

# DOPE LABS

Transcript of Lab 047: All (Immune) Systems Go

**Zakiya:** If you've been tuning in to our New Year series, you know, we're talking about making the best version of you. And in our sleep episode last week, we talked about how important sleep was for immunity.

**Titi:** Yes, we did. Sleep is so important to so many aspects of our overall health. But one of the things that stood out the most to me was how it impacts our immune system. Which is wild.

**Zakiya:** Yes. And, you know, over the past couple of years, I feel like the "I" word, immunity, has been everywhere.

**Titi:** Yes.

**Zakiya:** But do we really know what it is?

**Titi:** No, we don't. It's clear I've seen the tweets OK. We're flinging that word around as if it means a thousand different things, but I know that it means something very specific.

**Zakiya:** Well, you're in luck. That's what we're talking about all this lab. Let let's get into it.

**Titi:** I'm Titi.

**Zakiya:** And I'm Zakiya.

**Titi:** And from Spotify, this is dope labs. Welcome to Dope Labs, a weekly podcast that mixes hardcore science, pop culture and a healthy dose of friendship. This week we're talking all about the immune system. Specifically, we really wanted to know more about how it works and what we can do to make it stronger.

**Zakiya:** Yes, it's peak cold and flu season, and I've seen a lot of you sharing elderberry, sirup, ginger, lemon emergency, all of that. All your IG stories. You're telling us all about your immune system, hacks and boosters. So this lab is really for you. We're going to get into what the immune system is and how it works. So let's get into the recitation.

**Titi:** So before we say, what do we know, what I know and what Zakiya knows is two very different things? To be clear, I feel like I know next to nothing about the immune system and how it works. I feel like I know very, very basic things that I think most people know, like your immune system is important and having a good immune system will help you. But that's kind of where it stops for me.

**Zakiya:** Well, that's OK, because I'm going to help you ask some other questions like where exactly is the immune system in the body? How does it work? What happens if it's not working or if it's overworking? What's going on there? And then I think the question we both have, Titi, is about all the hacks we see about strengthening and boosting and enhancing the immune system.

**Titi:** Yes, some of it just seems like made up stuff like, who told you that? Who told you that? Like you on your big toenail for three minutes and then spit it out and spin round like, I don't know.

**Zakiya:** Yeah, I wouldn't chew on it. But if you do happen to chew on it, then definitely spit it out. All right. That makes me feel like we are ready for the dissection. You ready Titi?

**Titi:** I'm ready. Hold my hand friend.

**Zakiya:** Our guest for today's lab is Dr. Payel Gupta.

**Dr. Payel Gupta:** My name is Dr. Payel Gupta. I am an adult and pediatric allergy and asthma specialist and also an immunologist, and I live and work in New York City.

**Titi:** Ok. For me, let's start with the basics. What is the immune system?

**Dr. Payel Gupta:** Our immune system is our body's way of protecting us from foreign invaders. And what I mean by foreign invaders are things like viruses like bacteria, like fungi and even cancers.

**Titi:** OK, so these are all the things we definitely don't want in our bodies.

**Zakiya:** So if we zoom out, we can think about the body as this single tube from the mouth to the booty, basically. And your skin is wrapping all of that and keeping everything in a closed system. So your skin is like your protective barrier, right? Our skin is a physical barrier to those foreign invaders and particles.

**Titi:** You know you got to stay moisturized, you got to put lotion on those elbows.

**Zakiya:** Yes.

**Titi:** Moisturized skin is soft and supple and plump, but not moisturized skin or dry skin, cracks and bleeds and things like that.

**Zakiya:** All right. We have our protective barrier of skin protecting everything inside. If anything penetrates, that barrier it's then facing our immune system, and the immune system can be split into two parts the innate immune system and the adaptive or acquired immune system.

**Titi:** So innate being the immune system that you are born with.

**Zakiya:** Yes, and that's not unique to us. So if we look at all animals have an innate immune system and so do plants.

