

Squiz Kids Q+A with Dr Karl

Hello and welcome to a very special Squiz kids Q&A, the podcast where you, the kids of Australia, get to ask the questions. I'm Christie Kijurina and today we are in for a treat because we're joined by one of Australia's most curious minds, a man who has spent more than forty years answering questions about how the world works.

Doctor Karl Kruszelnicki was born in Sweden to parents who survived the horrors of World War Two before the family moved to Australia, where he grew up in Wollongong, known as the Gong to locals. As a kid, he was full of curiosity and love, finding out how things worked, a habit that eventually led him to collecting degrees in physics, engineering and medicine and to spend a lifetime explaining science to the rest of us.

You might know him from his science talk back on triple J radio and podcasts, where listeners have been asking him questions since way back in nineteen eighty one, or from the nearly fifty science books he's written about everything from space and climate to belly button fluff, which, believe it or not, he once researched so thoroughly it earned him an IG Nobel Prize. And I know lots of you have been watching Doctor Karl on his ABC show, How Things Work, because you've told us. He has won awards all over the world for helping people understand science, including a very prestigious UNESCO prize. And in two thousand and three he was named Australian Father of the year.

Doctor Karl even has an asteroid named after him. It's out there orbiting the sun right now in the asteroid belt between Mars and Jupiter. So, whether the question is about space, the human body, animals, the planet, or the weird mysteries of everyday life. There's a very good chance Doctor Karl has thought about it, and today he's agreed to jump into the Squiz kids Q&A hot seat to answer questions sent in by curious Squiz kids listeners from all around Australia. A very enthusiastic Squiz kids. Welcome Doctor Karl.

Good morning and thank you for the intro. Doctor Karl, the Squiz Kids listeners all around Australia sent in their questions and they blew up our inbox. We had so many brilliant questions come in, but we had to choose just a handful.

Can we get started?

Yes. Let's rock.

Amazing. So our first question comes in from Annabelle.

Hi, my name is Annabelle. I am nine years old and I live in Northcote in Victoria. And my questions are. What was your favourite subject when you were little and what inspired you to be a scientist?

Uh, English. I loved learning grammar. Emma love learning about the English language and how it all made sense. Um, that was my favourite subject. And so I

know about subjects and verbs and predicates and adverbs and do some grammar kids. It's great fun.

Brilliant. And what inspired you to become a scientist, doctor Karl?

Um, asking questions. So at one stage, the teachers told us in primary school that there was this thing called photosynthesis.

I've heard of that.

Which is how the plants turn sunlight into energy. And I was walking home and it was really hot, and the bitumen was really sticky on the road. And I was sort of kind of sticking to it. And I thought, wow, well, black absorbs heat better than green. So how come plants are green? Why aren't they black? And that was the first thing there was a question. And then I thought, well, the sky is blue, but why isn't it yellow? Why doesn't it have polka dots? So that's it. said asking questions will turn you into a scientist.

Wonderful. And you've given our Squiz Kids some homework now as well. Let's jump into question number two. Next up we've got a little question from Isla.

Hi, my name is Isla. I am eleven years old and I live in Morayfield in Queensland. My question is what's your favourite sci fi world?

What a great question Isla. Doctor Karl, what is your favourite sci fi world?

It goes way back to the very first science fiction story I ever read, which is Thunderbolt of the Spaceways. Apparently the book is still around, but in terms of modern sci fi on the movies, the sci fi is not as good as it is in books, because in books, the pictures are perfect because you're in your head. A lot of sci fi movies have got the exactly the same theme here. It comes in the future. The wealthy people control everything and everybody else is really poor and it rains a lot.

So nothing like real life then?

Well, it's not it doesn't have the same inspirational motives that you find in written science fiction. Absolutely. So start off with Isaac Asimov, and then through the classics. Yep. And you'll find some really good science fiction. The thing is that what you want to have is at the end of a science fiction story, you thought, wow, I didn't know it was going to turn out like that.

Oh, our next one is about the many different jobs you've done over the years. Doctor Karl.

Hi, my name is Lizzie. I am nine years old and I live in Jindalee, Queensland. My question for Doctor Karl is which one of your jobs is your favourite and why is it your favourite?

All of them. I loved each one. I did because I loved it and as soon as I stopped loving it, I went to do something else. And, um, so I loved working as a physicist at the steelworks, teaching and doing research in New Guinea. Being a taxi driver, being a filmmaker, helping start up a set of Australia's first cable TV network, being a car mechanic, designing and building a machine to pick up electrical signals off the human retina. Working in the media. Going to Antarctica.

