David Glanz: Health is a topic that is close our hearts, and all our other organs, too. We're already used to medical practitioners using technology to measure, test, and fix us, but the rapid technological change is going to disrupt healthcare just as surely as it's disrupted so many other areas of our lives. So, let's take a look into the near future of medical technology, and what it means for patients, doctors, and service providers.

David Glanz: Hello, and welcome to this podcast brought to you by the Australian Academy of Technology and Engineering. I'm David Glanz, and today I'm talking to the president of the academy, Professor Hugh Bradlow. Hugh was previously Chief Technology Officer and Head of Innovation at Telstra and was named by Global Telecom Business as one of the 100 Most Influential Telecommunications Executives in the World.

David Glanz: Hugh, you've identified three big factors that will disrupt healthcare, the internet of things, big data, and machine learning. So, how about you take us through them one at a time?

Hugh Bradlow: Okay, thanks David. So, let's start off with the internet of things. What do we mean by that? Well, what we mean is the ability to use new, low cost, low power, cheap sensors to measure all sorts of things. In fact, what we're going to see if a Cambrian explosion of sensors measuring the world we live in, and that world includes our bodies. So, what that means is that you can take measurements, cheaply. You can transmit those measurements through networks, and we now have almost pervasive cellular networks in place, that allows you to transmit to data centers, and those data centers then can assemble data at scale, which we can thank the internet providers like Google and Facebook for.

Hugh Bradlow: Once you can collect that data, you can then perform analysis, and that analysis, the most important form of the analysis that people are performing today is machine learning, which is mistakenly referred to as artificial intelligence. It is a form of artificial intelligence, but what machine learning has turned out to be very good at is recognizing pictures and images. That's turned out to be its most powerful capability, and so you can find patterns in images that human beings can also find, but it can do it much more consistently and without the vagaries of a human who gets tired and has other issues.

Hugh Bradlow: So, that sequence enables two things. First of all, it turns measurements, measuring of our health, from an episodic event into a continuous, real time event. And secondly, it allows us to automate the detection of anomalies at scale. So, eventually one day you'll have your own 24 by 7 personal physician who of course will be a machine learning algorithm that will hopefully then be able to do preventative medicine as well as reactive medicine.

David Glanz: So, we're literally talking about a situation where there could be medical intervention before you're even aware that you have a medical problem?

Hugh Bradlow: That's potentially possible. I don't know if it is really possible. There's some debate in the medical fraternity as to whether you can actually get that proactive detection, but certainly it should be able to give you very rapid detection. I always make the joke that you'll be sitting at work one day and an ambulance will come and cart you away, and you'll be saying "I feel fine, I feel fine", but it detects that you're about to have heart attack.

Hugh Bradlow: Whether you can do it that proactively or whether you have to... on the moment you have a heart attack, some intervention occurs and they detect that, is still unclear, but with time, I think we'll know.

David Glanz: So, more generally from the consumer's point of view, the human being's point of view, what does this mean? What will these changes, the internet of things, big data, machine learning, what will it mean for you and me as human beings with all our frailties?

Hugh Bradlow: Well the first thing it'll mean is that you get much better information about your health. And these are trained now for consumers to be much more involved in the management of their own health, and that will just escalate with the availability of information. A lot of the medical profession will argue that the consumers won't know how to interpret the data, but as I say, if you apply these machine learning overlays, they may well be able to interpret data much more effectively.

Hugh Bradlow: But I think the big thing it'll mean, and I'll give you a specific example. If you have some sort of heart arrhythmia, what they do today is they send you off to a pathology lab where they fit you with a thing called a halter monitor. It's a 12 lead ECG, it's in a little pack that sits on your belt. You wear it for 24 hours, they collect the data locally, and then go and analyze if offline. It's inconvenient, it's expensive, because you've got to go have two trips to the pathology lab, and they've got to have technicians put it on and take it off. From a consumer point of view, you're not doing your normal daily rhythm. You can't shower with it, you can't swim with it, you can't run with it, all these things. So, the future looks much more like you'll have a little elastoplast sitting on your chest, which is in fact a single lead ECG. That will transmit a continuous heart rate measurement, a single heart wave measurement, a single lead ECG, through the network, into a data center, where it's being analyzed in real time by machine learning algorithms.

