

Coronasode: Virology Update

with Dr. Shannon Bennett and Dr. Mike Natter

Ologies Podcast

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Oh Hey, it's that sticky quarter, hiding under your floormat just waiting for you to get desperate enough to use it at a parking meter, Alie Ward, back with a Coronasode. This is the third installment of Coronavirus episodes. The first one was with Virologist, Dr. Shannon Bennett from Cal Academy. Then we had an isolation era, March 31st episode called "All (Washed) Hands on Deck with Dr. Michael Wells" about testing resources, what we all can do to help, and also how to practice self-care during a really tough time. It's been two months, and things are starting to slooowly re-open in the U. S. and we all have a looooot of questions. So I hopped on the horn with past guest, Dr. Mike Natter. He is a physician in New York City, who you know from the Diabetology episodes. He has been on the front lines in emergency and ICU Units, and gives an account of the disease, prognoses, what to expect next. I also chatted with Dr. Shannon Bennett, a virologist extraordinaire, to talk about how the virus behaves and how we should behave. Because that's a big part of it.

But before we get to them, quickly, just a few thanks to everyone on Patreon.com/Ologies for submitting questions for this episode - this is all your questions – and for supporting for as little as a buck a month. Thank you to everyone sending these episodes around via word of mouth, and social media, and subscribing, and rating and, of course, reviewing. Your reviews have kept me company [*sing-songy voice*] during lonely time, and as proof I read a fresh one that someone left each week. This one is from hstrykid, who says:

This podcast makes learning about topics I've never even heard of so interesting and enjoyable. I have to confess, her intro and the show's theme music always make this 55-year-old man cry with joyful anticipation.

Thank you, History Kid, for letting me creep your weeps, and everyone who left reviews this week, for serious.

Okay, let's get to the interviews with Doctors Natter and Bennett. We'll learn about herd immunity, and vaccine progress, what it's been like on the front lines, if the virus will mutate, if it's seasonal, what PPE we should be wearing, if picnic in the parks are a good idea, and when you can hug people again. Are handshakes cancelled? You will find out. It starts out tough, explaining the importance of having flattened the curve, and by the end you will have a clearer picture of the future. So, get comfy, and listen up, and then bang on a saucepan, and applaud into the dusk for physician Dr. Mike Natter and Virologist Dr. Shannon Bennett.

Dr. N: I'm okay. My goal is to not cry in the 30-minute chat that we have. [*laughs*]

Alie: Fuck. Please, don't feel like you have to stick to that.

Dr. N: Can I tell you? I have been ugly crying, like, I feel like what I imagine a very, very pregnant woman with, like, lots of hormones flowing through.

Aside: So, you heard Dr. Mike Natter in the Diabetology episode, and you may recall that he is a super sweet, super empathetic dude, and he works in a family of three hospitals in Manhattan. He has seen things, not on the news, not explained via press conference, but firsthand. He knows the real shit.

Alie: Can you explain to me a little bit of what it's been like since early March? Mid, late March?

Dr. N: It was a lot. There was *a lot* of volume. We had to basically... It's always tough because when you're in the hospital, you see the trees, you don't see the forest. You don't necessarily know what everyone else's experience is, so I can only speak to that. I was seeing a lot of trees. A lot more trees than is typical for this patch of forest.

Just to give you some scale, the hospital and internal medicine works like this; if you come to the Emergency Room, they try and get you better so that you don't have to be admitted. But if you are sick enough to need admission, which unfortunately many of the folks that have really bad COVID do need because their oxygenation is so low... If they are sick, but not too sick, they go to what's called the General Floor. We call it The Floor, or some people call it The Wards. [*slowed down and deepened Alie Ward's voice: "Oh Hey."*]

The General Medicine floor is kind of like, you're sick enough to be admitted, but you're not on death's door, by any means. Then if you get sicker, then you go to what we call The Unit, which is short for the ICU. There's different flavors of ICU, but in general they're all acute critical care. On average, in one ICU, let's say there's maybe 30 or 40 beds, there will be, maybe, on my particular team, 10 to 20 patients, of which, maybe, 5 to 7 of them are intubated and are very, very, very sick.

The *entire* ICU plus a million other floors that we had to makeshift into ICUs were being overrun with patients. There were hundreds, literally hundreds. At the peak, at this particular hospital, I think close to 200 intubated, ventilator-necessitated patients and it was really, really bad. So, that was bad. That was at one particular hospital. Then, I rotate between another one, and the hospital up the street which has a lot more resources was *even more* overrun than that hospital. We had people from surgery, plastic surgery, from pediatrics, from psychiatry, from neurology, who we just needed to come help us with the volume. It was an onslaught of volume of patients.

Alie: What was life like in New York at that time? You were born in New York; you've lived most of your life in New York. What's it like going from the hospitals back home every day, knowing that that's kind of an epicenter in America?

Dr. N: It's scary. You know, New Yorkers are pretty rough, and gritty, and nothing really affects anyone. No matter what's going on in the world, everyone seems to be able to do their thing, no matter what. There was this clear sense of unity and comradery. The only other time that I've lived through that felt even remotely close, but for different reasons, was 9/11, and to some degree, Superstorm Sandy. But it just was different. It's a very different vibe. It's so eerie, and very uncomfortable, and jarring for me to see the streets as empty as they are, because that's something that's like a constant of New York. That the lights are on, people are moving around, things are going on no matter how crazy the world gets. The fact that that's not the case is also extremely noticeable and jarring.

Alie: Mm-hmm. How are doctors looking at the curve for New York? Where is it at now? We're in the beginning of May, how is it looking?

Dr. N: It's looking a lot better. It's all, what I would say, thanks to good leadership from Cuomo and to some degree De Blasio, because the idea of shutting things down to limit the spread. We are seeing a massive flattening of the curve for that reason. Hospital admission rates are significantly down. Death rates are coming down each day. There are still *packed* ICUs, and there's still lots and lots of very, very sick, sick patients. But, we're able to manage them because the volumes have started to settle down. It's almost indefinitely thanks to the social distancing, and the lockdown, and the shelter-in-place orders that have been issued by the Governor.

Aside: So, a few patrons had questions about symptoms of COVID-19. COVID-19 is the disease caused by SARS-CoV-2. Which is a new type of coronavirus. Coronaviruses are a type of virus named for 'the crown' or the *corona* of structures on its cell surface that help it bust into our cells.

A recent Center for Evidence-Based Medicine article stated, "Between 5% and 80% of people testing positive for COVID-19 may be asymptomatic." Between 5% and 80%! What?! That's a big range. So, we don't totally know how many people have it, but experts pretty much settled on 50% are asymptomatic.

