

John Rogers Interview & Summary

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John Rogers

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Founder of Sibel, wireless wearable vitals monitoring system for neonates biomedical startup

Summary

John Rogers talks about the origins of his startup company, Sibel, a wireless wearable vitals monitoring system for neonates. He elaborates on the intricacies of the problem this device addresses and provides insight from his experience launching a biomedical startup company. He speaks about the biggest technical challenges his team faced while developing this wearable device and how it takes a tremendous effort to coordinate the right people in order to test, validate, and introduce a medical device into a hospital setting. Lastly, he touches on how his research techniques have evolved over time. He emphasizes the value of being able to rapidly prototype devices from end-to-end so that each iteration of the device can be tested properly. He explains how this capability helps his group investigate the appropriate issues to improve the device and how this prototype-and-test-focused process is highly beneficial to the learning experience of students in his research group.

Interview Q&A

Q: What inspired the creation of the product?

A: We, as material scientists and biomedical engineers, have been interested in soft electronics, as interfaces to the human body and the skin has been a point of interest in that broader context, because it provides a non-invasive way to interface electronics to the body and the skin can be used as a window for measuring underlying physiological characteristics of health. We had been working in that space for awhile. I happened to be invited to give a keynote presentation at the Society for Investigative Dermatology and I floated an idea of maybe using our devices to monitor vital signs in neonates, so premature babies more specifically in neonatal intensive care unit facilities, because I thought that the wireless operation of these platforms and they're sort of soft, gentle mechanical interfaces to the skin would be particularly valuable for that patient population, not knowing much more beyond that, but just appreciating that as maybe an area of opportunity and Amy Poehler was in the audience, she's head of the dermatology department here at Northwestern but she got her career start in neonatal dermatology. She actually worked for a time as a physician in a NICU unit here and so she thought that was a great idea and approached me about possibly collaborating on those technologies for that class of patient. We got deeply engaged with her and her team and the head of neonatology got involved, and you know long story short, you know four years later, we were able to put it all together and make it work and published a paper in the spring of 2019 in Science and it, you know captured the attention of the popular press and also Bill Gates, and so I had a chance to meet Bill Gates and he's interested in health related topics in the developing world and saw this platform as an opportunity to improve maternal and neonatal care in in Africa and India and Pakistan and so he put forward, you know, a large funding mechanism to take that technology, ruggedize it, optimize it for us and in remote settings. He was interested in facilitating pilot scale deployments in Africa, and we couldn't really do that through my academic group very effectively.

Grad students can't build thousands of devices and so that was the catalyzing event for founding Sibel health. Sibel was originally set up to execute on that Gates Foundation Program and to take the technology out of an academic lab setting and a specialized hospital here in Chicago and move it out into the real world at scale. We published a paper on that ruggedized version in Nature Medicine last year in March, and you know we've deployed many thousands of devices in Zambia, Kenya, Ghana, and we'll be in India and Pakistan later this year. It's been great. That was the origin for starting the company. It wasn't built around you know kind of a market assessment and a pitch deck and an exit strategy, and you know that type of thing - it's not a California style startup. Rather one that's really focused on engineering excellence, device development, and deployment. ...

Q: When you created this device, were there other devices like it out there?

A: Not really. You know, if you look at what's done in the NICU today, even Level 4 facilities like we have here in Chicago, it's basically unchanged for the last 30-40 years. There are a number of reasons for that you know getting new technology into that part of a hospital complex, there's probably nothing more challenging than that because you think of a premature baby as a pretty fragile patient, by any metric, and probably one of the most precious assets that you would encounter in a children's hospital or hospital in general, I mean there's just tremendous scrutiny and attention to what's going on in terms of the care of these patients, who are extremely vulnerable, there's probably no more vulnerable patient that you could envision, and so it's not exactly the type of operation and part of the hospital where you just try stuff out, you know come in with a new technology let's see how it works. It's just not the way you know, obviously, I think there's a tremendous hurdle for the development of new technology and getting it in there and validated and customized. You have to have all the right pieces as engineers, as dermatologists, as pediatricians, as neonatologists, the nurses have to be fully on board, and you know it's just tough to do that. Then you add on top of that what I mentioned before, is that if you look at it purely from a market and business opportunity lens, you'd never do it because it's impossibly difficult. The patients are fragile, the skin is underdeveloped it's super easy to damage the skin applying things and removing things. The market is not that big like who would invest in it, the answer is no one and so nothing had really happened. There was really no alternative, but it felt like a problem that was worth working on and a set of patients who could benefit from something that's newer and better and eliminates the wires and the risk for skin injury and in a mode that allows parents to engage with their child physically. That's basically why there's really no free market incentive out there, and so I think that the capital really wasn't available if somebody wanted to do it, but we're set up in a different way. We benefited from a lot of philanthropy initially from trustees here at Northwestern. They put together an endowment for work in this space and that's been very helpful, and then once you get it to a level that begins to look real and captures a broader awareness out there, then Bill Gates and others like like him right can step in and help push it to the next level and that's the way it's played out.