**Titi:** Oh, I didn't know that.

**Zakiya:** Yeah.

**Titi:** I need to treat my snake plant better. There is currently three leaves sitting on the floor. OK, so there's our skin, which provides a physical barrier. Then there's the innate and acquired immune systems. So let's talk about the innate immune system first.

**Dr. Payel Gupta:** And so then innate immune system is our first line of defense and this line of defense, or this army reacts to fight infection quickly.

**Zakiya:** The innate immune system is nonspecific, so it just says invader respond, right? It doesn't know who you are. It just knows that is not right.

**Titi:** That's like your house security system. When you come in the door, it's like, Hey, I don't know who you are. You may be the owner. You might not be yet, but you better put it in the security code. Or there's going to be some problems.

**Zakiya:** Yes. You know, so let's say that system is not very specific is just a strong first response. Our second line of defense is the acquired immune system. So if we were to compare these things, the innate immune system is not specific. Acquired is specific. The innate immune system is permanent and the response is immediate. For the acquired immune system it's transient, it's not always permanent and the response is not immediate, but it is specific and is coming right for you is right on time.

**Titi:** So the acquired immune system is something that your body builds over time, and that's based off of socio physical factors?

**Zakiya:** That's a really good question. You begin building your acquired immune system from being a fetus right? Across the placenta the mom is giving you some immunity right there.

**Titi:** Thanks, mommy.

**Dr. Payel Gupta:** When a baby is first born, they're not ready to fight every infection. They are fragile and are immune systems. When we're born aren't where we want them to be.

**Zakiya:** Then even thinking about what happens as soon as you're born, you have been inside this other closed system so you don't have any bacteria. You know how we talk about the microbiome on the skin and how we talk about the bacteria that's part of our personal environment. You acquire that as you pass through the birthing canal or if you are delivered by C-section, you acquire that from that delivery process and then you know that skin to skin contact with mom. At that point, you are being colonized with bacteria and other microorganisms, right then. And those things are all over your skin colonizing the body. So that's what's helping you specifically, Titi, when you're eating all that crazy food and helping you not get sick. Those bacteria in your gut, you acquire that stuff from birth.

**Titi:** So your adaptive immune system starts developing from the jump through the birth canal, skin to skin. All those germs getting into your tiny baby body are what your body needs to adapt to the outside world.

**Zakiya:** And so when you think about when a baby, Titi, is always sick, you know, like you've seen your nieces and nephew with those runny noses.

**Titi:** Yes.

**Zakiya:** That is them being exposed to these foreign particles and pathogens and their immune systems are beginning to recognize these things and getting smarter. And so that's why kids get so sick when they first go to like preschool or to daycare.

**Titi:** Because their bodies are being introduced to new bacteria that they've never seen before.

**Zakiya:** Bacteria, viruses, all of that. And that is how you develop that learned or acquired immunity.

**Titi:** So then when you get to a big age, like our age, we've seen a lot of the things that were in the nursery already. So our bodies are better equipped to fight it.

**Zakiya:** Yes, and you may be able to clear those things really quickly, so a cold that may have your little toddler cousin with a runny nose for a week. You may have the sniffles for like one day and you're good. You're ready to bounce back and keep it moving.

**Dr. Payel Gupta:** And then as we get older, we get exposed to the environment, which also exposes our body to foreign particles, foreign substances and our body starts to recognize what is normal, what is abnormal, and then the immune system slowly starts to grow.

**Titi:** So our immune system generally peaks between puberty and young adulthood and starts to decline around the age of 60.

**Dr. Payel Gupta:** That's why older individuals, we have to be extra careful, just like we are with babies, because they are more susceptible to infection.