Patron Lisa Moore asked about neurological symptoms. In one small Chinese study of 214 people hospitalized with COVID-19, more than a third of them had neurological symptoms, like headaches, and change in smell and taste, nerve pain, tingling in the extremities, and wooziness and dizziness. Other observed neurological effects of COVID-19 are; short-term memory loss, difficulty concentrating, tremor. So, it can affect you neurologically.

Patron Toby Christink asked: If there's going to be a second wave, will there be new and unknown symptoms? They say: I'm already hearing about 'corona toes'. So, yes, other observed symptoms of this coronavirus have been corona toes, which are lesions on the toes, diarrhea, and perhaps even something called, Kawasaki Disease, which has been seen in some children. It presents a little like Toxic Shock Syndrome, with high fever lasting several days, and abdominal pain, vomiting, a bright red or what's called a 'strawberry tongue', and tiny peeling rashes on the feet, and hands, and groin. Other complications of COVID-19 we did not necessarily know much about a few months ago are, blood clots and stroke, inflamed heart tissue, lung scarring, and even issues with male fertility.

I know you're like, "What the fuck are all these symptoms? Why are you bumming me out, Dad?" Well, there's a chance that you or someone you love might have symptoms without realizing it is the 'rona, so I'm here to tell you. Now, the tough part is that this is a novel virus. We've only known about it for a few months, so every day we get more information. So, every day, yesterday's information might a little more wrong. But the good news is that people are working around the clock on it. Dr. Natter explains:

Dr. N: That's a good question. I think, just speaking generally, a lot of the fear around this, is that we don't know things. We don't understand why some people who get coronavirus have a sniffle and then they get better, or they have a few fevers and then they get better. Then the same individual who's... I mean, I saw very young patients with no comorbid or past medical history who have died, and many others who are on dialysis, and ECMO machines, and hemodialysis, and ventilators, and all these things, that doesn't make sense. So that fear is felt, really, amongst the general population but amongst health care workers. I think we

like to intellectualize as a defense mechanism, but you can't intellectualize when you don't know, and when you see what you're seeing.

Aside: So, worldwide, as of this recording, 285,971 people are reported casualties of the virus. Over 80,000 in the US alone. So, how is it still spreading, any surprises? Virologist at the California Academy of Sciences, Dr. Shannon Bennett, explains:

Dr. B: Well, it's really fascinating. I would say that it's, by and large, behaving as we would have expected; the way it was this steep exponential growth rate early on, then flattening and leveling off. I'm talking about leveling off in terms of the number of daily new cases, and the number of daily new deaths. In both... Death lags behind the new cases, but they start to ramp up, then they level off, such that the number of daily new cases are almost the same day over day, maybe over a sliding two-week window. Then it starts to drop down the other side of the wave.

So if you're in California, where there's a big surfing culture, it's like surfing a wave. You go up, flatten, and then down the other side. I do apologize, making light of this. This is very serious, but it is an effective analogy, I think, to indicate that. Just like an energetic wave in water, the number of cases out there... because any individual case is infecting a certain number of other individual cases, that number can be pretty high at the beginning of the epidemic, the doubling time was on the order of a few days. Then it sort of spread out as we flattened the curve. That metric represents the energy of the virus to push out and push through a population just the way the energy in a wave that we surf behaves.

So, the 'energy' of that 'force' of infection is becoming dampened as the number of daily new cases starts to level off. Then, that gets reflected in the reduction in the number of daily new cases, day over day, until it's close to zero. That's the bleeding out of energy in that wave as well as that force of infection. That's the way it's rolled in most countries. Including our country, here in the US. State by state, maybe the intensity, the height of the peak of the wave, might look a little different. It was certainly the highest in New York. The timing of that wave is jittered. Some states hit their exponential growth sooner. Others have hit it later and to a much lesser extent.

What's interesting to me is looking at different states, or even different countries. Although, the form of the wave largely plays out the same, with some exceptions. We can really see how countries and states have implemented different policies and that kind of plays out on the epidemiological landscape. You can really see the difference. You can see how different states, for example, really managed to keep that curve very low, very flat, delayed its start, and in very quick time have seen it decrease.

Alie: So, you're seeing that policies have a direct mathematical effect on that curve?

Dr. B: Yes, most definitely.

Aside: Patron Johanna Gebhard asked: Do we know what the mortality rate is yet? And I awkwardly asked Dr. Natter.

Alie: How much higher were the mortality rates of your patients than you're used to dealing with?

Dr. N: Massively. Massively.

Alie: How did you deal with that?

Dr. N: Uh. [*long pause*] Not well.

Alie: Yeah.

Dr. N: Yeah. [*pause*] Not well. It's hard. It's really hard. While in the hospital, surprisingly, I think you have a purpose, and you have tasks, and you're able to get your head down and do your work. You feel like you're doing something of substance. But then [*long pause*] coming home is very difficult.

Alie: Are there any plans in the works for how to deal with that emotionally and psychologically, for healthcare workers?

Dr. N: I think there's a lot of talk. I think it's very well understood and known that there's... a lot of this trauma is being, kind of, dealt with. We know that. And I think a lot of our colleagues in psychiatry have been really great and they've been helping us out, offering us WebEx therapy sessions, and debriefings, and having group meetings and stuff, which is great. I think, for me at least and I think for most of my colleagues, right now we're *okay*. I think it's more what's going to happen days, weeks, months, and likely years from now that's going to be... interesting.

And I worry a lot about my colleagues who graduated a few months early from medical school so they could come join the ranks with us. I think it's so traumatic to be an intern to begin with. Your first days as a doctor, it's very stressful and difficult, and then having to deal with this whole pandemic as your first foray into medicine, I think, could potentially sow some seeds of trauma.

Alie: Yeah. How about actual PPE. How well protected are you all now?

Dr. N: We're good. I feel as though... I don't think I've ever been without having actual PPE. My institution has been pretty good. There's three hospitals in my institution and one is a public hospital of New York, which is obviously less funded than others. But the amount of donations and people coming out has been phenomenal. There have been people pouring in money to get PPE, or actual PPE, and obviously, food. There's signs in chalk on the street. There's everything you can imagine. Free scrubs and all this stuff. We're being very much showered and pampered, which is great.

I feel kind of shitty in that there's such a need for food in the country, and there's lots of food banks that are going dry, and we are literally just inundated with food. Like really, really good food, and I always feel so bad that I'm like, "Some of this food really needs to be diverted to some of these other places that need it."

