Emerging Technology: At-Home Blood Testing Transcript

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Introduction to at-home blood testing

– Welcome back to this episode of the reverse inflammagng summit body and mind medicine and I'm your host Dr. Robert Lufkin. Today we get to look at a very important area in longevity and that is through at home blood testing.

And we're fortunate to have one of the leaders of a new cutting edge company in this space. Michael Dubrovsky before we dive into the area. There's so much information to talk about here but maybe you could just tell us a little bit more about your background and how you came to be so interested in this area. – So my backgrounds originally in biochemistry I've done a couple of startups and more recently I was working actually in photonics and materials at uh at M. I. T. And about five years ago I found this field of silicon photonics which a lot of people don't know about.

So basically there are the electronic chips that are in everything so in your car, in your phone etcetera and your T. V. Obviously uh and those are very well known but there's a sub field of semiconductor where you actually manipulate light In Silicon structures.

And over the last 20 years it has become mature. So like 20 years ago there were no products and now the entire Internet is running on these chips. So our conversation goes through data centers and fiber optics.

So every fiber connection requires light instead of electrons.

From silicon photonics to lab-on-a-chip diagnostics

So there are many many silicon chips between us right now that are converting photons into electrons and back in order to make it possible to communicate with your electronic computer using light in between the computers. So that that whole industry that's like, you know, very quick explanation. But basically that whole industry has grown up over the last 20 years in the past it was very large boxes at the end of the fibers with discrete components like lasers and lenses and so on.

And all of that has become uh, you know, chip based and uh that enabled other industries to start miniaturizing. So basically uh my co founder and I like three years ago, so he's from the telecom space. So he basically built one of the most successful chips for internet communications, like 50% of internet traffic goes through the ship today. Him and I were kind of looking at what other industries require, like next generation versions of this technology where you take some large optical system made of different discrete components and combine it.

Um and I obviously had a big interest in biochemistry because of my background and we found that the lab lab equipment generally is actually optical. So if you get your blood drawn in a tube and it's sent to a lab is their use optics and it's typically very complicated large optics instrument.

But then at home testing like a paper strip test or miniaturized and make them low cost. So typically in that test like a Covid test or a glucose test, use a totally different technology which can't really be like improved to the point where it actually gives you the same performance as a lab test and we realized that we had the opportunity to take a full true piece of lab equipment and make it so small and low cost that it can become a consumer product.

That's, that's how we got started with. – Well, I have to ask one question that's probably on a lot of people's minds right now is um, just because of the current events and the current events cycle.

Um, why didn't Elizabeth Holmes and Theranos use this technology and they could have saved all the jail time and people's money. What what, what is different about this than their approach and why didn't they use it?

– So that's that's a good question. Also frequently asked questions. So basically, um, there actually was a company

founded right around the time that they're also founded that uses some of this technology, but at the time and this is like 2008, uh, it wasn't very mature.

So they, they succeeded in building something, but it's still a lab instrument. It just has uses less blood volume and gives you more markers, but it's $150,000 tool that takes inside it.

So this, this is one of our cartridge. This is the disposable chip here which has 15 immuno s a real time, you know, s a sensors on it. Um, basically there's already an existing tool that the company was founded actually right around the time Theranos was founded. So their, you know, their whole existence been in parallel which use this technology to make a high plex low blood volume instrument for central labs.

But at the time it wasn't possible to miniaturize everything that goes into the reed to the readout. So the sensor is miniaturized. But then it that device is like $150,000 large box that reads out this type of sensor.

We were able to miniaturize everything that goes into that onto this board. So this is a board with four optical chips and it goes into a device right now it's this size.

By the time we launch in Q three of next year we launched studies, it's going to be even smaller. It's 80% of the space. So we have to optimize like the case, But the this is the disposable cartridge and this is the reusable reader and so they click together. Uh and what's enabled?

This is basically that over the last 10 years because of the boom in optical chips and telecom, they've become much more components are in chips like lasers and like it's a long story, but essentially there's been a really big slope of progress in this field.

And so that's enabled miniaturizing not just the sensors but also the readout.

