Audio file

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Transcript

00:00:00 Speaker 1

Hello everyone and welcome to the Old India Institute and welcome to the Oxford Martin School here in the Oxford Martin School.

00:00:09 Speaker 1

We support projects across the university, addressing some of the major challenges of the 21st century, and we do talks and hear about projects.

00:00:20 Speaker 1

Across all fields of research, but my background is a biologist and it's a huge pleasure to have one of the legends of contemporary biology.

00:00:29 Speaker 1

Be with us this afternoon.

00:00:31 Speaker 1

Doctor Leroy Hood Doctor Lee Hood.

00:00:35 Speaker 1

Lee has had a career in many places, but especially Caltech, University of Washington, the Institute of Systems Biology, which he's set up and most recently as CEO of Phenome Health, which we're going to hear hear about in his talk.

00:00:51 Speaker 1

Lee has done major fundamental research in a number of areas of biology, in particular immunology, and is also responsible for inventing some of the machines that have powered modern biology, protein and DNA sequences, and machines that synthesise macromolecules as well.

00:01:12 Speaker 1

And not only an academic scientist is set up a a number of very major companies applied by systems. It is is one of them.

00:01:23 Speaker 1

Lee, I think you're sometimes referred to as a father of systems biology. The study of networks and networks within biology, and I think you actually coined the term yourself.

00:01:36 Speaker 1

If I was to tell you how many prizes Lee has, there would be no time to actually hear Lee talk.

00:01:43 Speaker 1

So I'll mention the Lasker Prize, the Kyoto Prize, and the National Medal of Science, which was presented to leave a few years back by President Obama.

00:01:55 Speaker 1

Now in a moment, Lee is going to give us talk P4 health care and precision population health, a transformation of health care.

00:02:03 Speaker 1

But before that, a colleague of Lizar doctor, Robert Kilpatrick, who works at Phenome Health and R, is in chance of communications and strategy, is going to introduce.

00:02:16 Speaker 1

The short film, so Robert. If you'd like to do that and then we'll pass.

00:02:19 Speaker 1

Straight over to Lee.

00:02:20 Speaker 2

Thank you.

00:02:22 Speaker 3

It is such a delight to to be here today. We are in the midst of of creating a full length documentary film about 90 minutes long, and it's called the Phenomic Age, a quest for Wellness, and it looks at 5000 years of all cultures.

00:02:42 Speaker 3

In the world as they have quested to understand longevity, prime of life, youth, and all of that, and then in 1953 we suddenly have DNA and the door opens and there's a new path that begins the quest for the science of Wellness.

00:02:59 Speaker 3

That allows Lee to work with many others to create the Human Genome Project and now the beyond the Human Genome Project.

00:03:06 Speaker 3

So we're going to show you a two minute trailer. Its purpose is to stimulate stimulate a global conversation about Wellness and its place in the world and our creative director Maurizio Ziola.

00:03:21 Speaker 3

And his team from Milan, Italy are back here. They're filming something today and as you leave if you want to chat to him, he has a lovely white Italian scarf on. So I'm done. Enjoy the show.

00:03:51 Speaker 4

Graduation is moving beyond the number boundaries of.

00:03:56 Speaker 4

Thought it is exploring areas that haven't been explored before.

00:04:15 Speaker 4

The advances in science, from my point of view, come through new ideas and new approaches and new strategies and new thoughts about how to think about the real world.

00:04:30 Speaker 2

Second, what you can imagine you can realise.

00:04:57 Speaker 4

We see this as the largest change in medicine ever. A shift from a disease orientation to a Wellness orientation.

00:05:14 Speaker 4

The new personalised medicine we envision will democratise healthcare for every individual in the world.

00:05:25 Speaker 4

A social impact beyond our wildest imaginations.

00:05:48

Right?

00:05:50 Speaker 4

So I'd like to talk about a a new nonprofit organisation called Phenome Health that's driving in a sense. The Second Genome project, which we've labelled as beyond the human gene.

00:06:05 Speaker 4

No, and I think the key point about this is it's a challenge for science, for technology and for society and striking ways. And we need to bring that kind of cross disciplinary, diversity and power together to make it become.

00:06:26 Speaker 4

Real what I'd I'd like to do is tell you a little bit about my career because it heightens how I think about wealth.

00:06:37 Speaker 4

And when I went to Caltech in 1970 as an assistant Professor, I debated about the directions my lab should go and chose 21 was molecular immunology in which I was well established at that point in time.

00:06:57 Speaker 4

But the second was to develop new kinds of technologies. My my pH. D Advisor Bill Dryer at Caltech.

00:07:08 Speaker 4

Had told me.

00:07:10 Speaker 4

You should always practise biology if leading edge. It's more fun there, but he also said if you want to fundamentally change a discipline, invent a new technology that lets you visualise things you've never seen before, and that was that was.

00:07:30 Speaker 4

Very much the focus of my interest in human complexity and trying to understand it, and I remember thinking at the time about the analogy.

00:07:42 Speaker 4

With the elephants and six blind men each feeling a different part of the elephant and declaring it was a spear or a fan, or a stump and and of course, what was interesting about that is they only looked at the outside of the elephant, and they only looked.

00:08:02 Speaker 4

At a single part of the elephant.

00:08:04 Speaker 4

And when I started thinking about it, that in the complex, in the context of human complexity, 3 ideas emerged.

00:08:13 Speaker 4

Now I'm going to phrase them in a more modern fashion now than I did at the time, but I did have these three ideas at that time.

00:08:24 Speaker 4

And of course the 1st.

00:08:26 Speaker 4

Was big data. I was convinced that complexity 1.

00:08:31 Speaker 4

Of the 1st.