Aside: At Dr. Natter's behest we made a donation to Food Bank for New York City in his name. So that's 2,500 more meals that will be made possible in the New York area by him mentioning that to us. Thanks for the heads up, Dr Natter.

Now, if up to 80% of folks with it are asymptomatic, how many people have or have been infected with SARS-CoV-2? Dr. Bennet says what we see is probably the tip of an infection iceberg.

Alie: Do doctors have any idea? Because testing in the general population is so rare. Do we have any idea what the mortality rate of this is?

Dr. N: *[sigh]* We have a sense, but the way we calculate rates is that we need to have a numerator and denominator to figure out all of this. And the denominator is based on if you've tested someone. I think we've caught up a little bit in terms of testing, but there's a lot of miscommunication, and guidelines that were shifting in terms of who should get tested, when they should get tested. Oftentimes, to not overload the ER we would tell people that if you have symptoms but you're not short of breath or you're not becoming hypoxic to really not come in because we'd have people that would overrun the ED to get tested when they weren't sick enough to necessarily need to be admitted. And they were basically either exposing themselves in the ED or creating more volume for the Emergency Room physicians that they couldn't handle.

Aside: This week the President of the United States - and I'm just going to quote this in a *[robotic effect]* very neutral informational way - said, "By doing all of this testing, we make ourselves look bad because the case numbers go up." *[pained: "Oh! Ow!"]* So... there is that information.

Now, I checked in with Dr. Michael Wells, who we spoke with for the All (Washed) Hands on Deck episode in late March, and I got an update from him just today on his database of scientists willing to help with the testing. He said, "The database has now exceeded 9,300 scientists from all 50 states." Side note: yeeess, Wyoming, you did it! Also D.C, Guam, and Puerto Rico, and he now has a large team of coordinators, many of whom found out about the database through *Ologies*, which is awesome to hear. Way to go y'all! He said:

Scientists from our database are helping process tests in Los Angeles, D.C., and Michigan, we even had a few visit SpaceX in Los Angeles to help with some of their COVID-19 efforts. And we are spending a majority of our time actively seeking additional volunteer opportunities across the country.

They have a new website, so people can keep updated on their activities, and I will put a link to those in the show notes. Many of you patrons asked about testing, such as Rachel Weiss, and Ira Gray, and Sophia Dill asked: What is happening with testing and when will we have testing widely available? Sophia, I appreciate your triple interrobang on that question.

Dr. B: We really need to broaden the testing and the kind of testing, and that's happening. We're starting to test here in San Francisco, anybody with symptoms associated with anyone with symptoms can get a free test. This is a PCR-based test, so it's a test that looks for the direct presence of the virus, so there's no point running off to get tested if you had the virus or you thought you had the virus three weeks ago. It's really just measuring the direct presence of virus at the moment that the sample is drawn, so it has a very short applicability.

Aside: Meghan McLean asked about the depth that they plumb into your nasshole, asking: Why does the testing swab have to go so far up into your noggin to get results? And that 6-inch spelunking - I looked it up - it's hitting the back of the nasopharynx, which is where your sinuses meet the back of your throat, kind of like a taint, but for your mouth-nose. Will you have to have this done twice if this thing mutates? Many of you, including Arica Stares, Marisa Holzman, Anna Okrasinski-Maddox, Cameron Siewert, Stephanie Enkel, Anna Thompson, Dawn Zwart and Kevin Lahey wanted to know about strains and mutations.

A paper came out in late April by the Los Alamos National Lab that noted the G-strain of the virus is more prevalent in Europe and on the East Coast of the US, and speculated that it's a

more virulent form, but that paper has not yet been peer reviewed and many other scientists say there's pretty much only one strain. Coronaviruses apparently mutate at one-tenth of the rate as influenza, and that G-strain may have just by chance become more prevalent. It might just be a lucky virus with good odds, not necessarily more dangerous or more infectious. So, the jury is still very much still out on that. Now, if you've had COVID-19, are you immune if it mutates?

Dr. N: Even if you do have immunity, when does it start to wane? Are you going to be immune for a couple of weeks? A couple months? A couple of years? Forever? We don't know. And then, is this virus, you know, possibly able to mutate? And if it mutates, then maybe your immunity is not going to be useful. The best example of that is the flu. The flu is a virus and you have to get a flu vaccine every year because there's something called 'antigenic drift' and 'antigenic shift'. What that means is that their DNA is very susceptible to mutation. And so you get these tiny little mutations and that's just enough for it to, basically, evade the antibodies from the previous season. That's not a coronavirus. so maybe it's not the same mechanism. I don't know. But no one knows.

Now that being said, if you have antibodies and you get tested positive for these antibodies, that should not mean that you're less vigilant about how you go about your life. It might give you a little bit of mental solace, which is good, but you should still wear your mask. You should still be careful. You should still wash your hands. You should still socially distant when you can. All of those things still apply.

The other thing I want to say is that the antibody tests... and this is actually very interesting. We were so behind on the diagnostic PCR test, the "do you have COVID or do you not have COVID?" test. That was in part because the FDA was so heavily regulating how those tests got rolled out, which is what their job is. But in a pandemic, they really, kind of, laid the book down and said, like, "No, you, Medical Academic Center X, can't make your own diagnostic test even though you have a lab and you have the utilities to do so because we need to regulate it." And that was part of the reason why it took so long to get a wider diagnostic test out there.

They went so far on the other end of the spectrum with the antibody test and they went to the free market saying, "Have at it, do it as much, as quickly, and as many as you can." And what that spawned was a very large spectrum of reliable antibody tests. So, the same antibody tests from a different manufacturer may not give you the same reliable tests, meaning you can get false positives and false negatives. You can imagine what that would mean if you get a false positive saying "Yes, you have antibodies," and people then maybe get a little less vigilant, and then then you're going to have a lot of problems.

Aside: A bunch of Patrons, like Crystal Mendoza, Oda Helene Schiøtz, Michelle Neer, Gwen Kelly, Marisa Holzman, and first-time question-asker John C. Faludi wanted to know about antibody tests and errors in testing.

Dr. B: Antibody tests have to be validated to show that they're sensitive enough to pick it up and specific enough to distinguish between this SARS-CoV-2 virus versus other related viruses. A lot of those validation tests are still ongoing. It's very, very, very much a work in progress, and in many cases, if those tests are being done by commercial labs, there's not always full transparency into the rates of false positive or false negative results. So you know, there's

no point getting a blood sample drawn for a PCR test because it turns out that the virus is mostly in your mucus membranes in your nasopharyngeal passage and lungs.