Why Theranos failed and what is different now

I think one important one interesting like analysis. I mean there's many great things you can read about Theranos, but one interesting analysis about this is just that in difficult fields, like deep tech field. So lithium ion batteries, uh, you know, lidar um ai self driving cars, you know, blood testing, whatever, something where there's actually a problem.

It's not just a problem to find a market, but it's actually a problem to solve the technical challenge in all of those fields. There's something like a Theranos every decade and some some size. Right?

So, I mean, the biggest problem, you know, the reason Theranos is very famous is that they actually hurt people. So they if they never delivered any results, it might have might have actually gone over better.

But basically there's a niche that's easy to fill, which is okay. There's a desire, like we want to do a full blood panel out of one drop, like everybody wants to right uh and technical people in the industry never promised to do this because you have to do blood counts, blood chemistry and immuno essays to do a blood panel.

So for example, we just focus on immuno essays. How are you going to do that? Right. There's no obvious what it means. You have to put it into three different machines because the machines are very different. So you have to split this single drop of blood.

It's like a it's not an obviously possible proposition. It probably is possible, but it's the niches just promise whatever people want and then you can raise money for at least five years before people realize that you have nothing.

So that that is a general niche across many of these industries. So it's happened in lidar, it's happened in self driving cars. Like it happens in every one of These difficult problems.

But I think it shouldn't uh, you know, there are real good working mid ours that have come out over the last 10

years in parallel to the ones that raised money and never delivered anything. So I think it's important just not to be held back by the fact that this just fundamentally happens in any difficult problem.

Um, and in the end, you know, just like there are probably many airplane companies that never flew anything right? Uh, it doesn't really matter 50 years later.

Right? Like what matters is the companies that actually deliver something. – So the technology that's, that's possible right now that you're, you're optimizing is the immunoassay technology.

So, um, what, what does that exclude? You obviously mentioned red, you know, cbC, which complete blood count where you'd have to count the number of red blood cells and stuff that would, that's not an immunoassay.

What other things that that we go to a doctor for for blood work would not be amenable to this immunoassay approach. – So we don't do anything. Like for example, if you've heard you've definitely heard of Grail, like the liquid biopsies.

So those are all RNA DNA based. So we don't do anything like that. We stay away mostly from like ions. Although it's probably possible on our platform but there are easier ways to do like chloride or uh you know magnesium and things like that. So we don't really do that.

Um And yeah it's possible to do things like ketones or glucose but they're already existing very soon. Simple devices for that. So we also don't focus on those. We generally focus on things that are high value change very often and are very difficult to measure at home.

So testosterone hs cRP insulin like things, you know fertility hormones, things that people would really like to have a quantitative measurement of but can't today with a simple, you know simple at home device – and to be clear this this technology and it is amazing technology um is a one shot measurement, right?

Your it's not currently um you know there are only a few things we can do continuous monitoring of, you know like glucose and now ketones are in the pipeline and other things but that's not in the in the near future for this this approach.

Just because the methodology is that right? – So the core technology is actually because it's real time sensing it's actually able to do a wearable, like a wearable form factor as possible. But and it's in our roadmap but it's like five years away. So because there's no you know there's no glue commenter for inflammation. There's no glue commoner for hormones.

So so it's already didn't make a lot of sense for us to go straight to wearable because just like glucose, you know, used to have to go to the to get a blood draw to get a glucose measurement. Then it became a glue commenter.

So it doesn't really make sense to try to jump straight to a wearable because wearables just take much longer to develop because of the implant. Like the subcutaneous implant is very complex but it's not it's not impossible but it's not the first step on the road map. – Yeah. Yeah. Well let's let's back up a little bit and this this conference is about uh about longevity and certainly this technology is gonna is really important for longevity. But before we, before we look more at the technology again, maybe you could just tell us your kind of your personal view of longevity and aging.

What the platform can and cannot measure

Uh what's the model that you are the lens you look at it through in other words, why? Because everybody has sort of a different view. It's interesting. So in your in your view why do people age, what is longevity about? – This is a great question.