00:08:31 Speaker 4

Steps you had to take in dealing with it is to generate an enormous amount of comp of data and in time that came to be genome data and phenome analysis and we'll talk about that in some.

00:08:48 Speaker 4

The the 2nd in looking at the elephant analogy is you only looked at the outside of.

00:08:55 Speaker 4

The elephant what?

00:08:56 Speaker 4

Was happening that all the organs on the inside and that's where I clearly had this idea of blood was a window into health and disease because.

00:09:08 Speaker 4

It bathed all organs and they released molecules into the blood that if you could read them, you could infer that.

00:09:18 Speaker 4

Like the state of internal organs and so forth, and I'm not going to talk about it today, but we developed a technique whereby we could identify organ specific what proteins and use those as the proxies for looking at the brain or.

00:09:37 Speaker 4

The liver or heart.

00:09:38 Speaker 4

Or the kidney, and they're very powerful.

00:09:42 Speaker 4

In allowing you to see changes in state of those organisms across time in a human being. And of course the the final point was if you took the external data of a human, which we can see easily from the outside and.

00:10:02 Speaker 4

Combined it with the internal data that could come from blood.

00:10:06 Speaker 4

You needed to be able to integrate and combine that looks we didn't want to do that. Combine that together and that was really the beginning.

00:10:15 Speaker 4

Starting in in a somewhat in Kuwait, way to think about systems thinking that it's we know now that you need to take global.

00:10:26 Speaker 4

Holistic and integrative view of complexity of organ.

00:10:32 Speaker 4

Organisms and so forth. And I remember reading in 1973 a book that really impacted me and that was a structure of scientific revolution by Thomas Kuhn, and he talked about paradigm changes and physics and.

00:10:49 Speaker 4

And and and.

00:10:50 Speaker 4

Really, if she stripped down the essence.

00:10:52 Speaker 4

Of what he had to say.

00:10:54 Speaker 4

It was one.

00:10:59 Speaker 4

Thinking about paradigm changes really requires thinking outside the box, and he made the interesting observation that our educational systems are absolutely abysmal at training people to think outside the box.

00:11:12 Speaker 4

So it's a really interesting question. How do we do that? I think there are very good ways of doing it.

00:11:19 Speaker 4

But the second thing he pointed out that even if you could validate your paradigm change unequivocally.

00:11:30 Speaker 4

Getting people to change their behaviour is really hard because most of us.

00:11:37 Speaker 4

Are embedded in our past education.

00:11:41 Speaker 4

And it's view of our world and it's view of how we should operate and.

00:11:48 Speaker 4

As you get older, it becomes more and more difficult to imagine, change and so forth, so my feeling and having as you'll see the moment participated in a number of.

00:11:59 Speaker 4

Of different paradigm changes is is the key to getting them accepted as one unequivocally, validating that the paradigm change is real but two focusing on younger people who are much more open to thinking about change. I mean, it's really hard to read.

00:12:19 Speaker 4

Educate old scientists.

00:12:21 Speaker 4

Quite often so.

00:12:25 Speaker 4

Then as I said, I have either LED in or participated 7 different paradigm changes and I.

00:12:34 Speaker 4

Tell you about these.

00:12:35 Speaker 4

But both because each really dealt with complexity in interesting ways, but it framed how I think about healthcare and what we should be doing in future, and that'll give you a context for what I talked about. So the first was we really brought engineering.

00:12:55 Speaker 4

To biology at Caltech and.

00:13:00 Speaker 4

What was enormously interesting about that is biology at Caltech hated the fact that I was doing engineering and biology because it defiled the purity of classic biology and some of the older faculty argued I should be moved.

00:13:21 Speaker 4

Which the chair never did. Fortunately, for lots of reasons, but we developed instruments you heard and and the instruments really, as you'll see, in just a moment, enabled us to do really remarkable kinds of things, and let me take just a moment and talk about.

00:13:42 Speaker 4

This paradigm change because it actually is really interesting in a lot of ways, so we developed.

00:13:49 Speaker 4

Automated sequencing of DNA and proteins. And everybody knows the DNA sequencer really revolutionised things at that time. The protein sequencer, which was 200 times more sensitive than any other instrument.

00:14:10 Speaker 4

Revolutionised things because you could sequence vanishingly small amounts of interesting proteins like erythropoietin.

00:14:21 Speaker 4

And with the other instrument, let me make before I go to that one more point, I always felt any real instruments that you developed.

00:14:30 Speaker 4

You ought to commercialise and I thought it started three different companies along the way that commercialised the six instruments that you see here. All of these things.

00:14:41 Speaker 4

They are successful today and in fact the automated.

00:14:46 Speaker 4

In chat technology, synthesiser is what Agilent still uses today and everything. But what was interesting about the 1st?

00:14:55 Speaker 4

Instruments is they were an interesting integrated system and and what that meant is if we sequence of vanishing these small amount of mythril point we could translate that protein sequence in degenerate DNA sequence and we can use that to clone the gene.

00:15:16 Speaker 4

Then we could analyse the gene with the DNA sequencer and even make antibodies against it with the peptide synthesiser, but this allowed us to open up a whole series of new fields for exam.

00:15:31 Speaker 4

Sample we seek once a referral point in with Amgen, a company that was a co-founder of, and it became the first billion dollar product in in modern biotechnology and it was very much against the classic drug view of the.

00:15:51 Speaker 4

Only good drugs are little molecule.

00:15:54 Speaker 4

And for a lot of reasons, little molecules are terrible drugs and.

00:15:59 Speaker 4

We can talk about.

00:16:00 Speaker 4

That point if we want it.

00:16:01 Speaker 4

But the other point I would say is it really made me think about the roles of academia and industry and what what the relative roles are. So what academia is about is conceptualization.

