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5 SPEAKERS
Jennifer Khakshouri
Lukas Sommer
Sabine Werner
Edoardo Mazza
Bettina Müller

START OF TRANSCRIPT

[00:00:05]
Thanks for tuning in. This is the ETH podcast. I'm your host, Jennifer Khakshouri. When was the last time you jumped out of your skin or did you save someone's skin lately? I'm sure you've experienced both, total shock or help someone. I use these kinds of sentences without really thinking of the literal meaning of the words. But in this episode, I want to talk about skin, literally.

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What I find fascinating about the skin is that it's kind of this barrier to the outside. It's exposed to extreme harsh conditions. And I find it amazing how skin achieves to be maintained despite this harsh exposure.

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It's the largest organ of the human body.

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What is important is the fact that skin is deformable. So it is something that can adapt to the variation of position, motion of the human body and the movement of the extremities. So it's a type of protection that is adaptable to the needs of the physiology of the organism. My name is Eduardo Mazza. I'm a mechanical engineer.

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The word deformable Eduardo just mentioned is vital for his research. He's working on the biomechanics of soft biological tissues. Therefore, he knows just about everything about the skin's elasticity. Eduardo is one of the directors of skintegrity.ch. CH stands for Switzerland. Skintegrity.ch is a Swiss nationwide interdisciplinary group. Sabine Werner is the co-chair of skintegrity.ch

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Skintegrity.ch s a consortium of basic researchers, engineers and clinical colleagues who have one major goal, to better understand skin diseases and abnormalities in wound healing. This is the ultimate goal to better diagnose and treat these diseases.

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Sabine's a professor for cell biology, and she's been working on tissue repair and cancer for many years. She was one of the founders of skintegrity, and it all began small.

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It started with a lunch between Eduardo Mazza and myself. Where we realized there is so much knowledge in skin and we could do so much together that we initially brought together a group of eight people who came up with additional names of people who are interested in skin research in Zurich. And then we had a workshop which was also encouraged by the Vice President for research, Detlef Günther. And he encouraged professors to come up with bottom-up projects. And we thought, well, perhaps we should do something together on skin. So he actually was very much in favor that we set up a workshop, which actually happened in 2015 with about 24 people. And most of the people actually stayed in this consortium. And then we started with a group restricted to Zurich.

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One of them is Lukas Sommer. Sabine got him aboard. And together with her, Lukas is co-chair of skintegrity.

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I'm a professor at the University of the University of Zurich, at the Institute of Anatomyat a double affiliation with supposed to medical faculty, as well as to science faculty. And I am a basic researcher, and my research interest is really stem cells in development. So how does an embryo form and stem cells then also in regeneration regenerative tissues such as the skin and stem cell properties in tumor regenesis and that Links then really kind of like what you also see in the skin. We have to maintain this tissue. We then also made not so long ago a switch to regenerative medicine, namely understanding similar properties of stem cell activities, not only in melanoma, but also then in wound healing. So regenerative processes,

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Skintegrity.ch is a flagship project of University Medicine Zurich, a partnership of university and ETH with four university hospitals, all located in Zurich.

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We have been interacting before for quite some time, but the really kind of trigger for the entire thing was certainly the university medicine Zurich. So so so-called Hochschulmedizin Zürich which is a great platform, not just promoting so-called flagship projects, but also as a network, provides the knowledge of how to interact and things like that. And then really there was this call for such a flagship project by the University of Medicine Zurich. And we thought, OK, we are a group already kind of loosely connected. Let's apply for that. And we were successful. We were lucky and happy and honored, obviously, and that was then the basis for our consortium as it stands now. So that is really a fascinating what I feel is this kind of paradigm example of what such a network can do and that it is representing, you know, university medicine, which means research, but also education. And at the end, application, patient care, patient treatment, etc. So that you bring the institutions together, the groups together first on a local level, and our ideas, obviously, to now bring it to a more national level.

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One of the main fields of the work of skintegrity.ch is wound healing, for instance, wound healing of children with severe burns.

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One of the major topics is to generate what we call artificial skin, to make skin in a dish. And you can actually use that skin for basic research. That is very important because you can work with material. It very strongly resembles human skin. That also saves a lot of animals. So we don't have to do so many mouse experiments anymore. And on the other hand, we can use that in virtual generated skin for transplantation onto injured areas, for example, it's very important, for example, for burying children. So at the Children's Hospital, they have this big center where they transplant this artificial skin back to the patients after a burn.

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Can you tell us about the breeding of the skin, how that happens? And how that, what that looks like, what thoughts come up when you see skin in a, I mean, I assume it's like a glass or that's a little, you know, a container or something?

