# Episode 11 – Vaccine Types & How They Work Part 2

## With Dr. Paulette Grey Riveria

Clay (00:00):

Well, welcome to part two of our Vax Matters voyage into modern day vaccines. If you missed part one, be sure to check it out. It was really good. But without further ado, let's get it started.

Clay (00:17):

Hello everyone, Clay Young here. Happy to be back for another episode. Thanks for listening to Vax Matters as we begin part two of our sequence exploring the vaccines we use today. And of course, I am joined by my podcast partner, the great Diane Deaton. Hi, Di.

Diane (00:34):

(laughs) I love you, Clay. Thank you so much. Now this episode will continue our conversation from last time with our fabulous guest. Oh, she is so good. Dr. Paulette Grey Riveria. She is, of course, the Capital Region Medical Director and Administrator for the Louisiana Department of Health. Thank you, thank you, thank you for agreeing to do part two of our show again, Dr. Riveria.

Clay (00:59):

You know, it's amazing, jumping in. I just knew I was gonna say Rivera the first time (laughing) we had the conversation on the podcast. (laughs) Uh, but let's jump right back into it, Dr. Riveria. Could you explain what a toxoid vaccine is?

Dr. Riveria (01:12):

Yeah, so-

Diane (01:13):

It sounds scary. I'm just gonna say it-

Clay (01:15):

A little horrifying-

Diane (01:15):

... right off the top.

Clay (01:15):

A little horrifying.

Diane (01:16):

Yes, yes.

Dr. Riveria (01:16):

It does sound scary. Well, a toxoid vaccine examples are, uh, tetanus, diphtheria. Those are vaccines that use the toxin that the pathogen would release, show a small amount to our body, to

our immune system, so that the immune system can then mount a response to that toxin. So in those toxoid vaccines, there is no viral or bacterial particle, only the chemical that those particles would produce to cause their damage.

Diane (01:50):
So they're an inactivated vaccine?

Dr. Riveria (01:53):
It- it's a complete class all its own.

Diane (01:56):
Oh it's- oh, okay.

Dr. Riveria (01:57):
Mm-hmm (affirmative). So it's a-

Diane (01:57):
Completely separate-

Dr. Riveria (01:57):
... separate-

Diane (01:58):
Okay, okay.

Dr. Riveria (01:58):
Because in inactivated and in live attenuated, you are still g- dealing with the germ itself.

Diane (02:04):
Mm-hmm (affirmative).

Dr. Riveria (02:04):
In toxoid vaccines, there is no germ.

Diane (02:07):
Okay.

Dr. Riveria (02:07):
It's just the toxin or the chemical that those germs would produce to cause damage. So by-

Clay (02:13):
Interesting.

Dr. Riveria (02:13):

... showing your body a small amount of it, not enough to actually damage the body, but just a small enough so the body can learn, then the body can mount a response to that.

Clay (02:23):

How's it introduced?

Dr. Riveria (02:25):

Well, it's introduced... Do you mean, um-

Clay (02:28):

How- like how does- how does one, um... 'Cause I'm trying to understand. It, it's like Diane said in the beginning. It's horrifying. But h- once, once you get the vaccine, how does- what's the impact of it? We talked in the last episode about some vaccines mimicking the virus and you sometimes have these phantom, uh, symptoms that, that mimic say, like, the, the COVID-19. When, when with toxoid vaccine, how does that- how does it work?

Dr. Riveria (02:53):

Well the way it works is that once it enters the body-

Clay (02:55):

Mm-hmm (affirmative).

Dr. Riveria (02:56):

... so you have your first line cells that say, okay, this chemical does not look like a chemical that my body would produce. So let me wave the flag and bring on some cells that can address this. So our body would produce cytokines that basically go out and try to- try to inc- uh, encapsulate and, and basically stop this toxin from spreading. And then you have the whole other sequence of events. So-

Clay (03:21):

Mm-hmm (affirmative).

Dr. Riveria (03:21):

... your immune system mounts, uh, uh, develops those antibodies. And then the memory cells are produced so that the next time, if you are to see this toxin again, then right away those B cells and T cells will come to the forefront much quicker.

Diane (03:37):

And you said examples were tetanus and diphtheria-

Dr. Riveria (03:41):

And diphtheria. Yes.

Diane (03:42):

And so do- I, I can't remember. I think that these are part of our adults- adult shots-

Dr. Riveria (03:47):
Yes, so-

Diane (03:47):
... that sequence.