**Zakiya:** We talked about this in our "protect ya neck" episode. Really young babies and infants, so under six or seven months can't get a flu shot, so everybody around them gets a flu shot to kind of cocoon them and to keep themselves from passing something on to the baby. Similarly, older adults over 65, they also have a weak immune system, but their immune system can handle a little bit more than an infant can. So what we find is that if you think about a flu shot, if you were under five years old, we could say just have like one dose. Compare it to if you're an adult of great health and you're not immunocompromised in any way, you would have what we consider maybe two times the dose. But for people who are over 65, the amount of flu vaccine they're receiving is considered three times the dose of what a kid would get. Right, because a kid needs much less prompting their immune systems are so robust, it's like, got it. Like if you were trying to do a tiktok, I'm going to need a little bit more time to get my takes up together than somebody who's 12 right there are native to that system, They know what to do. It's just like a learning curve for your immune system as you get older.

**Titi:** So now we know what the immune system is. We know that there's some that is innate. So that stuff that you're born with. And then we know that there's some aspects of our immune system that we acquire over time based on exposure. But where is all of this happening? Is there like an immune system organ? Is it near my pancreas? This one of the, you know, one of the only organs I remember from biology.

**Zakiya:** Oh my goodness

**Titi:** pancreas kidney.

**Zakiya:** You're doing good. You're doing good.

**Titi:** Stomach.

**Zakiya:** Well, basically, it's all over. It's not in any one place. So in your bones, and I'm not just talking about one bone, all your bones. Inside, there's bone marrow, which is just like spongy kind of stuff that is the place where lymphocytes are made. Lymphocytes are also maturing in the thymus, which is if you think about like where your neck is, that butterfly organ over your neck, that's your thyroid. Come straight down between your lungs and your chest. That's the thymus and cells that are part of the immune system are maturing right in there. You also have like your lymph nodes, which are kind of like under your arms. If you've ever gotten sick and felt like sore under your arms or right there under your jaw line a little bit. There's even lymph nodes right in the groin area too. Other areas are like the spleen and even your tonsils. I just think of that as like the battleground for our immune system.

**Titi:** Really, our tonsils our spleen. What was the other one?

**Zakiya:** The lymph nodes.

**Titi:** Lymph nodes, spleen. Ok.

**Zakiya:** You're getting it.

**Titi:** I'm following. I'm following.

**Dr. Payel Gupta:** Some of the fighters in this army are things like macrophages, basophils, dendritic cells or neutrophils. So these are all fancy names for cells in our body that do different things to get rid of the bacteria or viruses or other foreign invaders. Macrophages are kind of like these big cells that kind of engulf whatever foreign particle they see. The chemicals inside of the macrophages just eat up whatever they see. And so that's kind of what a macrophage does. Neutrophils are kind of in a similar way doing that same thing.

**Zakiya:** Those cell types, neutrophils, basophils, mast cells, dendritic cells, those are all part of our innate immune system. And so Titi, like you mentioned, if things slip past our innate immune system, they move on to our second line of defense, which is our acquired immune system.

**Titi:** The acquired immune system uses lymphocytes. So those are cells that circulate in the blood and are made up of T cells and B cells to target specific pathogens.

**Dr. Payel Gupta:** These cells take longer to develop because their behaviors evolve from learned experiences. But they tend to live longer than innate cells and adaptive immune cells remember foreign invaders after their first encounter and then fight them off the next time more easily. So this is really the fundamental concept and promise for how vaccines work, for example.

**Zakiya:** Yes. Remember, in the HIV episode with Dr Christine Daniels, we talked about creating that mug shot. And so your immune system is, I already know who you are and I know what to do. That's basically what we're doing when we expose our bodies to vaccines, speeding up that learning process.

**Titi:** So now that we understand how the immune system works. What are some signs we can look for to know that it's working?

**Zakiya:** One of the most common misconceptions is that if you get quote unquote sick, so like if your nose is running or if you are achy or if you have a fever that your immune system isn't working. But that's actually a sign that it is. Let's take lymph nodes, for example.

**Dr. Payel Gupta:** Lymph nodes are tissues that are found all over our bodies, and lymph nodes produce white blood cells and white blood cells help fight off infection.

