**Inspiring Queensland STEM professionals podcast series**

**Professor Peter Doherty**

*Peter Doherty is best known for winning the Nobel Prize in Medicine in 1996, a fellow of the Australian Academy of Science and named Australian of the Year in 1997. He was born in 1940 in Brisbane, Queensland, where he attended local state schools including Indooroopilly State High School (which now has a lecture theatre named after him). He is the Patron of the Peter Doherty Institute for Infection and Immunity at Melbourne University and the Queensland Department of Education Peter Doherty Awards for Excellence in Science, Technology, Engineering and Mathematics (STEM) Education were named in his honour.*

**Announcer:** This is a Queensland Department of Education Podcast

**Speaker 1:**

Welcome to the Queensland Department of Education podcast series, about the importance of STEM. In this podcast, Dr. Terri Burnet chats with Professor Peter Doherty, Nobel Laureate and immunologist. Professor Doherty was born in Brisbane and is the patron of the Peter Doherty Institute for Infection and Immunity at Melbourne University. The Queensland Department of Education Peter Doherty Awards for Excellence in Science, Technology, Engineering and Mathematics education were named in his honour.

**Dr. Terri Burnet**:

Thanks so much for your time today Professor Doherty, it is an honour to chat with you.

**Professor Peter Doherty:**

It is pleasure.

**Dr. Terri Burnet:**

The Australian Financial Review recently described you as a living national treasure but we prefer to think of you as our own Queensland legend. You grew up in Oxley in Brisbane and attended local state schools. Can you share some of your experiences growing up with us, particularly what first triggered your interest in STEM?

**Professor Peter Doherty:**

Well, I grew up in Queensland, I am kind of ancient, born in 1940. So in primary school, I started in the primary school at the local school, which no longer exists actually, it was knocked down and rebuilt on another site, but straight after World War II. So, that really takes me way back. I don't remember much about learning science in primary school, but it really came into my consciousness when I got to high school. And we took physics and chemistry as our two main science subjects and mathematics, of course. So, I was always good at math and physics... Sorry, chemistry and physics. And also my dad did a lot of sort of handiwork stuff. So, I was kind of practical as well. So, I was focused on actually doing things with my hands, as well as thinking about things. And of course the practice of science, at least biomedical science, at least early in your career has a lot with hands on. The one thing we didn't learn in high school though, was biology at that stage, in the particular school I was at.

**Dr. Terri Burnet:**

I was going to ask you if biology was your favourite subject, so you didn't actually take biology at all.

**Professor Peter Doherty:**

It wasn't an option to take biology in the state high school I was at. I went to Indooroopilly High School in the first year the school opened. So, the first time I encountered biology was at the University of Queensland and I went there when I was just 17. And even though I was studying in the veterinary faculty, we did our primary zoology and botany and science subjects with the science faculty. And I was fascinated by biology from the outset, particularly zoology, which was taught by a guy called Stevenson, who had been a guy who worked on worms, but he became allergic to worms, and so he switched to marine biology. And so I almost switched out of the vet faculty to be a marine biologist, but I reckon I would probably get to sunburn, so I didn't.

**Dr. Terri Burnet:**

So, do you think Professor Stevenson contributed to your initial sparking of interest in biology?

**Professor Peter Doherty:**

Yes, he was an inspired teacher, truly passionate and I would run into people like that in high school. I felt my schooling just got progressively better from primary school through secondary school then to university because I am the sort of person who likes to go in great depth with things and try to understand things. That is kind of basic to who I am. And so science has always been something that suits me particularly.

**Dr. Terri Burnet:**

Do you think students' perception and the community's perception of the importance of STEM will change as a result of all the impacts of say COVID-19?

**Professor Peter Doherty:**

I think it changes transiently. And I think we make it a bit mysterious by calling it STEM even, and kind of divided off from the arts. I think what we want in the community is a general understanding that well, basically evidence is important. Actually getting some evidence for something you are saying is very important, that is basic science. It is not really the gossip you hear over the back fence or the person you talk to in the supermarket queue, but really trying to find out if someone is telling you something that is related to science, why are they telling you that and what is the evidence for it? And you can check that out online pretty easily now because you can start just with Wikipedia for instance, so anyone can access and go from there. But we also need a sort of general understanding of some very, very, concepts that are very basic to science. And one is relative risk because that comes up all the time, and probability. And those are central to actually approaching life, but we don't translate those across into a lot of our thinking.

