David Glanz: Imagine you've been hit by a car. You're bleeding, you've got a punctured lung, and the paramedics get a spray can out to fix you. Spray on surgical glue, it sounds more like something out of the Terminator movies than real life. But that's just what my guest today has been working on. I'm David Glanz, from the Australian Academy of Technology and Engineering and I'm talking to Tony Weiss, who is Professor of Biochemistry and Molecular Biotechnology at the University of Sydney. He's a Fellow of the Academy and to add to a long list of honours, he's just won the Clunies Ross Award for knowledge commercialization.

David Glanz: Welcome Tony.

Anthony Weiss: Thank you, nice to be here.

David Glanz: Surgical glue, where did that idea come from?

Anthony Weiss: Well, remarkably, it originally came from the recognition that we could replicate components inside the human body. We literally could make copies of the natural building blocks that are found in a whole range of different tissues, including in the blood vessels that might get busted up in a car accident, or components of lung that might undergo tear and damage as well, and we figured we could repair those rather rapidly.

David Glanz: How does that work? It sounds fascinating, but what's the actual process? What have you added in that makes this happen?

Anthony Weiss: Well, it's one of these classical stories. A long time for an overnight success story. We effectively have taken this building block, which we call by the long name, Tropoelastin. It just simply is like a Lego piece. It's used to assemble in a series of Lego pieces to build up tissue. We then modified it slightly in collaboration with colleagues, at the time at Harvard University, and now at UCLA. We modified that little piece, and imagine if you will, Lego pieces shrunk down to beyond the visual range. You have a series of these all assembled there and you could literally allow those to magically self assemble at a wound site, you shine a bit of light onto there and the whole thing forms a seal.

Anthony Weiss: That's pretty well what we made. We literally, to scale up the story, we simply transferred our idea into a modified solution. Imagine if you will, you had a spray on container like you said, or a syringe of some sorts without the needle tip, that looks like clear liquid. But in this clear liquid are all those little tiny Lego pieces we just described. Tiny, tiny, each one a bit more than a billionth of a meter in size, and all we need to do is take that clear liquid that sits in that syringe and squirt it onto the affected wound site there, shine light over that location, and in less than 60 seconds, ka-pow, the whole region is sealed over with this elastic seal that promotes [crosstalk 00:02:51]

David Glanz: Just with normal light, or UV, or anything special?

Anthony Weiss: We started using UV light, and we realized the UV light of course is special, so we transitioned across, eventually using now visible light. And extraordinarily, even visible light will do the job now for us too.

David Glanz: That's an amazing story. And this glue, what we're referring to is glue, I think you also refer to it in different places as synthetic skin or an elastic protein.

Anthony Weiss: Yes.

David Glanz: Does it bend the way that human skin bends?

Anthony Weiss: Exactly. It's made of the same building blocks that the human skin would contain in its elastic tissue, and indeed, it works most effectively deep inside the body where there are wet wounds. As you know, you can imagine a super glue could be used to seal up skin, but really, you can't really use a super glue or something similar to seal up wet wounds, and we really tailored this to be able to treat for example, a damaged blood vessel, or I think I gave the example of a damaged lung earlier on as well. So anything like that really is something that can be treated rather dramatically and rapidly, and it provides a very tight seal, looking just like the natural material found in those tissues.

David Glanz: So if I'm the car accident victim and it's my lung that's punctured, I'm struggling to breathe, obviously, if stitches were put in, I would breathe but it would be quite painful I assume.

Anthony Weiss: Yes.

David Glanz: With your invention, would I both be able to breathe, and would it give me some relief from pain as well?

Anthony Weiss: I can't comment on the pain part because it depends upon where and how the actual lesions occurred. Usually when there are wounds, we'll all feel pain to some extent. The idea over here is to do two things. One of these is to be able to speed up the process and the second one of these is to be able to provide something that accelerates the healing process as well. So in terms of speeding up the process of repairing a wound site, we've demonstrated and published on this in a fine journal, Science Translational Medicine, again in collaboration with colleagues internationally.

Anthony Weiss: We can generate a seal on the lung that is superior to that obtained through suturing. So literally stitches are not as good as squirting on our material and shining a light onto there, it does a superior job. But the second of these, I think, is just as important, and that is through other work, we have demonstrated that these materials, and related materials like these, can accelerate the way which wounds heal up, and I think that is wonderful as well.

David Glanz: I think any patient would want for nothing less. Does this apply or does this have an application for burns?