But an antibody test is actually going to want to look for the antibodies in your bloodstream because you don't build up a lot of antibodies in your nasopharyngeal passage. And by the way, you don't build up antibodies until at least 10, maybe 15 days *after* the virus is cleared, or in some cases after the symptoms start. So it's really challenging. When you take the sample, and what kind of test, and from which tissue type it's taken from, and how much virus you had in your system are all important variables that can change the outcome of the test in an artifactual way.

Aside: So, can you get it twice? A study out of South Korea thought "Maaaybe yes?" Then they realized that their tests were so good, so sensitive, that they were just detecting old fragments of the first infection, so that is good news!

Patrons Jen Athanas, Jessica Janssen, Carolyn Wolfram, Patty Bergmann, Jenni Hoover, Ellen Skelton, Mike Monikowski, and Zoë Buckley wanted to know: Can we get it like a double whammy?

Dr. B: If you had it in January and now you are exposed again, we don't think so. Almost all evidence indicates that you cannot get it again because you do develop immunity - some degree of protective immunity. What we don't know is how long that protective immunity lasts. It might be that either the virus evolves away from what your immune system has trained on. Or it might be that your own immune response is maybe not that effective. When you get a virus deep into your lungs, there's a really amazing blood viral interaction so that you can develop a really strong immune response to viruses that infect you at that, sort of, intimate level. But the viruses we get in our nasopharyngeal passages, the common colds, we never really develop anything but very transient immunity because there's no opportunity to really have that nice viral-bloodbath interaction to really develop a strong immune response. [*slow, sinister voice: "Let the bloodbath begin."*]

With common colds, we only ever get transient immunity, and then the next season, next year, we can get the same cold. And so it goes, over and over again, year over year. The big question is, will we develop protective immunity to severe disease, to viral pneumonia? Will this virus then kick up a new, quasi-existence as sort of a common cold-like virus where we never really develop a protective immunity to - only transient immunity to - a more upper respiratory type virus?

Aside: I asked Dr. Natter about that too:

Dr. N: It's a very good question. The truth is, we don't know the answer yet. But we think that... If you look at just what we know in medical science, typically speaking, when your immune system gets introduced to an antigen, or a foreign invader like a virus, or bacterium, or something along those lines, one pathway of your immune system is to make antibodies in order to fight that off. Your body then has things called memory cells, or plasma cells, that then essentially turn into these factories of that specific antibody, and they just crank them out. That's how you develop an immunity.

Aside: Marisa Holzman and Emma Fiori wanted to know about herd immunity, and in patron Wayne Hovey's words: How does this herd immunity thing work? So, as long as I had

a smart virologist on the line, I asked this stupid question [*deep pitched, warped*] for all of us.

Dr. B: No such thing. [*laughs*]

Aside: Okay, I don't quite understand, when we all come out of isolation, how are we not going to just keep spreading it again? From an epidemiological standpoint, what is going to happen in a couple months when we're all out and about like we used to be?

Dr. B: Yeah, this is a really important concept. It relates back to this concept of herd immunity. It's recognizing that there's a certain proportion of people that we may interact with in our populations that might have had the virus and be immune so they're no longer susceptible. What we assume is that when the epidemic wave starts to drop, two things are happening. For whatever reason, policy-wise or not, the energy in the wave has bled out because there aren't as many infecteds spreading the virus to as many susceptibles. And so we can impact that wave by reducing the number of infecteds, which we isolate people and their opportunity to interact with susceptibles, so we're reducing those buckets.

But when we all go back out... And we've seen this in China. Why didn't the virus flare back up to pre-peak-of-the-wave levels? We presume that the virus has basically run out of susceptibles that a certain number of infecteds might run into. There's, like, how many infecteds are circulating, how many susceptibles might they run into? Are there hotspots of transmission, for example? Are there these key sectors in the public domain where people would more likely exchange virus? And that's why people are thinking about different scenarios when we all go back out there.

Maybe we'll be getting back up there slowly where we may try to put in place some social distancing mechanisms, or trickle back in so we can keep that contact right between infecteds and susceptibles low. All the while, we try to understand the base herd immunity, like how many people truly were impacted and might be immune so those susceptibles would be, sort of, taken out of the equation because they're not susceptible, they're immune.

So, looking empirically at the way things are rolling in other countries that have seen the end of the wave and opened back up, they haven't experienced a resurgence, but they're doing a lot of things. They had a wave, they definitely have some herd immunity, but they're also coupling that with social distancing measures.

Aside: What if you have had it and want to put your body fluids to good use? According to the Red Cross, people who have fully recovered from COVID-19 have antibodies in their plasma that can attack the virus, and this convalescent plasma is being evaluated as a treatment for patients with serious or immediately life-threatening COVID infections. It's called 'convalescent plasma.' Patrons Gwen Kelly, Anakin Janiak, and Marisa Holzman wanted to know about it.

Alie: Is there a way to donate, like, plasma if you do have antibodies? Does that even work?!

Dr. N: That's a good question. Yes, there are plenty of ways you can do that. I think you have to reach out to your local academic hospital to find out how they're doing it and where to go. I know that in New York for sure, Mount Sinai and NYU are doing that. But the way that works is very interesting.

It's not a blood donation as much as it is a plasma transfusion. The difference between blood and plasma; plasma makes up part of the blood. The blood is a bunch of cells. It's got white cells, and red cells, and a bunch of other stuff. [*squishy splat*] It also has plasma. Plasma is kind of like the Gatorade portion. If you took out all the rest of the stuff you get this, kind of, yellowy fluid. It's got all the electrolytes and all the good stuff, but in addition to having all that, it has your antibodies. So, if you had coronavirus, you got better, you got tested for antibodies, and you were positive, and you're healthy, and you're able to donate blood, then you might be someone that could donate your plasma.

They do what's called a centrifuge, so they spin it really fast to separate the plasma from the blood, and they take that plasma, and they can give it to someone who is very, very sick who has COVID at that time, theoretically giving them the actual antibodies. Their body hasn't made the antibodies yet, you're giving it to them, they get better. We think this might help. Back in the day they would do this and there was some evidence for it. We're still testing it. We still don't have the hard data to say it will. The science suggests that it should. The same idea, if you have tested positive for antibodies, the science says you should have some immunity, we think. But until we have the numbers and the objective data, you can't say for sure.

Aside: And what about the effects on our hearts? And by hearts, I mean brains.