00:16:15 Speaker 4

And proof of principle. That's because it doesn't cost very much money. What industry is about is making instruments.

00:16:23 Speaker 4

Grow, rub robust and then scaling them up and these are all rough estimates on what it costs to do.

00:16:31 Speaker 4

The DNA sequencer and of course that whole process starts all over again with second generation DNA sequencing and actually third single molecule DNA sequencing.

00:16:43 Speaker 4

Which came out of Oxford here many real ways and everything and. And So what was the 2nd paradigm change? Well, the automated DNA sequencer got me invited to the first meeting ever held on the Genome project.

00:17:01 Speaker 4

In the spring of 1985.

00:17:03 Speaker 4

Where 12 of.

00:17:04 Speaker 4

Us were invited by Bob Sinsheimer to come and pass judgement on the Genome project and and we did and and two interesting things came out of it. 1 admittedly difficult. We were convinced it was.

00:17:20 Speaker 4

Going to be possible to do, especially with the automated sequencer, even if that's early prototype form and every.

00:17:27 Speaker 4

Thing, but two. We were split 50 to 50 on whether it was a good idea and those against it were against it, primarily because this was viewed as big science which would take money from small science, which is what biology was all about that time and.

00:17:47 Speaker 4

I remember going out into the community in 86 and 87 and seeing that that 8% of the biologists were absolutely opposed.

00:17:57 Speaker 4

And in fact, NIH was opposed up until the very end.

00:18:02 Speaker 4

And their arguments were we don't need the genome project 'cause we spend $300 million a year on genomics.

00:18:09 Speaker 4

But it was really genetics. And of course there is a slight difference between snow mix and genetics, which the NIH bureaucrats didn't really understand. What, from my point of view.

00:18:22 Speaker 4

The complete genome sequence gave us was accessed human variability and the capacity to compare it with Wellness phenotypes and disease phenotypes, and we'll return to that later.

00:18:37 Speaker 4

What happened at Caltech? And again, the professors utterly hated this is my lab got very big 'cause I brought in all the different kind of cross disciplinary people you need. It's developed these technologies and I realised that this probably wasn't healthy.

00:18:57 Speaker 4

So I argued to biology at Caltech. Look, let me start an applied department where I'm going to recruit faculty who represent all of these disciplines. That's the logical way to do it.

00:19:11 Speaker 4

And and the engineers and the chemists love the idea that physicists were utterly different, and the biologists categorically opposed it for reasons that are obvious, I think. But Bill Gates, actually.

00:19:25 Speaker 4

Enabled me to move in 1992 to the University of Washington.

00:19:30 Speaker 4

He set up the 1st.

00:19:31 Speaker 4

Crossed this flattery department and it was spectacularly successful in the eight years of its existence. So Phil Green developed the two major algorithms for the Human Genome Project. The ability to assemble fragments and the ability to assess the quality of DNA.

00:19:52 Speaker 4

And Rudy Abras Holland. John Yates pioneered proteomics. They developed the first two critical techniques, 1 computational and one chemical, that really fueled this whole new discipline. We invented the inkjet technology there and so forth, but I really wanted to build.

00:20:13 Speaker 4

On top of.

00:20:15 Speaker 4

That crossed this layer, department systems biology, but I've learned my first big lesson then about dealing with big bureaucracies. 'cause at Caltech you don't have any big bureaucracies, so.

00:20:30 Speaker 4

And that was there were 100 ways I was blocked from setting up a really effective systems biology approach.

00:20:41 Speaker 4

For example, when I talked to the head of computing about my needs for for computation for systems biology in the future, he came down and showed me this.

00:20:51 Speaker 4

Really small janitors room, and he said that's all the computing Yelp spatial ever need for anything you're going to do as a biologist, and I decided that. And for ten other reasons that I resigned in 2000 and started the Institute for Systems Biology.

00:21:08 Speaker 4

And we took these global and holistic approaches to things. And, you know, systems biology really underlies a lot of what we look at today in biology.

00:21:19 Speaker 4

But systems biology is very much big data and generating a lot of information, but it's then converting it.

00:21:28 Speaker 4

Into biological networks, which are the physiologic framework and the underpinning of a lot of biology? And then it's looking at the dynamics of these systems so you can come to understand them in some detail. But early in 2000.

00:21:46 Speaker 4

We looked yet I looked at at medicine and healthcare and decided that what was key in the future for healthcare with the four peas, predictive, preventive, personalised and participatory. And we'll talk about all of those in more detail in just a moment, but.

00:22:06 Speaker 4

What health care was really all about were two things, Wellness and disease, and in 2000, let me tell you, nobody in medicine thought about Wellness in any way, and frankly, that's still true to a large extent today.

00:22:25 Speaker 4

And it so I started thinking about a lot of technologies and strategies we could use for beginning to study Wellness. And I must say I had an enormous.

00:22:39 Speaker 4

Lack of success in sending these things to NIH, and they gave them most pathetic excuses as to what this wouldn't work so.

00:22:49 Speaker 4

You know, if the bureaucracy won't give the money, you have to go figure out how to do it. So I decided what I do is go to small countries and say look, I'll help you get started with systems biology if you'll give me the money to invent the tools I need for P4 medicine.

00:23:09 Speaker 4

So the 1st.

00:23:10 Speaker 4

Four countries I went to we won't talk about. I failed in all cases. In fact, the chair of my board said to me, Lee, don't you ever learn you fail four times in a row.

00:23:22 Speaker 4

He said this fifth one you're proposing to me is ridiculous. He said if you succeed, I'll believe in the tooth fairy.

00:23:29 Speaker 4

And I went to Luxembourg and we persuaded.

00:23:32 Speaker 4

Them to put in.