Glad you know, I never thought I'd be asked this question. But basically in 20, late 2020 when it became clear that we were going to succeed in building this. I started thinking about like what are the use cases the most, what is the

most general use case?

And the general use cases lifespan, right? So increasing like getting more data to actually increase lifespan and so I read all the popular longevity books and all the classic papers. So I wrote this post, there's an internal message board at y Combinator called book Face. So I posted there saying what are all the longevity things people recommend reading. So I read all of them over Christmas and basically the only thing I learned was that you should do intermittent fasting like that space from all everything I read, I literally could not extract like anything that I was 100% sure about except for intermittent fasting. So I started doing intermittent fasting which was which has been great.

But that's what I learned I think for me coming in from the outside. So I never thought about this at all before building a blood test. Uh it's it feels like there's a paucity of data and I know this is like this is also me talking my book of course, but it's uh it does feel like it's very hard to collect data and there's many, many unofficial clinical trials ongoing. So people are trying many things and and it's whether or not they're working I think will be, I mean the more people do things and the more even like reddit slash bio hackers I think is an incredible resource because there's a lot of self reported, like very interesting information there.

But if there was more hard data, I think it would be easier to evaluate what's working and what isn't and from the perspective of like longevity interventions.

I think from a theory of aging I have one thought that I'll share um that I don't think I have a good answer to, but if it's possible to have like a 40 to 40 year old people, this this might not be maybe in the longevity space.

This is this is like an obvious thing. But for me it's kind of interesting if 2 40 year old people can have a zero year old child, right? So they can produce somebody that will live a full life.

That means the information is still there in the 40 year olds, right? So at 40 people still contain all the information necessary to make like a zero year old person.

So I think that's pretty encouraging. That's you know, like at a high level. But you know, how do you translate that into adding 10 or 50 years to lifespan. I don't know.

– But it certainly speaks to the fact that there is no inevitable wear and tear that wears down cells uh that can't be reversed or fixed. Otherwise our germ cell line wouldn't be immortal.

Like it is, which is which is sort of what you're saying. So which which of the uh the blood markers do you think or how our blood markers going to help people uh with longevity? Certainly an intermittent fasting.

We can see responses, favorable responses with bio biochemical profiles. What other ones, what do you how do you see that? – One of the first ones that I got interested in was HS CRP.

So looking at inflammation.

Cortisol, inflammation, and longevity markers

Um I mean people like to look at, I mean the more markets you can get the better. But one interesting thing about HS CRP is that it's triggered by cytokines. So if you're tracking HS CRP you're actually implicitly tracking several cytokines as well so I can go into what it is briefly.

So your liver makes Crp HS Crp and Crp are the same thing. It's just a part of the range that you're looking at. And normally it's supposed to be very low and in response to bacterial infections and certain other events it's supposed to spike. But the average American crp is like 22 mics per deciliter or two mics per liter. And uh if you look at it, there's there are clear correlations, almost 20 of, you know, all cause mortality and crp so ideally you want it at zero and the average american is at two.

But because the average american is that to the reference range goes from 1 to 3. Uh So essentially like if you get a recommendation from a normal medical source it'll actually say as long as you're below three.

That's fine. But all the data suggests you should be below one. Um So that that I thought that was pretty eye opening. Um And then the same turns out to be true about many markers essentially that the reference ranges that are given if you just google it the web and the reference range is based on the statistics rather than on what's known to be actually good for you.

Um So I think that's one of the fundamental things. That's interesting about starting to look at this yourself. – Such a good point that the normal range is not necessarily where you wanna be. You want to be in the optimal range because the normal normal American let's say is overweight, prediabetic metabolically abnormal. So you have to be careful about the normal range and it's such a good point. And and uh finding with the optimal ranges for good health is can be a challenge because many of our doctors just check oh you're in the normal range, you know, for for diabetes, you're not prediabetic until your glucose raises a certain point. But anyway, what one test I noticed you measured is cortisol on this on your panel, which is great because cortisol is not something that's frequently measured by most my most primary care doctors yet cortisol is the stress hormone that that correlates with mental stress.