**Dr. Terri Burnet:**

Professor Doherty you were instrumental in making one of the most profound discoveries in the last 50 years in the field of immunology back in 1973/74, what was the significance of the discovery for people's lives?

**Professor Peter Doherty:**

Well, it was basically a discovery that illuminated a whole set of questions in biology. And you have to understand this is a long time ago in science, a very long time ago. Because science has gone on and become incredibly more sophisticated. I have been interested in all my research career in virus infections and how viruses do damage and how we get rid of them and clear them and control them. So, my area of interest is what we call virus pathogenesis, that is how disease develops. And also in immunity, how we manipulate immunity, which of course we did through vaccinations and so forth. So, we were studying an immune cell, a white blood cell that goes round and round in the body called the killer T lymphocyte. It is called the killer T lymphocyte because it can kill other cells. That is what it does.

 It is kind of an assassin that goes around the blood in our body to bump off cells that have gone wrong. And these things we now know can keep cancers under control or some cancers under control and so forth. But what we were looking at is a virus infection and what these killer T cells do during a virus infection is they kill off the cells that are infected with the virus because viruses can only grow in living cells that get into our cells, that is where they grow. And if we got to stop them being produced in even greater numbers within our bodies, we have to bump off those cells. So, that is what these cells do. But what we found out is that these cells were focused onto the surface of the cells they had to kill, because if they are going to kill them, they have to get up close and personal and do that really by making contact. But they are focused because the virus is changing what we call the transplant molecules on the cell.

**Professor Peter Doherty:**

So, the transplant molecules are the molecules that were identified by people studying organ graft rejection. Now, nobody had before linked immunity to viruses or to cancer and anything else with immunity to the transplant molecules. And that is what we did, we linked immunity to viruses, to immunity to modifications caused by the virus, the modifications of the transplant molecules. We called it altered-self. So, what we did is we explained how this harm of immunity operates in a very broad sense. But we also explained why we have a transplant system in the first place, because there was no obvious reason why we would have that. So, it was a major... it overturned a whole area of understanding of immunity, turned it on its head and made people look at it differently. And that is what they give Nobel Prizes for breakthrough discoveries.

**Dr. Terri Burnet:**

A little bit more than 20 years later, you received the Nobel Prize for these profound discoveries. How did the Nobel committee in Stockholm let you know you had won the prize?

**Professor Peter Doherty:**

Yeah, yeah. We got the Nobel Prize 20 plus years later, which is pretty normal to Nobel Prizes now. They don't want ever to get it wrong. And during that time, this subject, very, very few people worked on, probably 100 people in the world at that stage. Then had thousands and thousands of people working on it, so we also got the credit for a lot of that work in getting that Nobel Prize. So, that is a good deal, isn't it? That is how to win a Nobel Prize. I wrote a book on it, discover something really big, that is good advice. You can't decide to discover something for obvious reasons.

And so we got a call, I was living in the United States at the time. And so they make that decision at about 10:00 or 11:00 in the morning in Stockholm, on the first Monday in October, who is going to get the Nobel Prize for medicine. So, they called us at about four o'clock in the morning because of the time difference. And my wife picked up the phone and the guy said, "This is Nils Ringertz from Nobel Foundation." And she said, "This is for you".

**Dr. Terri Burnet:**

How did you feel?

**Professor Peter Doherty:**

A bit shocked, but wasn't totally unexpected because the year before that we had been awarded the Lasker Award, which is the big American medical research prize, and about half of the people who get the Lasker Award go on to get the Nobel Prize. But of course, being a Queenslander and brought up in public schools, I was telling myself, you don't want to have too high expectations. I was telling myself, half the people who get the Lasker Award never get the Nobel Prize.

**Dr. Terri Burnet:**

How did you collaborate with other scientists then? Or-

**Professor Peter Doherty:**

It was all local. If you wanted to talk to someone you’d write them a letter or you’d telephone them. That was it. I mean, there was no internet. So, that was how you communicated. We submitted a research paper, you would send it off in the mail and wait to hear.