Hugh Bradlow: So, it's much more convenient from a consumer perspective, and it's much more informative from a medical perspective.

David Glanz: And for people who are listening to this and think this sounds strange or bizarre or it's pushing the boundaries, I suppose we have to remember that many of us are now wearing Fit Bits or we have health apps on our mobile phone, and we're all... Does that mean a lot of this data is already being collected?

Hugh Bradlow: Well, in fact, if you're wearing a watch like I'm wearing here that does that heart rate measurement, they've shown for example that the Apple watch, they can detect from the heart rate measurements on an Apple watch, they can detect whether you've got atrial fibrillation with 97% accuracy. Now, they don't report the false positives, so that's, you know, the interesting the data they leave out of these reports, but you're already starting to see that. But the single lead ECG, the elastoplast sensor that I mentioned is already available. It's going through FDA approval as we speak.

David Glanz: This obviously has implications for doctors and other medical professionals. Are they still going to be needed? Are we going to reach the point where we interact essentially with AI in the form of a robot? Or will we still value and appreciate the importance of human intervention?

Hugh Bradlow: So, quite a few things in relation to the medical profession. The first is, there's clearly going to be a medical profession, but the skills they will need will be much more about interacting with people, understanding what's really driving their fears, and being able to interpret data and present it to them rather than just being simple measurements and analysis of data. The second thing is, it will hopefully undermine the power that the medical profession has in the health system. So, I always describe health as a provider driven profession. The medical profession controls the profession. So, there are plenty of examples of that. You take the ophthalmologist who got a machine that allowed them to do six cataract operations per hour as opposed to one. They still insisted on being paid the same amount per operation, and the government caved in and agreed to that. You get the fact that doctors are charging up to 10 times the Medicare fee. There's virtually no control over the fees. Some doctors out there are so presumptuous and full of themselves that they think they're 10 times better than the average professional.

Hugh Bradlow: So, this uncontrolled, provider driven world will hopefully be broken in the sense that we will now see ways of bypassing that and creating alternatives. But most importantly, what we hope should happen is that we see a true marketplace emerge, where you can actually get good information about what a doctor is charging and how effective they are. That's going to be the key to the big changes we'll see in medicine. But it doesn't mean to say that doctors will disappear from the system. By the way, there are, and an aside, there are certain areas where people are more forthright in speaking to a machine than they are to a human being. For example, confessing things like how much they're drinking, they're much more likely to be honest with a machine than they are with a person. But on the whole, human doctors will still be required. The question will be do we need as many of them as we do today, because a lot of the work that they're doing will be automated.

David Glanz: Elsewhere you've referred, in relation to doctors, as something called a figure of merit. Do you want to explain that term? Because I think it's new to most of us.

Hugh Bradlow:	Well, it should be, because I invented it on the fly. So, what I mean by this is, go back to my concept of a marketplace. If I buy a widget on eBay, first of all, I can see how reliable the seller is, and secondly, I can look up reviews of how that widget performs, what are its specifications, how reliable it is. I can get data on that. So, I can make an informed decision in that marketplace. If I have to have an operation, and I want to know how much a doctor charges, it's, until recently, been very hard to find that, even now, it's still very hard to find that. There is a site called Health Share, which will tell you the sort of range of charges that individual doctors have, but it's not fully populated.
Hugh Bradlow:	More importantly, how do I know if the guy who's charging 10 times the Medicare rate is really 10 times better than the average doctor? If you try and apply data metrics to doctors, they have a million excuses, many of which are absolutely valid. So, you know, they'll say "Oh, well, you can't judge me on the success rate of the procedure, because patients vary so much. I may have had a group of patients who are all 65 year old obese smokers, and the guy next door had a group of patients who were 25 year old elite athletes. So, clearly the outcomes are going to differ in those circumstances."
Hugh Bradlow:	So, what you're going to need to do is take a much more sophisticated measurement of the overall performance of the doctor. Now, this becomes possible with machine learning, and that's the key, because you can recognize patterns. So, you can take a whole pile of data, you can take data about the actual patients, you can take data about the hospital and the environment in which the doctor is working, and you can take data about the doctor him or herself and you throw those all into a mix, and then try and do pattern recognition on that to come out with a metric which says "Overall, given the range of patients and things, or patients of your age, weight, and size, et cetera, this is the way that doctor will perform, and therefore him charging 10 times" It is always a him, by the way, "Him charging 10 times more than the average person is not worth paying for." And that means that that doctor's charging 10 times will presumably become marginalized in a truly open marketplace.
Hugh Bradlow:	So, the figure of merit is something that's new in the sense that the technology hasn't existed to allow it to take place, and we don't have yet the data assembled. But what I'm encouraging, and people are looking at this, is that we collect that data, and then start developing metrics based on machine learning.
David Glanz:	It's only a few years ago that no one had heard Uber or Airbnb because they didn't exist, but the ubiquity of smartphones and apps and the emergence of big data means these are now Goliath in the global marketplace. Who can we expect to see emerge as Goliath of the healthcare scene?
Hugh Bradlow:	Well, my thesis, and it's a presumption at the moment, is that the big consumer players, like Amazon and Google, are well turned to a consumer audience and will be able to deliver services to them much more effectively than the traditional healthcare providers. So, Amazon are the most interesting. They've

