

Ask A Biologist Vol 098 (Guest: Randy Nesse)

Why We Get Sick

What does evolution have to teach us about getting sick and how do we make use of what we are learning? Dr. Biology gets over a cold while visiting with **Randy Nesse**, psychiatrist and Founding Director of the ASU Center for Evolution & Medicine. The two talk about why we get sick and some of the amazing things our body can do to repair itself. All of this is part of the study and practice of evolutionary medicine.

Transcript

Dr. Biology: This is Ask A Biologist, a program about the living world and I'm Doctor Biology. You probably don't know it, but I just got over having a cold, so if my voice sounds a little bit different, that's probably why. If you describe it, it's the typical sneezy, runny nose and coughing type of cold. And while I say typical, well even cold viruses, there are a whole bunch of them - at least 150 different types. Just ask my wife who was getting over a cold when I got back with this particular cold virus while I was away on a trip and so one cold is bad enough, but in her case she got two colds in a row, which brings me to the topic of today's show getting sick and why do we get sick?

My guest today is Randy Nesse, a physician and Foundation professor in the ASU School of Life Sciences. He's also the founding director of the Center for Evolution and Medicine. For today's show I'm hoping we can talk a little bit about why we get sick. How evolutionary medicine is helping us stay healthy. And if we have time, I'm hoping we get to talk about Randy's new book called Good Reasons for Bad Feelings. Randy, Nessie, thank you so much for joining me on Ask a biologist.

Randy: Great to be here. Dr. Biology.

Dr. Biology: I was talking about just getting over a cold and it got me thinking about our conversation for today and the fact that we just do get sick as humans and animals. We do get sick and that's a curious thing in itself. Why do we get sick?

Randy: You know, before we talk about why we get sick, we should just all be amazed that we don't get sick most of the time. Our bodies are so spectacular at fighting off viruses and bacteria and keeping ourselves in good shape. We should just be astounded at that. But our bodies aren't perfect and so we do get sick sometimes.

Dr. Biology: So we do get sick sometimes. What are the reasons? I mean there's the classic one, you cut yourself or you scraped your knee.

Randy: Yup.

Dr. Biology: But there are others I've just mentioned. I have a cold that I'm getting over and it was a virus,

Randy: Right, and each one of those has some kind of pretty specific explanation about why this person gets sick. Now you got a virus from somebody when you were traveling and that virus went into your nose and spread through your body and then made you sniffle and cough and sneeze and feel bad and have headaches and fever too. And those all seem like bad things. But one of the wonderful things that evolutionary medicine tells us is that we should recognize that those symptoms are actually useful.

Dr. Biology: Let's see here. You said something about evolutionary medicine.

Randy: Yeah.

Dr. Biology: I know you have a center that is all around this topic. Let's dive in a little bit about what is evolutionary medicine.

Randy: So what we try to do is understand why the body is the way it is. I mean, most biological science simply describes how things work. We want to know why it's that way. How come we have two arms instead of three? How come we do have this capacity for fever? Doesn't have to be a capacity for fever. How come the nose can get running sometimes? It turns out that all those things exist for some good reason. Not everything exists for good reason, but those things do. Runny nose for instance. Here's a really good question for all of us. Is that to get the viruses out of there or is it a great way for the viruses to spread?

Dr. Biology: Mm. Or is it a little bit of both?

Randy: It could will be both. And this has practical implications also. Some people use kind of a spray thing to put up their nose to make their nose stop running. It would be very interesting to find out if that makes you stay sick longer because you're interfering with one of the useful parts of your body's responses.

Dr. Biology: Oh. So there are things that the body does. We had Paul Turk on the show before. He's a pediatrician that as part of his practice, he does evolutionary medicine.

Randy: And a good friend of mine.

Dr. Biology: And one of the interesting things we were talking about is the fact that, you know, the body's built to do certain things to combat getting sick. Right. So you mentioned fever for example. This is a really interesting one because the question is when is a fever good to have and when is it something that we need to actually control?