And um one of our, one of our guests just commented that 30% of DNA methylation is driven by cortisol or has ties to cortisol. So stress is a significant factor for DNA methylation as as measured in methylation, aging clocks, you know the horvath clock and biological clocks and and all.

And um is that why you picked cortisol? You've already cRP is inflammation. That's important and cortisol drives inflammation. What was your thinking behind?

Including cortisol in this? – So the reason we include cortisol in the at home test kit is I mean there are so there are a couple of reasons to measure cortisol, but one of the major reasons that we also track sleep and activity and heart rate. So we we connect to all the pretty much any common wearable device and we put it all in the dashboard so you can see your blood data next year. What we do is we add average your sleep for the month or the week before your test. So you can see how your sleep is affecting your test or how it's affected by your blood data. And cortisol has a curve that it's supposed to follow during the day. I mean I'm telling you things you already know, but basically there's a circadian rhythm to the cortisol level.

And so if your cortisol is low in the morning, you're going to feel very tired when you wake up. If it's high at night, you won't be able to fall asleep and this is just a very common problem and it's pretty easy to fix.

So we try to kind of like uncover these things for our users so that they can these are things that you can fix easily without medication often. So it's something that's high value because if you can find, oh you have low cortisol in the morning, that's actually very valuable information for the user.

That's mainly how how we look at it. – Yeah, it's it's great things and and just speaking of biological clocks and longevity measurements, morgen Levine who's also involved with this program as a researcher from Yale now Altos labs and she working with Steve Horvath I think came up or she herself came up with Fino age which is a biological clock as as you know with lab markers. And I wonder does does the sea fox health home health tests, Does that include everything you need for the final age?

I didn't go through that and check but – so when we were actually developing the panel, we considered going just pure fino age. So why don't we just use that?

But unfortunately for, you know, age, because it's from normal lab tests it takes um it doesn't have a lot of like the interesting proteins and hormones because people don't often get those measured and instead they use things like accounts.

So we don't we can't do that from home. So we can't do the final age easily. But what we are doing is we're going to try to basically work with somebody like morgan Levine to take our panel and correlate it back to an aging clock

because obviously we're very interested in that and and also break it down more systemically.

So how's your metabolic system, How are you in terms of inflammation relative to like your age and and things like so we're going to attempt some interesting aging scores.

But that that's in the works for like over the next 3 to 6 months, – you know, is there this this at home blood testing with a finger stick? A couple drops of blood is so appealing. There's so many arguments just from the cost the convenience everything.

Is this the future of at least the the blood tests that are amenable to immunological testing like this um is what's gonna happen to quest and lab course sort of the old, the old old school lab testing companies, will they all adopt this technology as well or is there a downside to it? – That's a good question.

I mean, I think once you're drawing a tube of blood already, for any reason you might as well, basically there's no at that point you have an infinite quantity almost and you can run it on five different instruments if you want.

You can get very esoteric things.

Biological age, reference ranges, and future aging scores

So there are reasons to, once you've actually done it, you know, you've punctured the vein. There are reasons to take a couple of tubes and kind of send them to the gold standard labs, I do think the central lab will become more for broader, so like long term future.

Right? You should probably be getting, you know, there are 3000 proteins in the blood. Uh you know, probably another 10,000 other markers or maybe 20,000.

So you should probably just be getting all of the measured right. If you're going to draw a whole a whole tube of blood, you should get something in return, right rather than like 5 markers or something. So, so I think in the long run you'll get these two axes right. Like some something, some things will go wide, like very broad, but you only get the test once a year and then other things will go deep.

So you're going to get this test every week or every month and it's going to be much more convenient, much cheaper. That's what we're working on, right. But I think doing very broad test is really interesting. There is a company that came out of Stanford called Iolo that just went through y Combinator. So they're doing meta below mix.

So again it's there's enormously rich data just in like 20 biomarkers that are standard and have been measured for decades, right? But in parallel companies are starting to get very broad. I mean that's what the aging clocks are.

That's what of course like D. N. A. Tests aren't so I'm just taking a very broad snapshot once in a while. Um and trying to, trying to correlate that to things that are happening, you know in a shorter time scale.