00:23:34 Speaker 4

20 million a year for five years? And that really revolutionised what we do in technology and computation. Really set us up then for thinking about Wellness, which we really started 2013 or so. And again, I remember.

00:23:53 Speaker 4

Going to Francis Collins in 2013 and saying look I wanted to start a pilot project of 100 people and to use very dense data and analyse the phenomics as well as the journal Genomics and come to understand Wellness.

00:24:12 Speaker 4

Better Francis gave me this very sanctimonious.

00:24:17 Speaker 4

Lee NIH is only interested in disease. We will never support Wellness. So again, I went back and raised the money to do that small project from philanthropy and that enabled us then to start a company called Ervil, which over four years.

00:24:37 Speaker 4

Allowed us to recruit 5000 individuals and for.

00:24:41 Speaker 4

Each generate longitudinal data clouds that have really been transformational in understanding human biology, and I'll give you some indications of what that's all about. So what happened in?

00:24:56 Speaker 4

In 2016, the CEO of Providence, a large healthcare system, 51 hospitals and in seven different states, came to me and said, what we'd like to make you, our Chief scientist Officer, and I thought, what a terrific opportunity.

00:25:18 Speaker 4

As it evolved, I started thinking about this new position I had. I decided the best thing I could do was push a project that was.

00:25:28 Speaker 4

Uhm, 200 times larger than the original 5000 person project. Namely, argue we should look at the genomes and genomes of 1,000,000 people. And that is the project we called beyond the Human Genome project and.

00:25:47 Speaker 4

I will say what I learned at Providence.

00:25:52 Speaker 4

Is that healthcare systems can even be more conservative than bureaucratic state systems, but that's another interesting story, and that in fact is why I resigned recently.

00:26:04 Speaker 4

It started this company called Phenome Elf, and that's what we're going to talk about now. So what did I learn from these things?

00:26:13 Speaker 4

It was a fascinating experience going through those. It really changed how we thought about biology and medicine. Each of those paradigm changes. Each of them was met with enormous scepticism.

00:26:27 Speaker 4

But the next thing is by far the most important thing. Every single one of those paradigm changes required a new organisation to emerge from.

00:26:40 Speaker 4

Truly innovative ideas rarely emerge from old organisations and quite frankly, academia has major problems in this regard. Now there are ways to do it, but most people don't think about those ways.

00:26:57 Speaker 4

Uhm, you need to be able to.

00:27:01 Speaker 4

Ah, continue. Although many of your colleagues are laughing at you and of course, how do you really prove a paradigm change well?

00:27:11 Speaker 4

First it.

00:27:12 Speaker 4

Demonstrated success and then re educate people and those are those are all challenges but those are things that you need. So 21st century medicine, the four peas and the fact that they represent 2 domains.

00:27:31 Speaker 4

Need to be seamlessly integrated together to give you the the the essence of what P4 medicine is and in fact the 1st 3P's are all science and I'll say to a first approximation we know how to do those pretty well and the future is.

00:27:52 Speaker 4

Is pretty extrapolate able? The 4th P is all about psychology and sociology and education and percipi that we'd love to see.

00:28:05 Speaker 4

If Oxford Martin couldn't help us with in various ways and so forth, and in a sense we're talking about deep medicine here at its natural stage and extent so.

00:28:18 Speaker 4

The 4th P.

00:28:20 Speaker 4

It's about the players that are in the healthcare system.

00:28:25 Speaker 4

The patients, the physicians, the healthcare leaders, the regular.

00:28:28 Speaker 4

Leaders, the academic and industrial members of this healthcare constituency, and for each of them you have to take different approaches. And how do you? How do you solve the problems? Well, for the majority of them?

00:28:45 Speaker 4

I think the major way you solve the problem is 1. Prove you can really increase the quality of health care and to.

00:28:53 Speaker 4

To show them that you're going to save them a boatload of money in costs, and we can.

00:29:00 Speaker 4

Do both of those.

00:29:01 Speaker 4

Across the 10 year period that I'm proposing how?

00:29:05 Speaker 4

Do we go to?

00:29:07 Speaker 4

The various classes and minorities and the anti science and anti VAX people.

00:29:14 Speaker 4

And persuade them to participate in the number of in healthcare and later to underdeveloped countries. I mean, this represents a whole series of prop.

00:29:29 Speaker 4

Challenges and you need different approaches for each of these kind of things. It would be great to have a discussion on that.

00:29:37 Speaker 4

I'll talk a little bit more about that later and and I think it's going to be this data driven Wellness. They're really going to allow us to attack what I call

00:29:49 Speaker 4

So 5 fundamental problems of contemporary medicine. So is quality.

00:29:55 Speaker 4

It's the ageing population is the explosion of chronic diseases, its cost and its diversity and equity and I think we have really superb solutions for all of those and you'll come to understand at least.

00:30:11 Speaker 4

Some of them.

00:30:13 Speaker 4

And we would really like to. I mean, if we're not able to move medicine from you, pay doctors according to how many patients they touch to a value based motivation. That argues you have to keep populations healthy.

00:30:30 Speaker 4

We'll never succeed with this endeavour, and that is one of the major objectives of this whole programme in the future.

00:30:39 Speaker 4

So you know we're going to change the world in ways we can only begin to imagine because it it really has the potential for democratising healthcare for the world.

00:30:51 Speaker 4

If we can solve this P4 challenge and it is absolutely an enormous 1.

00:30:57 Speaker 4

So onto beyond the human genome project. So the first genome project took 13 years to do 1 genome. What we propose to do in 10 years is 1,000,000 genome sequences plus their longitudinal femaleness and we'll define.

00:31:17 Speaker 4

That in a few moments, and of course what we want to do with these data.

00:31:23 Speaker 4

Or convert them into actionable possibilities.