Alie: I just think there's more of a psychological impact that we, maybe, won't understand until... You touched on PTSD, but I think there is a certain kind of psychological trauma of being scared of this invisible thing that could kill you, or if you go into the store to go buy soup that you could end up killing seven people by doing it. I would never handle a live firearm, much less start shooting into an open crowd. It's kind of like... That level of fear, I think, is probably pretty exhausting for people.

Dr. N: Yeah. For better or worse, I think people are becoming less vigilant and anxious, and I think that's good in some ways for mentality. But I think it's also dangerous because as people are letting up, obviously there's going to be a lot more potential for outbreaks and so on.

Aside: As we mentioned in the first Virology episode, one of the reasons COVID-19 spreads so effectively is that unlike SARS-1, it's transmissible even when you don't have symptoms, and a lot of people don't have symptoms. Now, a bunch of Patrons like Katia Nizic, Gwen Kelly, Anna Thompson, Jenifer Lowe, Janna Wisniewski, Jillian Klug, Anna Talley, Jamie Pickles, and Marissa Laws want to know what we've learned about how it's transmitted. How far can our juicy, infectious droplets travel, and why is it important to wear masks, and why is social distancing so important?

Dr. B: You know, originally we were, kind of, assuming... a lot of people were assuming that the pathology of this virus is viral pneumonia, so we recognized that it was binding to cells in the respiratory tract - at a large scale in the lower respiratory tract - and then transmitting through viral pneumonia-like symptoms, causing disease like viral pneumonia, and those symptoms where these explosive coughs and sneezes. So, that's bringing droplets from deep within your lungs, up and out, and spreading the virus.

What we've learned since is that this virus also pretty efficiently infects the upper nasopharyngeal passages and tissues. So, it is infecting those mucous membranes in your nasal passages, for example, even before it gets into your lungs and can potentially infect

your lung tissue. That suggests that, you know, maybe the virus could pretty efficiently transmit through the products from our upper nasopharyngeal passage, maybe if you clear your throat, or you just have a tickle, like a light cough, or maybe you're breathing very heavily from exercising.

So, you'll notice there was a change in policy. Two sources of information came together. One; that from the population-level perspective, all the estimates of how transmissible this virus was, was pretty high, suggesting that it's maybe not just people with severe disease products that are spreading the virus, but rather maybe more people could spread it asymptotically through breath, or light coughs, or tickles. Then, there was also some laboratory data that showed – especially in hospital settings when we use equipment like ventilators – we can nebulize the virus into the tiniest, tiniest droplets. These are like a millionth of a meter, 0.1 microns. The virus can float in the air for up to three hours through the tiniest of droplets.

Now, when we cough or sneeze, there's a very, very small fraction of droplets that are that tiny, so most of the droplets will fall down. They're bigger, they fall out of the air at that 6-foot level. But, because there could be a very, very small fraction of the tiniest of tiniest particles that could have the virus, that's really why you could see policy change to have masks, even cloth, homemade masks, be worn as a general protective measure.

Aside: A lot of you asked about masks, like Kacey Wight says: Masks? What's the real scoop on them? Jessica Craver, Ivonne Bustos, Dawn Zwart, Edgar Villeda, Ellen Silva, Sarah Kulig, Deborah N, and Kathryn Mah wanted to know: What masks are the best to be wearing?

Dr. Bennet told me she wears a homemade, triple-layer, high-quality, high thread count cotton fabric mask. It's fitted around her nose with bendable wires, and it's two layers of that high thread count cotton with a layer of pantyhose. Some researchers think a strip of pantyhose, nylon stocking, can also be tied over a fabric mask to help seal the gaps between your face and the mask. [*echoing*] Mind the gaps! Let's say you're just using a flappy cowboy bandana. It's better to at least tuck it into your shirt.

Now, Dr. Natter wears a respirator used for spray painting and that filters out, he says, about 99% of particulates and it has changeable filters.

Alie: What about if you're going running or biking? Wear a mask?

Dr. B: So, a mask is protecting both you from shedding virus, and remember, up to... There's a huge variability in asymptomatic rates, people that are undetected symptoms, right? It ranges from, I think, 30-85% with an average of 50%. So, you might be infected. A mask protects you from shedding virus. Not completely, but it blocks big droplets, for example, and it also may protect you from sucking in virus-infected droplets.

If you're working out, you're going to be breathing more heavily. You're going to be breathing out more heavily and in more heavily. But, it's actually really hard to wear a triple-layer mask and workout. So, I am trying whenever I can to wear a mask, but then as I'm beating along on my hike towards the top of the hill, I might have to rip it off and take a big, deep breath, and try to get air, and then I try to put it back on.

I'm sheltering in place, and I'm staying local, and I'm walking up the trails in my neighborhood. There are a lot of people out there. So, unless I wait until very late in the

evening... which I'm now doing to of not run into people. I hesitate to exercise without a mask because there's just so many people you can pass, and you can try to socially distance yourself by moving across the street, but it's really challenging. I would recommend wearing a mask all the time.

Aside: Listener Kaitlyn Mills wanted to know if this will go away in the summer. How cyclical will COVID-19 be?

Dr. B: So, in a lot of seasonal viruses, they're seasonal because humans in the temperate zone are gathering together in classrooms, or in inside spaces where the air is recirculated, and it's cool and dry, and they're crowded up. It's probably, in many cases, host behavior that's driving seasonality in many viral pathogens. But this is a big question that remains to be seen, whether this virus needs that seasonality boost of clustered-up humans to kick it back into circulation in the fall.

The biggest risk is when you have touched something that has virus on it and then you touch it to your mouth or nose. So, you might imagine... Let's say you buy a box of Cheerios, and you bring it in the house. If you put it away, and... We call them viral fomites when somebody deposited a virus particle on the surface of something. It's called a fomite. So, let's say there might've been a couple fomites on the box and you put it in the cupboard. So long as you wash your hands before you prepare food, and you wash your hands before you eat, you're going to put in a barrier between you, and those fomites, and your mouth or nose.

That said, you want to put barriers up at every opportunity, right? And there have been some studies... There was a lab study that... This is new information; we didn't know this at the beginning. We were just inferring how long viruses last on surfaces from what we knew about other viruses. We know this virus is encapsulated in an envelope, a lipid layer, two-membrane layer of lipids. It's actually a delicate virus because soap can break that outer layer up and make that virus basically dissolve. That's why people are saying wash your hands with soap. You can wash surfaces with soap. I'm washing my fruits and my vegetables very well. Maybe a little soap. Then there was a study that asked the question, "If you don't wash with soap, or ethanol, or isopropanol, or some disinfectant, how long would the virus last on a surface?"