Probably the best job I ever had was being a doctor in a hospital. But then when a current affairs started telling lies about vaccines, the vaccines were not safe. And then we started having, for the first time in twenty years after zero deaths from whooping cough, we started having babies dying from whooping cough. I then resigned from the kids hospital. As I said, the best job I ever had in my life and went to work in the media because I figured I could do more good for people and telling them to get vaccinated and save more lives that way, rather than working one at a time with each patient and family. But it was still the best job I ever had. Being a doctor in a kid's hospital, I loved it.

Oh that's beautiful. Lots of our squiz kids are Newshounds also, so they're all about finding out about mis and disinformation and vaccines is one of the things that they know about. So that's really important. Great message. Now we're going to head into some science territory. This one is from Gemma. Gemma's ten and from Melbourne in Victoria.

Hi, Dr Karl, my name is Gemma and I am ten years old. I saw you wearing a shirt with the periodic table on the show. How things work. My question for you is which one is your favourite element on the periodic table and what makes it so special?

Plutonium. Can you explain why it's so special for us? Well, it turns out that most of the stuff in the periodic table is a metal. So if you look at the periodic table, you've got hydrogen over here and then a whole lot of stuff. And then over on the extreme right hand side, you've got like a few nonmetals. And in between there's a little sort of staircase. And they're the things that are halfway between metals and nonmetals, and they're the basis of most of our semiconductors today. Wow. Gallium silicon. But down at the bottom you've got the radioactives.

Now it turns out that metals can form crystals. They usually do. And plutonium is the only metal is the only element that has all possible six crystalline states. Oh, wow. So think about a cube. So you've got one, two, three, four atoms at the top. And then one two three four atoms at the bottom. That's a cube. But you can chuck another atom in the middle as well on top. And then suddenly you've got what they call a body centred cube. Or you can chuck one atom in the middle of each face. So one at the top, one at the bottom, one at the front, one at the back, one on the left

and right. And that's a face centred cube. And so on and so on and so on. And plutonium is the only element that has all six possible crystalline states.

That is incredible. Wow, that is totally amazing.

On the other hand, I'm very fond of oxygen. Oxygen makes up sixty percent of the mass of a human being. So we humans, we're not all star stuff. So the hydrogen and helium was not manufactured in stars. It was there shortly after the universe cooled down, right around three hundred and eighty thousand years after the Big Bang. But all the other elements were manufactured as a result of stars doing their things. Um, except maybe beryllium, but that's a bit weird. So yeah, we are mostly star stuff, but the hydrogen makes up a lot.

Does that mean. Does that mean all the things in our body are that. That old doctor Carl, that we're really, really very old.

The hydrogen atoms in the water go back to the beginning. But the oxygen atoms in you could have been made very soon after the Big Bang, or when the earth formed about four and a half billion years. So what happens is that the way to think about it is a star is a machine that turns light elements like hydrogen and helium into heavier elements and gives off a lot of energy. Now, I could have done that, say four point eight billion years ago. Wow. And then blown up and then thrown some of its outer coverings into, which include oxygen into what's called a stellar nursery. That's where stars and planets are born. There's about seven thousand of them in our galaxy, the Milky Way. And so the oxygen atoms could have been made maybe five billion years ago or way, way back, maybe, say one hundred million years after the Big Bang. You know, like thirteen point seven billion years ago. So they're variable in age, but the hydrogen is all very old.

So we're looking very good for our age though.

Oh, sometimes you're lucky.

That's it. Um and next question. I reckon a lot of kids and adults will relate to.

Hi, my name is Olivia. I'm ten years old and I live in Roseville, New South Wales. My question for Doctor Karl is how do you manage digital distractions like YouTube. When you're doing work or homework online?

It is very difficult. So if you start doing doom scrolling, you might, for example, run up, run into movies. Now, the movie might have cost between twenty and one hundred million dollars to make, and there'll be some good scenes in it. And what they do is they show you the best 30seconds or 90seconds. You go, oh my God, that was good. And then they go to another movie which cost one hundred million dollars and they pick out the best 60s. And so you've got to realize that yes, they are really, really attractive, and then you've got to be strong or else you end up, um, half

unconscious with your battery flat on your phone and it's two o'clock in the morning and your eyes are buzzing and you can't sleep anymore. So what I do is, um, I need a little break every now and then and I'll say, okay, I'll have a break at ten o'clock, and for five minutes I'll go doom scrolling. And then after that I'll go back and do some, I do some exercise and I'll get back to work again.

