the world with the result that vaccine-preventable diseases have increased and we'll have some discussions on what to do about it.

Erin Welsh

We are also joined today by two very exciting guests who were kind enough to take the time to share their experiences and knowledge with us. The first, Dr. Peter Hotez, you just heard from. Dr. Hotez is Dean of the National School of Tropical Medicine at Baylor College of Medicine in Houston and is also Co-Director of the Texas Children's Hospital Center for Vaccine Development. He has spent his entire career working on infectious disease, particularly neglected tropical diseases and developing vaccines for them. We'll hear more from him later in the episode when we talk about the most common misconceptions or questions about vaccines and vaccine safety.

Erin Allmann Updyke

We were also thrilled to chat with Bill Nye.

Erin Welsh

Bill Nye, you guys.

Erin Allmann Updyke

Like Bill Nye the Science Guy, have you heard of him? We're not joking. We got to chat with him about the challenges facing science communication in this age when headlines travel at lightning speed and it can be really difficult to distinguish between information and misinformation.

Erin Welsh
The format of this episode is a bit different than our others. So first I'll talk about the history of vaccine opposition and then Dr. Hotez will help us go through some of the common misconceptions about vaccines and finally we'll talk with Bill Nye about science communication. So let's get going.

Erin Allmann Updyke
Let's do it!

Erin Welsh
But first-

Erin Allmann Updyke
First.

Erin Welsh
What time is it?

Erin Allmann Updyke
It's quarantini time!

Erin Welsh
That's right. (laughs) What are we drinking today?

Erin Allmann Updyke
Today we're drinking Injection of Reason. It's a good one.

Erin Welsh
What's in Injection of Reason?

Erin Allmann Updyke
Well you know Erin it's basically a passion fruit mojito.

Erin Welsh
Oh god, my favorite. It's so good.

Erin Allmann Updyke
Do you wanna know why?

Erin Welsh
Tell me. Tell me why passion fruit.

Erin Allmann Updyke
Because people get so passionate about these debates. (laughs)

Erin Welsh
(laughs) Wonderful.

Erin Allmann Updyke
Oh it's my favorite. Also delicious.

Erin Welsh
So good. So it's basically rum, passion fruit juice, mint, simple syrup, lime juice, etc.

Erin Allmann Updyke
We'll post the full recipe for that along with our placebo which is the nonalcoholic version on our website and all of our social media channels. Yep.

Erin Welsh
We also need really quick need to make a fun little announcement. We are working on an episode where we answer questions you send us about us or about disease ecology or epidemiology or podcasting or cocktail techniques or honestly whatever you can think of.

Erin Allmann Updyke
Anything you want to know. So send us your questions by email to thispodcastwillkillyou@gmail.com.

Erin Welsh: And if you decide to send us a question that you want us to answer for this episode, please put 'Ask the Erins' or something to that effect in the subject line and let us know whether you're okay with us saying your name on the episode.

Erin Allmann Updyke: We can't wait to hear from you! Now can we get going?

Erin Welsh: Now we can get going. Now we're ready.

Erin Allmann Updyke: Sweet. Excellent. After a quick word from sponsors.

TPWKY: (transition theme)

Erin Welsh: In the first vaccine episode I covered the history of vaccine development and touched on some of the amazing impacts they have had on the world. But throughout that entire history there's a parallel story of people opposed to vaccination. And I think it's really important to explore that story because in tracing these histories we can see that what's happening now is not new, not really. The rise in vaccine-preventable diseases as opposition increases, we've seen that before. And the rhetoric that's being used to manipulate and incite fear in people? Heard it before. Opposition to vaccines is as old as vaccines themselves. By and large when Edward Jenner's smallpox vaccine began making the rounds in 1796 it was hailed as a modern medical achievement and vaccine rates continually grew. Yes, there was outcry and political cartoons and religious opposition but in general it was viewed as a positive because smallpox is horrific and people don't wanna get it. And if you don't believe us, listen to Episode 3 where we get into the gory details.

Erin Allmann Updyke: Yeah. It's very gory.

Erin Welsh: Oh yeah. By the mid 1800s though, vaccination rates had dropped considerably both in the U.S. and in England. What happened? In the U.S. a country-wide anti-vaccine movement had emerged from a fringe element that was Luddite-esque in their philosophy. So the Luddites - do you know who the Luddites are?

Erin Allmann Updyke: No, I was gonna ask. Can you tell me what that means cause I'm dumb?

Erin Welsh: No, no. (laughs) So the Luddites are a 19th century group that destroyed agricultural technology like cotton gins and so on because they believed that machines were stealing jobs for humans.

Erin Allmann Updyke: Oh. It's almost like I've heard that before.

Erin Welsh: Yeah, yeah. So the term is kind of used as a catch-all for anti-technology but that's its specific roots.

Erin Allmann Updyke: Oh interesting.

Erin Welsh

So what started out as anti-vaccine murmurings took on momentum. Satirical cartoons showing vaccinated people with animal-like features like horns and udders and whatever were taken as a real warning by the uneducated public of what was actually going to happen to them if they got vaccinated. And in England vaccine rates had plateaued or started to fall also, likely because the lower disease incidence made people a bit complacent. In 1853 the newly founded Epidemiological Society of London lobbied the British parliament for a compulsory vaccination act coming on the heels of a deadly smallpox epidemic. The bill required all children to be vaccinated by 6 months of age and those who were not in compliance were fined or imprisoned. But there was basically no enforcement so vaccination rates fell even more.

The government passed another new and improved act in 1867 and this one required parents to show a certificate proving vaccination and if they couldn't they were taken to court and fined. But because the lowest vaccination rates were among the poorest due to the cost of vaccines, they often didn't have the money to pay for the fines or court costs in which case family assets were seized and sold at a public auction.

Erin Allmann Updyke

Geez.

Erin Welsh

And if that didn't settle the bill, someone was going to jail. So this act that required vaccination is what gave birth to the anti-vaccine movement in England. Within a few decades, tens of thousands of members belonged to the Anti-Compulsory Vaccination League which urged people to join as an act of patriotism.

Erin Allmann Updyke

Wow.

Erin Welsh

Yeah.

Erin Allmann Updyke

That's fascinating.

Erin Welsh

This league spread all kinds of rumors about the smallpox vaccine like that it was made from the venom of adders, the blood, entrails, and excretions of bats, toads, and suckling whelps. (laughs) That's like a quote, yeah.

Erin Allmann Updyke

(laughs) Suckling whelps. All right. Just any old suckling whelp, or...?

Erin Welsh

I don't know. Didn't go into details.

Erin Allmann Updyke

Cause isn't that just any... That's like just a catch-all term for baby animals, right?

Erin Welsh

Yeah.

Erin Allmann Updyke

Or is it only dogs?

Erin Welsh

I thought it's anything.

Erin Allmann Updyke

Yeah. Weird.

Erin Welsh
Yeah. Well these people, this league also distributed pictures of vaccinated children turning into all kinds of mythical monsters. And at the public auctions where the property of those who couldn't pay the fines was sold, the league held large protests which frequently turned violent. In 1898 the British government gave up the fight and passed a conscientious objection law which is where we get the term 'conscientious objector'.

Erin Allmann Updyke
Wow from vaccination!

Erin Welsh
From vaccination. I really thought it was war.

Erin Allmann Updyke
Me too!

Erin Welsh
But no. So within a year of passing this law, more than 200,000 conscientious objectors had gotten their pass and vaccine rates started to plummet with smallpox outbreaks following. Meanwhile around the same time, so in the mid to late 1800s, in the U.S. several prominent anti-vaccine voices started to grow louder, largely motivated by occultist and mystical beliefs such as that of the Swedish mystic Emanuel Swedenborg.

Erin Allmann Updyke
(laughs) (Swedish accent) Don't you know I'm Swedish!

Erin Welsh
One of Swedenborg's beliefs was that infection or contamination left a scar on the soul and was viewed as sin in that way.

Erin Allmann Updyke
Ooh.

Erin Welsh
And so to Swedenborg the willful vaccination of yourself or your children was morally reprehensible.

Erin Allmann Updyke
Wow.

Erin Welsh
The focus of these anti-vaccine efforts narrowed in on children thanks in large part to an American woman named Lora Little whose 6 year old son died in 1895 after a short and tragic life filled with injuries, ear and throat infections, measles, and diphtheria which is what ultimately got him in the end. However his death from diphtheria was preceded by smallpox immunization by several months, I think like 7 months or something.

Erin Allmann Updyke
Oh no.

Erin Welsh
Yeah. Which were required for school. Lora, his mom, was distraught over his death and sought any explanation except for diphtheria which I guess was too obvious or something. She concluded that it wasn't diphtheria that caused his death but the smallpox vaccine.

Erin Allmann Updyke
Oh dear.

Erin Welsh
So she took up the anti-vaccine crusade and she as well as all of the anti-vaccine voices during this time and well into today had no regard for truth and constantly spouted statistics or medical quote "facts" that were blatantly false. But her voice was reaching a sympathetic audience because due to the political climate at the time, people felt that the government had too much reach. So it was a campaign of fear and I think we all know how difficult for logic to fight fear.

Erin Allmann Updyke

Yeah.

Erin Welsh

And when it's something as important at stake as children, it's really easy to win people over with that fear.

Erin Allmann Updyke

Yeah it is.

Erin Welsh

So Lora Little's anti-vaccine campaign was supported in large part by the Truth-Teller which was a paper, like journal kind of thing, whose primary role was advertising for homeopathy and snake oil remedies both of which had taken a major blow when in 1906 Teddy Roosevelt signed into law the Pure Food and Drug Act that forbade false advertising and unregulated ingredients.

Erin Allmann Updyke

These are like old school blogs, man.

Erin Welsh

Basically yeah.

Erin Allmann Updyke

I love it. I love that they've been around for so long.

Erin Welsh

(laughs) Oh yeah. So they lost this battle once Teddy Roosevelt signed that into law and so they switched their attention to vaccines, publishing completely made up exposees supported by 'authentic facts' which were anything but. At this time, so the early 1900s, it is true that vaccine production wasn't as well regulated as it is today and there were some bad batches that caused a lot of suffering and some deaths. And I mentioned some of these in the last episode. But those events which were the exception and not the rule still did not justify her campaign against vaccination which was based on their unnaturalness and her belief in their immorality. Her issues with vaccines had nothing to do with regulation, it was just more of a hand-wavy, 'You're putting this artificial thing into your body and it's harming you in some way that I can't define or describe because i have no experience or knowledge of molecular immunology.'

Erin Allmann Updyke

(laughs)

Erin Welsh

Not that anyone did at that time but it didn't matter to her.

Erin Allmann Updyke

Right.

Erin Welsh

Because what good are facts and knowledge when faced with righteousness and fear? The message of Lora Little and others in this anti-vaccine movement was being heard loud and clear across the U.S. and their impact was clearly seen in the increased infection rate and death toll of vaccine-preventable diseases, notably smallpox which had almost been eradicated in the U. S. in the 1800s.

Erin Allmann Updyke

Geez.

Erin Welsh

The vaccine opposition movement and the prevalence of vaccine-preventable illnesses had grown so much in fact that it resulted in a 1905 Supreme Court decision about compulsory vaccination. *Jacobson vs Massachusetts* heard from a Swedish-born pastor, where vaccination was mandatory, who felt that vaccination violated his rights as an individual. The court decided 7-2 in favor of the state, so upholding the authority of states to enforce compulsory vaccination laws. The court acknowledged that yeah, for certain people who have medical restrictions forced vaccination would be a violation. But Jacobson didn't have any legitimate grounds for denying vaccination. The court stated that individual rights are superseded by the rights of masses when individual rights may harm others. This decision however did not permit the forceful vaccination of people but upheld that states could be permitted to enforce legal and financial consequences if someone refused to vaccinate. And 17 years later after this Supreme Court decision, the court doubled down on vaccine refusal and ruled that a school could refuse admission to an unvaccinated student.

Erin Allmann Updyke

Right.

Erin Welsh

And that's being talked about a lot today in headlines.

Erin Allmann Updyke

Yeah, mm-hmm.

