

Ask-a-Biologist Vol 041 (Guest: Douglas Lake)

Ouch- Body Defense and Repair

It can start with a paper cut, or bruise, sometimes it might be a cold or the flu that triggers your body defense and repair system. Listen in as Dr. Biology and Co-host Ramon Santos from Paul Lawrence Dunbar Elementary learn more about how our bodies can repair themselves even while we sleep. Guest biologist Doug Lake talks about body repair, our immune system and how it might be used to treat cancer.

Transcript

Dr. Biology: This is "Ask-a-Biologist", a program about the living world and I'm Dr. Biology. Here with my co-host Ramon Santos.

Welcome to "Ask-a-Biologist".

Ramon Santos: I'm very glad to be here.

Dr. Biology: All right. Well, it's great to have you on the show. Can you tell us just a little bit about yourself?

Ramon: I'm a nine year old. I go to Paul Lawrence Dunbar School. It's fun over there and I like it a lot.

Dr. Biology: You like it a lot? What's the name of your teacher?

Ramon: Mr. Osinski.

Dr. Biology: Mr. Osinski. All right. He actually got to come and visit with you today, didn't he?

Ramon: Yes.

Dr. Biology: Ramon, let's introduce our guest biologist. What do you think?

Ramon: Ouch!

Dr. Biology: Oh. Let me see that. You got a paper cut. Luck for us, in this studio we have band aids and we have antibiotics. So we're going to fix you up. And it also turns out that our guest scientist can tell us what your body is going to do about that cut, because even if you don't know it, your body is about to go to war. And the battlefield is the paper cut you just got.

Hang in there with us, folks. We're going to fix him up.

[fast forward noise]

All right. So now we got Ramon fixed up and now we get to introduce our guest scientist,

Profession Doug Lake from the School of Life Sciences at Arizona State University. Dr. Lake does research on cancer. He is learning about how our bodies find tumors and once found how they destroy them.

He can also give us a good idea of just how busy our body can be repairing itself even when we are sleeping. Even if you don't have a cut on your finger or you don't have cancer, the body is always trying to repair itself. So, welcome to the show Professor Lake.

Professor Douglas Lake: Thank you for having me.

Dr. Biology: Let's just be clear on this. Ramon, that cut that you got is not going to give you cancer. So don't worry about that. But the weapons the body uses to heal that wound, the cut on your finger that we just bandaged up, it's going to use some of those, and not all the time, but some of those things can be used to cure cancer.

So why don't you start off and ask Dr. Lake your questions.

Ramon: How's my body going to fix this cut that I have?

Doug: That's a good question. What your body is going to do: the first thing that happens is it notices when something goes into your skin. Remember you have these things called blood vessels inside your skin. When something breaks those blood vessels, those blood vessels are like little tubes and inside those tubes are like little rivers of blood.

When something breaks those little tubes, the first thing that happens is the ends get kind of sticky. And if the ends are sticky things called platelets go and stick to those sticky ends. And they try to stop the blood from flowing out of those tubes. Those tubes are called blood vessels.

Dr. Biology: So the first thing is you want to stop the blood from flowing right? But what else happens?

Doug: So then what next happens is something called a blood clot. It's kind of like glue. It's not glue that you would buy at the store, but it's a glue that your body makes that starts to completely stop the blood from going out. And it forms a scab. If you have ever skinned your knee... Pretty soon that paper cut is going to form a scab.

That scab is partially platelets and partially the glue that keeps your blood from falling out of your body. It keeps you from bleeding to death, basically.

Dr. Biology: What about the antibiotic ointment we put on? Is there a reason for doing that?

Doug: So that's another good question, Dr. Biology. Is the antibiotic ointment probably prevents bacteria from growing in your paper cut because everything you see around you has bacteria, has viruses and bacteria and fungus on it.

So, if you cut yourself on something, chances are, you have some bacteria that were on that paper that are going into your cut. And we want to make sure that we kill off those bacteria right there at the site of your cut. Your immune system is going to do a good job at that, too.

Ramon: What if I couldn't put that antibiotic on my finger?

Doug: Well, if you didn't have any antibiotic, and most people aren't as well equipped as this studio. Your immune system would take care of those bacteria that were trying to get into your blood. And what would happen is that you would have white cells in your blood. You have red cells and white cells. The white cells are the ones that are going to surround and eat those bacteria. And when they eat those bacteria they are going to digest them so that the bacteria are dead. They are not going to survive anymore.

And those are really, really important to have because those are going to be the first ones also at the site of where you cut your finger.

Dr. Biology: So you can imagine you have this bacteria that comes in and it's like the invading army. And then you have these white blood cells that come to the rescue and they come to the cut and they start attacking all that bacteria and basically destroying it.