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Yeah it grows in a little world, we have these three centimeter worlds and initially seed some cells from the dermis, the lower layer of the skin. And then they grow for a couple of days. And then you put the curtain aside on the top and you only realize that it's actually skin like when you make sections and stain them. Otherwise it looks a little bit like a shiny tissue.

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Is it something weird when you see that for the first time? I mean, for you, it's probably completely normal because it's your everyday work life.

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It's not really weird because it looks a bit like skin. It looks like a little sheet. But we have been used to growing cells in culture for a long time. So it's a natural thing to do.

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I didn't get to see what Sabina calls skin in a dish, but I imagine it like a piece of very thin leather with perfect angles. The breeding of skin is something that needs to happen as quickly as possible to cover up wounds and save lives. Tissue engineering is what Eduardo does in bioreactors in his lab.

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We have a collaboration with colleagues of the University of Zurich and they developed one of the most advanced skin substitutes products. These is for large wounds so for covering large wounds and in particular for pediatric applications. So they are at the Kinderspital. Right. So for cases of burns and where you have these very large wounds, then it is important to be fast in replacing the skin. And there are different techniques for transplants. But one important option is to create these tissue engineered skin substitute that offers the possibility of covering larger areas of the skin. And that's what they have been working on. And that is indeed a very interesting application within skintegrity, because out of our better understanding of the skin mechanics and mechanical biology, then together with the colleagues of the Kinderspital, we developed a new type of bioreactor when we subject the scaffold. So these construct where you have the cells of the patient. And we stimulated them mechanically in a way that we are able to strongly accelerate the maturation of the scaffolds. So this we do also in my laboratory, and that was very effective in the sense that we have identified for a specific step of the production of this skin substitutes. We were able to make it much, much faster. And every day that you can save right in this procedure is very important for the patient. So that's why that was, I would say, a very important step ahead. And now we are looking for more and for a concrete implementation in their production line so that that can be exploited.

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Transplantation is an extremely important field of skintegrity, but

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There are many, many more aspects into it. I think skinintegrity is almost everything you want to know about these different types of skin diseases and wound healing disorders that we are studying. And it's very, very broad. And although this artificial skin and the transplantation is incredibly important there are other projects, for example, imaging molecular analysis of skin cancer function. They're all equally important.

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Sabine, Lukas and Eduardo are all located in Zurich, each one about 20 minutes apart from the other by public transportation. Eduardo and I chatted in his office just near the main building of the ETH with a phenomenal view of the lake of Zurich and the entire city. His lab is in the same building. A few stories down. So tell me what we see here.

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So what do we see here? So, first of all, hi, actually, Bettina.

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Hi. Nice to meet you. Nice to

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Meet you. So, Dr. Müller, Bettina has developed this nimble setup for characterization of mechanical properties of this skin. And maybe you can help us and have it running so we can quickly demonstrate.

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Yeah, it's basically a section cup, that we can place on the skin surface and then it draws the skin inside and it lets it go again. And then we can detect skin stiffness, for example.

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So you immediately notice these are very small. Right. The fact of being very small is a great advantage because it's also light and we can apply it everywhere. In particular, it was also applied to children to monitor the evolution of their scars. How it progress over time. Right. And obviously, children move around and so on. You cannot have them quiet. And the fact that they're so light, this is a great advantage for them. With this nimble, we can identify properties of the skin. Right. Mechanical property. And there are a number of other applications where the evolution of these mechanical parameters might be related to pathologies. Excellent. Thanks a lot. Have a nice day. Bye bye.

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From Bettina Müller, who just earned her Ph.D. and is continuing her research as a postdoc and the small particle she collects, I tried to get a larger picture and put pieces of the skintegrity puzzle together. How do different teams collaborate? Does Eduardo's team collect skin particles for Lukas Sommer?

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Let's say it can go in both directions. So we, for instance, had the collaborations where we just, you know, like as basic science is, we try to discover new potential mechanisms. And so we come up with certain basic mechanisms that is a part involved in wound healing. And then we start to interact. Well, how does that affect the mechanics? And by knowing what he has, what the technologies is, we suddenly realize, well, maybe we should look more at changes in the extracellular matrix of the skin, because that might be important actually for the process we have investigated before. More on the molecular and cellular bases. And that's kind of a mutual interactions which are really fruitful and are promoting this initiative.

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Is that correct? If I put up the thesis, that skintegrity changed the way you research?