Erin Welsh

The reasons for opposition to vaccines in the 1800s and early 1900s came in a lot of different flavors ranging from spirituality or religious beliefs to a deep fear that personal rights were being violated to legitimate concern about the safety and efficacy of vaccines. So let's just give ourselves a bit of historical context to see if we can understand where these views are coming from. Okay so for about the first 60-ish years of the smallpox vaccine's use, microbiology wasn't a thing. No one knew that microbes caused disease and could be transmitted from person to person and even once the field developed it would be a while for the science to reach the general public.

Erin Allmann Updyke

Right.

Erin Welsh

People tend to be afraid of things they don't understand, so it makes sense that they would've been scared of vaccines. They had been equally scared of variolation.

Erin Allmann Updyke

Right.

Erin Welsh

I can't really speak to the spirituality or religious aspect of vaccines being immoral but I guess it sort of just goes along with people being afraid of something that seemed to work like magic, I don't know.

Erin Allmann Updyke

Yeah.

Erin Welsh

But anyway. But then there were the people who were opposed to vaccines not necessarily because they hated vaccines themselves but because vaccines represented the long arm of the government, one more way for the government to violate your personal rights. And yeah I mean the repercussions for not vaccinating could be severe and involve violence, they were also classist and racist in part because not everyone was equally targeted to prove they had gotten their vaccines and certain groups were blamed for spreading disease over others.

Erin Allmann Updyke

Even when totally not true.

Erin Welsh

Even when totally not true. Compulsory vaccination was one small part of many different groups' campaigns against government overreach which is why you see anti-vaccine advocacy from abolitionist groups, suffrage groups, and other groups that seemed very forward-thinking otherwise. And finally there were those opposed because they didn't believe vaccines were safe and there was some truth to that. Vaccines did not have the oversight that they do today and there have been serious incidents. But because many of these people wanted to see reform in vaccine regulation rather than no vaccination whatsoever, they tended to be drowned out by the other reasons. Of course I'm oversimplifying here quite a bit, people could certainly be opposed to vaccines for many different reasons all at the same time but these seemed to be the strongest motivators.

Erin Allmann Updyke

Yeah.

Erin Welsh

And some of these reasons probably sound a bit familiar to the rhetoric of the anti-vaccine lobby today. And there are others echoes claiming that doctors are evil and motivated only by greed or worse a desire to cause human suffering. Public rallies that are filled with a burning rage resulting in the destruction of images of vaccine advocates such as when an effigy of Edward Jenner was hanged and decapitated or when giant photos of the director of the CDC's National Immunization Program were labeled TERRORIST in big block letters.

Erin Allmann Updyke

Wow. Wow.

Erin Welsh

Language that planted feelings of paranoia or the thought of conspiracy in anyone who would listen happened both then and now and then there's the outright lying about vaccines being unsafe to further their cause. Minimizing the deadliness of vaccine-preventable illnesses, suggesting that natural infection is better was another big line of both then and now.

Erin Allmann Updyke

Yeah.

Erin Welsh

Which by the way, it's not.

Erin Allmann Updyke

It's not. That's a really scary one too cause it's...yeah.

Erin Welsh

Yeah. So who stood to benefit from opposition to vaccines back then? First it was smallpox variolators whose job security was under serious threat when the smallpox vaccine, much, much safer than variolation, came onto the scene.

Erin Allmann Updyke

Wait that's interesting. (laughs)

Erin Welsh

Isn't that? Yeah. It was also people who developed or sold alternative treatments for vaccine-preventable diseases, just your typical snake oil salesmen. Let's throw lawyers into the mix because there's plenty of those wanting to capitalize on this. These people who could make money off of parents' fear and grief stoked those flames until the movement grew and grew. And that I think is the biggest similarity between the historical and modern opposition to vaccines, amoral, greedy, and opportunistic people preying on a vulnerable population using lies and manipulative rhetoric to make money.

Erin Allmann Updyke

Yep.

Erin Welsh

Let's talk about the origins of the modern anti-vaccine lobby.

Erin Allmann Updyke

Oh gosh.

Erin Welsh

As government oversight of vaccine development and deployment increased throughout the first half of the 20th century, vaccine opposition settled down, never completely going away but fading into the background as the benefits of vaccines became obvious. But that would change in 1973 when an English pediatrician named John Wilson gave a presentation in which he said that the pertussis vaccine was linked to frequent and dangerous health outcomes in children including a fever leading to seizures, coma, and possibly death. His study was the result of him seeking out and compiling these cases and his findings were preliminary and not independently confirmed. Despite this his claim quickly made its way onto the headlines of newspapers calling for vaccine production to immediately cease. The year before Wilson made his announcement 79% of British children were immunized against pertussis. Four years after his announcement that number fell to 31%.

Erin Allmann Updyke

Oh my goodness.

Erin Welsh

Yeah, 31%. And the drop was largely due to family practice doctors not recommending the vaccine.

Erin Allmann Updyke

Oof.

Erin Welsh

All because this one preliminary, extremely biased study. It wasn't even a study, it was a collection of anecdotes. As you might expect an outbreak of whooping cough occurred in which over 100,000 children were infected, 5,000 were hospitalized, 200 developed severe pneumonia, 80 had seizures, and later reports suggest 600 children died. 600 children died of a preventable disease because of a study that was essentially stories. Just a collection of stories. And Wilson, this pediatrician, found himself a nice gig as advisor to the Association of Parents of Vaccine-Damaged Children which quickly began seeking monetary reparations for their suffering. Ultimately it would turn out that the children in Wilson's study likely had Dravet syndrome which is a genetic disorder caused by mutations that happen long before birth, nothing to do with vaccines at all.

While many physicians were taken in by Wilson's study, researchers wanted to see a carefully planned study with appropriate controls to determine whether his claims would hold true. Dr. David Miller, a professor of community medicine, launched a comprehensive study examining the relationship between children with neurological illnesses and the DTP vaccine. He found a statistically significant association between the two. According to his study 3 doses of the vaccine caused permanent brain damage in 1 in 100,000 children. This study would be used as the basis for countless lawsuits over the course of the next several decades. Put a pin in that study.

Erin Allmann Updyke

Okay.

Erin Welsh

Remember. Miller's study.

Erin Allmann Updyke

Miller's study, 1 in 100,000. 3 doses.

Erin Welsh

Yep. In response to the headlines about the possible dangers of pertussis vaccines, parents began to organize crusades and buy radio time to get their message out. Fear is an effective motivator and I get it, there's a voice in your head that says 'what if?' And for some reason that 'what if' question that the anti-vaccine lobby asks is, 'What if I choose to have my kid vaccinated and something bad happens?' Not 'What if I don't get my kid vaccinated and they die of a preventable illness?'

Erin Allmann Updyke

Yeah.

Erin Welsh

Yeah. The anti-vaccine movement, just like an infection, was spreading. In 1982 in Washington, D.C. a TV station broadcast a documentary made by reporter Lea Thompson called 'DTP: Vaccine Roulette' which featured a bunch of grief-stricken parents who recounted their tales of how their children had suffered due to the vaccine. The camera slowly panned over horribly sick or developmentally disabled children and their teary parents with a voiceover that stated that these tragic cases were all due to the pertussis part of the DTP vaccine. The voiceover also minimized the seriousness and often deadly outcomes of actual infection with pertussis and it overstated the adverse outcomes of vaccination. It made unsubstantiated claims that dozens of children every year were permanently brain damaged by the vaccine, a claim that after many, many scientific studies, epidemiological and otherwise, was found to be completely false. Lea Thompson, the reporter who made this documentary, she called it the most important story of her life and said only that she regrets not telling it 10 years earlier.

For parents with children that had suffered seizures or been diagnosed with developmental disabilities and had asked themselves why, why us? They suddenly had an answer. It was the vaccine. The TV station set up a hotline for people to call in and they provided an extra service. They connected callers with other callers, allowing for a massive grassroots movement to form.

Erin Allmann Updyke

Whoa.

Erin Welsh

Soon after it aired a couple of people with no background in medicine or science founded a group called Dissatisfied Parents Together, DPT. This group would only grow in members and financial backing over time. In the 1990s they made a slight adjustment, they changed their name to the National Vaccine Information Center.

Erin Allmann Updyke

What?

Erin Welsh

And their singular goal was to convince parents that vaccines are far more dangerous than the diseases they prevent.

Erin Allmann Updyke

Are you kidding me? They called themselves the National Vaccine Information Center?

Erin Welsh

Yep.

Erin Allmann Updyke

That is just...oh no.

Erin Welsh

That is a classic branding technique that's used by the anti-vaccine lobby. They say, 'We are not anti-vaccine, we are pro-safety in vaccines' or whatever else. Like it's very manipulative and very sneaky.

Erin Allmann Updyke

It's yucky.

Erin Welsh

It's disgusting. Yeah. This website, their organization or whatever, is full of blatant misinformation that's pushed on fearful parents who don't feel heard by their pediatricians. In 1985 the two founders published a book that became a bestseller. Money, money, money.

Erin Allmann Updyke

Yeah.

Erin Welsh

That stated that vaccination in general was directly responsible for all kinds of neurological impairments in children, including but not limited to seizures, chronic encephalopathy, and autism. Also all disproven, also all false. As you might expect, things quickly turned litigious as parents sought to get some financial remedy for their child's health issues and cases like these required scientific experts to be on the stand to give their professional opinion. The prosecution's experts tended to be fringe. One who was in several trials in the U.K. was a real piece of work as we like to say. His name was Gordon T. Stewart and he used his credentials as a physician to promote radical ideas about disease transmission including that the human immunodeficiency virus, HIV, didn't actually cause AIDS but that AIDS was just a manifestation of the gay lifestyle.

Erin Allmann Updyke

Oh my god, I'm gonna rage.

Erin Welsh

Just wait, just wait. So many people, a disturbing number of people bought into this including the president of South Africa, Thabo Mbeki. It's estimated that 365,000 South Africans died unnecessarily because of the policies of HIV denial. So this was the guy who was the star witness on several anti-vaccine trials in the U.K. which were highly publicized.

Erin Allmann Updyke

Cool, cool, cool, cool. Cool, cool, cool.

Erin Welsh

Yeah. The rulings were consistently against the parents who sometimes failed to disclose that their child actually had been diagnosed with epilepsy prior to being given any vaccines or that the fever and spasms arose 5 months after the vaccine was administered, not 7 hour after as they had initially claimed. Throughout all this Gordon Stewart made a fool of himself, contradicting himself and being caught out time after time.

Erin Allmann Updyke

Shocking.

Erin Welsh

He also made some money in his role as professional witness. Not a single bit of the prosecution's expert testimony could be supported by actual scientific research and the cases slowed down in the U.K. Unlike in the U.S. where things got more litigious.

Erin Allmann Updyke

Great.

Erin Welsh

The amount of money requested in these court cases in the U.S. rose from \$25 million in 1981 to \$3.2 billion in 1985.

Erin Allmann Updyke

Whoa. In four years.

Erin Welsh

Yeah. I mean you hear about one success and you're like oh, hmm. These court cases were quite a bit different in the U.S. compared to the U.K. First of all the defendant in the U.K. cases tended to be the physician or health services although every now and then a pharmaceutical company would stand in whereas in the U.S. it was often the pharmaceutical companies themselves. At the beginning of this rise in lawsuits, pharmaceutical companies settled out of court but the lawsuits just kept coming in. In response the companies began increasing the prices of their vaccines to pay for the lawsuits. Within three years of that DTP Vaccine Roulette "documentary" quote unquote airing, the cost of one dose of the DTP vaccine was 35x higher than it was in 1982.

Erin Allmann Updyke

Ugh.

Erin Welsh

Yeah. So there seemed to be only one way forward for these companies: stop making vaccines. And that naturally led to a shortage. Basically they had to be rationed out under an unideal vaccination schedule.

Erin Allmann Updyke

Cool. Cool, cool, cool.

Erin Welsh

But the funny thing is pressure was still on to create a new pertussis vaccine despite the first one not being shown to cause epilepsy or any other neurological impairments. But the acellular pertussis vaccine which is in the DTAP nowadays came onto the market in the 1980s and 90s. With all this uproar about vaccine safety there was increasing pressure on the government to do something to ensure that children were protected. In 1986 Reagan, U.S. president at the time, signed into law the National Childhood Vaccine Injury Act which tasked a bunch of highly trained, credentialed researchers with investigating the safety and potential health outcomes of various vaccines. After four years they determined that there was absolutely no link between the DTP vaccine and autism, meningitis, chronic neurologic damage, spasms, and many, many other side effects. The first line of this report read, quote: "Next to clean water, no single intervention has had so profound an effect on reducing mortality from childhood diseases as had the widespread introduction of vaccines."