So it's a really cool battle and when you only have a paper cut, pretty easy. The bigger the cut the more the battle. Also, we're going to talk about cancer and then that's going to be an issue as well.

Ramon: What does the word cancer mean?

Doug: We all have cells in our body and those cells have a certain lifetime. Then they die and then they are replaced with a new cell. Just like if you scratch your skin, sometimes the cells fall off, but new cells are there to take their place.

Well, in cancer the cells forget how to die. If they forget how to die, that means you get more and more and more cells and pretty soon you have a big ball of cells. Maybe it's not as big as this microphone I'm talking into but sometimes cancers first start to grow about the size of a pea.

Then what happens is the cells go out of that little cancer that's growing that's the size of a pea and then they go into places where we really don't want them to. Like they'll grow into bone or they'll go up to your brain. And then they'll start growing again.

We don't want cancer to grow in our bones and our brain. Well, we don't want it to grow anyplace. That's what really makes cancer dangerous is when the cells escape that first little pea sized tumor and when they escape. Then they'll go and grow someplace that they shouldn't grow.

Dr. Biology: So we see these cells, Ramon, as out of control. Typically the body has a really nice balance. Other than if you eat too much and you gain weight because you get

too much fat, we have a nice balance. Cells die. Cells divide and new ones replace them. But when they don't die or when you get them out of control as far as dividing, then you get these growths.

And you were talking about tumors, weren't you, when you were talking about these things that may not be as big as this microphone but can start out the size of a pea. So tumors you have been working on, right?

Doug: Right. Absolutely. The cells first start out as single cells and then they divide and become two cells and then four cells and then eight cells. Pretty soon you have a little pea size tumor. That's kind of when tumors might be dangerous. We might first be able to see them and then those cells will go and they'll find another place to grow. And that's, like I said, when they become really dangerous.

Ramon: How do people get cancer?

Doug: Well, that's a question that frankly nobody knows how people get cancer. A lot of people do and a lot of people are doing research trying to find ways to help cure people with cancer.

Dr. Biology: OK, so it's a bit of a mystery then here. We're still trying to figure that out. Because if we know how they get cancer that might help us treat it, right?

Doug: Absolutely. Some people think that it's in your DNA. In other words, if you're mom had breast cancer, maybe your sister will get breast cancer. Or if your aunt had breast cancer, maybe your mother will get breast cancer. And, of course, we hope that that doesn't happen. But some people think that cancer runs in families.

And it does. We've been able to show sometimes that cancer does run in families. So certain families have cancers but most cancer is just random. We don't know exactly why people will get cancer.

Ramon: OK. How many people have it?

Doug: Oh, there are hundreds of thousands of people that have all different types of cancers in the world. There's leukemias, which is cancer of the blood, so different types of cells in blood. There's lung cancer, there's breast cancer, there's melanoma, which is skin cancer. So there are lots of different types of cancers and there are millions of people that have cancer.

Dr. Biology: Ramon, I believe the statistics are that every minute someone dies from cancer. So you can imagine there are a lot of people that have cancer and a lot of people that are dying from cancer.

What else about cancer have you been curious about?

Ramon: Is cancer contagious.

Doug: Cancer is probably not contagious. Now, remember I said that there's a type of cancer that's leukemia? There is one type of virus that people can get that causes leukemia. But generally cancer isn't contagious. You can't get it if you kiss somebody with cancer. You should always kiss people with cancer.

Ramon: Why do people get cancer and some don't?

What other questions do you have?

Ramon: How do people know that they have cancer?

Doug: Well, generally people start not to feel very good. Another way is if people have skin cancer, which is called melanoma, is they can see if they have a mole on their arm or a mole somewhere, and that mole starts acting funny. Or if they have a freckle and that freckle starts acting kind of funny and it starts growing a little bit more or it bleeds a little bit, then they might want to go to their doctor.

Because that's a way that you can see that you might have some cancer. And if we can catch cancer early like that, then the doctor can just cut it out and just put a band aid over it.

Ramon: If you can't see it or if you don't feel anything, how do people know they have cancer?

Doug: Sometimes, in order to catch cancer early, you kind of have to be lucky and be going to the doctor for a normal checkup. And then if the doctor does some blood work and they look for proteins or things that a tumor might produce or that a tumor is giving off, that's swimming or floating around in your blood, then they can take a tube of blood and they can test the blood to see if it contains anything from the tumor in it.

Dr. Biology: And what about x-rays, in general? If you happen to go in you might have an x-ray and they might detect it? Or are there other ways, possibly?

Doug: Sure. So another way might be an x-ray. So if you x-ray your knee, for example, they can look inside your bones to see if they see any tumors. Some people have things called cysts, which look like tumors, but they're probably not tumors. So sometimes they're just right behind your knee. But those really wouldn't be a tumor. So doctors know what tumors look like when they look on an x-ray.