How will Big Data impact healthcare
Transcript by [Rev.com](Rev.com)
Page 4 of 6

done a couple of things recently which ought to shake the medical profession to its very core, because, first of all, they've assembled their own, what the Americans call an HMO, which is basically a combination of insurance and contracted providers. And they've, between them, JP Morgan, and Berkshire Hathaway, they've got a million staff members who they are going to serve with their own HMO. But they've stated the intent that they will encourage their providers, in other words, they have control of these people, because they're paying them, to use digital technology to improve healthcare outcomes.

Hugh Bradlow: And the second thing is, you can bet your bottom dollar they will be looking at those providers from the point of view of their performance and charges, and therefore they will be pursuing that figure of merit that I talk about, and they're very well place to do it. The second thing that Amazon have done is they've just bought a company called PillPack, which is an online pharmacy, because they've seen a real opportunity in the pharmacy market. The Consumer Organization in the United States did a survey of a basket of five prescription medicines, what it costs from different providers, and the price range for the basket of five from $66.00 to $928.00. So, obviously, Amazon see a huge opportunity to exploit that... If you think that's a marketplace failure, then so is the providing of medical services, and of course they will see that opportunity and go into that as well.

David Glanz: All right, so there's big changes coming through the system. Some we know about and some we can speculate about in an informed way. Is there anything we should be worried about? Sometimes people get a little bit nervous about the idea of artificial intelligence, or, as is currently a big debating point in Australia, the question of privacy with online systems. So, do we have anything to worry about? Do we need regulation? Do we need to save ourselves from our own future?

Hugh Bradlow: Look, you always need regulations for things like privacy. So, that's clearly got to be done. Interestingly enough, I was looking at my health record yesterday, and the default is they provide your health record to all the providers, which is clearly a failure of that particular implementation. It should be the other way round. Even if it's a default opt out, it should also be a default it's locked down until you release it. You can't say to control the release of your data, but it's defaulting to release this to any healthcare provider, which is a poor implementation. So, we always have to worry about privacy. We have to be vigilant about it.

Hugh Bradlow: The other thing we have to worry about is these new technologies are going to be enormously hyped, and there will be failures, and we need to be on the lookout for where things are breaking down. So, I mentioned that study that looked at detecting a-fib, atrial fibrillation, with 97% accuracy from your watch. What they don't say is what is the false positive rate. So things like you've got to have much more sophisticated management of these studies, so that... because a false positive will set alarm bells ringing and may induce stress and may cause

other problems, so we need to make sure that the metrics that are applied are carefully worked up, but they're not insuperable. So, you know, yes, privacy's an issue, security's an issue. These are not insuperable problems, they just have to be managed.

David Glanz: All right. Well, perhaps we'll leave it there. Thank you, Hugh. You always bring in enormous insights, and I look forward to perhaps having a conversation with you again on another topic down the track.

Hugh Bradlow: Sure.