This act put into place several programs to increase vaccine safety and information access even more. The Vaccine Adverse Event Reporting System was established, VERS, which requires that all healthcare providers report certain adverse events regardless if there's a causative link. It also set up the National Vaccine Program Office which works with various other branches of the U.S. government to coordinate the vaccine immunization campaigns. It also required that all healthcare providers give their patients an informational sheet describing the disease and the risks and benefits of the vaccine. So you've probably gotten this with the flu shot every year or whatever else, yellow fever shot.

Erin Allmann Updyke

Yeah. Or when you take your kids to get all their vaccines.

Erin Welsh

That as well. What happens when a vaccine does cause an adverse reaction? So we can actually see how this plays out with the rotavirus vaccine that had been licensed in 1998.

Erin Allmann Updyke

This is a good story.

Erin Welsh

Yeah. There had been reports of intussusception which is when one segment of the small intestine kind of telescopes or goes into another and gets stuck.

Erin Allmann Updyke

It's gross, dude.

Erin Welsh

It's gross.

Erin Allmann Updyke

(laughs) You're belly just goes (slurp) and sucks into itself. Your intestines.

Erin Welsh

(laughs) Well this horrible thing was happening in infants which is unusual. So it can happen just naturally but this was happening in infants and that was not normal and not good. 15 children experiencing this were reported to the Vaccine Adverse Events Reporting System, VERS, within 10 months of the vaccine being licensed. The CDC immediately pulled its recommendation for the vaccine even though the risk of this adverse event was still minuscule and the company that produced it stopped selling it. So it was just done, off the shelves, no more of this.

Erin Allmann Updyke: And you said 15 kids?

Erin Welsh: 15 kids.

Erin Allmann Updyke: Okay.

Erin Welsh: Fifteen.

Erin Allmann Updyke: Yeah.

Erin Welsh: 7 years later a new and safer rotavirus vaccine came onto the market with no such adverse side effects seen. So this response happened rapidly and it very effectively shut down any dangerous aspect of this.

Erin Allmann Updyke: Right.

Erin Welsh: And so that should reassure parents and it should have that not only are the CDC and other government organizations actively monitoring the safety of currently available vaccines, they're also incredibly cautious when dealing with the lives of children.

Erin Allmann Updyke: Yeah.

Erin Welsh: Okay. So let's go back to that pin that you put in that study that set so much of this off.

Erin Allmann Updyke: Miller, 1 in 10,000, 3 doses.

Erin Welsh: 1 in 100,000.

Erin Allmann Updyke: Dang, I came so close.

Erin Welsh: And 3 doses of DTP.

Erin Allmann Updyke: Yeah.

Erin Welsh: Okay. This study inspired many other researchers to try and replicate miller's findings. Some studies asked what was the mechanism by which the pertussis vaccine caused brain damage and there wasn't one. Actual pertussis, like a live infection, can cause brain damage by reducing the amount of oxygen in your blood due to non stop coughing. But the pertussis vaccine consisted of whole killed bacterial cells so their presence alone could not and did not cause that oxygen depletion. Maybe it was tiny amounts of endotoxin in the vaccine but that didn't work either. Endotoxin causes brain damage through a pathway that necessarily involves fever but many of the children who had seizures or mental disabilities never had a fever after the vaccine.

Other studies looked at the epidemiological side of things. So one compared two groups of children. In one group which was 130,000 children, the kids had just received the DT vaccine, so diphtheria and tetanus vaccine and the other group also about 130,000 children, they received the full DTP vaccine including pertussis. The researchers then looked to see are there more cases of brain damage or other negative outcomes in the DTP group? No, there is absolutely now difference between the groups. None. Another study looked at how changing the vaccination schedule might affect the occurrence of this. If the vaccine caused epilepsy or other negative side effects, the occurrence of those should change along with the change in vaccine schedule but it didn't. So time and time again studies involving tens or hundreds of thousands of children all around the world simply could not find a link between the DTP vaccine and any epilepsy or other neurological damage.

Miller himself kind of came under scrutiny after all of these studies could not find a link. So it turns out, it came out during a trial that doctors in the study had actually been instructed, 'if there is doubt, code the worst picture.' So they had been advised to draw conclusions when there were not conclusions to be drawn to paint the horrible picture, to give the worst outcome.

Erin Allmann Updyke

What?

Erin Welsh

It was also revealed that the study had been published prematurely with only a subset of the children it said it had studied were actually involved in the analysis.

Erin Allmann Updyke

Oh no.

Erin Welsh

So when the follow up was finally completed and the data were reanalyzed, no association was found.

Erin Allmann Updyke

It's like a really number one rule is you can't only analyze on a subset of your data when you... (laughs)

Erin Welsh

Right. And also if you're a co-author on that paper, do your due diligence and make sure it's done right.

Erin Allmann Updyke

Yeah man.

Erin Welsh

God. Okay. But with the Miller study, damage had already been done. And speaking of damage done, let's talk Wakefield.

Erin Allmann Updyke

Ugh, do we have to?

Erin Welsh

We absolutely have to.

Erin Allmann Updyke

I know we have to. (laughs)

Erin Welsh

Discredited doctor Andrew Wakefield got his medical degree at St. Mary's Hospital in England specializing in gastroenterology. He did not to my knowledge, although I could be wrong, receive any formal training in medical research beyond what might be covered as part of medical school, which means he was not trained to design, conduct, or analyze scientific studies. But he wanted to make a name for himself. On February 28, 1998 Andrew Wakefield published an article in The Lancet which is an old, well known and well respected medical journal. In this article Wakefield describes his study in which he linked impaired neurological development and autism with MMR vaccination. His sample size was 12 children, 8 of which he said had developed autism following the MMR vaccine. Wakefield didn't posit any mechanism by which the vaccine could cause autism beyond some vague hand waving. But when this report came out people latched onto it. It promised an answer for so many parents that had been waiting for one for so long.

Let's take a closer look at Wakefield's study because it really needs it. An investigative journalist named Brian Deer focused on the Wakefield study over the course of 6 years from 2004-2010. Deer was suspicious of the study after reporting on the many class action lawsuits that seemed to be motivated by greed and by the lawyers preying on grieving parents over the supposed vaccine connection. Over the course of his investigation, Deer examined every aspect of the Wakefield study and uncovered some pretty appalling things. Starting in 2004 he announced his findings in a series of reports from 2004-2010. What did he find? Well first Wakefield was straight up paid to fabricate these findings. Just paid.

Erin Allmann Updyke

(laughs) Just straight up.

Erin Welsh

Yeah. An attorney named Richard Barr paid for Wakefield's study and put him in contact with 12 kids. These 12 kids were selected by Barr because they were all part of his lawsuit to get more money from vaccine companies. And it goes deeper. When publishing in any peer-reviewed journals, you are supposed to disclose whether you have any potential conflicts of interest and you also have to state where your funding comes from. It's standard practice. Wakefield lied on both counts. He didn't say he was getting any money from the lawyer and he didn't say where his funds were coming from. And he also lied when directly asked by the British Medical Research Council. He didn't disclose that A) his study was fully funded by an attorney actively seeking remuneration in a lawsuit against vaccine manufacturers, B) that the kids in his study were all involved in the lawsuit, and C) that he himself had already received £50,000 for his work.

Erin Allmann Updyke

50,000. Geez.

Erin Welsh

Yeah. That's a lot of cashola.

Erin Allmann Updyke

Yeah.

Erin Welsh

Nor did he disclose to the council or his co authors that he had put the children through unethical and painful medical procedures including lumbar punctures, general anesthesia, and intrusive bowel imaging.

Erin Allmann Updyke

Why?

Erin Welsh

Great question. Money. Money is the answer. Money and some sort of other agenda. I don't know. And it didn't end there. It turns out Wakefield wasn't even opposed to vaccines, he was just opposed to one that he couldn't directly profit off of. He had actually filed for patents for his own measles, mumps, and rubella vaccine. And this study was just step one in trying to discredit the existing safe vaccine and to strike fear into parents so that he could get them to opt for his vaccine instead. Yeah.

Erin Allmann Updyke

This is deeper than I knew.

Erin Welsh

Oh yeah. It also turns out that he paid, at his son's birthday party, he paid his son's friends £5 each to draw blood from them.

Erin Allmann Updyke

(laughs)

Erin Welsh

Yeah.

Erin Allmann Updyke

I'm sorry, that's just... Where were their parents?

Erin Welsh

That's a great question.

Erin Allmann Updyke

Where was his... Oh dear.

Erin Welsh

Yeah. Once these extremely unethical behaviors were revealed there was public outcry and Wakefield was stripped of his license in 2010. That's why he's discredited doctor Andrew Wakefield.

Erin Allmann Updyke

Yeah. No longer doctor.

Erin Welsh

No longer a doctor, cannot practice. The Lancet retracted the paper in 2010 also. In 2009 the Omnibus Autism Proceeding which is basically this massive class action lawsuit against vaccines was a huge decision that was made. The MMR vaccine did not cause autism, nor did thimerosal-containing vaccines. That meant that limited the ability for people to sue on the grounds that those vaccines caused autism. One special master wrote, quote: "Sadly the petitioners in this litigation have been the victims of bad science conducted to support litigation rather than to advance medical and scientific understanding of autism spectrum disorder. The evidence in support of petitioners' causal theory is weak, contradictory, and unpersuasive. This is particularly apparent when considering the impressive body of epidemiologic evidence contradicting their theories." But that should be it, that should be shutting the door then, right? So we know for sure there's no link. No.

Erin Allmann Updyke

Erin these doors never get shut.

Erin Welsh

Nope. As I have said many times in this episode, the damage had already been done. Wakefield could then play the role of martyr, crying conspiracy and continuing to promote his anti-vaccine agenda. He wrote books, he made a documentary, he gave paid lectures, and he gained followers, among them many celebrities such as Jenny McCarthy, Jim Carrey, Alicia Silverstone, Charlie Sheen, Robert Kennedy Jr, Bill Maher, and Donald Trump who has tweeted multiple times about a link between vaccines and autism long after those links had been proven not to exist.

Even more appalling are the doctors that have climbed aboard this train. Robert Sears is a California pediatrician who wrote a best selling book in 2007 that openly says, 'this is not an anti-vaccine book' and then goes on to suggest an alternative vaccine schedule approved by no vaccine researcher. And he also tells parents, 'Don't share your fears about vaccinating with your neighbors because if too many people avoid MMR vaccine, there will be outbreaks.' He has no background in vaccine research, he has no background in any field remotely related to vaccine research that would give him any sort of credentials to write this book and advise parents.

Erin Allmann Updyke

How do you not see that as a huge red flag? Like, 'Hey, do this thing but don't tell anyone cause if everyone does it we're all gonna die of measles.'

Erin Welsh

Well it's the tragedy of the commons because it does make sense in a certain respect to say you know what, it is safer is I don't vaccinate but then everyone believes that and then it becomes unsafe for everyone.

Erin Allmann Updyke

Right cause if you don't vaccinate you essentially have to never go in contact with any other people is what that means, right? Cause that's the only way to actually stay safe.

Erin Welsh

Right. And then even the ground because tetanus.

Erin Allmann Updyke

Well yeah. (laughs) Just like tile floors, no dirt.

Erin Welsh

Don't be fooled by this book by Robert Sears, he lies throughout it and he couches - I think this is the most galling thing is that he couches his false statements in scientific language to manipulate readers into thinking that he's telling the truth and that he has all the information and that he has the right facts. Then there's Dr. Oz telling pregnant women don't get the flu vaccine, it's not safe.

Erin Allmann Updyke

I hate that human. Just so everyone's clear.

Erin Welsh

Don't listen to anything Dr. Oz says about anything, ever. Ever.

Erin Allmann Updyke

Ever. That's a horrible human right there.