Aside: Dr. Bennett cited a recent study that seeded SARS-CoV-2 on different materials, including cardboard, stainless steel, copper, and plastic. Researchers found that on plastic and stainless steel, it could live up to 72 hours. Now, some types of coronavirus live only a few minutes on cardboard and paper while others can live for days. We're just not sure.

Dr. B: In some cases, I'm just getting home, throwing my mail in a bin; I'm going to check it in three days. I'm not in a big rush, right? In theory, the virus doesn't stick around that long on surfaces because it's, kind of, delicate up to 72 hours and it can be killed by lot of different kinds of surface disinfectants, including something as simple as soap and water. And furthermore, if you don't want to be bothered washing every piece of groceries, just wash your hands before you prepare food and before you eat. And don't touch your eyes, nose, and mouth before washing your hands.

Aside: What about when you're in the grocery store? Deborah Latz has a great question: If I'm wearing a mask and gloves, for instance in a grocery store, is it safe to be less than six

feet away from other people who are also wearing masks and gloves? Or should I wait until the aisle is empty and *then* grab the butter?

Dr. N: That's a good question. In a perfect world, you remain six feet away from everyone, but your risk is much more mitigated when you take the precautions of wearing a mask and the other person is wearing a mask. But you shouldn't feel like you have your invisible cloak of immunity on that you can walk up to anyone on when you have a mask on. And I would like to make a point about gloves. It's impossible, in your everyday life, to properly wear masks and gloves. I will say this also: these masks and gloves, medically, are designed to be single use. You're meant to wear them into a patient room, have your patient contact, and then what we call doff the PPE, take off the gloves and the mask, and they shouldn't be used ever again because they're contaminated.

My point about gloves is that for people wearing gloves, the same risk is there even if you're not wearing gloves. If you take the gloves and touch your face, then you've done nothing. The gloves have done nothing for you. Any surface that the glove were to touch, if that were contaminated, then the gloves are contaminated. What I always say, especially to my parents who wear the gloves, is wear the gloves but pretend that the gloves are not on and wash your hands the same as you would, meaning you can put Purell on the gloves. I try to, kind of, indoctrinate them to wash their hands even if they have gloves on.

Aside: Patron Greg Walloch chimed in and said: Amen on the glove question! Do people even understand how gloves actually work? I saw a woman eating a donut with her gloved hand. She's keeping herself from getting sticky fingers, I guess. Researchers do report that 100% of those eating donuts get sticky fingers afterward. I am researchers.

Actually, what are scientists busy studying right now? Let's get into it. Both Dr. Natter and Dr. Bennett mentioned that the cytokine storms that cause organ shutdown tend to be less severe in younger patients than older patients; and comorbidities like lung disease, obesity, and heart disease can contribute to less optimistic prognosis, and those are less common in kids. Now, hospitals are starting to prone patients. This is a practice that Dr. Natter's colleagues affectionately refer to as 'tummy time' because laying on your stomach with an oxygen mask gives the lungs more space has been shown to be a promising option over intubation. Other research is being done with medication.

Dr. B: The amount of studies that are currently ongoing, the amount of publications that are coming out... A lot of my colleagues at my institution are brilliant, and there's a lot of interesting theories, a lot of interesting stuff going on. I think we are going to have nailed down, very soon, good guidelines and treatments for when to do what. None of this... We don't have treatments like the Remdesivir...

Aside: Remdesivir is an antiviral drug that, according to a paper published April 29th in the journal *The Lancet*, has been shown to reduce hospital stays by about four days, but it hasn't been shown to reduce the risk of death. Still, it's in huge demand and some hospitals can't even get their hands on it. Dr. Natter explains:

Dr. N: There's a lot of talk about Remdesivir, which is a great drug, but it's not a cure, and it's not going to necessarily reverse course as much as we hope. Unfortunately, the other drugs that were getting a lot of hype as well, that I've seen anecdotally, are doing nothing; the hydroxychloroquine, and the azithromycin, and the zinc. But I will say, I am curious to know

if those drugs were started very early on in the course before someone was hospitalized if that would have any effect, because I think once someone gets hospitalized, what we're seeing is less of the viremia, and more of the immune destruction, and a cytokine storm. I think that part of why a lot of these antiviral treatments, if they're not started up front, are not going to have as much of an impact. That's totally my guess; my theory. I don't know if it's true.

Alie: I was talking to the virologist right before this and she was talking about all of the different publications you can look at, and what people are working on, and how inspiring that is that there's a lot of people behind the scenes just working on it very diligently.

Dr. N: Oh, it's amazing. And not only behind the scenes. There are a lot of physician scientists who will literally work with me on a shift. One of my attendings will be there, and we'll be there on our 12 hours, and they'll go home and basically type up all of this stuff, and do all this research, and publish, and the next day in it's in *JAMA*, and I'm like, "Jesus, do you not sleep? What are you doing?"

Aside: This is what Dr. Bennett had said.

Dr. B: One thing I do for jollies is I go onto the WHO website. They actually have a registry of all clinical trials worldwide. You have to register clinical trial for any of these things, whether it's an antiviral, or a vaccine, or a test, or even an epidemiologic toolkit that you want to develop. You take it into these clinical trials and you have to register with the WHO. Then the NIH - that's our own US National Institutes of Health - also has a registry of clinical trials. You would be amazed at how many clinical trials are in progress, and for me it gives me a great deal of hope. There are hundreds and hundreds of antibody tests, vaccines, and therapies that are currently being tested and examined. At a minimum, many of these can be used for emergency use, at least the therapies.

Aside: Speaking of vaccines, in Amanda Mueller's words: What is causing the holdup? Kathleen Carlson, Eileen Prince, Will Plewa, Lau, Kaitlyn Mills, Dawn Ewald, Betsy Shepherd, Adam Drake, Gwen Kelly, and Zoltán Szászi all echoed our universal impatience. [*clip from Pulp Fiction: Vincent, "Get the shot!" Lance, "I am if you let me!"*]

Alie: And then what about vaccines? Are they taking doctors aside to be like, "Hey, it's gonna be September?" Or are they like, "Hey, it's gonna be never?"

Dr. N: I've heard nothing that the general public hasn't heard about vaccines. I do think we are going to see a vaccine significantly faster than we would normally. Normally a vaccine takes about four years. [*clip from E.T.: E.T., "Ouch."*] I think we're going to see a vaccine way sooner than that, and that's partially for a couple of reasons. For one, everyone in the world is affected by this virus, so there's a huge impetus to get this done. But the other thing is, a lot of folks have been working on vaccines for similar things like MERS, like Ebola, like other viruses, so some folks have a head start.