00:31:28 Speaker 4

That if acted upon by the relevant individual, will allow them to improve Wellness and or avoid disease and in a moment we'll talk a little bit more about how we define these actionable possibilities.

00:31:42 Speaker 4

Uhm, I will say for actionable possibilities we came up with about 200 of them in the Air Vale programme for 5000 people.

00:31:52 Speaker 4

I think we'll come up with more than 10,000 in this larger programme, and we're going to need AI.

00:31:59 Speaker 4

To deliver them to physicians 'cause they will not be able to understand the complications and you'll. You'll understand why in a moment.

00:32:08 Speaker 4

So we're proposing the federal government. I have proposed that we do this project for 10 billion / 10 years, and we're.

00:32:19 Speaker 4

Negotiating now and we have short term projects that will let us get started immediately and I'll tell you about that.

00:32:27 Speaker 4

But what we've done at Phenome health is we've assembled the key partners. We need to really carry out this kind of programme with other partners that we will continue to as we go on. And, of course, what moves us beyond the human Genome project is longitudinal phenomics.

00:32:49 Speaker 4

Which will define now the gene.

00:32:52 Speaker 4

More or less invariant across your life apart from cancer and and a few rare mutations. And of course the PHENOME is essentially the convergence of your general, your behaviour and your environment and they impact.

00:33:11 Speaker 4

Your life at every instance all the way across your transition from infancy all the way up to to your final adulthood and everything.

00:33:25 Speaker 4

And we can analyse these phenomics in hundreds of different ways. But what we've found quite successful is to measure blood analytes to measure the microbiome to use digital health kinds of mechanisms and other things that we'll talk about a little bit.

00:33:44 Speaker 4

Later wrong, so with the human genome and a single genome prototype for getting started. And now we want to do a million and be able to sample them across there.

00:33:59 Speaker 4

The transitions that occur naturally in life, transitions and normal development and transitions from Wellness to disease and the finel marks those transitions absolutely beautifully. So what is the essence of what we're really talking about?

00:34:19 Speaker 4

Here then, is that we have the ability to follow your health trajectory in a data rich manner and then to use the data we.

00:34:29 Speaker 4

And rate to optimise that health trajectory and what do we mean exactly by a health trajectory? Well, that's your your your lifetime of health and I would say health has three very separate divisions. Wellness.

00:34:48 Speaker 4

It has transitions to disease than it has to.

00:34:52 Speaker 4

Disease and progression, and we'll see that we can increase the dimensionality for every one of their Wellness as well as extend its length. We can now identify biomarkers that mark the earliest stage of transitions to chronic diseases.

00:35:12 Speaker 4

And use those in the future with appropriate partners to reverse the disease before it ever manifests itself as.

00:35:21 Speaker 4

A disease phenotype?

00:35:22 Speaker 4

And we will show you some really interesting approaches. For precision medicine we can use to deal with disease itself.

00:35:31 Speaker 4

So in the future.

00:35:32 Speaker 4

What we'd like to do is reverse.

00:35:35 Speaker 4

Your transitions as they come up and keep you in a perpetual state of Wellness with the idea that you could move into your 90s or even hundreds mentally. Agile, physically capable and.

00:35:53 Speaker 4

It's a really interesting question which we're going to return to later is if you get 30 extra years of functional life, what are you going?

00:36:01 Speaker 4

To do with it.

00:36:02 Speaker 4

That's a deep.

00:36:03 Speaker 4

Question that's very interesting. We think this will be the largest paradigm shift in the history of medicine. We have two proof.

00:36:13 Speaker 4

The principles arravale that I've described and I'll talk about some of the conclusions we can draw from those data, and we have a new partner going forward called positive, which deals in a digital manner with brain health.

00:36:30 Speaker 4

They have digital measurements that can assess 25 different cognitive features, and they can fill in cognitive deficiencies beautifully again with digital kind of training and so forth, and I'll say only a little bit about that, but I want to point out.

00:36:51 Speaker 4

They've carried out 250 clinical trials and more than 10,000 patients, so the evidence and the data are really quite compelling. That this is really essential for brain health, and I'll ask.

00:37:07 Speaker 4

Thank you.

00:37:08 Speaker 4

How many physicians have ever asked you how your brain IAS physicians utterly ignore brain health and the brain health?

00:37:19 Speaker 4

Is every bit as important as the body health and really keeping you functional obviously so in in ervil we did complete genome analysis.

00:37:30 Speaker 4

We looked at three different types of blood analytes twice a year, almost a little more than 1000 of those proteins metabolites.

00:37:39 Speaker 4

Clinical chemistries we did. The gut microbiome twice a year. We used Fitbits and other measurement devices for Physiology and these data for each individual could be analysed in terms of these actionable possibilities and I'll show you exactly.

00:38:00 Speaker 4

How we did that in in just a second so.

00:38:07 Speaker 4

The science of Wellness and prevention is what we really want to push. That's what we've learned from these 5000 different data clouds and so forth. Then this is actually.

00:38:21 Speaker 4

An analysis and and I do it in the 100 and eight person project 'cause it's simpler to illustrate than the 5000 personal project. But basically we were able to take 56 different data.

00:38:36 Speaker 4

The types and ask for each data bit within a type. What statistical associations they had with data bits and the other five types, and we were able to identify essentially 3500 of these correlations and then what we did.

00:38:56 Speaker 4

Is manually looked through and took the most interesting correlations and went to the literature, and from that we could validate actionable possibilities that came from tying together these two different points of information and an example of that.

00:39:13 Speaker 4

Is I was in the first programme, my vitamin D level was microscopically low, so my my Wellness coach said oh start taking 1000 international units of vitamin D and it'll come back very nicely, didn't touch it and then we looked at my genome carefully.