Dr. Riveria (03:48):
So you've-

Diane (03:48):
Yeah.

Dr. Riveria (03:48):
... probably heard of Tdap-

Clay (03:50):
Right.

Diane (03:50):
Yes, yes.

Dr. Riveria (03:51):
So that's tetanus-

Clay (03:52):
Yeah.

Dr. Riveria (03:52):
... diphtheria and pertussis.

Clay (03:54):
Yeah.

Dr. Riveria (03:54):
But you've probably also heard of DT or TD.

Diane (03:57):
Mm-hmm (affirmative).

Dr. Riveria (03:57):
That's just tetanus and diphtheria.

Clay (04:00):

Mm-hmm (affirmative).

Dr. Riveria (04:00):

So the pertussis is the whooping cough. That comes in combination with diphtheria and tetanus but tetanus can come alone.

Clay (04:07):

Yeah.

Dr. Riveria (04:07):

Tetanus can come in combination with diphtheria or pertussis. So sometimes these vaccines are given in combination because- just to, to minimize the amount of vaccine shots that have to be administered. And these things are studied to see which ones are safe to give in combination, which ones are best to be separated and given on their own.

Diane (04:27):

And I think a lot of adults don't realize, we've had conversations in prior podcasts, that some adults don't realize you have to have adult shots. This isn't just something for your childhood. That you really do need to keep up with your vaccines. And to make sure that you talk with your healthcare provider. Some of them not- you don't have to have them very frequently. But you still need to make sure that what you're, you know, your diphtheria, your, your tetanus and, and then of course another whole other conversation would be, uh, for any other type of shot as far as, like, shingles or whatever.

Clay (05:03):

Mm-hmm (affirmative).

Diane (05:03):

But you just- you need to be aware of that. It just doesn't end in childhood as far as shots are concerned.

Dr. Riveria (05:08):

Yes, that's correct. There's a childhood immunization schedule-

Diane (05:11):

Mm-hmm (affirmative).

Dr. Riveria (05:11):

... and then there's an adult immunization schedule. And the reason it may not be on the purview of most adults as readily is because the childhood immunization schedule just involves so much more and at these specific-

Diane (05:22):

Yes.

Dr. Riveria (05:22):

... uh, cadence, at a specific frequency. Whereas adults, okay, supposedly most of us have received our childhood vaccinations and now we're just being boosted, so to speak, for some of the other vaccines. Or, in the case, for example, of pneumococcal, shingles-

Clay (05:37):

Mm-hmm (affirmative).

Dr. Riveria (05:37):

... you know, again, those are still versions of other vaccines that we may have received before.

Diane (05:42):

That chickenpox type of thing-

Dr. Riveria (05:44):

Exactly.

Diane (05:45):

... for shingles. Yeah, yeah.

Dr. Riveria (05:45):

Mm-hmm (affirmative). Exactly.

Clay (05:46):

It's interesting, uh, so let's talk about the difference between a- and, and Diane, let's run through these-

Diane (05:52):

(laughs) Oh yeah. Okay, Clay.

Clay (05:55):

... subunit-

Diane (05:55):

Uh-huh. Recombinant maybe?

Clay (05:57):

There you go.

Dr. Riveria (05:57):

(laughs)

Clay (05:58):

And polysaccharide. Okay. We could wrap the show up.

Diane (06:01):
Yup, yup, yeah. Uh-huh.

Dr. Riveria (06:01):
(laughs)

Diane (06:03):
Yes. You're gonna make it easy for us, right doctor?

Dr. Riveria (06:04):
Yes.

Diane (06:04):
Thank you. Okay.

Dr. Riveria (06:05):
Le- let's make it easy.

Diane (06:06):
Whew.

Dr. Riveria (06:07):
So the easiest way to think about, uh, subunit recombinant polysac- saccharide and conjugate-

Clay (06:14):
Mm-hmm (affirmative).

Dr. Riveria (06:14):
... is that these are pieces of a germ.

Clay (06:18):
Okay.

Diane (06:19):
Oh, okay.

Dr. Riveria (06:19):
So I think I like to-

Diane (06:21):
So far, so good, Clay.

Dr. Riveria (06:22):

(laughs) Yes, yes.

Clay (06:24):
So far, so good.

Diane (06:24):
Uh-huh.

Dr. Riveria (06:24):
Yes. So I like to think of it too, like a- again, if we use our clothing analogy, like what the- what the germ's jacket might look like, the hat-

Clay (06:31):
Okay.