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Absolutely. I would actually say that as an example, we have been collaborating before. Specifically, let's say with dermatology etc. But now it's like a consortium to see all the people that bring in complete different expertises. And so we start to ask the question, so if you have like as a basic scientist interacting with a dermatologist, we have an idea of how potentially we could treat, let's say, in an animal model for certain disease or a wound, etc. there are certainly people in the in the consortium which have this knowledge of like how to establish actual functional treatments, applied technologies and things like that, which before we would not have really thought of or the skin substitute. So we established a model system using the skin substitute, not just like to heal patients, you know, like kids with burns, but to use this as a model system for, for instance, melanoma development, you know, like so it's kind of an in vivo, x vivo model system that we can use to study our processes. So you can go in both ways from bench to bedside, but also from the bedside back to the bench. And that, I think, is the fascinating part about this consortium.

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Eduardo, Sabine and Lukas, three professors from two universities in Zurich, all of them are part of over 40 research groups with five directors from across Switzerland. Physicians, biologists, material scientists and engineers collaborate to improve the diagnosis and therapy of skin diseases and wounds. How does Sabine, as the co-chair, keep an overview? On a practical level

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There are a couple of subprojects projects that are funded by either by ETH, because we have this open ETH project. But also university contributes, so there are a couple of projects that we define that include at least three to four people from different research. So within the different subgroups, they perform at different projects. Then, of course, we would like to reach out to the other groups as well, because we always are interested in starting new projects, and this is done by regular meetings. So we had two official meetings this year where people introduced their work, students and postdocs gave presentations, and also the PIs that talk about project that are still at an early stage so that we can help each other and do something together to bring this into another leak.

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Sabine, whose office is on the ETH Hönggerberg campus, is an energetic and enthusiastic person. My impression is nothing can ever stop her from getting things done. Also, Eduardo and Lukas are curious and passionate. The skintegrity.ch family is huge and every family, smaller or larger, also has conflicts, potentially, at least.

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Of course, there are discussions. You know, we are also in a highly competitive field. Right. So I tell you about the enthusiasm that we have for our research. But it's not simply happy science and happy engineering. Right. We have to push because we have to show we are at the forefront and VPIs, but also our co-workers they need to show the high profile and performers that will ensure them right to be successful in their next step. So there is pressure. Right. So who will be now the lead author in that paper? Am I contributing to something that will help me and who will present that at this or that conference. There are these components. And, of course, we need to watch it and try to every time to address it so that everyone feels that we are dealing in a fair matter. Right. So this is the present. And why does that not escalate to major conflicts? I have the impression we have a very sound climate where no one is forced to do anything. So what we offer in skintegrity are opportunities. But obviously, it is possible to go back in your own lab and do your research and continue like this, I mean, at least this is certainly true in my laboratory, and I see that is true for my colleagues in the close environment within skintegrity where I interact. We are like coaching these people and we offer them these opportunities. And of course, there is some pressure that comes from the fact that we are all engaged. But but I think at the end of the day, what avoids the big problems is the fact that every day the fact of participating in this collaboration is a choice by the people involved. Right. I would say.

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Collaborating and communicating curiosity, motivation, passion in a literal sense integrity is vital to become part of skintegrity.

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We need to have certain competitivity but we also need to work together in different disciplines in order to achieve bigger goals. And for that, I think skintegrity.ch could be really a model for complete different disciplines, for different research directions. And I really hope that this will become true.

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But came out in the past with the years of this consortium, I would have never thought that this would be possible. There are so many original projects that came out, and the publication has a very good reputation already internationally. What is really essential that we keep getting the funding to continue this research. And unfortunately, this gets more and more expensive, because the more it goes to the clinic, the more funds are actually required.

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One of the most precious results of the consortium she sees in the experience that young researchers can make.

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It's an incredible chance to get an interdisciplinary education at the border between disciplines. And I think this will be absolutely essential for the next generation of scientists, clinicians and engineers. And we are particular proud of the young investigator program of skintegrity.ch where the students and postdocs get together and start new projects and talk to each other. And this is a remarkable chance for these young people to get a better education at the borders between disciplines, not only in skin, it's in generally, you suddenly work on projects that otherwise you would have never thought you could actually do this. And you get information that you could not get just with your own research and your own technologies. It really brings us into another league if we have this interdisciplinary approaches.

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Eduardo Mazza, Sabine Werner and Lukas Sommer, three of five directors of skintegrity.ch from the ETH Zurich and the University of Zurich. By the way, at the Scientifica on September 4th and 5th, you can have a look at the suction device nimble and also look at part of the bioreactor. Eduardo, Sabine and Lukas will be there as well. For detailed information, visit the skintegrity.ch website. I produced this episode of the ETH podcast together with This Wachter's audio story lab and sound designer Luki Fretz.

END OF TRANSCRIPT