00:39:34 Speaker 4

It turned out I had two variants.

00:39:36 Speaker 4

In genes that lead to blocking the uptake of vitamin D, so I had to have mega doses of vitamin D to elevate me up to normal levels and then quite large doses to maintain me there. So that was an actionable possibility that without the data you would never, ever have.

00:39:56 Speaker 4

Figured out and we had two hundred of those. It's integrating different types.

00:40:01 Speaker 4

Data that, briefly that should come up with different actionable possibilities, and we call that quantitative Wellness or scientific Wellness.

00:40:11 Speaker 4

Second thing we could do is because we had individuals that ranged from 21 to 93. We could bend them into 10 year categories.

00:40:22 Speaker 4

And and what we showed is in almost a linear way as you age.

00:40:28 Speaker 4

The envelope of control you had for the three classes of analytes came broader and broader and broader, and we could use that information to develop an algorithm.

00:40:41 Speaker 4

And this is.

00:40:42 Speaker 4

All published, but it was algorithm that allowed one to determine.

00:40:48 Speaker 4

One biological age, the age your body says you are as.

00:40:51 Speaker 4

Opposed to the birthday.

00:40:53 Speaker 4

So the lower your biological age is relative to your chronological age, the more healthy your ageing.

00:41:00 Speaker 4

And what we demonstrated in arvale for those individuals that stayed the course is for every year they were in this programme.

00:41:10 Speaker 4

They lost a year of biological age. If you're a man and a year and a half if you're a woman, so this is a metric for Wellness.

00:41:20 Speaker 4

We're going to use in all subsequent forward going tests and and we had 40 different kinds of diseases in this population. The most serious of which was diabetes.

00:41:35 Speaker 4

And if the for the 250 people that had diabetes that we looked at their average biological age was six years older than their chronological age. We looked at one COVID-19 patient in the very severe group.

00:41:53 Speaker 4

And he was 20 years older.

00:41:56 Speaker 4

He is a chronological age, yet unfortunately he died, so we didn't go back and get the rest of the data, but it's a metric for Wellness there, so those are all about the science of Wellness. And now we'll talk about science and prevention because.

00:42:16 Speaker 4

We had whole genome sequence. We can take polygenic scores and convert them into genetic risk for the 5000 people and then bend them from very low to very high and.

00:42:27 Speaker 4

3 categories in between and the first one we looked at was a risk for LDL cholesterol and what you see in Orange.

00:42:38 Speaker 4

There is the level of cholesterol in people that weren't taking statins or other equivalent chemistries and it goes up, you know beautifully.

00:42:47 Speaker 4

Linear kind of fashion and what we were able to demonstrate very effectively is if you had a high genetic risk for LDL cholesterol, a proxy for heart disease.

00:43:00 Speaker 4

You could only bring it down with statins if you have a low genetic risk and high cholesterol. Diet and exercise worked beautifully, and the important point is for all of these polygenic scores we're going to treat low risk and high risk people differently in the future as we come to learn exactly.

00:43:20 Speaker 4

What these mean? And we'll watch the high risk people very carefully to identify their earliest transition state and try and reverse it before it becomes clinically manifest.

00:43:33 Speaker 4

And the final point I'll make about these data was what was absolutely fascinating, as we saw 167 individuals that transferred from Wellness to a diagnosable disease. We took ten of these that diagnosed various kinds of cancer and we looked at.

00:43:53 Speaker 4

Blood samples drawn prior to the diagnosis and we asked for each blood sample. Were there any of the protein analogue?

00:44:04 Speaker 4

That were out of alignment with the average concentration of proteins and normal individuals at that point in time. That blood drawn time.

00:44:13 Speaker 4

We had all of that data and for all ten we saw a multiplicity of proteins and more than half the proteins gave us.

00:44:24 Speaker 4

Deep insights and what the nature of the cancer was and what we hope to be able to do is to use those early transition biomarkers.

00:44:35 Speaker 4

In collaboration with pharma and academics to reverse the disease at that point and it's it's a real hope for being able to deal with chronic disease in in the future. With the million person project over 10 years, we estimate will have 250,000 transitions.

00:44:55 Speaker 4

And that will give us incredibly powerful statistics for being able to pinpoint precisely what type of transition we're looking at, and a final point. We just submitted a paper on something that we call a metric for metabolic PE.

00:45:13 Speaker 4

My so as you know.

00:45:16 Speaker 4

Traditional BMI is is height and weight kind of measurement thing, but you can do the same thing with metabolites but the metabolite BMI is better in two ways. One, if you're a really muscular athlete, you're almost.

00:45:36 Speaker 4

Always classified by traditional BMI as obese or enormously obese, and it's just a lot of muscle. This distinguishes muscle from fat beautifully.

00:45:49 Speaker 4

And the other thing is, it's very much more sensitive to metabolic changes, diet, exercise and things like that. So that's going to be another metric we'll be following in all patients. So in the future. So there are really two kinds of Wellness, right? One is the classic bonus.

00:46:10 Speaker 4

That you all know about exercise, diet, sleep and stress management, and so forth. And they're a gazillion kind of companies that are using these in various ways. The second type of Wellness is this data driven Wellness. Where from.

00:46:26 Speaker 4

Either the genome.

00:46:28 Speaker 4

Or phenome, or the integration of different data types. We can get new kinds of actionable possibilities and what is critically important is the data driven Wellness. Give us deep insights into how to optimise classical walnuts, and there's a company out there called SOS.

00:46:49 Speaker 4

It shows this beautifully with the gut microbiome, and.

00:46:54 Speaker 4

Health with regard to diabetes and things like that, but so these things together in normal are going to be enormously powerful in the future. And we will integrate those all together into a coherent fashion.