Dr. Riveria (06:32):
... uh, the shoes, the socks. And if these things are specific to that germ, it'll be recognized each time. For example, my son has a Spiderman hat. It's really unique. He has all these buttons on it (laughter). If I saw another kid from a distance with that hat, I would probably say, oh, there's my son. And I would run up to him and try to hug him. You know? It's, it's-

Diane (06:48):
Mm-hmm (affirmative).

Dr. Riveria (06:49):
... that specific.

Diane (06:50):
Mm-hmm (affirmative).

Dr. Riveria (06:50):
So for example, subunit. So a subunit vaccine, it is basically saying it's a vaccine that's made from an antigen of the vaccine- of, of the virus rather, or the, um, the pathogen. And antigen is just a fancy name for a protein. So I like to think of proteins as either the bad guys or the good guys. So our good proteins in our own immune system are our antibodies, are the enzymes. The bad guys' proteins are the antigens. So our good proteins will be attracted to the bad proteins, will encapsulate them and then attract those killer cells to come and, and kill that cell. So these are all vaccines that are made from the bad protein of a pathogen. And an example of that would be-

Clay (07:38):
And give, give us bad and good one more time.

Diane (07:39):
Yeah.

Dr. Riveria (07:39):
Yeah. So bad is antigen.

Clay (07:41):
Mm-hmm (affirmative).

Dr. Riveria (07:42):
Good, for example, is antibody.

Clay (07:44):
Okay.

Dr. Riveria (07:44):
And antibodies bind to antigens. So they, they have a mutual attraction but not for a good outcome. (laughs)

Clay (07:51):
Okay.

Dr. Riveria (07:51):
So an example of a subunit vaccine is hepatitis B.

Diane (07:55):
Mm.

Dr. Riveria (07:55):
And the only... It's- the only special thing to remember. You don't have to remember, well, this is a subunit, this is a toxoid. All you have to remember is that this particular type of vaccine, either it will contain the whole germ o- or it will contain some part of the germ, or what the germ produces, or, like we said, a vector, some other conduit. So if you remember that.

Dr. Riveria (08:19):
So if you think about it, you're using pieces of a particle. Then imagine the response may need to be strengthened over time. So if you think about the hepatitis B vaccine, even in that first series, that requires three shots over time-

Diane (08:36):
Oh, it does?

Dr. Riveria (08:37):
It does.

Diane (08:37):
Oh, okay.

Dr. Riveria (08:38):
So, and then over time, you may actually need another shot-

Diane (08:42):
Mm-hmm (affirmative).

Dr. Riveria (08:42):
... uh, as you age. So these are pieces of a germ. So the attack may not be as well informed or as robust so you'll need the, the renewal vaccines.

Diane (08:55):
I gotta- I gotta tell you doctor. Just sitting here listening to you explain all this from last time and this time, the body's response, it is- I don't even have adjectives. It is just incredibly phenomenal what all the little, as you said, bits and pieces in our cells and our makeup, our, our DNA, how it works. And how it works together. And I have to tell you, I think we all- I can- think we all can say this, we take our bodies for granted sometimes.

Clay (09:28):
Mm-hmm (affirmative).

Diane (09:29):
When our bodies work, boy, we're working, we're pushing, we're doing this, we're doing that. Then all of a sudden, something goes a little haywire-

Clay (09:36):
Right.

Diane (09:36):
... you know, some of these little nasty things kind of ha- hang on. And it's like, well, what's wrong?

Clay (09:41):
Right.

Diane (09:41):
Well, what's wrong? And then we appreciate how wonderful our body is.

Clay (09:47):
Yeah.

Diane (09:47):
And how it takes care of us. I don't think we- I don't think before COVID, I think now that's kind of in the forefront of our brains, we think about it a lot. But before then, we just... Y- your body just did. It just did. It just did. Until it didn't.

Dr. Riveria (10:01):

Exactly. And, of course, you know, you have 100% agreement coming from me.

Clay (10:06):
Yeah.

Diane (10:06):
Uh-huh. Yes. Yes.

Clay (10:06):
All right. What about recombinant?

Dr. Riveria (10:08):
So recombinant is, if you think about it, re-combine. So it's basically pulling together multiple pieces of the germ, combining them in a way that the immune system will most optimally recognize. So an example of that is the, um, HPV, human papillomavirus.