Erin Welsh

Yes. After the Wakefield study vaccine rates plummeted particularly among rich, educated people. MMR vaccine coverage went from over 90% to 80% by 2003, five years after the study was published, and measles cases increased including the first measles death in 14 years in the U.K. Because you need 95%, 95-97% coverage to prevent outbreaks.

Erin Allmann Updyke

And those vaccination rates, that was in the U.K. in the early 2000s?

Erin Welsh

That was in the U.K. I believe, yeah. This increase in measles cases can be directly linked to the drop in vaccine coverage by people choosing not to vaccinate their children or themselves. In a way the Vaccine Roulette documentary and Wakefield's study would act as templates for the constantly shifting arguments of the vaccine lobby. It goes something like this. Vaccine A causes disease A but then that gets debunked so then it's vaccine B actually causes disease A and then that gets debunked. And the specific vaccine or vaccine ingredient changes as does the disorder or condition or whatever it's supposed to cause. The anti-vaccine lobby needs something to cling to after their unscientific claims are debunked time after time. After measles and epilepsy it was the homofluous influenza B vaccine and diabetes or other chronic diseases. Then it was MMR and autism, then thimerosal and autism, then aluminum and autism. All of these have been extensively studied and disproven.

Since removing thimerosal from vaccines, rates of autism have not changed. It's actually looking more like autism develops prenatally. The vaccine lobby has done a huge disservice to the autism community as well because so much time and money has been devoted to a cause that has no scientific basis. Wouldn't it have been better spent developing programs or services for autistic people who aren't able to live alone? Or to raise awareness about the neurodiversity movement?

Erin Allmann Updyke

Yeah. What a concept.

Erin Welsh

What a concept. But instead what the anti-vaccine lobby has done has made parents afraid and mistrustful. They have told parents, 'You did this to your kid.' There are so many people in the anti-vaccine lobby making a massive profit by preying on the fears of the parents who just want to do the right thing for their child. Lawyers, quote "doctors" pedaling alternative disease prevention therapies or treatments for autism such as bleach enemas or chelation.

Erin Allmann Updyke

No!

Erin Welsh

Yep.

Erin Allmann Updyke

Don't do that!

Erin Welsh

Don't do that. 80% of people who reported to VERS that vaccines caused autism weren't doctors or nurses or nurse practitioners or parents, they were personal injury lawyers.

Erin Allmann Updyke

Ooh.

Erin Welsh

Yeah. So we hear a lot about the anti-vaccine movement in the U.S. and in the U.K. and sort of the different lines of argument that they use, those are not the only places in the world that have anti-vaccine lobbies.

Erin Allmann Updyke

Right.

Erin Welsh

I focused on those because those are the ones that I could find the most information about to be honest. But anti-vaccine sentiment has caused huge issues in other places as well. So for instance in Nigeria in 2003 a rumor started that the polio vaccine caused AIDS and infertility in young girls.

Erin Allmann Updyke

Uh oh.

Erin Welsh
Vaccinations basically stopped. So polio up to that point in 2003, polio had been so close to eradication but within 3 years polio cases that had originated in Nigeria had popped up in 20 countries that had been previously polio-free.

Erin Allmann Updyke
Wow.

Erin Welsh
As a result 5000 people were permanently paralyzed from the infection.

Erin Allmann Updyke
Wow.

Erin Welsh
This is a problem all over.

Erin Allmann Updyke
Worldwide, yeah.

Erin Welsh
And so much of it has to do with just not understanding how vaccines work and not believing that they work and there are also long term issues of forced sterilization and people being injected with things that are not good for you.

Erin Allmann Updyke
Yeah. Right. There's a lot of mistrust of organizations that are imposing vaccinations on people and a lot of that mistrust is not necessarily misplaced so it does make it very, very complicated.

Erin Welsh
Yeah. Well put. Those how fall prey to the manipulation and lies of the anti-vaccine lobby are themselves victims. It's completely understandable to have questions and fears about what is safe for your child and it has gotten so difficult to know how to find factual information on the internet especially if you have no background in science.

Erin Allmann Updyke
Yeah.

Erin Welsh
The rapid spread of misinformation surrounding vaccines is highly concerning and it can be tough to know how to educate yourselves. Hopefully these vaccines episodes will help a little bit.

Erin Allmann Updyke
Hopefully.

Erin Welsh
And we will also post in our show notes some links to credible websites that have lots of info on vaccines. Okay.

Erin Allmann Updyke
Okay. (laughs)

Erin Welsh
Erin, take us through some of the common misconceptions around vaccines today.

Erin Allmann Updyke
Ugh, I can't wait to.

TPWKY
(transition theme)

Erin Allmann Updyke
So let's talk about some of the major myths, the major misconceptions surrounding vaccines.

Erin Welsh
Okay.

Erin Allmann Updyke

I feel like we might as well start with the vaccines and autism situation because this is where you ended.

Erin Welsh

Yes.

Erin Allmann Updyke

Okay, so let's dive deeply. There are a few main arguments, as you've mentioned, that have been cycled through as to what it is about vaccines that causes autism. I'll first of all say none of them have any merit but let's go through each one individually and explain why it has no merit. Okay. I'll also say that there is a document that I will link to on our website, it's a 21 page document, it's a little bit old so I also have a number of more recent studies on our website but this 21 page document has links to and summarizes a number of different papers that outline all of these points so it's not like just a few papers, we're talking dozens and dozens of studies across hundreds of thousands, in some cases millions of children.

Erin Welsh

Wow, okay.

Erin Allmann Updyke

Yeah. The amount of information that we have about vaccines and autism is quite frankly incredible.

Erin Welsh

Oh yeah. It's one of the best studied topics.

Erin Allmann Updyke

Yeah. So number one, the MMR vaccine does not cause autism. The assertion that it did, as you said, was based on that single study by Andrew Wakefield. And since then dozens and dozens of studies, epidemiological studies have looked at the connection between getting the MMR vaccine and later being diagnosed with autism and they have found absolutely not a single link.

Erin Welsh

And can we also point out that these studies by and large are funded by government grants and so the scientists are not getting directly paid for this research, they are usually employed by the university and then they have to apply for funding to then fund the research materials.

Erin Allmann Updyke

Yes.

Erin Welsh

And so these are not people who are paid by pharmaceutical companies producing the vaccine.

Erin Allmann Updyke

Exactly, right. Yes. Thank you for saying that, that's an important part of it.

Erin Welsh

It's a big thing that pro-vaccine activists get accused of being shells for pharmaceutical companies and that's simply not the case.

Erin Allmann Updyke

Yeah. It's not the case.

Erin Welsh

No one goes into academia to get rich because that would be the most foolish way to go.

Erin Allmann Updyke

(laughs) Yeah. So there also is another study, a very recent one that just came out in March of 2019 looking at hundreds of thousands of children that again found no link between the MMR vaccine and autism. There's also been studies that specifically looked, and I think this is very interesting, they specifically looked at children who had an older sibling who was autistic, who had previously been diagnosed with autism. And they found that even in those children there was no increase in autism diagnoses in children who receive the MMR vaccine if they had a sibling who was also autistic. So what that means in that even if because some groups tried to say, 'Well MMR only causes autism in susceptible people.' So if there is a genetic component to autism then people who would be susceptible might be people who have a family history of autism. But even in those groups there was no link between the MMR vaccine and autism.

Erin Welsh

Right. That's a very powerful study.

Erin Allmann Updyke

It's a very powerful study. Some more. Thimerosal in vaccines causes autism. Okay.

Erin Welsh

What is thimerosal?

Erin Allmann Updyke

Thimerosal is a preservative, it contains mercury, it's a preservative that used to be used in some vaccines as a protection against infection of vaccine vials. So when pediatricians used to use multi dose vials of vaccines then thimerosal was added to those vaccines to make sure that they didn't get contaminated. I will say that in the U.S. all pediatric vaccines are now single dose vials so they no longer contain thimerosal.

Erin Welsh

Okay so you get, for each person you get one disposable little dose, one vial.

Erin Allmann Updyke

One vial, yes. So we're just filling the landfills but not using thimerosal. So another assertion has been it's not the MMR vaccine itself, it's this mercury-containing thimerosal compound that causes autism. Again here people have very specifically looked at this, dozens of studies on hundreds of thousands of children who received thimerosal-containing vaccines, not just MMR, a number of different thimerosal-containing vaccines, there is no link whatsoever between thimerosal in vaccines and autism. Denmark actually found an increase in the rates of autism diagnoses after discontinuation of thimerosal.

Erin Welsh

Yeah.

Erin Allmann Updyke

So whatever that means. Dunno.

Erin Welsh

(laughs) Well I think it probably has to do with the changing criteria for what is considered autistic or not.

Erin Allmann Updyke

Yes. That's what I wrote as well.

Erin Welsh

And so this is another thing, another anti-vaccine lobby statement is that autism is going to increase at such a rapid rate that it'll be 1 in 2 children by the time whatever, whatever. That's not true but it is probably true that rates of autism diagnoses probably will increase because we're just sort of getting a better grasp on what it is and then also particularly what autism might look like in females which historically have been more difficult thing to sort of describe or nail down.

Erin Allmann Updyke

Interesting, I didn't know that.

Erin Welsh

Yeah.

Erin Allmann Updyke

Okay so then once thimerosal and the MMR vaccine were pretty thoroughly discredited a newer assertion was that it's aluminum. (laughs)

Erin Welsh

Yep. I love this one cause it's great, yeah.

Erin Allmann Updyke

It's so fun. So aluminum hydroxide, I think it's aluminum hydroxide and aluminum phosphate are both two aluminum salts that are sometimes used in vaccines, these are mostly used in conjugate vaccines and what aluminum does in a vaccine is it helps to stimulate a more robust immune response. So like we talked about in our first episode which again, if you haven't hear it it's a great episode, if we do say so ourselves, about the biology and history of vaccines. Some vaccines like the conjugate vaccines, you have to get a number of different boosters because they don't stimulate a super robust immune response. So adding aluminum, it's called an adjuvant, it essentially stimulates your immune system because it's another foreign particle that stimulates your immune system to give you a more robust immune response, you have more immune cells coming to the injection site and therefore you get a better and longer lasting response to that vaccination. So that's why we have aluminum salts in some vaccines. But then some people said this is what it is in the vaccines that cause autism.

Okay. A number of the studies that I've already highlighted that again are linked on our website, the vaccines that also contained thimerosal also contained aluminum and again no association between aluminum in these vaccines and autism. I also want to point out that the amount of aluminum in vaccines is very, very, very minuscule. So over the first 6 months of a baby's life if they get all their recommended vaccines, they'll get about 4 milligrams of aluminum from their vaccines. If they're feeding on formula they can get anywhere from 38-117 milligrams of aluminum just from that formula, if they're breastfed they get less but still over 7 milligrams from breast milk. And it's not just in the food that we eat, aluminum is in the dirt that your child is probably shoving into their mouth, it's in skincare products that we use. What our body does with aluminum is it mostly excretes it through our kidneys. So not all of the aluminum that you're injecting or ingesting is staying in your body, the vast majority of it your kidneys filter out, they do a really good job of it as it turns out.

Erin Welsh

Don't adult humans ingest through just food, normal food, like 5-10 milligrams a day or something like that?

Erin Allmann Updyke

Probably, I didn't look up what adults ingest but...

Erin Welsh

Let me check cause I do have that somewhere.

Erin Allmann Updyke

Yeah.

Erin Welsh

Yeah. Everyday. 5-10 milligrams.

Erin Allmann Updyke

Everyday. 5-10 milligrams. Cool. Cool, cool, cool. And so again in a number of different studies that have looked at vaccines that contained aluminum there's been no links found between any of those vaccines and autism. Okay so there's one more floating around that is very new and that is that maternal vaccines cause autism. So giving vaccines to a pregnant person causes autism in the fetus. Now this is a very new, very recent assertion so there have not been quite as many papers specifically addressing this topic but there have been a number of studies looking at vaccination in pregnant people and the outcomes of babies in general. So let's talk about that.