**Titi:** Lymph nodes can be found underneath our neck, under our arms, near our groin and literally all over.

**Dr. Payel Gupta:** When we actually get sick, then our lymph nodes go into action, and that's when they get inflamed, and that's when they get bigger. That's evidence that your body is doing something to fight off infection.

**Zakiya:** And so when we think about people's response to the COVID vaccine and boosters or even the flu shot. Sore arms, fatigue, all of that is just a sign that your immune system is working.

**Titi:** You know, the flu shot makes me hurl every time I get it.

**Zakiya:** I didn't know that.

**Titi:** Girl it happened at your house in North Carolina.

**Zakiya:** Oh, the flu shot did that to you, and you just had a different kind of response.

**Titi:** Paint the picture for you, OK? I was at Zakiya's parents house?

**Zakiya:** Oh at my parents house?

**Titi:** Yes, we were hitting golf balls with her dad, and I had just gotten a flu shot like two days before. It was my very first flu shot, so I didn't know nothing was going to happen to me. He put Lamb on the grill. We was eating good. OK, hitting golf balls. Her dad is launching those golf balls into the stratosphere, and then all of a sudden I'm like, Something is not right. I start to feel lightheaded and then I say, I'm about to throw up. I run to the bathroom. I felt awful because we had so much good food that I was like, I really hope he doesn't think it was his food because I know it's not his food. I don't know what's wrong with me, but then I was like, I have to go home. And so I drove back to Durham and then proceeded to vomit my life away for the next two days.

**Zakiya:** And does this happen every time you get a flue shot?

**Titi:** Not that extreme. So that was my very first shot. So it makes sense based on what you and Dr. Gupta have been saying about the immune system. My first experience with the flu shot, I had a really strong reaction because my body's like, OK,.

**Zakiya:** What is this?

**Titi:** How do we get rid of this? What is this? This is something new that we've never seen before. But now every time I get the flu shot since then, I'll get super nauseous, sometimes out there up. But the last time I got it, I just felt a little queasy. And so I'm guessing this immune system is doing what it's supposed to do is giving what is supposed to give.

**Dr. Payel Gupta:** And if you don't have those symptoms, if you don't have that or you didn't really get sick, it doesn't mean the immune system wasn't working. It just means that you can feel your immune system working more than maybe somebody else.

**Zakiya:** Another example of the immune system working baby, you've seen me suffer from this is allergies. That's our immune system overreacting.

**Titi:** Listen, I have allergies, but I have never seen someone suffer like my friend. OK.

**Zakiya:** You don't want to be outside with me without a Zyrtec and a Flonase spray into the nostril.

**Titi:** I've got to get my friend inside. She is perishing everytime

**Dr. Payel Gupta:** Our immune system all of a sudden looks at a dog protein or cat protein or, you know, dust mite and all of a sudden thinks that this is something that I need to react against when in fact, it's not something that you need to react against. So it isn't like the tree because tree protein is actually good. It's good for our environment. We need more of it. But it's that when our body sees it, it's reacting in an abnormal way and causing a ripple effect of all these chemicals being released. And those chemicals are what caused the damage and the inflammation and all the symptoms that we experience.

**Zakiya:** So when we think about how people are treating their allergies, a lot of people are taking antihistamines and things like this, and what they're doing is actually dampening their immune system. They're turning that reaction down so that they're not getting so much of the runny nose and the inflammation. Histamines are chemicals involved in our immune system. And if you take Benadryl or something like that for allergies, you'll see the term antihistamine. And what that's doing is you can think of it as kind of sequestering those histamines away so you don't get those responses like the runny nose and the itchy eyes and the inflammation that's associated with our immune systems overreact and to these allergens. Right. So you're basically saying, Hey, take it easy. All right,

**Titi:** It's holding your immune system back. Hold me back hold me back.

**Zakiya:** Yes, that's exactly what it's like. And the nice thing is that is specific to the allergens. So it doesn't mean that your immune system is impaired from protecting you against other things. So that's really nice to have that kind of specific targeting for allergies.