Diane (10:30):
Mm-hmm (affirmative).

Clay (10:30):
Yeah.

Dr. Riveria (10:30):
And you've probably- if you've ever seen human pop- papillomavirus advertised, you see all these numbers after (laughing)-

Diane (10:36):
Oh, you do. Yes. Yeah.

Dr. Riveria (10:36):
And those are all these different genetic combinations of pieces of that virus that are used to make this vaccine. And the reason that's done is because some of these viruses, like we alluded to before, can be really tricky. They can evade the immune system. And some of them can be more dangerous or more virulent than others. So by combining many different, um, pieces of the virus, you're more likely to get the best coverage in terms of your immune system-

Diane (11:07):
And that's what you're looking for.

Dr. Riveria (11:08):
Yes.

Diane (11:08):
You need that best coverage for the longest period of time.

Dr. Riveria (11:11):

Yes. Because there are many different types of human papillomavirus, for example. So the vaccines try to combine many different types to give you the best protection so that you wouldn't have to get 15 different shots.

Diane (11:22):

Mm-hmm (affirmative).

Clay (11:23):

That's so interesting. Deciding the parts of the virus that are chosen to construct the vaccine sounds fascinating. How does that work?

Dr. Riveria (11:34):

Yes, I wish I could really lay it out for you.

Clay (11:36):

(laughs)

Dr. Riveria (11:37):

So the last time I was in the lab was when I was a junior in college. But-

Diane (11:40):

Oh gosh.

Dr. Riveria (11:40):

... but basically, these particles are studied in laboratory conditions, uh, human- parts of human cells and the human body are introduced to them and then they're studied to see what happens. Wha- which, which cell produces a successful attack? What chemical is most successful against this part and that part and this part? And then once you find the success in terms of the attack, then you have to try it out in different environments.

Diane (12:05):

Oh gosh.

Dr. Riveria (12:06):

So it's a- it's a really complex field of science. And I'm not in- in- you know, really in the nitty gritty of that-

Clay (12:13):

(laughs)

Dr. Riveria (12:13):

... anymore. Um-

Clay (12:14):

No, that's okay. My mind is already blown by what you've said so far-

Diane (12:16):
Yeah. Yeah.

Dr. Riveria (12:17):
But, uh, but it is fascinating and I think it is easy to take for granted all this- the robust science and thought that goes behind this, particularly when a vaccine is not as effective as we thought. So-

Diane (12:28):
Mm-hmm (affirmative).

Dr. Riveria (12:28):
... again, using the flu vaccine example, you know, every year the question is okay, now I have to get another one-

Diane (12:35):
Right.

Dr. Riveria (12:35):
It's because these combinations are constantly being studied, and con- scientists are constantly trying to find the best product to minimize the number of injections you have to get but would still allow you to respond to what the virus is doing, which is constantly changing.

Diane (12:51):
Mm-hmm (affirmative). And with the flu, with that in mind too, you know, you talk about people always say, well, I'm not gonna get the flu shot because, you know, I got one a year or two ago. Nothin- you know, I got the flu. Or so and so got the flu. They did a really poor job of isolating, you know, which strain of the flu. So I'm not gonna get it anymore. I mean, that's just, come on!

Dr. Riveria (13:11):
Yes. And if you think about it, if you wanna just be a little bit more benevolent toward the people who are really working on this day in and day out-

Diane (13:17):
Mm-hmm (affirmative).

Clay (13:17):
Mm-hmm (affirmative).

Dr. Riveria (13:17):
... some of this is prediction.

Diane (13:19):
Right.

Dr. Riveria (13:19):

Because I don't know what will happen next year with the viral strain. So the best that the scientists can do is take what has happened last year, the year before, and the year before and try to predict. And so I think some of these concerns, I think they're valid when you say, well, this shot wasn't effective for me. Or I, I- it never works. But for most people, it will.

Diane (13:43):

Correct.

Dr. Riveria (13:43):

So those are exceptions.

Diane (13:44):

Yes, yeah.

Clay (13:45):

It's interesting. Before we get to, uh, polysaccharide and, and, uh, conjugate, I'd like to ask. You talked about them studying- 'cause I'm so fascinated by that point, studying the virus and determining in the case of a re- recombinant, the portions of the vaccine that would attack the virus. We have seen the- the coronavirus evolve over the last couple of years. And i- for, for the im- the world, this is the first really pandemic we've, we've dealt with in, in a hundred years.