Anthony Weiss: So, the answer is, it does. But because often in burns you tend to see that there is damage to the upper layers of skin, in more minor burns and of course as the burns increase through severity, secondary and even tertiary style burns, those burns get deeper and deeper within tissue. Now, there are two steps involved with trying to treat burns, particularly more substantial ones. One of these is, of course, first of all you'd like to save the life of the patient, you want to make sure that the region that has been damaged substantially is cut away surgically and that hopefully something else can grow in its place rather rapidly. Second of these is that then there are follow up surgeries that are done months later, sometimes even years later, and often these can lead to just incremental benefits and perhaps could even be dozens of operations.

Anthony Weiss: What we've been seeking to do is to treat both of those stages. We're seeking to, indeed, treat the initial type of wound damage so that there is a shortening in the time needed to be able to generate appropriate repair. The second of these, of course is just as important, wouldn't it be great to be able to rather than having dozens of surgeries to just trim down to ideally just to two procedures. The first one to save the life, the second one to give them quality style of repair of skin. And we did just that. Not using the glue material, but using a different type of material.

David Glanz: What was the light globe moment that made you have this insight?

Anthony Weiss: Ah. I love to talk about the light globe moments, the little light bulb above the head. So, really it's the foundational stage with the elastin research I realized that if we simply could make that little Lego piece I described earlier on, if we had some way of being able to take and make the little pieces, maybe make first and then take, the little pieces that are involved in assembling elastic tissue and look identical to that for example found in a newborn babies skin. But we could ethically make replicas, a bit like a copy machine, could make precise copies that means you don't need to go to animals, you don't need to go to humans, you can just literally teach bacteria to make precise copies of the natural protein. It's almost like we could literally begin to assemble fibers and sheets and tubes. So the light bulb moment was me realizing that no one else around the world knows how to do this, and if only we had the building material, we could build a whole range of extraordinary things.

Anthony Weiss: And I just sat up one day and realized that that would be a possibility. About the same time as this little light bulb moment happened, I was approached by a remarkable PhD Doctoral Philosophy student who has just finished off at Oxford University, and wanted to join my lab. I was very fortunate he wanted to join the lab, Stephen Martin, and he and I eventually, in Sydney, stood by a white board, it was a proverbial light bulb moment followed by a white board moment. And I then scribbled things on the white board, showed him what I

would like to be able to do, which is to build the ways of being able to construct these fibers and sheets and tubes and repair a whole range of tissues. To his credit, Steve said yeah, he'd love to do it. And he'd already been funded anyhow so maybe I sort of had him already entrapped so to speak. But to his credit, agreed and we then set about construct in this rather grand project. And it succeeded. And it was literally the equivalent of a biochemist climbing Mt. Everest.

Anthony Weiss: We got to the top, we planted our flag, it happened to be an Aussie flag at the time, I think, with somewhere there's a Union Jack in that as well. And we simply celebrated over time, since, and indeed since that time we have seen from the lab hundreds of publications in this area, recognition internationally, and I should also mention that the patents that serve to drive the commercialization have got to the stage now, I now have 95 awarded patents in 18 patent families, which I think is fairly unheard of within Australia. So I think its been a tremendous journey from that eureka moment where thankfully I didn't quite do the Archimedes thing and leap up the way he did, but certainly enjoyed my discovery just as much and now see it coming full circle and hoping to retreat people and improve the quality of life around us today.

David Glanz: That's tremendous. Now, of course whenever a lay-person like me hears about this, the first question that springs to mind is, how quickly will this be used? If I'm knocked over by a bus on the way home tonight, will I have the benefit of this? And I know the answer is, these things are fairly slow, so I think the next stage is human trials. What's the sort of time scale we're looking at between now and this being actually available for medical practitioners?

Anthony Weiss: So we have a series of material we've been through, directly from the lab, all the way through into a commercial setting because as you know, the only way you can truly provide these to help a lot of people is through the commercial process. They have to be materials that are sitting on hospital shelves or in an ambulance, whatever the case may be. So I'm pleased to say we have taken Aussie technology and progressed it dramatically through this process. The earliest products literally moving through now are expected to be on the shelves in about a year to 18 months from now, and they're designed to treat small wounds and small lesions on skin. After that, there is a slightly slower process involving the larger and larger wounds, because the larger the wound is the longer time it will take to make sure these things come through.

Anthony Weiss: But even with the large wounds themselves, we are still adopting a very aggressive path. We have a path that will give us, we believe, materials that are available to help the broader range of people within the next 3, perhaps the most, 5 years from now.

David Glanz: That's very positive.

Anthony Weiss: Thank you.