**Titi:** OK, so let's take a break. And when we come back, we'll talk all about what happens when the immune system doesn't work and what we can do to strengthen our immune system.

**Zakiya:** We're back and we're talking about the immune system with Dr. Payel Gupta now that we have a better understanding of what the immune system does and how it works. What happens if it's not working?

**Titi:** So what we've learned is that there are some immune system disorders and they mostly have to do with the immune system operating out of balance, either under reacting or overreacting to a foreign invader. When the immune system is under reacting, it's called an immune deficiency.

**Dr. Payel Gupta:** So an immune deficiency is when our body isn't reacting to viruses, bacteria, fungi and it can be from the cells. You know, all of these different cells from a part of those cells



not working properly, or that there aren't enough of those cells to help fight infection. So it can be either the function or it can be the amount .

**Zakiya:** An immune deficiency can be primary, which means it was inherited at birth or secondary, which means it's not an innate disorder, but something that is secondary to another condition such as cancer or AIDS, which stands for acquired immune deficiency syndrome. And those immune deficiencies can range in severity and treatment.

**Dr. Payel Gupta:** So in those situations, you know, those patients need extra boosters, they need more antibiotics, they need stronger antibiotics than other people. If it's a severe immune deficiency, we sometimes have to actually replace the bone marrow and that the more severe ones will show up at birth. And so we actually have a screening system to kind of find those immune deficiencies very quickly when a baby is born so that we can help protect them and take care of them and make sure that they don't get that first infection, that could lead to unfortunate circumstances.

**Titi:** So then what about the other side of the coin when our immune system is overreactive.

**Dr. Payel Gupta:** And then the overactive immune system is, you know, things like autoimmune diseases. So you know, where like thyroid dysfunction, lupus, rheumatoid arthritis, things like that, where our immune system might be acting against us, then we get other issues where a lot of inflammation, a lot of the things that we use to fight infection in turn then causes problems in our body.

**Titi:** So some parts of our immune system, we cannot change because it's just what we're born with. And so there's not much we can do to fix it. But there are aspects of our lives that do affect our immune system that we have some control over, like sleep. And we just finished talking about sleep in the last two labs. And what we know about sleep is that it is not created equal. There are some of us who have the privilege of being able to get eight hours of deep sleep, but there are other people who don't because of where they live, their job schedules, or anything in between.

**Dr. Payel Gupta:** But definitely for the immune system. We know that during sleep we're actually producing certain cytokines that we need in order to fight infection. So cytokines are essentially just chemicals that then call other players into action.

**Zakiya:** If we don't produce those cytokines. We're susceptible to all types of attacks on our immune system. So like you said, Titi, Yes, sleep is key for a healthy immune system, but what are some of the other things you've seen people doing to increase their immune health?

**Titi:** Oh my goodness, so many things. I think you mentioned the elderberry, which,.

**Zakiya:** Yes.

**Titi:** I had never heard of.

**Zakiya:** Right before COVID right.

**Titi:** Before COVID I'd never heard of elderberry, but now everybody is, you know, injecting it into their veins.

**Zakiya:** The other thing that I remember being big was celery juice. Do you remember when everybody was drinking all that celery juice?

**Titi:** Yes, and everybody is me. I was drinking celery juice for a little bit.

**Zakiya:** I didn't know that.

**Titi:** It's disgusting that's why. I was adding it into my juices that I was making at the time that had apple, cucumber, ginger and things like that. And I was like, Oh, celery, and I put the celery in the thing. Celery, let me tell you, you know, if there's celery in that juice that you're drinking because it turns into something pungent, you'll know. If it's gross, look at the ingredients, there's celery in it.

**Zakiya:** When you think about those things, celery feels like the tube, like you're playing a beautiful symphony with your juices. And if you put celery in there, it's like coming out \*horn sound\*.