Dr. Biology: Hmm. OK. So when you're taking that picture, that x-ray, you get a different look if it's a cancer cell, or a tumor, versus it's a cyst or just normal tissue.

Doug: Right. Because what cancer is, is it's a proliferation. And what proliferation means for cancer is uncontrolled growth. So the cell forgets how to die and it's just grows like crazy. But that's just a single cell. And when single cells start to grow and become 2, 4, 8, 16, lots of cells of exactly the same cell as it was originally, then doctors can tell what that looks like on an x-ray.

Ramon: What happens to your lungs when you get cancer?

Doug: What happens to your lungs when you get cancer?

Dr. Biology: Yeah, lung cancer.

Doug: If you have lung cancer, you're unlucky, because that's kind of a hard cancer to cure. But one way to be lucky if you have lung cancer is if the cancer is confined, or it stays, in one part of your lung. Doctors or a surgeon can actually take out one part of your lung and completely remove the cancer. But we always have to worry about with cancer, those few cells that maybe escape that first cancer and then go somewhere else. They might go to your bones or your brain.

Ramon: Does it go to your ear, too?

Doug: I haven't heard of cancers going to your ear. But a cancer is kind of funny because when people have cancer, all bets are off. We don't know exactly where those cells can go.

Some people with cancer can have really funny symptoms, like they can have ringing in their ears. That may be a sign that something is wrong, if people have ringing in their ears. So lots of weird things can happen when people have cancer.

Ramon: Can one relative pass it down to another?

Doug: That's another really good question, because some cancer runs in families. That's called familial cancer. So that would be in the case where maybe if you look at your grandmother, say your grandmother had breast cancer. And then if her sister had breast cancer, or your great-aunt had cancer, maybe it would skip your mom, but then maybe your sister would get cancer.

So, cancer can be passed down in your family. And hopefully, of course, that wouldn't happen to your family. But cancer does run in families. But most cancer is random; it just occurs and we don't know exactly why or how it occurs.

Ramon: Do people change color of skin when they get cancer?

Doug: I love that question, because I can answer that question several different ways. If people have cancer and their cancer goes to their liver or the cancer first starts in their liver, what will happen is their liver won't work right anymore. People will turn yellow and that's called jaundice. So people can have jaundice. But you can have jaundice or turn yellow for lots of different reasons. That's just because your liver isn't working right.

But, remember we talked about melanoma before, which is skin cancer? So sometimes, if your immune system attacks melanoma, sometimes your skin can lose its color and your skin will just become very, very white.

Most people have a tan and freckles and things like that. If your immune system is attacking melanoma, sometimes your immune system will forget what the melanoma

looks like and it will go and attack the, what's called melanin in your skin. It will turn your skin white. It will just kill all the parts of your skin that have color.

Ramon: Do people lose their hair when they have cancer?

Dr. Biology: Well, hey, I don't like the idea of talking about losing hair on this show.

Doug: [laughs]

Dr. Biology: Because Dr. Biology doesn't have a whole lot on top of his head anymore. But it is a good question.

Doug: We've all seen people that have cancer that don't have hair. Generally, the treatment for cancer, the chemotherapy-- you've heard, I'm sure, about people who have to get chemotherapy, which is they get really, really powerful medicine. The medicine kills their cancer but it also makes their hair fall out. But the good thing is that after the chemotherapy, or the medicine, kills their cancer their hair will grow back.

Dr. Biology: That's not the cancer that has them lose their hair; it's actually the treatment, in this case. Their hair gets to grow back, while Dr. Biology's hair does not.

All right, at the beginning of the show I mentioned a little bit about how our body stays very active, even when we're sleeping. Even if you don't have cancer, we're doing a lot of repair work in our bodies, right? So what are some of the things that happen while we're sleeping?

Doug: Whether you're awake or asleep, your body is constantly busy. When a cell dies, a new one comes up. Your body is digesting the food that you ate for dinner. Some cells are dying; other cells are being born. Cells divide all the time.

Remember in the laboratory, we talked about proteins and some proteins are enzymes and those enzymes chop up proteins?

Dr. Biology: Right, exactly.

Doug: So all that sort of stuff is happening whether you're awake or whether you're asleep. You don't even have to think about it because it's what makes you function and makes you alive.

Ramon: Is there any kind of foods to avoid cancer?

Doug: Well, some people are studying that. There are some people that are doing research that says if you eat lots of fruits and vegetables, you will be able to reduce your risk of colon cancer. Some people say that if you eat some fried foods, like bacon, that you might increase your risk of getting cancer.