00:47:10 Speaker 4

And of course, the brain health. The ability to do these 40 measurements that look at 25 different cognitive features.

00:47:19 Speaker 4

10 minutes left wow.

00:47:22 Speaker 4

I think I need another hour.

00:47:26 Speaker 4

Anyway, we can look at many different cognitive features and the.

00:47:36 Speaker 4

What Michael Merzenich, who invented all of this, demonstrated beautifully is for ordinary adults. You rise to a cognitive maximum in the mid 30s and you fade away and.

00:47:47 Speaker 4

Die he took.

00:47:49 Speaker 4

1080 year olds and sold with appropriate training. You could convert them back to what they should have been in their.

00:47:56 Speaker 4

Mid 30 fives.

00:47:57 Speaker 4

So it means there's a lot of hope for all of you who are starting to forget things that these things can be reversed. The gut microbiome has done many things.

00:48:09 Speaker 4

One of which is we've shown beautifully recently. The gut microbiome has enormous effects on what statins do to you.

00:48:20 Speaker 4

Both with regard to what we want them to do. Bringing LVL cholesterol down, but they also can impact major side effects like type 2 diabetes, so you need to know what your gut microbiome is relative to statins, and we think it's going to be true.

00:48:40 Speaker 4

For many different drugs.

00:48:41 Speaker 4

And I'm not going to show you this, so I'm going to skip by the. The microbiome has some very interesting things, say about ageing.

00:48:51 Speaker 4

So what about phenome health? We've put together seven partners and I'll just talk about the first major partner. That's guardian research.

00:49:02 Speaker 4

Or with which is an organised organisation that interfaces now with about 140 hospitals, thirty million patients, all of them have been consented for programmes like this, they've learned to is extract electronic health records, both structured and unstructured doctors notes.

00:49:22 Speaker 4

And things like that. So that is immediately accessible to us and they lie across major minority populations. So we conclude the kind of diversity we want.

00:49:34 Speaker 4

Technicity is let us build an incredible multi omic platform that does.

00:49:40 Speaker 4

A lot of.

00:49:40 Speaker 4

The other kind of things we need here.

00:49:43 Speaker 4

We've talked with NIH, DoD, and VA. They think both were different and interesting to collaborate. We have a great Advisory Board. I've talked to Congress.

00:49:53 Speaker 4

And got a really terrific reception.

00:49:57 Speaker 4

And we've introduced a health care system to join us, where we're going to take the science of Wellness and prevention to their family practitioners to get started in this whole endeavour, Jeff Wilke was number 2 at Amazon and Incredible Guy, he's going to lead the board that we have now, Roger.

00:50:17 Speaker 4

Cometer #2 at.

00:50:19 Speaker 4

At Merck, and he's a student of mine and a very good friend Victor Zao is head of the National Academy of Medicine and all the rest of these are very distinguished people. We've gathered together for fenom health. Really a terrific team. One of the best.

00:50:39 Speaker 4

Over the years that I've actually worked with and everything, and where do we stand now in implementing this?

00:50:45 Speaker 4

I won't go into all the details now, but let me say we're going to increase by more than order of magnitude.

00:50:54 Speaker 4

The amount of data we're going to be generating, and this is really going to be transformational. Bringing in brain health, bringing in electronic health records, and bringing in social.

00:51:05 Speaker 4

Determinants of health and patient outcomes and being able to integrate them. And we've set up with our partners these various.

00:51:14 Speaker 4

Aspects that can be controlled by this core database system and so forth to generate all sorts of new kinds of things.

00:51:26 Speaker 4

The way we're really going to function in the near future, 'cause getting the big programme going is going to take another year or two due to a war and other kinds of things. So we're using precision population health to attack.

00:51:40 Speaker 4

Back the major health diseases in terms of costs and diabetes is one that we're starting with. We're we're actually doing a complete detailed analysis of pregnancy. We learn more about it than ever has been learned before in the power of 60,000.

00:52:01 Speaker 4

Electronic health records for making deductions about pregnancy and vaccination and UN vaccination is unbelievable and the most interesting new fact is.

00:52:12 Speaker 4

If you got booster shots as a woman.

00:52:16 Speaker 4

That significantly improves your chance for better outcomes for you as a woman and your infant, so boosters, at least in some cases, are really worthwhile.

00:52:27 Speaker 4

Moderna is much better than Pfizer. J&J doesn't do anything as far as we can tell, helping.

00:52:36 Speaker 4

Pregnant women

00:52:38 Speaker 4

We're going to do a diabetic project where we look retrospectively at electronic health records and prospectively.

00:52:49 Speaker 4

At patients

00:52:51 Speaker 4

That we've used the electronic health records to poise before each of the major transition points in diabetes and.

00:52:58 Speaker 4

Follow the model over.

00:53:00 Speaker 4

Five year periods of time and the integration of retrospective and prospective. And then later we'll do clinical manipulations. Once we learn a lot about.

00:53:11 Speaker 4

Biology and so.

00:53:12 Speaker 4

So forth and, and this is the 100 year life. The idea of 100 years in this book.

00:53:22 Speaker 4

Traumatically missed one major point and that is the idea of 100 years. Should be 100 years of healthspan and not lifespan.

00:53:31 Speaker 4

And that's a disastrous shortcoming, but they had.

00:53:34 Speaker 4

All sorts of.

00:53:35 Speaker 4

Really interesting things that I talked about with regard to retirement education.

00:53:41 Speaker 4

And all of these kinds of things, and.

00:53:44 Speaker 4

Our point is, what are you going to do with these extra 30 years that we plan to give you and have it in the context of healthspan rather than just extending lifespan and so forth?

00:53:58 Speaker 4

Ah, then.