I think particularly in England, they seem like they're doing really well. The other thing is, even if you're able to get the right concoction for a vaccine, you obviously need to test efficacy, but you need to test safety first; but outside of that, you have to manufacture it. On average, a normal vaccine, the infrastructure is set up to make five, maybe ten, million doses. We need on the order of 300 million in the United States if it's a single dose vaccine. It might be a double dose and we'd need 600 million doses of this. The infrastructure - and I

think Dr. Fauci already started saying this - you need to start working on that now before we have a vaccine, and you need to convert different factories that could potentially manufacture the vaccine before the vaccine is even ready to be manufactured.

Aside: A vaccine, side note, is a weakened form of the virus injected into the bloodstream so your immune system can suss it out and make a good defense army against it. For more on this, you can listen to the epidemiology episode with guests The Doctors Erin of *This Podcast Will Kill You*. In terms of a Sars-CoV-2 vaccine, Dr. Bennett says:

Dr. B: In fact, some of the vaccine candidates that are being explored are the SARS-1 vaccine candidates that, kind of, left and never developed, so it's gotten us a head start. We have a good head start on vaccine candidates borrowed from other similar, related viruses. There are clinical trials happening right now with many vaccine candidates, and that definitely means it's going to be much shorter than four years out, and I would definitely put it closer to the 12-to-18-month track. That's great!

Aside: We'll get back to your questions in just a sec, but quick note on donations for this episode. They were made to the Food Bank for New York City in Dr. Mike Natter's name. We also made a donation to the California Academy of Sciences in honor of Dr. Shannon Bennett who does such amazing work there. Also, this episode, we are shouting out another great podcast with tons of great coronavirus info, *Science Vs* with the wonderful Wendy Zuckerman. Take a listen to that for some wonderful coverage.

[Ad Break]

Okay. Back to your questions.

Alie: So many people want to know, Kendyll Burnell, Emily Dilger, Madelyn Dunkle, Tamara Oliver, first-time question-asker, Cate Strehlow, and Michelle Harvey, Jamie Thorlin, and in Dave Miller's words: Are we absolutely nuts to have even partial reopening? Are we opening up too soon?

Dr. N: Oh, man, this is crazy. Imagine what it's like to be Governor Cuomo or some of these folks. No one knows. No one knows. I am worried because I do think that opening up inevitably will create more potential infection. I think if you look at... the reason the infection rates are down isn't because we conquered the illness and COVID went away. It's still very much there, so if you allow a city of six million to densely populate the subways all over again, I don't care how many gloves and masks you have on, there's going to be more transmission of this disease. It's this balance of how much longer can you keep people on lockdown?

I think it's this slow dance where you take a few steps out, slowly, and you track how many infections there are. You track the admissions rate. You track ICU admissions. You track the death rate. The death rate will obviously lag behind by a couple weeks, but you track everything you can and you test as much as you can. And then, you may have to go a couple steps back and wait a little bit as to not overwhelm the healthcare system, and to keep infections as low as possible. I don't think it's wrong to try, but I think it has to be done very responsibly, and very slowly, and with a lot *a lot* of vigilance and testing, and everyone buying in in terms of keeping their distance, and in terms of trying not to spit in anyone else's face.

Alie: Right. Avoid that... for now.

Dr. N: It's not recommended.

Aside: Let's get philosophical and ethical about it.

Dr. N: I think Governor Cuomo says it really well: "You're essentially asking, when you have to open things back up, how much is a human life worth?" is the way he sees it. And to him, when you open up, people are going to die. So he, I think, is doing a good job in trying to find resources for people to not have to go back to work. Give something to these individuals so they can have food, and they can, you know, not worry about getting evicted, and all these things. There's only so much that can be done, but I don't know. Who knows?

Alie: How do you feel when you see people in Central Park, just, picnicking?

Dr. N: If you can be six feet away from everyone else, great. Are you actually six feet from everyone else? Probably not. This past weekend I was talking to my friends about it, and it worries me a little bit. I think it's a harbinger for the inevitable second wave that's going to come after things start opening up, because I think as things start opening up people are going to start getting less and less vigilant and more and more flagrant about giving up this whole social distancing and stuff. I am worried and I do, unfortunately, think that there will be another wave, and I just hope it's nowhere near as bad as what it was.

Alie: Right.

Aside: This next question is from Patron Annie C, who tapped into our collective consciousness and inquired simply: So, how fucked are we? I asked Dr. Bennett what we can expect next.

Dr. B: Spring is in the air. We're all getting a little excited. We miss each other physically. [*clip from The Office: Michael Scott, "I'm sensual!"*] Everybody's observing that the curves are flattening. I would definitely say that it's definitely too soon to bunch up and we need to stay the course. I do cringe when I see people that are clearly not in family groups throwing caution to the wind and bunching up. I understand it, but it definitely is too soon, and we need to not do it. We're not ready. We will be ready. There is light at the end of the tunnel, but we shouldn't be racing for the end of the tunnel just yet.

Aside: Speaking of missing each other physically, Starr and Shannon Patterson wanted to know when they can see their parents and their family again. Marissa Laws asked: Should we cancel handshakes forever? And Tracy Michael wondered: Will we ever be able to hug freely again? I really miss hugs, they say.

Dr. B: I would trade out a handshake any day for a hug. I don't think we need handshakes, but I miss hugs too. My mom lives in Canada, and she was supposed to come down for my daughter's birthday and we couldn't make it happen. We miss our family. I, myself, struggle with this question. When is it okay to hug? It's about risk, right? It's about thinking about the risk of the person you're hugging getting a virus from you. If that's an older person or an older parent that's not in your immediate family circle, then you may be bringing a virus to a vulnerable person. That's one thing, for sure.

But, you know, everybody needs to be empowered to assess their own risk, right? So, it might be that if the loved ones that are in your family are themselves isolated, and they have a very, very tiny contact sphere, and you yourself have been really strict about containing your contact sphere, then, at some point as we lift shelter-in-place and we can start to

interact physically with each other or move to each other, then there's probably going to be a way for you to mitigate risk to your older loved ones that you can share hugs.

But maybe the proper and official answer, because that's kinda my metric as a person... the official answer really is that unless and until we know how many people are immune and what the true size of the iceberg of this coronavirus population really is... because, right now we just see the tip of the iceberg through the limited testing. Once we really understand how widespread it is and how many people are immune, and then once we build up our toolkit for responding to the infections by really strategic contact tracing, and social distancing, and we also have our toolkit to have therapeutics and vaccines: all of those things, we would want to bring them together to make risk zero. Or near zero for a hug. But many of us live with a little bit of risk every day.