That is excellent advice. Um, and next question comes in from Georgia. She's nine from the Mornington Peninsula in Victoria.

Hi, my name is Georgia. My question for Doctor Karl is will we ever know how big the universe is?

Yes and no ever is a long time. So at the moment we have three sizes for the universe. The universe is expanding. And so the further away something is from you, the faster it is going. So if it's around three million light years away, it's moving away from us at about sixty kilometres a second because that's how fast the universe is expanding. The Hubble constant. And if you double the distance, you double the speed. And so by the time you get to about fifteen billion light years away from us, that's where objects are moving away from us at the speed of light.

And we'll never know anything more about them because that light will never reach us. So that's the first size of the universe. The Hubble limit fifteen billion light years. But secondly, the universe has been around for a long time, and some things are on the other side of that Hubble limit. But they've been sending their light, and it's gone across that barrier in the past, and it's on its way to us and in fact, might hit us tomorrow. So we call that the observable universe. And that's about forty-three billion light years in radius. Forty-three billion to the edge.

And then finally, there's the everything universe, the universe, universe, which is infinite. And we don't really know that much about it, but we're learning. Will we ever know? Almost certainly not.

We're moving on to the next question, and we've got a question from Braxton, who's eleven years old, from Oran Park in New South Wales.

Hi, my name is Braxton. I am eleven years old. My question is, why can't fish breathe air?

Um, they need oxygen. They need oxygen. Now water is made of H₂O, and that means two atoms of hydrogen and one oxygen in the middle. Like a little boomerang. So oxygen and two hydrogens. And so even though you think water is this weird liquidy stuff, it's actually made up of little boomerangs. And in between our molecules of oxygen, which look like those little barbells, those little weights that you see at the gym, like a stick with a little weight on each end. So that's a stick. And then O and O.

They're living in a wet environment, which has advantages with regard to life evolving. And they've evolved down one pathway where they didn't leave the water, they stayed there. But to get the oxygen out of the water, they evolved membranes called gills and water flows over it. H two O is bigger than O two. You know, like a boomerang is bigger than little barbell. And then the oxygen goes across into their bloodstream.

So they don't have lungs. They need oxygen, but they get the oxygen directly from the water which flows across this thin membrane in your body is called the gill. It flows from the water into their blood and then out the other side.

This one comes in from Sadie. She's ten from Templeton in Victoria.

Hi, my name is Sadie. My questions are do dogs get goosebumps? And how do they stay cool when they have so much fur?

Oh, the way they stay cool. Unfortunately, um, is hampered by the fact they can't sweat. Yes. Now you. Now a dog can run faster than you and so can an antelope or a deer. Yeah, they got four wheel drive. We've only got two wheel drive, but we can sweat and dogs and deer cannot sweat. So if you're chasing down a dog, if you if you can run a marathon by the end of a few hours on a warm day, you can still keep on chasing the dog. It might outrun you, but you can still keep an eye on it, and it will have to slow down because it can't get rid of the sweat, the heat, the way they get rid of the heat is that they breathe out through their big mouth. And I have a wet tongue, a huge tongue with saliva, and they breathe cold air over it and it cools down. So you can do this experiment at home where you lick your hand and then blow air on it. And the bit where you have got wetness, you can use water instead of licking is cooler.

Ah that's right.

Do they get goosebumps? Yes. That's part of the sympathetic nervous response which is wired into us to deal with emergencies. If you come around a corner and suddenly there's a killer rabbit or a killer shark wearing a wetsuit automatically without you thinking about it. Your pupils will get bigger to let more light in. Your adrenal glands will release adrenaline so your heart will speed up, and so will your thyroid gland. You'll increase the blood supply to your muscles so you can fight better. But simultaneously, you'll decrease the blood supply to your skin.

Oh, right.

So that in a fight, you won't bleed so much if you get cut in the skin. And also each of the hairs that we used to have has got little muscles in it, and they then pop up to make you look bigger and more scary. And that's the goosebumps. So the goosebumps are what used to be hairs on our body when before we lost hair about

two million years ago as part of evolution to make us look bigger and scarier. That's incredible. And dogs can do that too.

That's amazing. We'll move on to the next one. Our next question comes from Emmett.

Hi, my name is Emmett. I am ten years old and I live in Henrietta in New South Wales. My question is, if aliens aren't real, does that mean we're all alone?