In general there's only two vaccines that are recommended to be given to pregnant women, the influenza vaccine and the DTP or the DTAP vaccine. The influenza vaccine you ideally get early in pregnancy because you are immunocompromised when you're pregnant and getting infected with influenza can have very serious complications for the fetus. There's been a number of studies that have shown that infection with influenza can have very serious outcomes. And you get the DTAP vaccine so that when the baby is born it has antibodies against pertussis because pertussis is a very, very serious illness if babies get it. So both of these, the influenza and the DTAP vaccine are not live vaccines which means there's no way to actually cause an infection whatsoever, you can't get sick from these vaccines. So a study just came out in 2018 last year that specifically showed no link between DTAP vaccination during pregnancy and autism in the baby later on. Another study looked at influenza infection and influenza vaccination and overall found no link between prenatal influenza infection or vaccination and autism. At all.

Erin Welsh

Okay.

Erin Allmann Updyke

So yeah. Again there haven't been quite as many studies but the ones that there have been have shown no effect whatsoever. In contrast there are a number of studies that suggest that maternal infection, especially infections that are severe enough to result in hospitalization during pregnancy, can potentially increase the risk of autism. So while that one study didn't find an association between influenza infection and autism, other studies suggest maybe that is possible. Again, the question of what does cause autism is something that we don't know at this point.

Erin Welsh

Right. We're starting to get a little bit of a better grasp on it though.

Erin Allmann Updyke

A better grasp on it. And it definitely seems like something that happens very early on in development and not something that vaccines have anything to do with, even maternal vaccines.

Erin Welsh

Right, right.

Erin Allmann Updyke

And someday we will have an episode about this because I think it's very interesting.

Erin Welsh

So there are physiological markers that seems to be associated with autism and these are evident long before any vaccines are even given to infants. So one research group was able to predict with 90% accuracy whether a 6 month old infant will develop autism at 2 years which really strongly indicates this happens prenatally and it's not linked to vaccines in any respect.

Erin Allmann Updyke

There's a lot of developmental child psychology videos that they make that you watch in med school to learn about child developmental psychology and yeah, there are markers that you see even very, very early on before you get a lot of these vaccines especially the MMR vaccine and things like that that are usually the ones quoted as...anyways. So moving on, I think that we've fully covered that, what do you think?

Erin Welsh

I think so.

Erin Allmann Updyke

Vaccines don't-

Erin Welsh

If there are still questions that you guys have, please send us.

Erin Allmann Updyke

Yeah. All right that's not all the myths and misconceptions that we have though, we've got plenty more.

Erin Welsh

Okay, good, good, good.

Erin Allmann Updyke

So here's a common myth overall, vaccines aren't safe, period. They're not safe, they're dangerous. The risks of vaccination outweigh the risks of infection. Okay. So vaccines are safe. There are a number of oversight bodies that make sure that vaccines are extensively tested before they're released and continue to monitor them as they circulate through the population, as people are actually getting these vaccines. There are some risks that are associated with vaccines.

The most common side effect from vaccination which we talked about a little bit in the biology section of the first episode is fever. That's one of the most common side effects from vaccines. You also can get pain or redness or swelling at the injection site. All of these are from your body mounting an immune response to the vaccination. All of these, even if they suck and you feel cruddy or your baby is crying because its arm hurts and it has a fever, this is part of how the vaccine actually works. And this is something that even though it is normal is considered a minor adverse reaction. So even though it's not serious, it's fever and pain, it still is considered a minor adverse reaction.

Okay so there are some more serious adverse events that are possible. Probably the most common serious adverse event is having a seizure after a vaccine. This is called a febrile seizure. As it turns out, when you are a small kid you can get a seizure from a fever, whatever the cause of fever. So because vaccines can potentially cause a fever they can in some cases precipitate a seizure in some kids. For an example of how rare this is though with vaccines, it's most common in the measles, mumps, rubella, and varicella, so that's four vaccines at once, MMRV. It happens in about 8.5 per 10,000 doses.

Erin Welsh

Okay.

Erin Allmann Updyke

Okay? And again that febrile seizure is the only one that will happen. The vast majority of the time that seizure is isolated, there's just that one. So 8.5 per 10,000 doses will have this one single febrile seizure. So even though that's very scary, I can imagine how terrifying that would be, it's very rare. Now other adverse events are possible. It is possible to have like you mentioned the old rotavirus vaccine had a rate of intussusception at about 1 per 20,000 to 1 per 100,000 doses and that vaccine was pulled because that was too high of a risk. It's possible to have severe allergic reactions, so things like anaphylactic shock would be a severe allergic reaction. These are generally in less than 1 per 1 million doses of vaccine.

Erin Welsh

Right. And it's not something that you can know beforehand whether-

Erin Allmann Updyke

Right. Exactly. I mean unless you know that you're allergic to a certain component of a vaccine in which case the you should not get that vaccine. In all of these adverse events, the very serious ones and the not serious ones like fever and things like that, these are all tracked by what you mentioned already, the Vaccine Adverse Events Reporting System or VERS. So parents, providers, and vaccine manufacturers can all make reports - and apparently lawyers, I'd didn't know that part - can make reports on VERS.

Erin Welsh

Uh huh.

Erin Allmann Updyke: And VERS takes every single report no matter how serious the adverse event or how minor the adverse event and they do investigate it. So based on, this is from Peter Hotez' book cause he summarizes these very nicely-

Erin Welsh: Yeah he does.

Erin Allmann Updyke: Between 2006 and 2015 about 3 billion doses of vaccine were given in the United States. 3 billion doses.

Erin Welsh: That's fantastic.

Erin Allmann Updyke: I know! That's 300 million doses annually. This is like a dose per person, there's like a little over 300 million people in the U.S. right?

Erin Welsh: Yeah.

Erin Allmann Updyke: So of these 300 million doses annually, VERS gets on average about 30,000 reports. So that's 0.01% of all the vaccines.

Erin Welsh: Okay.

Erin Allmann Updyke: And that is all of the adverse events combined.

Erin Welsh: And not necessarily causally linked.

Erin Allmann Updyke: Right. They don't have to be causal just to be reported to VERS. So for more numbers about 15% of those reports, so 3000-4000 of those 30,000 reports are more serious and involve, quote: "Hospitalization, permanent disability, or death which may or may not have actually been caused by the vaccine."

Erin Welsh: Right.

Erin Allmann Updyke: But again VERS is going to follow up on all of those to determine whether or not there is a causal relationship with vaccines. So overall vaccines are extremely safe.

Erin Welsh: Do we have numbers for what VERS has found in terms of what is causally linked in those severe outcome cases?

Erin Allmann Updyke: So if you look at the numbers of overall how many vaccine doses are given and how many serious adverse events are reported, it's about 1 in a million adverse events are reported.

Erin Welsh: Okay.

Erin Allmann Updyke: So 1 in a million doses. And again some of those are likely not directly from the vaccine.

Erin Welsh: Right.

Erin Allmann Updyke: All right. That was misconception number two. Misconception number three.

Erin Welsh: Ooh, boy. Okay.

Erin Allmann Updyke

This is so long. Okay. This is a very common concern that I hear and I actually think it's an interesting one to talk about. There are too many vaccines given all at once, your baby's immune system can't handle it, we have to delay the vaccination schedule. Okay. So first of all there's a misconception here. The misconception is that your immune system can't handle the number of vaccinations that are given or the number of vaccinations that are given at once. So we mentioned this briefly in the first episode, I feel like I've said that a lot. But pathogens aren't the only antigen that your body is responding to. Your immune system is responding to literally everything all of the time. Every breath that you breathe has thousands of particles in it. Viral particles, bacterial chunks, dust, dander, pet fur, poop, urine, all of these things.

Erin Welsh

Food.

Erin Allmann Updyke

Food. Hundreds and thousands of antigens that your body is going to react to and we do from the very beginning. So what that means is that even when you are a tiny baby you already have an immune system that's capable of responding to thousands and thousands of antigens. One study that looked at the number of B cells that a baby has and the amount of antibodies that it can produce found that a baby can respond to 100,000 vaccines at once and it would be fine.

Erin Welsh

(laughs) That's just a few more than what they're currently given, right? Just a couple?

Erin Allmann Updyke

Just a couple more. Just a couple more.

Erin Welsh

It's really cool, I mean I think it just shows how amazing our immune system is to constantly be working all the time.

Erin Allmann Updyke

It's incredible! It's so cool. Like thank you. Thank your immune system today.

Erin Welsh

Yeah, yeah.

Erin Allmann Updyke

I'm gonna thank mine and I have a cold right now. (laughs)

Erin Welsh

Have you thanked your immune system lately?

Erin Allmann Updyke

All right. We've got only a couple more, I swear. I'm almost done. Okay.

Erin Welsh

(laughs) I don't believe you.

Erin Allmann Updyke

Myth number four, misconception four. The flu vaccine straight up doesn't work, it sucks, I get the flu from it every year and it's not even effective so why should I have to get the flu vaccine?

Erin Welsh

Not to mention - okay can we also address the people who say, 'I'm too busy to get the flu vaccine.' Cause that drives me up a wall, I've gotta say. That really grinds my gears.

Erin Allmann Updyke

(laughs) Grinds your gears?

Erin Welsh

Yeah. I'm just too busy with life, man.

Erin Allmann Updyke

Some places try and make it easy and bring the flu vaccine to you and stuff but... Okay. Here's how the flu vaccine works. Every year scientists have to use data and models from the previous year's flu season to predict what are going to be the circulating strains of flu for next year's flu season. If you haven't listened to Episode 1 of This Podcast Will Kill You which was so long ago, if you have listened to that then you will know that the influenza virus is a very tricky virus. It has a very high mutation rate and it has a number of different surface antigens which means it's constantly changing. So it's not the same virus year to year to year. So that means that fairly far in advance we have to start developing vaccines for next year's flu season and we don't necessarily know exactly what those flu viruses are going to look like.

So some years we estimate correctly and we know exactly what strains of flu are gonna be circulating and those years the flu vaccine is especially effective. Other years a new strain of flu pops up that we didn't see coming and so then the flu vaccine that we have is not quite as effective. However even in years when the flu vaccine doesn't precisely match the strains that are circulating, the flu vaccine is still effective at a number of different things. It has been shown to reduce the rate of hospital admissions and doctors visits for the flu which means that even if you get the flu, you don't get as sick from it, so you don't end up in the hospital or getting a secondary bacterial pneumonia. The flu vaccine prevents tens of thousands of hospitalizations every year and it also seriously reduces children's risk of being admitted to the intensive care unit for flu infection. From 2010-2012 it reduced the risk of being admitted to the ICU for children by 74%.

Erin Welsh

That's amazing. Amazing!

Erin Allmann Updyke

Nobody wants their kid to be in the ICU.

Erin Welsh

No!

Erin Allmann Updyke

It's horrible. It also reduces the risk of adult hospitalizations and admissions to the ICU. But from 2012-2015 it reduced hospitalizations by 40% and ICU admissions 80%.

Erin Welsh

Wow.

Erin Allmann Updyke

And it reduces children's risk of dying from influenza.

Erin Welsh

Yeah.

Erin Allmann Updyke

So even if you still get sick with the flu in that year because you have some antibodies against it, even if they're not perfect, it helps your immune system not get so overwhelmed that you end up with a very serious infection.

Erin Welsh

The other thing too which I didn't really talk about in the history but I wanna get across is that when you choose not to vaccinate, whether it's for childhood vaccines or whether it's for influenza, you're not making a choice just for yourself or just for your child, you are making also making a choice for everyone that you are going to come in contact with ever.

Erin Allmann Updyke

Right. Yeah.

Erin Welsh
And that could mean someone who is immunocompromised and cannot get a vaccine or an elderly person who similarly cannot get a vaccine. And you could be responsible for transmitting an infection to them. So next time you think, 'Oh I'm swamped with work, I cannot get the flu vaccine this year.' Think about the infant that you might pass in the grocery store, think about the old person that you might sit next to on a bus. There's a social responsibility I feel like we all should think about when it comes to vaccination.

Erin Allmann Updyke
Because remember a lot of illnesses including measles and influenza can be transmitted before you ever show symptoms, so it's not like you can say, 'Don't worry, I'll stay home if I get sick.' You might be infectious before you even know it.

Erin Welsh
Yeah, yeah.

Erin Allmann Updyke
So vaccines are great. Two more, that's all I've got. Okay.

Erin Welsh
Okay.