Diane (14:16):

Mm-hmm (affirmative). In our-

Clay (14:16):

So most of us weren't around.

Diane (14:17):

... lifetimes. Yeah, yeah.

Clay (14:17):

Right. So, so then with it evolving and it being studied to determine what form of vaccine is best for people, how does- what does that work look like?

Dr. Riveria (14:28):

Yeah. So the coronavirus itself, this version is novel.

Clay (14:32):

Mm-hmm (affirmative).

Dr. Riveria (14:33):

But the coronavirus, the family of coronaviruses are not new. So that work, what it looks like is really, uh, I think based on, like we said before, decades of study. These- a lot of these particles, they're not new diseases. Um, well, let me back up. They're not new germs. They're new versions-

Diane (14:54):
Oh.

Dr. Riveria (14:54):
... of old germs.

Diane (14:55):
Okay.

Dr. Riveria (14:55):
For the most part. It's- I would be hard pressed to think of a germ that's just completely new that we've never encountered in any version. So the reason is because they are recombining, mutating, and just evolving in a way.

Diane (15:12):
They're kinda getting smarter, it sounds like.

Dr. Riveria (15:14):
In a way. Yes. And what the vaccines do is they interrupt that cycle.

Diane (15:17):
Mm-hmm (affirmative).

Dr. Riveria (15:18):
Um, I hope that answered your question-

Clay (15:19):
No, no. And it absolutely does. And, and we're learning about it. There are so many things that are endemic to areas that we don't hear about because they're not here versus the pandemic version of a virus where it's touching every part of the globe.

Dr. Riveria (15:31):
Yes. And not only because it's not geographically here, but some of these diseases or, we'll say, particles are not necessarily in humans.

Clay (15:39):
Mm-hmm (affirmative).

Dr. Riveria (15:39):
They exist in other parts of our-

Clay (15:42):
Yeah.

Dr. Riveria (15:42):
... humanity. So our-

Diane (15:43):
Mm-hmm (affirmative).

Dr. Riveria (15:43):
... they exist in animals.

Clay (15:44):
Mm-hmm (affirmative).

Dr. Riveria (15:44):
Uh, you know, or certain, um, other species. So they become discovered or novel when they infect us in a slightly different combination.

Diane (15:55):
Because we've heard so l- so much about the novel coronavirus, you know-

Dr. Riveria (15:58):
Yes.

Diane (15:58):
... it all- it all kind of just blended together and it's just one statement.

Dr. Riveria (16:02):
Yes. And really the virus that is responsible for COVID-19 is Sars-Cov-2. So whenever-

Diane (16:09):
Oh!

Dr. Riveria (16:09):
... you see a two, that means there must've been a one.

Clay (16:12):
Yeah.

Dr. Riveria (16:12):
And so this is just really a reiteration of a coronavirus that already existed.

Diane (16:19):
Wow.

Clay (16:19):

All right. Polysaccharide.

Dr. Riveria (16:20):
Polysaccharide. So the best way to think about this is just sugar.

Diane (16:23):
Oh, I like that. Okay. Sugar. We can do that.

Dr. Riveria (16:24):
And (laughs)- and you probably, if you think about, uh, you know, you, you may see some, you know, saccharides on your, um, you know, um, nutritional, um, labels of food. So these are just sugars that are outside of a particle. And the thing about these is that sometimes... Viruses, again, if you think about them or bacteria, they, they will encapsulate themselves in a protective coating. And so that can sometimes evade the immune system. 'Cause the dangerous part of it is cloaked by something that looks more neutral, a sugar.

Clay (17:02):
Hm.

Dr. Riveria (17:03):
So they're specifically-

Diane (17:03):
And what would be, you know, so harmful about that?

Dr. Riveria (17:04):
(laughs)

Diane (17:04):
You know?

Dr. Riveria (17:04):
Yes, yes-

Diane (17:05):
That's what you would think.

Dr. Riveria (17:05):
So there's specific-

Diane (17:06):
Mm-hmm (affirmative).

Dr. Riveria (17:06):

... types of sugars that encapsulate these particles that are studied. And then vaccines are used to attack them.

Clay (17:16):
I knew that sweet roll was a bad idea.

Dr. Riveria (17:16):
(laughs)

Diane (17:16):
(laughs)

Clay (17:16):
No, I'm kidding. I'm kidding, I'm kidding. What- what about a, a conjugate?