Uh, yes. If aliens are not real, that means we're all alone. However, the people who study this subject of life outside the earth are called astrobiologists, and every year they have a conference and everybody at the end, they have a show of hands who reckons that there's life outside the earth and everybody puts their hand up. Because in our solar system there are five places not on earth where we have underground oceans of liquid water. Mars, two of the moons of Jupiter to the moons of Saturn.

And then the second question is, who reckons there's intelligent life out there? And half of them put their hand up and I'm with them. At this stage, though, we have zero. We have nothing. We have no proof that there's any life out there at all. Um, but I'm sure that in the lifetime of the students watching today, we will discover life elsewhere in our solar system.

Incredible. And our final question today comes in from Aida. She's seven. She's from Darwin in the Northern Territory.

Hi, my name is Aida. My questions are, is time travel possible? And how do you find so many bright t shirts?

Uh, my wife makes them, uh, the shirts. Um, is time travel possible? I would have said probably not until I read something last week. So normally we have the. So the universe is made up of four space and time dimensions. Well, three space dimensions, one time dimension. So you can go backwards and forwards. That's one space dimension. Left and right is another space dimension. Up and down is the third space dimension and time only goes forward. There are two different machines that have been hypothesized for going backwards in time, and one of them is you get a neutron star, which is about twenty kilometres in diameter, and you reshape it into something that's about twenty kilometres long and one kilometre in diameter, and then you spin it at one thousand revolutions per second, and the outside is moving at half the speed of light. And according to John Wheeler, if you go into a tight orbit around it, you'll be taken back in time to when it was first constructed. But nobody has ever built such a machine.

Secondly, the second way of going having a time machine is you have a wormhole and we don't know if they exist. If you're interested, look up Einstein. Einstein - Rosen Bridges and what we today call wormholes. And they're thought to be able to

join black holes. We hypothesize that they exist. We have no idea. But if they do exist and you can get hold of one. One weird thing about them, if they exist, is you can go from one end to the other in zero time.

Wow.

So if you get a wormhole and you leave one end here on earth, and you take the other one for a drive at very close to the speed of light, which is impossible for our technology today. And you do that for an hour and then you bring it back. The bit that's been going at close to the speed of light has aged one second.

Oh my gosh.

The rest of it has aged one hour. Everybody else has aged one hour. So if you go through one way, you go back in time. If you go through the other way, you go forward in time. Nobody's ever proved that wormholes exist. At this stage. We can't make a time machine.

Okay, a couple of quick fire questions, Dr Karl. Charlie, who's six from Burpengary in Queensland.

Why do farts stink?

Ah, they don't all stink. But when they do, it's because of sulphur compounds, such as you get from the brassica type vegetables such as cabbage and kale and cauliflower.

Xilin, whose eight from Graceland in Queensland.

How do quantum computers work?

Just a small question.

A normal computer has Boolean... Boolean logic where any memory cell can be either one or nought. In a quantum computer it can be one and nought at the same time, as well as being the infinite number of numbers between one and naught, and so therefore, with certain calculations that need parallel processing, not all of them do. There are certain problems that instead of taking fifteen times the age of the universe to solve, we could theoretically solve them in a few seconds.

Amazing.

We kind of have built quantum computers, but they're not really useful at the moment.

Last one, Dr Karl for today.

Do animals have accents from Olivia in Fremantle?

Yes. They changed their accents depending on the environment. This was noted with birds living in different environments, such as in city and country environments, and the same species have different sounds to cut through the environment better and be heard better, depending on the background noise and when in the city's noise laws came in, making the traffic not so noisy and also at different frequencies, the birds change their frequencies. Thus the equivalent of having accents.

Oh my goodness, that's amazing.

And finally, when people go to Antarctica and they stay there over winter there, they develop their own accent in their little community, cut off from the rest of the world in as little as five months.

That is incredible. Doctor Karl, we have enjoyed having you with us so much today. Thank you so much. And thanks to our kids too for so many brilliant questions.

Doctor Karl, if kids or their adults want to find out more about your fascinating life or science in general, I hear you've written a couple of books.

Yeah. So go to drkarl.com . And next, by the next month, we'll start releasing one hundred, um, YouTube videos on climate change. And we'll be releasing them at one a day. Um, and how to fix it. It's got a happy ending.

And we've also invented a Dr Karl digital Doctor Karl chatbot that can talk to you about it. And it'll be available on YouTube, which is available to all the audience. And Tik Tok, depending on what their parents reckon.

That's brilliant. Thank you so much. And Doctor Karl, would you help us with the Squiz Kids? Sign off today?

Dear beloved Squiz Kids, I beseech you to enter the external world and have a most excellent day. Peace. Love. Mung beans.

Over and out.