Randy: Right. I mean it seems like a problem, doesn't it? Because it makes you feel bad and you're sweating and you're shivering. And a lot of parents take a lot of effort to try to get their child's fever down when they have an infection. And that's a very old fashioned way of thinking. Once you recognize that fever is there for good reasons, you recognize that you really don't need to do much about fever and you should let it take its own way unless it gets really, really bad. The Association of Pediatricians in the country over the last 20 years has changed their tune on this dramatically. It used to be, they said get that fever down and now they're saying, unless it's really

high, let the fever be it's normal and useful.

Dr. Biology: All right, here we have our fever and what's it doing for us?

Randy: You know, when the body temperature rises, it's a signal for all the other cells in the body to turn on their protective mechanisms. It's like raise your shields everybody. There's something trying to get in this cell and you better stop them right now. It's not that the high temperature itself kills things. It's more that it's a signal that turns on the defenses everywhere else in the body. And here's a subtle part of it that we're just starting to think about. So all of these viruses and bacteria, they have their own ways of getting around all of the defenses that we throw up. We put up a shield like a soldier on a battlefield and they figure out a way to get through it or around it or, or behind it. But in this case, and for every signaling system in the body that's based on chemicals, they make their own chemicals to get around it or to stop it. But fever changes the whole body in a way that the bacteria and viruses can't influence. So it's a signal that they can't mess with and it's, it's like a code that they can't break.

Dr. Biology: Ah, so if there was that virus that would actually keep the fever from occurring

Randy: And there are some.

Dr. Biology: oh,

Randy: That they interfere with our ability to create fever. Um, and so you might think of ways of getting around that. I mean, what if you created an artificial fever? What if you go on a sauna? And raise your body temperature some?

Dr. Biology: Hmm. Yeah. So how did evolutionary medicine start?

Randy: You know, it's so surprising that medicine hasn't used all of evolutionary biology for a long, long time. It's been 130 years since Darwin when published his wonderful book *On the Origin of Species*, and even now, most doctors never have a chance to learn the basics of evolutionary biology. They might a little bit, but not the more interesting things for medicine. Like for instance, how natural selection shaped fever and why it hurts when you skin your knee. These are profoundly important things for doctors to learn. And these are the kinds of questions that we ask in evolutionary medicine. It's not a special kind of practice, it's just using the basics of evolution the same way we use genetics, and physiology, and other kinds of things.

Dr. Biology: To be clear, it's not as if you decide, okay, I'm not going to do anything for the body as a physician and I'm not going to give any kind of medicines and I'm not going to do any control for a fever. It just means that you're going to watch and take advantage with the body already does well.

Randy: And I'm very careful always to say that no advice comes directly from evolutionary theory - ever. And what evolution does is tell you what studies to do. I had one dear friend one time call me from his hospital bed in London saying, these doctors want to give me something to reduce my fever and I won't allow them to because I told

him fever is useful. And I said, oh please, in your circumstance it's perfectly safe to reduce your fever. You've got a lot of other bodily defenses and you're in a hospital taken antibiotics. You should probably do what your doctors say, but do talk with your doctors so that you have an interesting conversation about this.

Dr. Biology: When we think about healthcare today and it's quite a topic quite frankly, right? When you apply the evolutionary medicine lens to it, what do you see that changing as far as healthcare in general?

Randy: I don't think there should be ever be direct clinical recommendations or policy recommendations just from theory, but it sure does bring us with new ideas about what to study. Here's a good one for us. Many doctors tell their patients when they give them a bottle of antibiotics; take every pill in the bottle because if you don't, you might create antibiotic resistance. You might make the bugs protect themselves against the antibiotic. And some good mathematical biologists for about 20 years now have been pointing out that they're not quite sure. That makes sense that it might be that taking antibiotics only until your fever is gone might be optimal and then let the body do the rest. Finally, just a year ago, there was an article in their British Medical Journal proving that for people who have a mild form of pneumonia, taking the pills until your fever is gone is just as good as taking all the pills in the bottle and better yet it prevents antibiotic resistance from growing and it protects the patient from all of the bad effects of taken antibiotics. Very practical thing. But here's the sad point about that. That article never mentioned evolution or all of these other research projects that had gone on because there's a huge grand canyon between evolution and medicine, and our goal is to try to build bridges across that canyon.