Dr. Riveria (17:16):
And conjugate, again, if you think about that word, something combining, a conjugate visit-

Clay (17:28):
Yeah. Yeah, sure-

Diane (17:29):
Mm-hmm (affirmative).

Dr. Riveria (17:29):
Come together, right?

Diane (17:30):
Mm-hmm (affirmative).

Dr. Riveria (17:30):
So that's really just combining a sugar and a protein. And developing a vaccine from both the protein coat and the sugar coat. And I, I didn't give an example of a, uh, polysaccharide vaccine, did I?

Diane (17:42):
Mm-hmm (negative).

Dr. Riveria (17:43):
Um, a polysaccharide vaccine, for example, uh, could be pneumococcal.

Diane (17:48):
Oh.

Dr. Riveria (17:48):

Um, some pneumococcal vaccines are polysaccharide, some are conjugate actually.

Diane (17:52):
Mm-hmm (affirmative).

Dr. Riveria (17:53):
Um, yes. And another example of a conjugate vaccine is hu- Haemophilus influenzae B, or Hib. So that's a common childhood vaccine that's given.

Diane (18:04):
Oh, oh, that's the childhood. The Hib.

Dr. Riveria (18:05):
So that's the-

Diane (18:05):
Okay.

Dr. Riveria (18:05):
... that's the bacteria-

Diane (18:07):
Oh, okay.

Dr. Riveria (18:08):
Yes. Hib. Influenza. So that's Haemophilus influenza, which is a bacteria versus influenza, the flu, a virus.

Clay (18:15):
And an example of, of conjugate?

Dr. Riveria (18:17):
Pneumococcal, some pneumococcal-

Clay (18:18):
Yeah, yeah, yeah.

Dr. Riveria (18:18):
... vaccines are conjugates. Mm-hmm (affirmative).

Clay (18:20):
Wow. That's a master class of describing all of these, by the way.

Diane (18:23):

Whew, gee whiz. Thankfully, there's not gonna be a test or any [inaudible 00:18:27]-

Dr. Riveria (18:26):
Yes. And I-

Diane (18:26):
... or a pop quiz. Please don't do that. Oh gosh.

Dr. Riveria (18:30):
Yes. And I think really the takeaway from all of that is, again, what about a germ could the immune system recognize and then attack? And in attacking that critical piece of the germ, it would a- defeat the pathogen itself. So if a germ comes equipped with all these proteins and it's gonna use those proteins to invade our cells, well, if we've already been vaccinated-

Clay (18:56):
Mm-hmm (affirmative).

Dr. Riveria (18:58):
... uh, using that prototype of the protein, well, as soon as that germ comes in, we know what to do right away.

Clay (19:04):
This maybe a, a, a crazy question but for people who have had, say, the coronavirus and were not vaccinated, obviously early on when they weren't as, as readily available, and got vaccinated after the fact, versus someone who had never had it but got vaccinated because they wanted to be in defense of it, what, what does that do to the body either way?

Dr. Riveria (19:24):
Well, what the vaccines tend to do, at least as far as a- early studies are purporting, is that the memory may last longer.

Clay (19:33):
Okay.

Dr. Riveria (19:34):
And I think the science is really out on the why. That is an active area of investigation. And it's also an active area of investigation as to whether that's actually the case across the board. I think one thing that this pandemic has shown us is that there is a diversity in reaction to mRNA vaccines. And this is the first mRNA vaccine.

Diane (19:55):
Mm-hmm (affirmative).

Dr. Riveria (19:56):

So you can, you know, we don't have, although the technology has been around for so long, this is the first case in when- in which we can see what happens when this is used in a vaccine.

Diane (20:07):

And I think that if you would start talking, or visit with friends or, or family or whatever, um, if you would ask 100 different people what their reaction was, you know, with the, the first two vaccines or the booster, et cetera, you know, no matter if it was the Pfizer, the Moderna, Johnson & Johnson, that, you know, you'd get a different answer. You know, some people say I, I had no reaction at all. I had-

Dr. Riveria (20:31):

Mm-hmm (affirmative).

Diane (20:31):

... a reaction to the first one, not the second one. No reaction to the first one but I had a bad reaction to the second one. I mean, it goes on and on. Then you have people say, oh my gosh. One version of the, the vaccine was better than the other. And, I mean, they're- I mean, they are just adamant about it.

Dr. Riveria (20:45):

Yes.