Some people say that if you eat bacon and then follow it with fruits and vegetables, the fruits and vegetables, especially strawberries, maybe will be able to fix whatever the bacon did. That's an area that people are studying right now.

Dr. Biology: You do a lot of work with cancer research. What in particular are you studying in your laboratory?

Doug: I'm studying very, very specialized white cells. Those white cells are called cytotoxic T lymphocytes.

Dr. Biology: Wow. That's a mouthful. I bet, Ramon, you want to try to say that?

Ramon: No.

Dr. Biology: [laughs] I wouldn't either.

Doug: They're hard to say, so we just say CTL.

Ramon: CTL.

Dr. Biology: All right.

Doug: That's much easier.

Dr. Biology: [laughs] All right. So what about these CTL cells?

Doug: CTLs are cells that are specialized white cells. These cells are capable of attacking and killing tumor cells just like they would attack and kill a cell that was infected with the virus. So some CTLs kill cells that are infected with the virus and other CTLs can kill cells that are tumor cells. They have the unique ability to figure out which is which.

Dr. Biology: Oh, so they can be very smart warriors, so to speak, in the body. They go out and they know what to attack, so there's no friendly fire.

Doug: Right. Although sometimes, remember I said that you can get white spots or your skin can change color; it can lose its pigment. Sometimes the cells get confused and they go after normal cells. But that's OK. I'd rather have spots on my skin that change color rather than melanoma, or skin cancer, because I won't die from spots on my skin, but I'll die from melanoma.

Dr. Biology: Right. Well, we always ask three questions from our biologist or scientist. I like to share them with my co-host when they're here.

I'm going to start with the first one and I'm going to let Ramon ask the second one. Then I'll probably do the last. I'll let the Ramon do the second one because I think it's the most telling about our guest.

So, let me start off. When did you first know you wanted to be a scientist or a biologist? When was that spark, if there was one?

Doug: That's a good question. I probably figured out that I wanted to be a scientist in my second year of college. I decided that I didn't want to work with computers because even

though we use computers in science, I really wanted to go into the laboratory to figure out why things you can't see, what do they do? How do they infect people? I wanted to figure out how the immune system works.

Ramon: If you weren't a scientist, what would you be?

Doug: I thought about this a lot. If I wasn't a scientist, I'd probably build houses. Because in science, we work with stuff we can't see all day long. We build things, but we really can't see it.

We have to use specialized instruments to see what we've built. We can work on something for six months and not be able to see and then at the end of that six months figure out that it wasn't what we thought it was. If you build a house, you can see what you've built right away. So being a scientist is much, much harder.

Dr. Biology: So what advice would you have for a young scientist or someone who wants to become a biologist, like maybe Ramon who's sitting over here? He's got a great big smile on his face. I think from your lab tour, he's kind of been turned on to biology. What advice do you have for him?

Doug: The advice I would give anybody who wanted to become a scientist is keep asking questions. A lot of people think that all the questions have been asked and we already know everything there is to know about biology, but that's not true at all. Because the more answers we come up with, the more questions we ask. There are lots of parts, even about a cell, that we still don't understand. So keep asking lots of questions and then you'll be a successful scientist.

Dr. Biology: Professor Lake, thank you for visiting with us today.

Doug: Thank you.

Dr. Biology: Ramon, I hope you enjoyed being a co-host on the show.

Ramon: I did very much and thank you for that.

Dr. Biology: [laughs] Was there something you liked most about today at ASU?

Ramon: Yes.

Dr. Biology: What was it?

Ramon: The lab.

Dr. Biology: The lab, OK. What in the lab was so cool?

Ramon: The microscope.

Dr. Biology: The microscope, ah. A young microscopist being born; I love it.

All right; you've been listening to "Ask a Biologist". My Guest has been Professor Doug

Lake from the ASU School of Life Sciences. My co-host has been Ramon Santos from the Paul Lawrence Dunbar Elementary School in Phoenix, Arizona.

The "Ask a Biologist" podcast is produced on the campus of Arizona State University and is recorded in the Grassroots Studio, housed in the School of Life Sciences, which is a division of the College of Liberal Arts and Sciences. Both the School of Life Sciences and the College of Liberal Arts and Sciences have provided funding for our co-host contest.

Oh, and remember, even though our program is not broadcast live, you can still send us your questions about biology using our companion website. The address is askbiologist.asu.edu. Or you can just Google the words "Ask a Biologist".

I'm Dr. Biology.

Ramon: And I'm Ramon Santos.

Dr. Biology: Hey, teachers, podcasting is also a great project to do in your classroom or in a school. We have all the information about how to do podcasting and the contest that we have on the "Ask a Biologist" website. You can learn about the equipment, the software, how to create podcasts. And much of the equipment, by the way, and software is inexpensive and, in some cases, free.