Dr. Biology: Well, now that you brought up antibiotics, one of the interesting things for me is that a lot of people don't understand that if you have viruses, if it's a viral infection, antibiotics don't work. They don't work, right. So while the case could be made that if you have a bacterial infection, that once you get the fever and you get it under control, maybe you're going to just stop taking them. It doesn't make it such that every time you go to the doctor you're going to say, oh, I want to need antibiotics. Just to be clear, I suppose the over prescription of antibiotics could be a challenge still.

Randy: It's a vast challenge and it's not a mild thing at all. We're having a huge epidemic now of something called auto immune disease where the body attacks itself, it's causing things like multiple sclerosis and rheumatoid arthritis and problems with people's bowels and diabetes too. These are all becoming much more common just in the last 30 years. Nobody is sure about why, but a number of researchers have pretty good evidence that kids who get more antibiotic prescriptions are more likely to get these diseases. I think when parents ask for an antibiotic prescription, they should be told - yes, in this case it probably is useful, but you know, we are running a risk for the long run by giving antibiotics for your child.

Dr. Biology: Right. And so the other piece about antibiotics is their very name means that they're actually out to kill bacteria and we have an awful lot of really good bacteria inside us.

Randy: Sure do.

Dr. Biology: There's even been a discussion of our second genome is the bacteria and viruses...

Randy: People talk about the microbiome, which is all of the bacteria and viruses together that live in our guts and on our skin. And they're supposed to be there.

Dr. Biology: Yep.

Randy: We've had them there for, you know, millions of years. And if they go missing, for instance, if you use soap that has an antibiotic in it, you're going to screw things up, right? There's so many things we're doing in modern life that you know, our body just isn't use to at all, which cause problems. It seems okay to just kill bacteria. When I was a young doctor, we all pretty much had the idea that bacteria are bad, we should have known better, we should have known better, but it's just not the case.

Dr. Biology: All right, so we've done the inside of the body with bacteria and viruses. What about the body's system? When I skinned my knee,

Randy: It hurts. That's the big thing. It hurts and after it hurts, it bleeds a bit. And then after that, as it's healing, it gets kind of pussy and the tissue changes color, and it sensitive for a while. So why is that? Well, first of all, wouldn't it be nice if things didn't hurt? It seems like it'd be just great, but there are very, very few rare individuals who are born with no ability to experience pain. And you know what happens to them? They usually die by the time they're thirty or so. Their fingers get smashed. They get appendicitis and they never know it and die. The ability to experience pain is a really good thing. When you have pain, you don't want it. And in fact, that's a good thing too. What if pain didn't hurt? What if you said, oh yeah, I got hurt, but it didn't bother you, well then you might do the same stupid thing again and keep putting yourself. So it's good for these negative feelings to be negative and painful.

Dr. Biology: Oh yeah. Yeah. It definitely reinforces not to do something again.

Randy: It gets you to do the right thing or not to do the wrong thing.

Dr. Biology: So now we've talked about bacteria and viruses and the body's ability to mend itself to repair itself. We actually have a really nice section on bones and a lot of people don't think about it, but they're not just sticks inside you. They are extremely important if you want to talk about blood production, you know, we better have our bones.

Randy: And we pause for a moment to just acknowledge most of them don't break. Isn't that fabulous? I mean, they're just long enough and thick enough and sturdy enough to not break except when you really do something pretty extreme. That's wonderful.

Dr. Biology: So now I'm going to shift a little bit to more of um, the mind, right? And feelings.

You have a new book out called Good Reasons for Bad Feelings.

Randy: Right.

Dr. Biology: And uh, the question I had, I haven't read it yet, but I immediately thought, hmm, is this a self-help book?

Randy: You know, a lot of people tell me when they read it, they find it enormously helpful, but it's not like the thousand other books that tried to help you, how to feel better in a day. It's a much longer perspective that tries to figure out why on earth do things like jealousy and anxiety and nervousness exist in the first place. You'd think we'd be better off without them, but in fact we're not there necessarily. They're useful.