**Dr. Terri Burnet:**

So, Professor Doherty, tell us about the research going on at the Peter Doherty Institute in conjunction with the University of Queensland, with Professor Paul Young's team in relation to COVID-19.

**Professor Peter Doherty:**

The University of Queensland group led by Paul Young and his colleagues has being doing a fantastic job developing a new vaccine technology, they call it the protein clamp. That was picked up a couple of years back by a global organization, I think which was set up initially by Bill Gates and the Gates Foundation with various other money coming in as well, called CEPI, the Centre for Epidemic Preparedness Initiative. So we call it CEPI. That is actually chaired by Jane Halton, former secretary of the Department of Health in Canberra, a very prominent Australian bureaucrat. So, CEPI funded them for two years to develop this technology, it is what is called the platform technology. It is a vaccine strategy that you develop that could be used for multiple infections by just slotting in a bit of the particular infectious agent.

So, as soon as I got the word on the gene sequence of the SARS-CoV-2 virus, the COVID-19 virus, they started slotting in the relevant bit of that virus into their platform. And so that went ahead and our role in this is we help with some of the assays, but really it is UQ driven project and I think their initial vaccine testing in animals is being done in the Netherlands right now.

**Dr. Terri Burnet:**

Scientific research is influenced by the needs of society. And as you already mentioned, needs to be evidence based. Why is it important for researchers to collaborate and work as a team such as you are doing at the institute with UQ and people overseas when you are gathering this evidence?

**Professor Peter Doherty:**

The time that Zinkernagel and I did the work that won the Nobel Prize, labs were often really quite small and because it wasn't facilitated by the internet, and also because the technologies were really so simple that most people could do them. There wasn't nearly so much international collaboration and things were more isolated in a sense. Now, because of the possibilities with the internet and so forth, and rapid international air travel and all the rest of it, we collaborate across the planet in various ways and everything is linked and networked. CEPI for instance, is networking the whole vaccine development strategy, I think for something like 12 different vaccines, I might have the number wrong and that is being done across the planet.

And so that is what we do because the situation is that because of the power of modern molecular technology. In a way, we kind of all doing the same sort of molecular things, but there is no point in us developing something if somebody else has developed it. And there is no point in us doing a set of particular tests, if someone else can do it much quicker and they are doing a lot of them. It is like surgery, if you want a heart transplant, you got to the guy who does two heart transplants a year. You go to the group that does 200 a year.

**Dr. Terri Burnet:**

There is a lot of misinformation in the media at the moment about this topic and other scientific challenges. Does it make you frustrated when you see some of the media reports that aren't based on scientific evidence?

**Professor Peter Doherty:**

At the moment, the media is generally being pretty... The legitimate media, I am not talking about the sort of crazy stuff that can go on online, but the legitimate media is being fairly responsible. I must say what annoys me a bit is when they confuse a drug with a vaccine. A drug is a treatment or therapeutic, a vaccine is a preventative. And so, it would be good if some of the journalists took a bit of time to basically understand it a little better, but I think they have been pretty good. And that is why I think we all need to have some sort of basic education in science and how it works.

I wrote a book for the general audience called The Knowledge Wars, which is about how science works and how you find out what is going on and how you see through the fakes and the phonies and the professional liars, because it is not that we are particularly besieged with them in medical science, we are getting some of it and we are getting some weirdness around any vaccination, that is all very complicated really, social logically, I think, but where are getting disinformation is of course around climate change. And that has been going on for some time with some major media organizations, really pushing anti science lines. And that has really been very distressing, but the problem is of course there is big money involved. With biomedical science, everyone wants to be healthy. So in general, it is not politically controversial.

**Dr. Terri Burnet:**

You are actually working on your sixth book at the moment, aren't you? You have already written five. One of my favourites was in 2012, you wrote a book entitled Pandemics, what everyone needs to know. Given now what we are dealing with, is there anything you would change in your book?

**Professor Peter Doherty:**

Oh, yes, a lot. I have actually published six books and I am working on two at the moment. One is nothing to do with science. I thought I was going to retire because I am almost 80. I am also currently doing a book on the COVID outbreak and which will be published next year. And there are pieces going up on our website if anyone is interested in reading them.