**Titi:** \*horn sound\*.

**Zakiya:** It's not right. But I wonder, like when I think about immune health and all of these things, the stomach and the acids in our stomach, they're destroying things that we put in there. So is that really working? Can we eat our way to better immune health?

**Dr. Payel Gupta:** But as far as nutrition goes and diet and the immune system in general, having a healthy diet is going to allow you to have that healthy immune system in a healthy body. So I'll take, for example, vitamin C. Our bodies don't make vitamin C, right, but we need it for our immune system and we get vitamin C from our diet. And usually it's from citrus fruits, strawberries, green vegetables, tomatoes. And the recommended dietary allowance for men is 90 milligrams per day, and for women, it's 75 milligrams per day. That's pretty easy to get. If you have a pretty well-balanced diet, you don't have to work very hard to get it.

**Titi:** But if you weren't in any of those things, then

**Zakiya:** I'm not saying anybody on this line is not eating those things, but some people might not be.

**Titi:** I do take a vitamin C pill.

**Zakiya:** Well, that's a good point. You are taking the supplement. So does that make a difference?

**Dr. Payel Gupta:** You know, according to Harvard Health, the data on vitamin C is that it's only marginally beneficial when it comes to things like the common cold. And when you see something like that where it says it's only marginally beneficial. That means that more than likely, taking large amounts of vitamin C is maybe going to help you a little bit, but maybe not.

**Titi:** So Dr. Gupta is saying that at least for something like vitamin C, focusing on a healthy, balanced lifestyle is the most important thing and getting plenty of exercise and sleep as well. Those are the best things you can do to keep up a healthy immune system and best to focus on before you start adding supplements.

**Dr. Payel Gupta:** And then the other big, big, big factor for all of these supplements and things like that is the cost and the safety. So, you know, even though it says, quote unquote natural on something, if you're taking it in larger doses because they're saying that these higher doses might be beneficial. Well, it could also be the opposite. It could also yield a side effect because anything in a higher concentration can also cause problems.

**Zakiya:** Well, just know our bodies can't absorb all those vitamins, and they really can end up as waste.

**Dr. Payel Gupta:** Something that my girlfriend said the other day, which is super important and she's a physician, also is that Americans have the most expensive pee in all of the world

**Zakiya:** Literally liquid gold.

**Titi:** This is perfect because in next week's lab, we are talking to Dr. Alice Lichtenstein about vitamins and why our pee is so expensive in the United States. We're going to talk about the vitamin industry, and we're going to be talking about what we need to be considering if or when we decide we want to take vitamins. I think one of the things I feel like is really important with what Dr. Gupta was saying is that our immune system, our innate immune system, or the immune system that we develop over time, it's not something that you know, some people can help. The stuff that we are born with or the conditions that someone might have that can dictate a lot of different things. So when she talked about the thyroid, there's thyroid deficiencies where you can have an overactive thyroid and then that leads to other health issues like weight gain or fatigue or depression. And those are all linked to your thyroid. So I think these types of distinctions are important to realize. One. Mind your business, and

**Zakiya:** Most of all

**Titi:** Mind your own immune system and keep those things in mind when people are struggling with different ailments like diabetes, like lupus, like thyroid disease.

**Zakiya:** I think first of all, you have no clue what's going on in your immune system until something goes wrong. I mean, it is magical how all these different systems are operating in interconnecting and with so many different inputs. If we think back to the things we talked about, psychologically, socially, how those things have biological implications, the health you had at 15 is not the health you're going to have at 30, and it's not the health you're going to have at 60, and

it's designed that way. So when people say I'm at the best health of my life that may be different than somebody else's health, you know. As much as we feel in control we're not really in control of, you know, what's happening in our bodies. You're born with a certain set of components and you do what you can with that. And I think there's been a lot of conversation when we think about wellness that sometimes I feel like it goes off the rails about like, Oh, you got to do this stuff to be healthy. There are genetic differences. There are all these other things that kind of happen along the way, and I think we just need to be aware of that. And that your immune system is designed to peak, you know, at a certain age and then start dropping off. And what those peaks and valleys look like and how often they happen could be tied to so many other factors. There's just no way to know.