Dr. Biology: So let's pick some of these. So I'm anxious. I get some anxiety and the classic one is - let's, we're talking about school, let's talk about test anxiety

Randy: Or just Vietnam called on in class. I mean, most kids think it's just them. It's not just them. Everybody gets nervous when they get called on in class, especially if the teacher is not too sensitive. And especially if you haven't done your homework, um, because you know, then you know, it could be kind of embarrassing if you haven't done your homework. So is that just a bad feeling? You know, that kind of anxiety can make it hard to talk. And so a lot of times there's too much anxiety, but boy, oh boy, it does get you to do your homework to prepare for that kind of thing. And it keeps you awake in class too. If you think at any moment you might get called on.

Dr. Biology: So there's, there's a purpose for anxiety?

Randy: There sure is. And just like we talked about with pain, you know, if you don't have pain, you're in even worse trouble than a person who has pain. But what about people who don't have anxiety? There are people like that and they don't come to doctors saying, Dr, please, I don't have enough anxiety and nervousness, can you please help me? But they sure do get in trouble. I mean, they do wild and dangerous and crazy things. You know, just in the last couple of weeks for people have fallen into the Grand Canyon and died. If they had been more nervous and weary, they would still be alive today.

Dr. Biology: So fear of heights would be a good thing.

Randy: Some fear of heights. Now I see a lot of people in my practice as a psychiatrist who have fear of heights so bad that they can't walk across a bridge. They can't even be high in a building and lookout. We can treat those people and reduce their anxiety and get it down to the useful level of anxiety. So anxiety is one of those things that I'm calling an anxiety. Really, we're just talking about nervousness and feeling kind of uneasy. Like, you know, I gotta get Outta here. Something bad could happen. So those feelings are things that everybody experiences and although they're useful to keep us out of bad circumstances, they are too much, too long, too soon, for a lot of us, much of the time. And we've got to figure out what it is and there's an answer.

Dr. Biology: Okay, I'm waiting.

Randy: So you know when you have a smoke detector in your kitchen, how many times does it go off when there's a real fire? Like almost never, because fires are fortunately really rare. But when you make toast or boil water that smoke detectors liable to go off, now you'll be tempted to just throw out your smoke detector because hey, it's a false alarm. But that's not very smart because the annoyance of a smoke detector going off for nothing is very small compared to the terrible thing of it not going off if there's a real fire, which could kill you or really badly burn you. So smoke detectors are designed to be really sensitive and to go off when they're not always needed. And it's the same for nervousness.

Dr. Biology: There are also interesting little cues. We have biomes. These are desert biome, rainforest biome, and in the biomes we have particular animals that you can see. And so in the desert biome, we happen to have one area you can go to and there's a rattlesnake.

Randy: Uh Huh.

Dr. Biology: And it's very interesting the reactions you get from people that go into that biome. It's VR. So it's virtual reality and they come across this rattlesnake, the image is one thing that cues them but really gets them is it rattles.

Randy: Uh Huh.

Dr. Biology: and they hear that sound.

Randy: There are some things that almost everyone fears spiders and snakes and snarling dogs and lions. And you have to ask, did we just learn those? And the answer interestingly is yes, but it's a special kind of learning in a marvelous experiment done with monkeys by Susan Minooka. She took baby monkeys who'd never seen a snake and she had them reach over the snake to get a banana and they were quite mellow about that. They were not scared of the snake at all. Then she showed those monkeys a video of another monkey being frightened of a snake and all they had to do is watch that one video and they got scared of snakes after just watching one video with no direct harm from snakes. But then she did the next part of the experiment. She showed them pictures of a monkey reaching across a flower to see if she could cause fear of a flower and she couldn't. It turns out that we don't have like what's called a built in fear of snakes, but we do have a system that sets us up to learn fear of snakes really, really easily. That's a good thing.