Diane (20:46):

It just makes you kind of crazy-

Dr. Riveria (20:48):

Yes. And there's variability also in the vaccine administration. We know that has a lot to do with this. So depending on the technique of, of vaccine administration, you may get more sore- soreness or, you know, more-

Diane (20:56):

Ooh, I was sore.

Dr. Riveria (20:57):

... swelling. Yes-

Diane (20:58):

(laughs) I was sore. Yeah.

Dr. Riveria (20:59):

Um, you know, and some people develop hematomas and that's been a common complaint. And that just has to do with administration of the vaccine, not necessarily the vaccine itself.

Diane (21:06):

Mm-hmm (affirmative).

Dr. Riveria (21:07):

But the other thing to recognize in terms of talking about vaccination induced immunity versus, uh, natural immunity or immunity that's conferred from the disease itself, is that the disease may come in a milieu you may not expect. And we experienced that with Delta, now Omicron, and then now three different versions of Omicron. So the vaccine covers those types. You don't know your impact with each subtype from the disease.

Dr. Riveria (21:37):

And I'll give you an example. So Delta. Delta, the way that subvariant liked to infect is deeper in the lung tissues. So people were getting sicker-

Diane (21:49):

And they-

Dr. Riveria (21:49):

... with Delta-

Diane (21:50):

... incubate, is that-

Dr. Riveria (21:51):

Yes.

Diane (21:51):

Yeah.

Dr. Riveria (21:52):

Uh, they were intubated-

Diane (21:53):

Yes.

Dr. Riveria (21:53):

They're getting sicker with Delta than people have gotten sicker with Omicron.

Diane (21:57):

Oh.

Dr. Riveria (21:57):

And that's because Omicron prefers to live in the upper airways. So if you think about it, inflammation here is less dangerous than inflammation here in your chest. And by here I mean inflammation in the nasal passages is less dangerous, in general, than inflammation in the deep respiratory passages. So again, you have to ask yourself do you know what subtype you will encounter?

Diane (22:21):

Mm.

Dr. Riveria (22:22):

Do you know what's coming next? Are you willing to risk that? Or would you prefer to get vaccinated using a vaccine that has good coverage for all variants?

Diane (22:38):

It's your choice. It's basically your choice. Yeah.

Clay (22:40):

In the interest of time I just wanna- one final area. What is an mRNA vaccine and how does it work?

Dr. Riveria (22:46):

So mRNA is messenger ribonucleic acid. And those are the string of proteins that tell a cell how to create its genetic code, how to create itself in general. So DNA is similar. Uh, but e- they each use different parts of genetic codes to tell the cell how to- how to build itself, basically and tell the organism how to structure itself. So when we take mRNA from a viral particle, for example, what we're taking are those coded instructions. So now, we can form a defense system against the very fabric of how the pathogen is made. So that's really stripping it down to the foundation.

Diane (23:26):

Mm-hmm (affirmative).

Dr. Riveria (23:27):

And in doing that, the attack is very specific. These mRNAs are very fragile. So the way these vaccines had to be made with mRNA is they had to be encapsulated in a lipid particle. And there is active study underway in that area too because the question of why people are reacting in certain ways or may have had adverse events from the vaccine-

Diane (23:51):

Correct, yeah.

Dr. Riveria (23:52):

So those lipid particles are being studied, uh, to see did that cause heart inflammation in some people? We're not quite sure. But in a very small group that is actively being studied. But because that- think of it as a- a very fragile genetic code. It has to be enclosed in something more stable so that it could be delivered to us. Otherwise it would disintegrate right away.

Dr. Riveria (24:15):

And a lot of the science over the past 50 years had been looking at how to make mRNA more stable so that it could be used. And they- and they figured it out. And that's why when the coronavirus, um, you know, embarked upon the world in 2020, or late 2019, if you'll count, you know, the, the landmark case, we were ready.

Diane (24:36):

So what... I know that we were talking about, uh, the COVID, any oth- of the other M- the messenger, uh, RNA vaccine, was that Ebola too?

Dr. Riveria (24:47):

Well, it has been studied with Ebola. It's being actively studied with HIV as well.

Clay (24:51):

Mm.

Dr. Riveria (24:51):

And so these, these, uh, are now areas of development. And I think, you know, scientists who are working on this are really trying to, to make sure that with the pandemic they are learning and taking away, um, what they need to take away-

Diane (25:04):

Mm-hmm (affirmative).

Dr. Riveria (25:05):

Now, of course, coronavirus and HIV, drastically different. Coronavirus and Ebola, drastically different.