**Titi:** Yeah, I think that's a great point. So it also makes you think like, check in with yourself. Are you noticing anything abnormal or something that you feel like it happens to you more often? Are getting sick more often than other people? Maybe that's the perfect time to talk to your doctor about it.

**Zakiya:** Yes, like we said in our early episode, protect your neck.

**Titi:** Did you see that people were making fun of Kevin Durant because his leg was ashy?

**Zakiya:** Yes. So you know that social commentary, but that's also health advice. Kevin Durant, please moisturize your first line of defense.

**Titi:** But one of the symptoms for Hashimoto's disease is.

**Zakiya:** Dry skin.

**Titi:** Is dry skin.

**Zakiya:** Yes.

**Titi:** So now I feel bad. Yeah, I mean, I didn't comment on the internet. Yeah, but I was like \*giggles\*

**Zakiya:** We never comment on the internet like that. You were keke-ing to yourself undercovers.

**Titi:** Yeah, but that doesn't mean go out and start diagnosing people with stuff. Mind your business. They will go to their doctor.

**Zakiya:** That's the main diagnosis. That's what I'm doing in 2022.

**Titi:** It's none of my business, it's not my business.

**Zakiya:** Yes. All right, it's time for one thing.

**Titi:** OK, so my one thing this week is something that actually Zakiya put me onto Not too long ago.

**Zakiya:** What?

**Titi:** And it's Wordle.

**Zakiya:** Yes.

**Titi:** So Zakiya put me on to this new game called Wordle. I don't even know the website, but if you type Wordle into Google, it'll take you to the website where you can play Wordle. And what it is is that each day there is a word that you're trying to guess and there's like some strategy and things like that in order to get the word. you get six chances to guess what the word is. I played it for a couple of days, so I've done two boards now. I have been able to guess one one time and it made me very, very happy. And you'll see people on Twitter or on Instagram everywhere talking about wordle. It's very popular right now, so I encourage everybody to play along. What's your one thing, Z?

**Zakiya:** My One Thing is my supplemental textbook for this episode, which I just absolutely love. It's called "Immune: a journey into the mysterious system that keeps you alive". It doesn't read like a traditional textbook is by Philip Detmer. It has great images. I love it. I'm holding it up right now. You guys can't see that, but I just just love the way is written, it's great science communication. I recommend it for anybody interested in the immune system. That's it for lab 047. Call us at 202-567-7028 and tell us what you thought about this lab or give us an idea of where lab we could do later in the semester. We like hearing from you. That's 202-567-7028.

**Titi:** And don't forget, there's so much more for you to dig into on our website. There will be a cheat sheet for today's lab, additional links and resources in the show notes. Plus, you can sign up for our newsletter. Check it out at [Dopelabspodcast.Com](http://Dopelabspodcast.Com)! Special thanks to today's guest expert, Dr. Payel Gupta.

**Zakiya:** Find her on Instagram @nycdactor and on Twitter @nycdactorgupta.

**Emory Price:** Dope Labs is a Spotify original production from Mega Ohm Media Group. Producers are Jenny Radelet Mast and Lydia Smith of Wave Runner Studios. Editing and sound designed by Rob Smierciak. Mixing by Hannis Brown. Original music composed and produced by Taka Yasuzawa and Alex Sugiura. From Spotify our executive producer is Gina Delvac and creative producers are Barron Farmer and Candace Manriquez Wrenn. Special thanks to Shirley Ramos, Yasmeen Afifi, Kimu Elolia, Teal Kratky and Brian Marquis. Executive producers from MegaOhm media group are my internet besties, Titi Shodiya and Zakiya Whatley.