Dr. Biology: So the threshold for being told that, hey, stay away or be careful is much lower. So it's really quick to be learning about those snakes.

Randy: Right.

Dr. Biology: Well, as the flower, we would hope it's so high that in most cases you're not

Randy: So there's something built in. When no mind sees an image of a snake, it's ready to

connect that with anxiety much more than it is for a flower.

Dr. Biology: What about some of the other feelings we get? Are there any that we could talk a little bit about?

Randy: There are times when people just feel sad and this doesn't feel good at all and people wonder are things ever going to get better again in life? And some people blame themselves for that feeling and say, I should just quit it. But you know what? After we lose something, whether it's someone we care about or even a toy, or sometimes when we fail on an examination, we just plain and feel sad. It turns out that even though that feels bad, it's a kind of normal and useful feeling. Now it goes overboard a lot. Just like that smoke detector does, a lot of times it's too much, too long. But that feeling, it's really normal when you lose something it helps us to not lose it again and to try to replace it and to, you know, try to pause in life a little bit and see what else we might do differently.

Dr. Biology: Is there anything we can do about, for example, those panic attacks?

Randy: A panic attack is a kind of really intense anxiety that starts all of a sudden where your heart starts pounding and you feel short of breath and you need to just run out of the situation and you really feel like you might be dying or something awful might be happening. It turns out that that too is something that happens to everybody on occasion. For some people it happens when there's no danger like in a grocery store or something. That's called panic disorder where there are panic attacks happening when they had no business happening. Imagine you're off in the desert and you're at a watering hole and you hear a little noise behind a rock we're going back to the smoke detector principle again. Should you run away? It could be a lion behind that rock or it could be nothing.

Randy: Well, it depends on how loud the sound is. If the sound is really soft, like [lamb sound], that's not a lion, you're fine. If it's really loud, like [deep growl], that's a lion. You better run. But one of it's [tiny growl]. It's someplace in between. Well, you don't want to run every time anything happens because that's silly. You'd never get any water, but you'd better run every single time or all most every single time there's a lion there. So the same thing we talked about before with the smoke detector principle applies here. The system is too sensitive because being attacked by a lion is a way worse than just running away.

Randy: When I began my practice treating people with panic attacks, we tried to figure out, you know, what was going on in that person's life in mind that might make them have panic attacks. And sometimes there was something. But it turns out that the treatment for anxiety is extremely simple. The treatment method is called exposure therapy, but you don't need to know that. What people do is go towards the situation that causes the anxiety instead of away from it. I treated so many people who have a fear of snakes, some of whom couldn't go on picnics with their kids or kids who couldn't go on picnics with their parents and now they wanted not to have this fear and they wanted something to be done about it. Drugs don't work for that kind of thing. And psychotherapy doesn't work all that well, but something called behavior therapy works great.

Randy: If you tell them the person here, would it be okay if I brought a snake into the room and they say, oh, I have a car, it's terrible anxiety. And you say, yeah, I know it will. But if you just put up with that anxiety for like half an hour, your anxiety is going to go way down. And the person says, really? And say yes, really? And so you bring the snake in the room and you say, can I bring it closer? And they say, no, no. It's very, very, it makes me feel terrible saying I know, but you're going to get better faster if you come closer. And for most people within one hour, that anxiety is way, way down or gone away completely. It's so satisfying to treat people. People can do it themselves sometimes, but it's better to have a professional to help you.

Dr. Biology: Oh, okay. So if we get back into some of the other things you can be afraid of that aren't snakes, that sort of thing. Uh, public speaking,

Randy: You know, most people imagine that it's just them who's afraid of public speaking. It's not just them. Most of us, the majority of people are pretty nervous when they get up in front of a crowd for the very good reason that you could say something stupid that you know, uh, makes other people not respect you as much. However, the secret to that is to go ahead and do it. And when we have people, even professors and musicians we treat who have too much anxiety in that kind of a circumstance, we don't tell them to try harder and harder to do it perfectly. What we tell them is go ahead and make mistakes. We have them make mistakes on purpose. And from that they learn that people put up with mistakes all the time. Even the world's most famous violinists get up on stage before a crowd of thousands, and sometimes they kind of forget. And everybody says, Yep, he kind of forgot, but it was really beautiful anyway. So that's a learning experience. It really relieves that kind of anxiety for most people. Of course, you do have to prepare your talk also,

Dr. Biology: Right. In this case, doing it. You say run towards it. Yes. So in this case, give a talk give more than one or two talks...