Erin Allmann Updyke
Myth number five: vaccines are made of fetus, I don't want to inject fetus into my baby who's no longer a fetus. (laughs) Okay so this is essentially not true. So Erin Welsh, you who I'm talking to-

Erin Welsh
Yes that's me, hi. How are you doing?

Erin Allmann Updyke
In the first episode you discussed how some vaccines were developed and a few vaccines including rubella, hepatitis A, rabies, more of them, they are grown in cell culture lines that were made from fetal lung tissue.

Erin Welsh
You know they're actually called strains because they die.

Erin Allmann Updyke
Oh really?

Erin Welsh
Lines are immortal.

Erin Allmann Updyke
I didn't know that.

Erin Welsh
Yeah.

Erin Allmann Updyke
Oh I did not know that.

Erin Welsh
Sorry.

Erin Allmann Updyke
All right cell culture strains.

Erin Welsh
That's my little 'well actually'. (laughs)

Erin Allmann Updyke
(laughs) Okay. So yeah, these cell culture strains came from a single fetus that had been aborted over 50 years ago, right, in the 1960s.

Erin Welsh
1962!

Erin Allmann Updyke

1962. So those are the cell culture strains that are used to culture some vaccines. This does not mean that babies are being aborted to make vaccines. All of these cell cultures came from the same fetal lung tissue and they've been in use ever since so no new fetuses are needed and it also doesn't mean that your vaccine is full of fetal tissue. You can kind of think of a cell line like the soil that you grow your vegetables in. So when you pull out a potato, yes maybe there is some dirt left on it but does that mean your potato is made of dirt? No. In the same way your vaccine might have been grown on a cell culture that was derived from fetal lung tissue but that does not mean that it is made of fetal lung tissue. That make sense?

Erin Welsh

That makes sense to me.

Erin Allmann Updyke

Excellent.

Erin Welsh

Can I also just say, so I am not a religious person but even the Catholic church has rubber stamped it's okay with the vaccines that are grown in fetal lung tissue.

Erin Allmann Updyke

Oh! New pope or old pope?

Erin Welsh

Old pope actually.

Erin Allmann Updyke

All right, there you go.

Erin Welsh

Benedict. Yeah he said as long as there is no alternative it is completely lawful for Catholics to use these and you actually should because you have a responsibility, etc etc.

Erin Allmann Updyke

Cool, all right. WTG. Last one. I think this is my favorite. The HPV vaccine.

Erin Welsh

Oh good. Okay. I had a whole section that I was like I have too much history.

Erin Allmann Updyke

(laughs) I'm only gonna say a couple of things about it but they're really important things.

Erin Welsh

Okay.

Erin Allmann Updyke

Apparently there's a myth, I didn't even know this was a myth, that the HPV vaccine causes cancer.

Erin Welsh

Yeah.

Erin Allmann Updyke

Yeah. So we're gonna have a whole episode on HPV.

Erin Welsh

Yes.

Erin Allmann Updyke

HPV stands for human papillomavirus. This is a very serious infection because it is the number one cause by far of cervical cancer. It doesn't only cause cervical cancer, it also causes throat cancer, it causes penile cancer, and it causes anal cancer and a number of other cancers. HPV infects basically your surface cells, so anywhere where you have what's called squamous cells, HPV can infect. And the way that HPV replicates in your body can lead directly to cancer. To HPV is very serious. The HPV vaccine does not cause cancer because it is not a live vaccine, it's not even a killed vaccine, it's a component vaccine or a subunit vaccine. So the vaccine itself is just made of particles of the virus, not the whole virus. So there's no way for it to infect your cells the way that a real virus would and cause the changes that a real virus could cause in order to cause cancer.

Erin Welsh

Mm-hmm.

Erin Allmann Updyke

So the HPV vaccine which I just have to say when it was first marketed they did a terrible job of it because they marketed it as protecting you against genital warts, which it does and like who wants warts?

Erin Welsh

Right.

Erin Allmann Updyke

It doesn't just protect against genital warts, it literally protects you against cancer.

Erin Welsh

It's a cancer vaccine.

Erin Allmann Updyke

It is a vaccine against cancer. Isn't that what everybody wants?

Erin Welsh

Right.

Erin Allmann Updyke

People are like, 'Why don't we have a vaccine for cancer?' We do. Literally.

Erin Welsh

Yeah.

Erin Allmann Updyke

I also want to say and this comes back to what I've said a couple of times now about how important it is to give vaccines to people before they're ever exposed. HPV is an extremely common virus, it's everywhere.

Erin Welsh

Yeah, it's everywhere.

Erin Allmann Updyke

I think it's something like it's estimated that 80% of adults will be exposed at some point in their life.

Erin Welsh

Yeah.

Erin Allmann Updyke

And not every strain causes cancer but there are a number of strains that do and the vaccine protects against a number of strains that cause cancer. So some people are concerned that giving the HPV vaccine to young children, which it's recommended for kids aged like 11-14, that this is somehow going to increase sexual promiscuity or the rates of other STIs because, 'Oh if we give them a vaccine that protects against an STI, they're just gonna start having sex everywhere!' There have been studies to specifically look at this and there is absolutely no evidence that giving young people, including young girls who are apparently the precious angels that are never supposed to have sex, there is no evidence that giving young people the HPV vaccine increases sexual promiscuity at all.

Erin Welsh: Can we talk though about the recent study that came out that showed the measurable decrease in cervical cancer diagnoses since the HPV vaccine has been widely distributed?

Erin Allmann Updyke: Yeah. There you go.

Erin Welsh: That's it.

Erin Allmann Updyke: That's it.

Erin Welsh: Because I understand that that was a big discussion about the whole sexual promiscuity thing but it really bothers me that that has held up people in giving it to their children.

Erin Allmann Updyke: I agree, yeah. Yeah.

Erin Welsh: Because a similar argument was made against hepatitis B vaccine when it was first introduced, they were like, 'This is a disease of drug addicts and it's a dirty disease and I'm not gonna give it to my precious angel because that implies they're going to be a drug addict' or whatever.

Erin Allmann Updyke: They're going to be dirty. Yeah.

Erin Welsh: And that is so... I can't even wrap my brain around it and it kind of makes me feel... It's like saying let's have a debate with an anti-vaccine person or community or whatever. I don't think that we should give them any more platforms. (laughs)

Erin Allmann Updyke: Yeah. Well talk about the hepatitis B vaccine, that's another vaccine that protects against cancer because hepatitis B increases your risk for liver cancer.

Erin Welsh: Yes! It does.

Erin Allmann Updyke: Yeah so those are all of the myths that I have to address. I think it's a lot of the biggest ones, the biggest concerns that people have. But we're not even done yet, are we?

Erin Welsh: No. You guys this is a really long episode so thanks for hanging in there with us.

Erin Allmann Updyke: Yeah.

Erin Welsh: We're very excited about it cause there's so much information and we are about to bring you some very thrilling interviews.

Erin Allmann Updyke: So thrilling. So you'll hear from Dr. Peter Hotez about even more vaccine misconceptions and myths and more information about just how safe vaccines are and then we'll talk scicomm with Bill Nye the Sci Guy.

Erin Welsh: So let's get started on those interviews.

Erin Allmann Updyke: All right. We should probably take a quick break, make yourself another placebo.

TPWKY: (transition theme)

Erin Welsh

Today we are joined by Dr. Peter Hotez, Dean of the National School of Tropical Medicine at Baylor College of Medicine in Houston and Co-Director of the Texas Children's Hospital Center for Vaccine Development. Did I get that right?

Peter Hotez

You got it perfectly.

Erin Welsh

Wonderful. Dr. Hotez thank you so much for taking the time to chat with us today, it's so great to hear from you because we have been huge fans since our epidemiology grad school days. This is definitely a celebrity moment for us, like oh my gosh.

Erin Allmann Updyke

Yeah. (laughs) Big time.

Peter Hotez

You are too kind but thank you.

Erin Welsh

Really. So today we wanted to chat with you about vaccines, in particular the misinformation and fear surrounding childhood vaccines and to go through some common questions about vaccines and the misconceptions that the anti-vaccine movement holds onto and promotes. But let's start with you. Can you tell us a bit about yourself and your professional experience with vaccine development and research and how you became interested in this field?

Peter Hotez

Sure. Well thanks for having me and thanks for the questions. So I'm a vaccine scientist sometimes called a vaccinologist and I co-lead a group that's developing vaccines to prevent or treat poverty-related neglected diseases, a group of conditions we call the neglected tropical diseases or NTDs. And I've been doing this my whole professional life since I was in graduate school, since I was an MD, PhD student at Rockefeller University in New York. So I have a lifelong passion to develop the vaccines that nobody else will make because they're targeted the diseases of the world's poorest people and there's no financial pot of gold at the end of the rainbow. So one of the interesting things that we do is not only the science of how we develop vaccines but trying to figure out sustainable business models because no one's done this before.

And so that's my major research activity so it's an interesting one in that it's a hybrid between the academic culture, so we write papers and grants like other academic scientists but we're also trying to develop stuff, we're trying to make a product. So we're a hybrid between a biotech culture and an academic culture which sometimes works and sometimes there are kinks to work out. But it's been a very exciting 30 year ride developing these vaccines. We now have vaccines to combat hookworm and schistosomiasis and moving it to phase 2 clinical trials and we have new Chagas disease vaccine going into phase 1 and hopefully a leishmaniasis vaccine to follow. So we target what we like to call the most common diseases you've never heard of.

Erin Allmann Updyke

Amazing. We actually mentioned your hookworm vaccine in our recent hookworm episode. And I studied Chagas for my PhD so that's really thrilling that there's a Chagas vaccine in the works, I didn't realize that.

Erin Welsh

How did you become interested in vaccines? So in terms of neglected tropical diseases which is a phrase I believe you coined or at least helped to promote and as its name suggests is a neglected area. So what kind of spurred your interest in that particular field?

Peter Hotez

Well it was actually I had a lifelong passion for studying tropical diseases and parasites. So I was a nerdy kid who grew up in West Hartford, Connecticut and had a microscope and my own lab in the basement. And you grow up in Hartford, Connecticut you either wanna pitch for the Yankees or the Red Sox and I wanted to study tropical diseases, so I'm living out my boyhood fantasies. The vaccine component I think is a certain humanitarian drive that I began in medical school and graduate school and have continued ever since. So my whole life I wanted to be a laboratory investigator. The one piece that I did not really think I'd be doing either earlier in life or this stage in life is all the public engagement to get people to care about poverty-related neglected diseases and getting people to care about diseases of the poor and neglected tropical diseases and now this latest craziness about vaccines and the anti-vaccine movement.

Erin Welsh

So moving into that area, in your book called 'Vaccines Did Not Cause Rachel's Autism' which was published last year, you talk about your personal experience as a vaccine developer and as a parent of a child with autism spectrum disorder. Writing about such a deeply personal part of your life must have been a difficult process and you mention in the book that it was a difficult decision to make but it's also so enlightening to hear your perspective and I'm sure it resonated amongst many readers. Could you share with us a bit about your daughter Rachel and why you decided to write that book?

Peter Hotez

Sure. So my wife Anne and I have four adult kids and Rachel is our youngest daughter, she's 26, has autism but not only autism a number of other severe intellectual disabilities. And I wrote the book because I became very alarmed by this aggressive rise in the anti-vaccine movement, we were starting to see measles outbreaks across Europe, we're starting in the United States. So we could talk about why we see measles before we see the other vaccine-preventable diseases and this rising chorus of anti-vaccine sentiments to the point where the anti-vaccine movement had morphed from a cult or a fringe movement to now dominating the internet. And on the other side I did not see a robust system in place to counter it, there wasn't really narrative that was out there that was easily accessible promoting vaccines.

So I thought well here I am, the vaccine scientist, pediatrician, and the parent of an adult daughter with autism, if I don't do it who's gonna do it? And talked about it with my wife and with Rachel and with the other members of my family and they were very supportive. And so the product is an interesting book. I haven't seen too many like it, it's a science book, it goes into some detail explaining the science of showing that there's no link between vaccines and autism whether it's the MMR vaccine as originally thought or stated by the anti-vaxxers or thimerosal preservative that used to be in vaccines or spacing vaccines close together or aluminum. They play this kind of game of vaccine whack-a-mole. So it goes into the science showing there's no link and studies over 1 million children. And then also going into autism, what it is and how it begins in early fetal brain development, the genetics of autism, the 99 genes, some of the epigenetics.