Q: What were the major technical challenges you faced?

A: I would say, for this patient population it's like the skin interface itself. The skin is really fragile, it's underdeveloped, you need some kind of mechanical and electrical coupling let's say for the chest unit to capture ECG, but you know it has to be very light adhesive, otherwise on peel back you can tear the skin and that turns out to be a big problem with the standard wired based devices. I think the fact that we can make these electronics very thin and soft reduces a lot of the interface stresses that would ordinarily tend to lead to the elimination of the devices, we also don't have a wire that's constantly tugging at that skin sensor interface. It turned out we were able to get away with adhesive with a much lower bonding strength than what's used conventionally but at the same time, you really have to work through all those different options in adhesives and because of the sort of the regulatory requirements and the risks, you

know we were really focused on commercially available adhesives already FDA approved, because if we come in with a brand new material and it's contacting the surface of the skin they'd never let us in the NICU with that, so we ended up having to go through a long list of different adhesive options, because nothing was pre developed for this particular type of platform. Getting the devices in and locating the adhesive was a big engineering challenge but we're pretty good at that type of thing and if we're working on a bench top we know how to do the engineering. There are a lot of challenges there, but I would say, at least from my perspective, a little bit more straightforward than like some of the skin related issues, because you can't simulate that in a lab. Skin is all the different for all the different babies and different gestational ages. There's just a lot of variability it's harder to develop crisp design goals in terms of engineering metrics, so it really requires the intimate involvement of NICU nurses, neonatologists, people with good like hands on level experience, because it's not something that's well quantified, but people kind of understand what's too strong and what's not strong enough and that type of thing, so it was kind of at that boundary of engineering and medicine, where things get a little bit fuzzy and it's a little bit more hard to quantify the metrics and the requirements.

Q: How do you feel your research techniques have evolved over the time you have been a researcher?

A: They evolve all the time. I guess the most recent phase of our work started maybe five, six years ago and really sort of motivated my move from University of Illinois Urbana-Champaign up here to Northwestern and that has been kind of a reorientation of our work beyond just basic material science. Material sciences is my home department and I've dived into translational biomedical engineering. Going to Chicago has allowed us to get very deeply embedded across the medical community here. We have expanded our range of activities from material science up to devices and prototyping and system level embodiments and data analytics and user interface - everything that you need to go all the way into a patient type of situation - and we weren't doing anything like that you know four or five years ago. But now, for instance, we have clean rooms, we do all like all the stuff we used to do, but we also have low volume manufacturing tools in our lab and we have pick and place machines, we have screen printers, we have reflow furnaces, we have presses, molding equipment, and everything you kind of need if you want to do high impact stuff. You can't show up you know to a NICU with a (unmanufactured) device. They want like the whole thing right, so they can really use it and understand it and I think, having that kind of end to end capability has been very powerful for us because I think once you're in the field with interacting with patients and users, it really illuminates the most important basic science that you should be doing for that kind of impact and without that insight, it's hard to pick and choose the right material science problems to work on. I think it creates a really positive feedback loop because advances in the materials then get mapped on the devices and then we learn something new, about how they're interfacing with a patient and we come back. That also is great for the students because they get exposure to the entire range of stuff. It's not just traditional academic research. You also see how research advances can flow into prototypes that go on the patients and I think a lot of the students in the group are very excited about that, and probably the reason why they joined the group in the first place is they like that kind of work. I think it's very highly motivating, even for the students in the group who are kind of tilted a little bit more toward the basic academic side. They have visibility on how all this stuff is moving forward, ultimately into companies, where there's you know less direct engagement. We do prototyping as part of the academic side of the side of what we're doing.