Diane (25:11):

Big difference. Yeah.

Dr. Riveria (25:12):

So we're talking about, uh-

Diane (25:13):

Apples and oranges-

Dr. Riveria (25:14):

Yes.

Diane (25:14):

... almost. Yeah.

Dr. Riveria (25:14):

And we're talking about without, for example, treatment, deadly diseases, hands down. So this is why, you know, much more time and dedication has to be dedicated to this-

Diane (25:26):

Mm-hmm (affirmative).

Dr. Riveria (25:26):

... to, uh, embark upon the future of other mRNA vaccines.

Diane (25:30):
And that leads us to what, what do you think the future of vaccines are?

Dr. Riveria (25:35):
From my vantage point, it looks like really leveraging nanotechnology to the utmost. So when we talked about how those particles are made to encapsulate these very fragile particles, as, you know, even in, um, if you look at a- any other realm of technology, chip technology, for example, the, the tools that are being used are smaller and smaller and smaller.

Diane (25:55):
Mm-hmm (affirmative).

Dr. Riveria (25:55):
So I think it really looks at leveraging some of the basic building blocks of pathogens and directing attacks toward those, versus these more generalized coatings and sugars and proteins. And really taking the attack more specifically to each pathogen before it can mutate or recombine.

Diane (26:12):
Mm-hmm (affirmative). So that u- that's what you're thinking the future of vaccines would be. What about- are any being phased out? Any vaccines that are no longer going to be-

Dr. Riveria (26:22):
No, I think- if you- I think one of the ways to think about it is, you know, yearly certain flu vaccines are phased out.

Diane (26:28):
Mm-hmm (affirmative).

Dr. Riveria (26:28):
But categorically, we're maintaining really the same vaccine set that we have-

Diane (26:33):
So the efficacy is very good-

Dr. Riveria (26:35):
Yes.

Diane (26:35):
... with the vaccines that we're now currently using.

Dr. Riveria (26:38):
Yes.

Clay (26:39):
Wow.

Dr. Riveria (26:40):
From my understanding.

Clay (26:41):
Such a master class, as I said earlier-

Diane (26:42):
Ooh boy, yeah.

Clay (26:43):
... explaining all of this. Thank you so much. Is there anything we left out?

Dr. Riveria (26:47):
I think one thing to consider, um, when we talk about vaccines is where people are internally with their-

Clay (26:54):
Mm-hmm (affirmative).

Dr. Riveria (26:54):
... decision making process. And one thing I would just implore people to do is if you have some hesitation with getting a vaccine, yes, ask questions. Two, interrogate the source of your information. But three, look at why you have hesitation. Is it because of mistrust in the system itself? Is it a concern with the science? Or is it just an obstinance to what seems like a mandate, like group think?

Clay (27:21):
Mm-hmm (affirmative).

Diane (27:21):
Yeah.

Dr. Riveria (27:22):
A lot of people push against a broader group and really want to rebel for the sake of rebellion.

Diane (27:30):
You can't tell me what to do.

Dr. Riveria (27:31):
Yeah. So I would challenge people to really interrogate their motivation there and be honest.

Diane (27:36):

True.

Dr. Riveria (27:36):

And then think about the community. If you think about it, the reason that some people can have the liberty of refusing vaccines is because most people have opted to get them. So you're, you're being protected by a group of people who have made the opposite decision. And at some point, if you think about it, if most people become hesitant and most people don't get vaccinated, well then n- we will have no, no community protection. So think about how we mostly phased out polio and smallpox. It's because there was a massive agreement and uptake of those vaccines. So the people who are on the fence or on the opposite side of the fence, you're actually being protected (laughing) by the immune decisions and the vaccine decisions-

Diane (28:21):

Right. Yeah.

Dr. Riveria (28:21):

... of people who have accepted them. And so if we think about it in that way, again a community, where are you residing in your community? Are you working with it and working against it and why?

Diane (28:31):

That community immunity. I mean-

Dr. Riveria (28:33):

Yes.

Diane (28:33):

... that's what it's all about, doctor.

Dr. Riveria (28:34):

Yes.

Diane (28:35):

Yeah.

Clay (28:35):

Wow. Ladies and gentlemen, Dr. Paulette Grey Riveria. Fantastic job. And that wraps up our walk through of modern-day vaccines. Thank you so much for joining us and we hope that you'll come back for the next episode of Vax Matters.