But then the other thing I do in the book is tell a very personal story and interweaves a very personal story. So I haven't seen too many books like this that's both science book and tells the personal narrative of a scientist. And it occurred to me as I was writing this book, you know we need to have more books like that, we need so much more of this, we need to have a new generation of scientists that have an interest and ability to do the public engagement. And that was the reason for the book.

Erin Allmann Updyke

So your book also dives into the history of the modern anti-vaccine movement and examines a lot of the common misconceptions about the safety or health risks of childhood vaccines and we've gotten a lot of questions from listeners and then also just seen common questions and concerns online. And so we're hoping that you can help us go through some of these sort of specific questions and kind of address them specifically.

Peter Hotez

Yes, happy to.

Erin Allmann Updyke

All right. So the first is because of a lot of advances in vaccines development over the years, the schedule for vaccinations for children today looks a lot different than it has in generations past, even in the time that we were growing up. And so sometimes today parents can feel overwhelmed looking at the list of how many vaccinations their baby has to get or how frequent these vaccinations are. So can you explain a bit about how these schedules are developed and why there are so many more vaccines than we've seen in years past?

Peter Hotez

Well let's unpack that in a few ways. I mean first of all we're now vaccinating against diseases whereas before we didn't have vaccines. What's happened is the industry recognizes that they wanna minimize the number of injections that kids get so they've been combining these into pentavalent vaccines, meaning targeting five diseases at the same time, in some cases heptavalent. So getting diphtheria, pertussis, tetanus, this one homofluous influenza type B, polio, sometimes hepatitis, and that way we minimize the number of injections. So I think the Food and Drug Administration industry have done their best to limit the number of injections. Then the anti-vaccine people respond, 'Well cause you're immunizing against too many diseases at once, you're somehow overwhelming the immune system.' But I'll point out that's not what the science says. The science says if you're an infant, your gastrointestinal tract, your respiratory tree, your lungs are incredible efficient organs of advantage in presentation. Probably an infant on average is getting exposed to hundreds of new antigens everyday and the idea you're going to "overwhelm the immune system" quote unquote by giving five or six antigens at once simple doesn't pass the laugh test.

But you see that takes time to explain, it's not a 30 second sound bite so we're up against an anti-vaccine lobby that will just spew out oh we're overwhelming the immune system of our kids giving all these vaccines and industry is profiting, neglecting to say how life saving these vaccine are because of the horrific diseases they're preventing and why it's outrageous to say we're overwhelming the immune system when there's zero evidence for that and there's no plausibility for it.

Erin Allmann Updyke

Absolutely.

Erin Welsh

Mm-hmm. One of the examples or another one of a specific disease that people bring up as a reason not to vaccinate is chickenpox. And so it's a recommended childhood vaccine but it's relatively new. So for instance I didn't receive it as a child, I had chickenpox, but now it's recommended a lot. And so a lot of people see chickenpox as just a routine childhood illness, not a big deal. And so can you explain why it actually is very important to vaccinate for a disease like chickenpox if the illness is mild in most cases?

Peter Hotez

Well again this is the anti-vaxxer playbook, right. They do their best to minimize their diseases and so for measles for instance they'll play an episode of the Brady Bunch where Marcia Brady thought it was a good thing to get measles cause she stays home from school, so that's evidence that measles isn't so bad, neglecting the inconvenient truth that prior to widespread vaccination 2.6 million kids died of measles every year, it was the single leading killer of children globally after smallpox was eradicated. In the United States hundreds of kids died every year, tens of thousands were hospitalized. And although varicella/chickenpox is not as severe as measles it's still a pretty bad actor in the early 1990s. Varicella/chickenpox caused 10,000-13,000 hospitalizations and 100-150 people died every year. Back when I was attending in pediatric infectious disease we saw some horrific disease from chickenpox. So the fact that we have a vaccine is great and what can be done sometimes is to combine it with the MMR vaccine, you have to give MMRV so you're not adding another injection.

Erin Allmann Updyke

That's awesome. Another one of the reasons that we hear often cited to not vaccinate is that getting infected naturally can provide a longer lasting immunity. So can you explain why that's not a good reason to not vaccinate?

Peter Hotez

Well in some cases experience with the pathogen will confer long lasting immunity like measles but the end of the dot-dot-dot is if you're lucky enough to survive the natural infection or survive without a permanent injury. So yeah, some of these infectious disease pathogens do confer immunity but that's the whole point right of vaccinating is to confer that same or similar level of immunity but doing it with a weakened or attenuated pathogen so you don't experience the illness. And that's why it can save lives. I mean measles in the pre-vaccine era in the early 60s caused 1 in 4 kids to be hospitalized, 500 deaths, tens of thousands of hospitalizations and many causing permanent injury from measles pneumonia, measles encephalitis. That's why we vaccinate is to give you a similar or same level of immunity without the disease.

Erin Allmann Updyke

Another question that we see very often is so vaccines have some risk associated with them and in our first part of our vaccines episode we'll talk about some of the potential adverse effects when we cover sort of the biology of vaccines. But I think that the fear of those adverse events happening is what drives some people to choose not to vaccinate. So can you explain how the risks of vaccination differ from the risks of not vaccinating and just how low these risks really are associated with vaccination?

Peter Hotez

Yeah. So the two things that the anti-vaccine lobby does first of all, it tends to play down the likelihood of your getting one of these diseases. They inconveniently don't tell you that measles is back, pertussis which is whooping cough is back, you're always at risk for tetanus if you get a severe injury. So there is risk out there for children in the United States or children all over the world.

And the truth is the risk of a serious adverse event from a vaccine is extremely rare. In the book we put it at about 1 in a million of a serious adverse event and some would put it at 1 in 10 million. And just to give you a sense of perspective there, on a website I found the likelihood of getting struck by lightning is 1 in 700,000. So you're more likely to get struck by lightning than to have a serious adverse event from a vaccine. In fact the risk of putting your child in a car even with a car seat is probably much higher than the risk of vaccinating. So we need to find a better way to communicate risk to lay audiences as well.

Erin Allmann Updyke

Mm-hmm.

Erin Welsh

I think a lot of us know people who are opposed to vaccination or at least questioning whether they need to vaccinate and having these doubts and I think we struggle with engaging with these people and talking to them about vaccines in a constructive way. What advice do you have to people who have friends or family members that don't vaccinate or questioning vaccination? How can you best communicate the importance and safety of vaccination to these people?

Peter Hotez

Well I do it in a few ways. First of all I explain to parents that they're victims of the misinformation campaign. Right now if you try to download, there's such dominance of the anti-vaccine lobby on the internet that if you now try to download any kind of health information about vaccines you're much more likely to download phony vaccine, anti-vaxx misinformation than you are real information. So in some way these parents are victims. And then I like to point out, you know I give a number of lectures across the country every year, pediatric rounds talking to pediatricians and nurse practitioners and many parents, I find most of the parents are not deeply dug in. They've downloaded misinformation, they've heard something unsavory about vaccines from a friend or a relative but if you're willing to take the time to have a discussion with them, you can make them understand why vaccines are safe and why your child deserves to be vaccinated. Your child has a fundamental right to be protected against serious or deadly infections.

Then there's another, I don't know what the number is whether it's 5, 10, 15% of parents who are deeply dug in and they buy the conspiracy theories and those ones are very tough to reach. But most parents you can have a pretty meaningful conversation with and make them understand that the benefits of vaccination far outweigh the risks.

Erin Allmann Updyke

For our audience, are there certain websites or resources that you can suggest specifically that have accurate vaccine information that people can go to and say, okay, this is how vaccines work, this is a step-by-step breakdown, this is sort of dismantling all of these myths and misconceptions that the anti-vaccine movement is pushing?

Peter Hotez

Well that's what I tried to do in my book and especially in the epilogue I provide the major phony talking points of the anti-vaccine movement to refute them. But in terms of websites, the CDC website actually has a ton of information, the problem is it's difficult to mine or wade through. So I know where to look cause I have an MD and a PhD but it's not very user-friendly for lay audiences. The vaccines.gov website is pretty good and actually the Canadian equivalent one is, I forget what it is but it's quite good. There are a couple of nonprofits, vaccinateyourfamily.org has got a good one, there's the Vaccine Education Center that's put out by University of Pennsylvania and Children's Hospital of Philadelphia. But it doesn't have all the glitz and the panache that the anti-vaxxer websites do and so we're still in the 1990s when it comes to the internet.

Erin Welsh

I think we've got one last fun question for you, hopefully fun.

Erin Allmann Updyke

(laughs) If you could snap your fingers and create a vaccine for any infectious disease today that doesn't have one, what would it be?

Peter Hotez

Well I would say the ones we're developing. I mean the one that's really moving along nicely is our vaccine for schistosomiasis, this is a disease of 200 million people who live in extreme poverty, a horrific cause of liver disease and intestinal disease. And a cause is a condition known as female genital schistosomiasis which many people are surprised is actually the most common gynecologic condition on the African continent, a cause of pain and bleeding and stigma, marital discord, polar depression, and now it's been linked to a fourfold increase in HIV/AIDS probably cause of the ulcerative diseases it causes provides a conduit for the AIDS virus. So this may be Africa's leading co-factor for HIV/AIDS. And we're developing that vaccine and I'd love to see that get to the licensure stage.

Erin Welsh

Great answer.

Erin Allmann Updyke

Thank you so, so much for your time. Like Erin said we are huge fans of your work, I think you are the single person I cited the most in my entire PhD dissertation so it's been very thrilling to get to speak with you and we really appreciate your time to talk with us about this topic.

Peter Hotez	Thank you, thanks for having me and congratulations on what you're doing. As I've mentioned a couple of times on this podcast, we need more podcasts like this. We need public engagement at an unprecedented level and there's only a few people like yourselves doing this. So I'm very grateful for what you're trying to do.
Erin Welsh	Well thank you so much.
Erin Allmann Updyke	Thank you.
Erin Welsh	It's been an absolute joy speaking with you.
Erin Allmann Updyke	Yeah.
TPWKY	(transition theme)
Erin Allmann Updyke	Well that was awesome and amazing and we're not done. This episode just keep getting better!
Erin Welsh	Mm-hmm.
Erin Allmann Updyke	Hopefully with the help of Dr. Hotez we've answered most or maybe all of your questions about vaccines and addressed some of the major misconceptions surrounding them.
Erin Welsh	But like Dr. Hotez pointed out, we need more people communicating this science to the public.
Erin Allmann Updyke	Yeah we do.
Erin Welsh	So this episode is going out with a bang and we've got one more interview to talk all things scicomm with one of the biggest science communicators out there. A name you've all heard.
Erin Allmann Updyke	Today we are joined by the world famous Bill Nye the Science Guy. Can we still call you that?
Bill Nye	Yeah! Absolutely, yes. It's trademarked! Copywritten.
Erin Allmann Updyke	(laughs) This is possibly the most thrilling thing that has happened to us. We both are huge fans since we were kids, it's very surreal to get to talk with you today. You honestly have been a big, huge inspiration for both of us in sort of pursuing our science careers so we really appreciate you taking the time to chat about the anti-vaccine movement and about science communication in general today. So most people I'm sure have heard of you but can you take a second and introduce yourself and maybe tell us a bit about your background in science and science communication and how you got into this field?

Bill Nye

I'm a mechanical engineer, I mean I'm human but I'm a mechanical engineer. I started out my first job was at Boeing, a commercial airplane company and then I went on to work at several aerospace companies in the Seattle area. And I got concerned about the United States and the future. People were building the Ford Pinto automobile and the Chevy Vega, abandoned teaching metric system, took solar panels off the roof of the White House. In the United States I got quite concerned about the future. So like so many mechanical engineers I started doing stand up comedy after I won the Steve Martin look alike contest in the Seattle area, I did not advance beyond there. And so I started writing jokes for a comedy show, I would work on a big drawing board 6 foot long, not quite 2 meter long drawing board all day, go home and take a nap and then go to comedy clubs. And then the head of the NBC affiliate or director of programming, NBC affiliate decided to have a comedy show. So I started submitting jokes to that.