The Pandemics book, it is 2012, so it is dated. Just been translated into Chinese, I have been told, but basically it is fine, but of course it doesn't cover the new things. And of course it is all very well to write about a pandemic, but it is very, very different experience to live through it. And even though we haven't had a bad time here at all, we have reacted quickly and well, and from everyone, from the Prime Minister down has done a really good job, and the state premiers and so forth. So, we haven't experienced worst of it, but just watching what is happening and just the experience of locking down and all that sort of stuff. I learned a lot more. The book would be somewhat different if I ever revised it, which I probably won't.

**Dr. Terri Burnet:**

As an enthusiastic and passionate advocate for STEM, what advice Professor Doherty would you have for students interested in pursuing a STEM based career?

**Professor Peter Doherty:**

Well, I would advise if you are a smart young person, unless you are totally turned off science, do some science certainly through school, because it can help you in lots of different ways. I talk a lot, partly due to writing books and partly due to my own personal interests, I talk a lot with people in the literary type of community and the arts type community, and some of them, I think have a very unnatural and quite unnecessary fear of science. It turns them off, and I think partly because some of the language that is used. So I think what is very important is not to make science in any sense mysterious, but to make it human, because it is the most human of all activities, especially curiosity. Following up on your curiosity and then trying to find out what that means.

It often comes across as kind of difficult and uncertain, but the basic principles are very, very simple. And I think that is what everyone needs to get. On the other hand, if you have got some capacity in math and/or science, particularly math two, try and keep it up for a bit and don't turn it off too quickly, because even if you are going to be a lawyer or a banker or an investment person or something, knowing something about science now is really getting to be pretty important because that is where a lot of the financial excitement is quite frankly, in innovation and technology. So, don't necessarily think even if you go ahead and do a PhD in science, a doctorate, that is you spend seven years at the university or eight years at the university doing science, that is not the only avenue forward for you.

We have people who have had that training have gone into banking and all sorts of other areas where and of course teaching is another one, we need more and more great science teachers. So, think of science as being part just part of your education.

**Dr. Terri Burnet:**

If I can finish on this question, Professor Doherty, out of all of your many, many successes, what is your proudest achievement?

**Professor Peter Doherty:**

My many successes, many failures as well. You actually can't do science without failing, because if you are not failing some of the time, you are not asking interesting questions, you are just cranking the handle, and that is pretty strange. Not very useful way to go quite frankly. There has been lots of great things. I mean, the usual family things, children, I married the right person, that was a good, that was a bit of good luck.

**Dr. Terri Burnet:**

Always a good thing.

**Professor Peter Doherty:**

Yeah. And all these things are important. I think stability and integrity and so forth is all very important. And being an ethical person and a moral person in science is absolutely essential. And you have to be absolutely honest with yourself above all. I mean, you have to be able to take your own bits of science and say, what is wrong with this? Where is the flaw?

The way I approach life is a science, I always pull everything back down to the basics and then try and build it up from there. Well, winning the Nobel Prize is kind of nice. I mean, it is pretty spectacular touch, that is kind of fun. The discovery itself was extremely exciting and we spent only about two years working together really in Canberra, those two years were really extraordinarily exciting and incredibly exhausting, quite frankly, but you win a few, you lose a few, that’s life. And if you are not making mistakes, you are not learning quite frankly.

Dr. Terri Burnet:

And finally, Professor Doherty, I would like to thank you for being our namesake for the Peter Doherty Awards for Excellence in STEM Education, this is the 17th year of the awards, and the selection panel is just finalizing the award recipients for this year.

Professor Peter Doherty:

I pass on my congratulations to everyone who has been recognized in the past and will be recognized this year and thank the Queensland government for taking this initiative in my name, I am greatly honoured by it. And it is great to have seen actually how Australia itself and Brisbane and Queensland in particular have really the Queensland governments have been particularly good at trying to build up science and technology expertise in the state. And that has been from both sides of politics and it has been a consistent theme and we have seen some great science emerging. And the fact that we have someone like Paul Young and that group developing this vaccine in Queensland is a tribute to that investment over the years from the Queensland government, because if you will guide them move forward in an area that is complex like science, you have to have that permeating the schools and the education system. And of course you will have to have great universities and research facilities.

Dr. Terri Burnet:

Thank you so much for your time this morning, Professor Doherty, it has been an absolute honour. Thank you.

Professor Peter Doherty:

My pleasure. Bye.