So I think that's where the evolution should go by basically the lab corpse of the world should be doing much broader tests, the same amount of blood and then the simple tests just need to go straight to the home or to the doctor's office and the technology is there to support that right? It's just a matter of the market evolving in that direction in parallel to people developing offerings.

– So if you if you require a blood test that that can't be done with this way and you got to put a needle in a vein then you might as well just do everything.

But if you don't then you really ought to do it with a finger stick and do it from the convenience of your home if you can. Um you mentioned uh yeah I was I was interested in that that y Combinator company Iolo is. I'm not sure how you pronounce it.

– I've only I think Iolo – Iolo Yeah. Yeah it looks fascinating and and they have what is it? 500 or so pro it's a metabolism – So it's small molecules what they do is they get a blood spot and they put it through a mass spec and they look at it, I think it's not fully quantitative, it's maybe relative values like you have 10 times more of this. I mean no acid than that one.

So it's really like a big data approach in some in some sense like you're paying them to be part of a study In a way because they're also, I think, I mean they have a lot of papers and everything, but it's not like with the gold standard markers we have, you know, 70 years of data on. But these are emerging right?

But I think it's really promising in the ends your yearly blood test will probably should contain something like this. So metabolite loan proteome, the whole like just thousands and thousands of markers should be in the yearly blood test.

– Yeah. I mean it's, it's such an exciting time. I looked at the, the Iolo output on the all the markers I'm going. Well, I haven't heard of most of these and it's probably because, you know, we've never been able to test them conveniently like this.

So it's a, it opens up a whole new field. Well, what about, what about your space? Are there, are there other companies, how is your company different from this? Is it um, are you guys locked in with intellectual property or is it is this just kind of the way of the future that everyone's going to be doing? What?

How do you see this in five years? Where um, where will sign Fox be and where the, where the competitors? What, how does that spin out? – I think the unique thing about what we're doing is that we are doing an at home test that doesn't use a paper strip or an electrochemical sensor.

The future of home testing versus central labs

That's probably the most unique thing because there is a sea of competitors do one of those two. There are some that try to do like something with micro fluid IX slightly different than that. But in general doing semiconductor, photonic semiconductors were pretty much the only company going after at home that that's, you know, really credible. Um I think uh the best example of a real competitor or like at least like, I don't know because the spaces were more, I wouldn't even call them a competitor, like we're friends with the founder, but it's called bloom diagnostics. It's in europe.

So they have a paper strip that plugs into a read and I think they offer one plex test, so it's like Fahrudin Crp and a couple of other ones. And so they're kind of stretching how far you can go with the paper strip test by trying to make it quantitative rather than a one or zero measurement.

Um So that but that's an example of a company. They're already on the market. They have something like an Apple store type of store that they actually have like a physical one where you can go in and try getting a blood test and so on.

And I think they're doing, they're doing quite well in Europe, so that's really encouraging. Yeah, but I think in general it's it's very hard to put together a product like this that's actually commercial ready.

So because it takes so many, you have to combine so many different skill sets. That's why we're pretty open about what we're doing. We have like video lab tour videos of our whole production facility and everything because it's just very hard to to replicate. Um but I think of course in the long run a lot of companies will be doing something similar. – and this and this is such a large space.

There's so many people that need this right now that, you know, not even beginning to scratch the surface, but looking forward, you mentioned you're going to have the home device reader.

And then people will pay for the reader or rent it or lease it from you or something. Uh and then do you see the price coming down? Obviously everything scales with volume and it's just a matter of that. But you see, do you see

big price drops in this or where, where would you like to get the pricing at in the future or is it about where it's going to be now, do you think? – Yeah, that's a great question.

So our one of our major goals is to just increase the volume of testing and the ease and obviously cost is a really big factor in that. Um, so we don't, you know, typical medical device approaches to get insurance reimbursement and have the cost as high as possible. Right?

So we're taking the opposite approach and saying, how do we get the cost down? And that's what chips really do. So if you look at literally any technology that's chip enabled, it gets cheaper and smaller every year or every several years.