David Glanz: Now, you've won the Clunies Ross Award for Knowledge Commercialization, my understanding is you've founded the company, Elastagen.

Anthony Weiss: Yes.

David Glanz: That's now been bought by Allergan, which is one of the 20 largest biopharmaceutical companies in the world. That's a big deal.

Anthony Weiss: Thank you.

David Glanz: How have you found it over the years, how have you found it possible to marry the pure science, which is where you started with all of this, with the commercialization of it. Are there compromises you've had to make or has it been smooth sailing?

Anthony Weiss: It's never smooth sailing to do anything, particularly when there are always nay-sayers around. You just need to keep focused on something you believe is worthwhile, do you know what I mean? So, in terms of responding to the process, it was absolute long term belief in the fact that this was the way to help the broad community. You know, I believe strongly that researchers working as I do at University have a social contract of sorts. You know, we receive grant funding from the Australian tax payers, as well as other locations. It's important to give back to the community as well. It's a fundamentally important thing that we do. So, it's great to receive grants for us to be able to pursue our research and our dreams, but by allowing us to be able to take these discoveries and help save lives, and improve the quality of lives, is deeply satisfying.

Anthony Weiss: And it turns out that within our society, one of the best ways to do that, truly, is to be able to establish and found a company and to be able to allow that technology to be able to progress through into the commercial realms so there can be these items sitting on hospital shelves and so forth. And that is exactly what I did in the case of Elastagen. Elastagen was founded and received its first funding effectively the 12th of August 2008 and we sold it through the hands, of course many great hands were involved in the story, not just simply me as the founder, and sold it in 2018, so it was a 10 year journey with an absolute belief that this was worthwhile doing.

Anthony Weiss: I can also wear that I find it very easy to reconcile the two approaches. I am fortunate to be a recognized academic. I'm thrilled about the Clunies Ross Award. Delighted particularly to be someone who is recognized for this and previous awards at the University of Sydney through the remarkable Charles Perkins Centre, and that's what I love doing. I can't imagine myself doing anything other than just pursuing research for knowledge' sake and also research to help improve the quality of life of those around us. So I see no difficulty reconciling those two events. Interacting with the commercial wall in order to achieve the greater outcome for all concerned, to me is a wonderful

scenario. As long as I can continue to keep my day job, which I'm very lucky to have, which is as a professor at a fine university.

David Glanz: It's obviously going very, very well. So obviously the fundamental research came out of Sydney, came out of your lab. I assume that Allergans' involvement now means that people worldwide will be able to benefit from your research and your insights once it's approved for human use. How much of the, to put it crudely, how much of the commercial benefit will flow back to the University, to research, and indeed, to the Australian tax payer?

Anthony Weiss: Understood. The great news is that the sale of Elastagen to Allergan has provided an incredible boost. Not only for the translation of the technology into what effectively is a massive funding program for something that has run from a little nudge, little ideas, a twinkle in the eye if you like, that I had some time back, and still continue to have these along the way, to something now that involves a company spending many hundreds of millions of dollars. It's the kind of thing that brings incredible satisfaction to me. In terms of the financial flow, this sale of Elastagen has been one of the most successful trade sales in the healthcare space in Australian history. And I think that's a wonderful outcome.

Anthony Weiss: The nice thing there is the majority, vast majority of the money that went into making Elastagen a success has not only come from Australian venture capital, who in turn were backed by the superannuation funds and so forth, was all supported by various groups at state and federal government level that provide a non-dilutry funding. A belief that what we're doing was worthwhile and continues to be. When the trade sale occurred and Allergan paid such a large amount for it, those dollars flowed into this country. And they'll continue to flow into this country. And in turn, behind all of this have been predominantly the superannuation funds, amongst others of course, who've really backed up the venture capitalists here in Australia.

Anthony Weiss: Those dollars have flowed back in primarily the superannuation funds over here. So looking at literally many hundreds of millions of dollars flowing into this country, and what a wonderful columniation that is. Not only do the dollars flow back in to help Australia more broadly, but in addition to that, we see along the way that all these lovely products that can help save lives and improve the quality of life take place as well. To me it's a fantastic columniation.

David Glanz: Well, congratulations Tony.

Anthony Weiss: Thank you.

David Glanz: A fantastic achievement. Congratulations on your award and congratulations on what you're achieving for science, for patients and, indeed, for the Australian community and economy.

Anthony Weiss: Thank you so much, David, I may also briefly add, I want to say thank you so much to the Academy for the generous process of giving me this wonderful award, which I'm absolutely thrilled.