Aside: Dr. Natter mentions the mental health effects as well.

Dr. N: This is a really, really stressful time. It's very emotional. People are losing their jobs. People don't have the same kind of outlets. They don't have the same social support, because physically they can't. It's hard. It's very scary.

And so, I think it's important to recognize what your triggers are. It's important to find things that are safe to do during this time and doing them. It seems like people are really liking the baking of bread right now. Finding something that's going to, kind of, center you and keep you sane, and recognizing that like this is a really scary, really **shitty** situation. But, I'm seeing a lot of amazing generosity, and charity, and humanity through all this, which is one of the more beautiful things.

And the appreciation that we're seeing and feeling for us, the healthcare workers, is tremendous. And I was thinking about how sad I'm going to be, because right now every night at 7pm everyone comes out, claps and bangs their pans, and the firefighters come over. And I was thinking, "I'm going to be so sad when this ends!" Because it hasn't ended. It's been going on for months now. And the day this stops, I'm gonna be really bummed out.

And I'm thinking: something like this... Not necessarily having everyone come out and cheer for us, but something along the lines of appreciating each other, hopefully, gets salvaged and stays with us. I think it will. At least on some level, I think it will. And I'm hopeful that this is all going to come to an end at some point.

I don't think it's going to go back to the same normal that we had. I think there's going to be a new normal, unfortunately. And I think it's kind of like living through 9/11. I never had to take my shoes off before getting on an airplane and now that's kind of routine, you know? So, I think there will be things that are different, but that we will very much adapt too. And that will be in everyone's best interest in terms of public health.

Alie: I'm glad that the banging on pots and pans doesn't annoy you as a healthcare worker.

Dr. N: Oh my God, I love it!

Alie: You do?

Dr. N: Why would it annoy me?

Alie: I don't know. Maybe you're trying to sleep? And then I wonder if there's a nurse out there who's like "Shut the fuck up!"

Dr. N: That would actually make a great comic! I should do it. My mom, who's the most adorable woman ever, my dad took a video of her on her terrace with her little pot and pan. It just made my day.

Aside: I looked this up and his mom, Ellen Natter, is an adorable, diminutive blonde woman with stylish horn-rimmed glasses. She's hipper than me. She's on her Midtown Manhattan balcony, smacking a saucepan toward the sky in appreciation for healthcare workers and hospital staff, who every day are putting their lives on the line, like her son. [*clip of Dr. Natter's mother banging a saucepan lid*]

Alie: I don't know how you guys do it. You're amazing!

Is there anything you would want people to do or take away from this, or continue doing, or not do? Anything that the rest of us who are just sitting around making sourdough can do for y'all?

Dr. N: No, keep making sourdough. I think we feel it. The healthcare workers, at least I can speak for myself and my colleagues, we feel the love, we feel the appreciation, and we really appreciate it.

I imagine the majority of your listenership are people that are very socially conscious, so they're probably already doing this anyway, but just follow the guidelines that are given. I recognize and get frustrated myself when they seem to change minute to minute and they seem to sometimes not make any sense, but if we don't do it all together, then a lot of it's not going to work.

And so, socially distancing I think is very key. Wearing masks if your local government tells you to, I think is very helpful. But just being kind to each other and just making sure that we get through this together. I should also say, I think it's important to recognize that your neighbors may be elderly, and alone, and might need some help; picking up some groceries for them and just kind of being a good human, I think now more than ever, is really important.

Alie: Checking on each other and such. Yeah.

Dr. N: Yeah.

Alie: That's good.

Aside: Dr. Bennett says that in-person relationships are important and maybe we're all realizing that more now.

Dr. B: What do we mean to each other? All of a sudden I think we mean a lot more to each other than we thought.

Aside: So, let's not take our friends for granted. Check in with each other, even if it's just to send a picture of a flower, or an apricot that looks like a butt. We need those moments.

Dr. B: And how much we all need other people, whether we're in the US, or whether we're Republican, or Democrat, or whether we're Muslim, or Jewish, or living in China. We all need other people.

So, call up old friends, or new ones, and ask them stupid questions, because no question is stupid and we'll get through this together.

You can follow Dr. Shannon Bennett and Dr. Mike Natter at the links in the show notes, and I'll also put a link there to AlieWard.com/Ologies/Virology2 so you can get more links to the studies cited, the *Science Vs.* podcast we mentioned, the organizations receiving donations, the database for scientists and more.

We are @Ologies on [Twitter](https://twitter.com/Ologies) and Instagram, I'm @[AlieWard](https://twitter.com/AlieWard) on [both](#).

Thank you Shannon Feltus and Boni Dutch of the comedy podcast *You Are That* for handling [merch](#).

Thank you Erin Talbert for adminning the [Facebook group](#), Caleb Patton for bleeping episodes, and Emily White for handling the ologies transcription efforts -- thank you to everyone who works on those transcribing them. Bleeped episodes and full transcripts are available for free on my site at AlieWard.com/Ologies-Extras.

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Nick Thorburn wrote and performed the theme music.

If you make it through the credits without bailing I tell you a secret and today, like an hour ago, I made a quesadilla with some corn tortillas that I noticed had a sell-by date of April 2nd. It's over a month ago, but they weren't moldy, and I was like, "I'm gonna eat them anyway." Then I went to get some cheese, and we had some jalapeno cheddar, and it was moldy. But I just cut the mold off and ate the good parts with the expired tortillas.

Now, it's been an hour. I'm still alive. I'm just at the part of quarantine where I eat garbage like a raccoon. Also, I made a quesadilla for Jarrett too, but I didn't tell him about the mold I cut off the cheese or the tortillas. And since he helps me edit, he saw this in my notes as my secret and I was like, "Are you mad?" And he was like, "No, just cut the mold off the cheese and eat it anyway. That's what everyone does." And I was like, "Tight!"

Okay, berbye!

Transcribed by:
Scott Metzinger
Elinor Austin
Lauren Fenton
Ashley Thurber
Jude

Links that may be of interest:

Follow Dr. Mike Natter at [Instagram.com/mike.natter](https://www.instagram.com/mike.natter) or [Twitter.com/mike_natter](https://twitter.com/mike_natter)
Dr. Shannon Bennett at twitter.com/microbeexplorer and [Instagram.com/microbeexplorer](https://www.instagram.com/microbeexplorer)
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