I quit my job October 3, 1986 approximately and then I worked part-time as an engineer, what you call a contractor engineer for another 6-7 years. And along the way on the comedy show I came up with Bill Nye the Science Guy. First bit was as you know the household uses of liquid nitrogen cause we've all got liquid nitrogen around. And then I wanted to be, the way I would express it in those days was I wanted to be the next Mr. Wizard. Mr. Wizard was a guy named Don Herbert who was on television in the 1950s and 1960s and was a big inspiration to me and I wanted to get the next generation of young people excited about science so in the future we'd have more scientists and we could change the world! And so I just remind everybody it takes years and years to get stuff like this together but we did 100 Science Guy shows.

And I now along with keeping my mechanical engineering license current I think I can describe myself as a science educator. And I am able to read a graph if it's about climate change, I'm able to read a graph of human population growth, and I can also understand maps that describe the outbreak of let's say measles or colony collapse disorder or what have you. But science education is very, very important to our future and you have to get people excited about science before they're 10 years old. Erin? Erin? You got excited before you were 12, right?

Erin Allmann Updyke

(laughs) Absolutely.

Erin Welsh

Yeah.

Bill Nye

So it's still a very important thing and I don't work that much in elementary science these days although my next book is called 'The Big Book of Science', comes out next spring and it is for young people. So we're just trying to change the world here, Erin! Erin!

Erin Welsh

No big deal.

Erin Allmann Updyke

(laughs) No, no big deal.

Bill Nye

How hard could it be? And so it's really a heck of a thing that we've got measles outbreaks. Now I'm so old - how old are you? I'm so old that I had measles and I lived through it. My first cousin once removed died of the flu so there's no need for this. Vaccines are what, 200 year old, 230 year old technology.

Erin Welsh

Yeah.

Bill Nye

What's going on in the world's most technically influential country? What is happening?

Erin Welsh

What is going on? That's a great question. So in this episode we're exploring these fears and misconceptions that surround vaccines and how the anti-vaccine movement has grown and changed over time. So you are an expert science educator, expert science communicator and so as you mentioned you know how to critically examine scientific research and interpret that and then explain it and that's what you've been doing to the public for so much of your career. But so many of the people who are opposed to vaccination decided to do their own research and are often not equipped with the skills to evaluate whether this information source is scientifically accurate or whether that one is based on some foundation that is just a propaganda machine. And the widespread prevalence of misinformation about vaccines and many other things that is readily available on the internet is really concerning. So what advice do you have for people who want to learn more about vaccines but don't know how to find reliable sources?

Bill Nye

Well listen to This Podcast Will Kill You. Turn it up loud! That's my advice. We have to chip away at this problem and I think you've hit upon the skill that we need now. When I was in school, well when I was working as an engineer the whole challenge was to find reliable information. You would go to the library, look in the card catalog, and you'd find encyclopedias that were quite trustworthy. It took a long time to find let's say four sources to verify a fact. When it comes to vaccines you can find this conflicting information and the skill we need to teach people or encourage people to acquire is how to sort this stuff out. The skills we need to teach would be for example correlation does not imply causation, and there's this old rhyme that's just fantastic. But it means just because something happened at about the same time something else happened, it doesn't mean it's not a coincidence, it doesn't mean that there was a cause and an effect.

This is a huge idea in science and it's a huge idea in philosophy and in a sense it's a very important idea in mathematics. And the example is autism. People get autism at about the same time they get a certain round of vaccines but that doesn't mean the vaccine caused autism and this has been debunked out the yin yang as it's often said, completely wrong. And so now what do you do?

Erin Welsh

Right.

Bill Nye

So Erin, Erin, I wish I had the answer to this problem but this podcast I presume is part of the solution. That is to say enlightening people about the cause and effect of vaccines.

Erin Allmann Updyke

You've had a very long career in science communication and science education and you've explored a lot of different media platforms from television shows to books and Netflix and radio. So how have you seen the field of science communication and science education change over the course of your career? And what do you see as some of the challenges that we face as science communicators and science educators going forward?

Bill Nye

So when I was coming along there were three or four television stations in any TV market. There'd be ABC, CBS, NBC, and then public broadcasting. And public broadcasting was often in what's called very high frequency VHF channels, you needed a loop antenna and reception wasn't as good and so on and so on. Now there are millions of channels available to anybody on the internet and so what is lost is this peer review, what's lost is the discipline required to broadcast something that was fact-checked. But then the great benefit is it's freedom of speech. Anybody can say anything and that's generally, you would think, a good thing.

What's changed is we have to learn much more carefully how to evaluate evidence. The phrase that's used now, it's a fine phrase, is critical thinking. We have to teach critical thinking skills. When I was coming along it might have been called reasoning or logic but critical thinking's a fine phrase. As I mentioned earlier there's a lot of media, a lot of television, radio, podcasts, science for people who are already interested in science. And that's good but there's still a need for elementary science, for getting people excited early on.

Erin Welsh

Yeah.

Erin Allmann Updyke

Yeah, absolutely. So based on your extensive experience in communicating science, what advice do you have for budding science communicators or people who are maybe interested in honing their skills as science communicators in this modern era of so much technology and the ability to communicate science on so many platforms? What kind of advice would you have for people interested in that or trying to get started?

Bill Nye

The first thing I tell everybody is figure out what you want to get across. What key idea do you want to transmit, do you want to communicate, do you want people to get? And when we were doing the Science Guy show the phrase was 'learning objective'. What's the learning objective? And a learning objective is a technical educator word, it means something you can test. At the end of the podcast, at the end of the television show, you can ask people what did you get out of that? And I hope it's vaccines are 200 year old technology and they work. I hope your listeners get that out of this podcast. And then the other thing that's very, very important is what I call discipline in vocabulary, DIV. It's very difficult to communicate ideas to people with words they don't understand or words they're not familiar with. And what we all do once we are in the business, like epidemiology that word right there is not accessible to everyone. They're people who study epidemics? That's weird. Yeah it is weird but I guess there's at least two of the and they're both name Erin. So that's a very important idea is that discipline in vocabulary.

What we did on the Science Guy show is pick 4th grade and that was based on very compelling research back then. People 10 years old and younger, you want the sentences and words constructed so the 10 year old can get it. And 10 year old turns out to be a pretty good level for everybody, especially with topics you're unfamiliar with, areas of research you've never heard of as a listener. So this is easy to say, hard to do and the analogs are the old saying 'I didn't have time to write a short letter. If you want it shorter that'll take a little longer.' If you want discipline in vocabulary, that's gonna take me a few minute to figure it out.

Erin Welsh

So we were wondering what sort of projects are you working on now? If you could tell us a bit about some of the projects that you are getting started with, I know that you mentioned a book, so could you tell us a bit about that? And then we hear you have a podcast that's going to be coming out, could you give us a little more info?

Bill Nye

Oh yes, turn it up loud. Science Rules starts May 16th, it will change your life. And my co host is Corey Powell who's the editor of my books, my grownup books, my general interest books. And I'm very proud of my first general interest book 'Undeniable: Evolution, The Fact of Life' where I talk about the importance of germs. So one of our guests is Peg Riley, do you know her? University of Massachusetts?

Erin Welsh

I don't believe so.

Bill Nye	So her big thing is bacteria sins. Bacteriocins are toxins that bacteria make to fight bacteria. And 'cin' is an old Greek word that means 'to cut'. So somehow bacteria sins cut open the cell membrane of bacterium. And in your gut, speaking of your gut microbiome apparently you've got bacteriocins fighting bacteria like crazy, it's a big happy war going on. Anyway Peg Riley's one of our guests on the new podcast Science Rules starts May 16th, turn it up loud.
Erin Welsh	May 16th, there you go.
Erin Allmann Updyke	So it'll be out by the time that our listeners are listening to this podcast, so go find it and download it.
Bill Nye	Oh my god, it's so exciting! Oh my goodness, it's so exciting! Oh my black hole, universe, it's so exciting!
Erin Welsh	(laughs) All right.
Erin Allmann Updyke	(laughs) Well really thank you again, that was super fun.
Bill Nye	Yeah.
Erin Allmann Updyke	If you had dreams when you were young of being the next Mr. Wizard, I had dreams when I was young of being the next Bill Nye the Science Guy.
Bill Nye	Cool! All right well, go get 'em! So please go out there and change the world!
Erin Allmann Updyke	(laughs) Thank you so much.
Erin Welsh	(laughs) Thank you so much.
Bill Nye	Thank you guys.
Erin Welsh	We really appreciate this, we had a blast.
Erin Allmann Updyke	Yeah.
TPWKY	(transition theme)
Erin Welsh	Wasn't that the most exciting thing?
Erin Allmann Updyke	I had the most fun with these two episodes, Erin.
Erin Welsh	Yes. I mean Dr. Peter Hotez has been one of our heroes for ages. Ages, years. And it was so thrilling also to talk to Bill Nye who we watched his science program growing up.
Erin Allmann Updyke	B-b-Bill! B-b-b-Bill! (singing) Bill Nye the Science Guy.
Erin Welsh	Just like that. (laughs) So that was really amazing and we really hope that you guys have enjoyed these vaccines episodes.

Erin Allmann Updyke We want to give some special shoutouts to people who helped us put these together. These episodes would not have been possible without the team at Rice University who helped us record our interview with Peter Hotez and with the one and only Steven Ray Morris.

Erin Welsh Oh my gosh.

Erin Allmann Updyke How exciting, we get to say his name not unintentionally on our podcast. (laughs)

Erin Welsh Steven Ray Morris. I know! (laughs)

Erin Allmann Updyke Who helped us record the interview with Bill Nye the Science Guy. And to Danielle from Exactly Right who set the whole thing up, this was so much fun.

Erin Welsh Yeah. This was wonderful. And thanks to the Exactly Right network, period.

Erin Allmann Updyke Yeah.

Erin Welsh I mean we haven't gushed at all but we cannot imagine, I mean it's so exciting to be part of this network which feels very like a family, like it's a really fun thing to be apart of.

Erin Allmann Updyke It's thrilling.

Erin Welsh And it's extremely thrilling.

Erin Allmann Updyke So many of you are here because you heard of us through Exactly Right which is also thrilling.

Erin Welsh Yeah.

Erin Allmann Updyke So just everything is... We're so happy right now you guys.

Erin Welsh Everything is awesome. Everything is cool when you're part of a team.

Erin Allmann Updyke (singing) Everything is awesome. Everything is cool when you're part of a team.

Erin Welsh (laughs) We're living the dream.

Erin Allmann Updyke (singing) Everything is awesome when you're living a dream. Yeah!

Erin Welsh Okay sources.

Erin Allmann Updyke Sources.

Erin Welsh So I will repeat the sources from the first episode. So 'Vaccines Did Not Cause Rachel's Autism' by Dr. Peter Hotez, it's a fantastic book, really highly recommend that everyone check it out. 'Between Hope and Fear' by Michael Kinch; 'Deadly Choices' by Dr. Paul Offit; 'The Vaccine Race' by Meredith Wadman'. A few papers and then again I'll recommend the Nova episode called Calling The Shots. There are two episodes of a podcast called Behind The Bastards that covered the anti-vaccine movement and also if you wanna hear more Dr. Peter Hotez he is featured on a recent episode of the Joe Rogan podcast, so go and check that out.

Erin Allmann Updyke

Yeah. Yeah. And as always all of our sources will be posted on our website thispodcastwillkillyou.com under the EPISODES tab. This is the most sources I have ever had so there's plenty to keep you occupied in your vaccine reading. And in our show notes we'll also post links to websites where you can get more information about vaccines in general.

Erin Welsh

Mm-hmm. Okay, well thanks to Bloodmobile for providing the music to this episode and all of our episodes and you can find more of his music on Bandcamp and there's a link to it on our website.

Erin Allmann Updyke

And thank you guys so much for listening, we really hope that this episode was helpful for you and that you enjoyed it. And don't worry you will get another episode next week, we're not messing around with the schedule, this was like a bonus episode.

Erin Welsh

Yeah. Three weeks in a row you guys, can you even?

Erin Allmann Updyke

It's like May is the best month ever.

Erin Welsh

(laughs) Okay. Well until next time, wash your hands.

Erin Allmann Updyke

And get vaccinated you filthy animals!