Randy: Right.

Dr. Biology: So it becomes something that uh, is less stressful.

Dr. Biology: Right. Randy, on this show, I never let my scientists leave without answering three questions.

Randy: I'm ready for the test now.

Dr. Biology: You're ready for the test and you have a panic attack coming yet?

Randy: It might be.

Dr. Biology: So the first question is, when did you first know you wanted to be a scientist or was it always your goal to be, in your case, a doctor?

Randy: You know, for me it was pretty specific and it had to do with historical event. I think it was 1956 maybe 57 Sputnik had just been launched. The very first satellite. The

Russians were getting ahead. It was all over the news and I was a kid in grade school still and it was really clear that science is where it's at. And so I started a science club with my friends at age, you know, nine and 10 and we started doing experiments and it's been wonderful. What a great life. It's been doing science.

Dr. Biology: Did you have an idea of what kind of career you're going to have?

Randy: You know, I, I long wanted to be a psychiatrist actually. I was just curious about why people are the way they are and particular like most people, I looked around me and saw a lot of people who weren't very happy and the like and I want to trigger, so why is that and can we do something about it? And that part of my career has been so satisfying as well. You know, you really can help people. And now that I'm more just teaching full time instead of seeing patients, I miss it. I miss the ability to help people one on one. But podcasts like this allow a chance to provide some help to lots of people or at least more insight into what's going on.

Dr. Biology: Well now I'm going to do something that might bring on, I don't think a panic attack, but maybe a little anxiety. I'm going to take it all away from you.

Randy: Uh-oh.

Dr. Biology: You can't be a scientist; you're not going to be a doctor. Most people that when they end up at the university really get addicted to teaching. So I take that away. What I want to know is what would you do? What would you be if you weren't doing that kind of a career?

Randy: So the other thing I always wanted to be as a forest ranger, just because I love to be out in nature. I just love it. Um, and I, and I still spend as much time as I possibly can outdoors whenever I can. I just love that now the real job of being a forest ranger turns out to be trying to control people and making sure they don't leave garbage and the trail and things like that. I don't think I would have liked that at all. So I guess what I'm talking about is being not necessarily a scientist but a naturalist and just helping people do appreciate nature.

Dr. Biology: I think I had a guest on not too long ago in a very similar manner and wanted to be out in nature. Yeah. Well the last question is what advice would you have for a young scientist or perhaps someone who's thinking about changing their career into the world of the sciences?

Randy: It's pretty simple, really. Ask questions that you find interesting and try to figure out ways to answer them. I see a lot of kids actually who think they want to become a scientist and therefore start taking really hard courses and trying to get into the best college and all that kind of stuff. And some of them get burned out because a lot of the stuff that they try to teach you in school, it's pretty boring. Um, but if you have your own questions and you're just playing curious about things and your pursue them, no matter what the teacher says, then you're going to have a good time and nobody can stop you.

Dr. Biology: I think that's good advice. It's something that I would, say that most people should

do. Randy, I want to thank you so much for sitting down and talking with me on Ask A Biologist.

Randy: Thanks so much Doctor Biology. It's been great fun talking with you.

Dr. Biology: You've been listening to ask a biologist and my guest has been Randy Nesse physician and Foundation Professor in the ASU School of Life Sciences. He's also the founding director of the Center for Evolution and Medicine. Now if you want to explore the topic of evolutionary medicine, we have a companion story on the Ask A Biologist website. You can search for these keywords, what is evolutionary medicine and our story should be a top result. If that doesn't work. We also have a link to the story from this podcast on our website, and if you want the full link, here you go - askabiologist.asu.edu forward slash explore forward slash evolutionary dash medicine.

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