So we're kind of just following the same logic. So right now what we offer, I don't think I went through this yet. So we have this kit, which is you've tried. So this is a standard mail and kit where you actually collect your blood onto what's called a serum separator card.

So the blood goes on these windows, it goes across the strip and serum is separated from blood cells. Then this is put dry into a mailer like a USPS mail or it goes on your mailbox. And the beauty of this is that it can last two weeks. So that enables like a very low cost logistics where if it gets stuck for several days in the mail, it doesn't get ruined.

You don't have to take the test again. So this technology has really become more ubiquitous in the last five years. There are a couple of companies using it.

The difference between us and other companies that we just packed as many markers as we could into that one blood collection. So we have the most markers on the market from that one card and we offer it at the lowest price and that's just because our whole philosophy is, let's just get the price as low as possible.

So the next step for us is to take this mail in test and move it to where you're taking this test once a quarter rather than once a month. And then you have the reader in your home and you're doing tests every two weeks or every week with the reader for the markers that you care about.

So you do the broad 17 biomarker test, you find out that you have low testosterone and high cortisol. And so then you try to adjust your lifestyle supplements, whatever it is you're doing, you talk to your doctor and then you take another test in two weeks with a cartridge that's at home that's specific also finger prick and lower blood volume easier to do and you get the result instantly and that's specific to X.

Y. Z. Uh you know, markers that you actually care about or that are the most important to you and then you do the broad screen again every quarter. – Yeah that that it's so exciting.

All this is just happening so fast and and it's gonna have a large effect on on the longevity space. These tools are going to be so important as we understand longevity and as we adjust our own lifestyle and stress and diet nutrition and exercise and and our pharmaceuticals that we take.

This is gonna be a incredibly important role. Um how how can maybe you can tell people how can how we can, how our audience can follow you on social media and also maybe you could repeat your website there also.

Pricing, roadmap, and how to follow Sea Fox Health

And also you I think you may have a free gift that people can get just by clicking next to us here that will include on the on the web page as well. – Yeah so I think let me just start by just giving the road map again. So today uh this kid is already on the internet, you can buy it. Uh Then in Q.

Three of 2023 will be starting a study with this device where people can actually use it in the home. It's already so we've already validated this third party triple blinded study for Hs Crp today.

So we're speaking now in December. And over the next couple of months we'll be adding more cardio metabolic markers. This device is already for sale for research use only and then in Q. Three people will be able to use it as part of our be approved study in their home alongside our mail in test and then in 2024 will be filing for FDA clearance for this device.

– I forgot to ask. Excuse me, may I I forgot we've been talking about cost and price and coming down. Maybe you could just quote some numbers just so they know approximately what it costs now. – So the device today for research use only is $1000 and the cartridges are $50. That's because it's all very low volume.

So by the time we're doing the I. R. B. Study it will just be included in the membership and at scale this will cost us under $100 to produce the reader and $5 to produce the cartridges. So that's by the time we're FDA cleared that's those are the price the costs that we're targeting.

– And will that be per test? Like I mean $5 per test for cartridges that which – so it's like per per cartridge and then the cartridge has up to 15 tests and one but we'll have a markup on that. But that's that's of course of course and maybe you could maybe you could mention the current pricing for the mail home kit if they want to get started with it right now and what that is.

– Sure. So we really want people to do this monthly. So we actually sell it at a small loss monthly it's $95 a month. And then uh it's 165 if you do it quarterly or 1 95 if you do it on a yearly basis.

And that's 17 biomarkers plus you connect your wearable device to have like a dashboard that they just saw the information and gives and there are some suggestions for kind of improving and correlating this data as well um And you can follow us at sea Fox health on twitter or follow me at Mike Dubrovski on twitter.

And we're also going yeah, offering a white paper as a as a free giveaway for this interview. So you can click maybe there something like that to download it.

– Great, thank you again, Michael for spending time with us today and telling us about everything that you're working on and and thanks for the great work you're doing to help truly make the world a better place and help us become healthier in our in our quest for longevity. – Yeah.

Thank you, Robert. Thank you. Thanks for having me on.