00:54:05 Speaker 4

Focusing on equity, we can recruit people now we can think about interesting payments with the kind of savings we can generate.

00:54:14 Speaker 4

How do you build trust that's the most important thing in communities and it's different for different minorities. Quite clearly, education. We're really doing a lot of different things.

00:54:26 Speaker 4

The scepticism of science. How do we get it across the science denier?

00:54:31 Speaker 4

There's they're probably the most intractable group that we we in the United States deal with. I don't know that you have anything equivalent to that here.

00:54:41 Speaker 4

We're doing a whole bunch of educational things and I won't. I'll make these slides available. You can look at them, but.

00:54:51 Speaker 4

And then finally.

00:54:52 Speaker 4

Uh, our vision.

00:54:55 Speaker 4

And it would be great to share aspects of this with with you as well on for.

00:55:02 Speaker 4

Is to keep people currently in a state of Wellness and to move into your late 90s or even hundreds mentally capable physically able of a health span of of that number of years and so forth.

00:55:20 Speaker 4

We think if you look at the five major challenges of contemporary health care, it's quality and age.

00:55:27 Speaker 4

Chronic diseases and and equity. We can. We have tremendous solutions for each of those and see very clearly how we can attack those things.

00:55:38 Speaker 4

So I'll leave you with this question. Are there things that we could work with together to attack these problems either?

00:55:46 Speaker 4

The science level, or especially at the level of the fourth P. Participatory so.

00:55:54 Speaker 4

Almost got done.

00:56:05 Speaker 1

Lee, thank you very much for that wonderful Tour de Force and I'm sorry we hurried you a.

00:56:10

Bit to.

00:56:12 Speaker 1

Start at the end.

00:56:14 Speaker 1

We have an online audience and can I say to the online audience, if you want to ask a question or if you want to vote on a question that's been asked by someone else please.

00:56:23 Speaker 1

Do and Claire at the end is going to is going to harvest some of them.

00:56:29 Speaker 1

Leak can I start off with a question so one of the challenges that you put at the end there is cost and both in your country in our country, even though we've got different models of providing health care, we're both facing the same challenges of escalating health care costs. If you were to look ahead 50 years when your mission.

00:56:48 Speaker 1

Has been accepted.

00:56:50 Speaker 1

And what will be the financial model of your Wellness vision of.

00:56:56 Speaker 1

Of future health well.

00:56:58 Speaker 4

Let me just give you 2 examples which will lead to enormous cost savings. So in the US anyway, we spend 86% of our healthcare dollars on chronic disease.

00:57:10 Speaker 4

I think in.

00:57:12 Speaker 4

15 years we will have eliminated most chronic diseases by this early reversal, which will be infinitely less costly than dealing with the disease. So I think you're talking about hundreds of billions of dollars there. A second example is what?

00:57:32 Speaker 4

Will automatically come out of the longitudinal phenome analysis is the identification of patients that are responders to a given drug as opposed to those that don't respond and the statistics in the USR 1.

00:57:51 Speaker 4

We spend more than 600 billion a year on drugs and two. If you look at the 10 most popular drugs sold in the US, less than 10% of the patients respond to those drugs. So in principle, if we can sell you just two to give the drugs too.

00:58:11 Speaker 4

We could save 90% of 600 billion.

00:58:15 Speaker 4

So my feeling is and that's just the beginning of things that we could talk about, but those are two really big ticket items that that and, and I think the ability to assess responders and non responders will get out that out of the 1st.

00:58:34 Speaker 4

Few years for all the.

00:58:35 Speaker 4

Major drugs anyway that will eats.

00:58:38 Speaker 4

The transitions to I think we'll get the transitions to major diseases, 'cause we'll really focus on those initially much earlier than some of the rarer kinds of things.

00:58:50 Speaker 1

So in the future in in the states where I normally buy health insurance and my company would buy it for me, then as part of the package with you'd still buy health insurance.

00:58:59 Speaker 1

But part of that package would be the phenome and and other monitoring parts.

00:59:05 Speaker 4

Right, well I'll, I'll tell.

00:59:07 Speaker 4

You, that's really an interesting question.

00:59:10 Speaker 4

The healthcare systems I'm going for are those that integrate payer with provider and the reason for that is it's the payers that get this front end saving and spades and less. They're integrated with the provider, the provider.

00:59:30 Speaker 4

Isn't going to have that much incentive to do this thing in a classic sense, and what I think we can do with integrated payer provider.

00:59:40 Speaker 4

This is drop their costs in such a striking way that other places are going to have to adopt those strategies to move forward.

00:59:49 Speaker 4

And you know there are health care systems like Kaiser that have done that kind of thing. Now Kaiser is.

00:59:58 Speaker 4

A nightmare of bureaucracy in some ways, but you know, I think we'll eventually be able to get through and and affect them. But we do have smaller healthcare systems that are.

01:00:09 Speaker 4

Payer providers and in fact part of Providence was payer provider. It's too bad it didn't work out there, but that's the strategy that we're thinking about. We're talking to providers and the first provider we talked to basically said look, I'm not.

01:00:29 Speaker 4

Interested in anything that saves money unless it saves money for me right now. You have to be able to show that I said no. It's going to take a few years to get all these things in place so.

01:00:43 Speaker 4

Now I that was a small provider and I think we can talk with some big ones. That and we haven't yet. That will be more.

01:00:55 Speaker 4

That will have the vision to see there could be enormous savings for themselves. You know part of that also question that the the payers are in the states argue with. Since we have all these different healthcare systems is look.

01:01:10 Speaker 4

As as a payer, I only have the average patient for three years, so why should I be worried about Wellness and optimising it if I don't get to keep them and and and again, this guardian research network and the 140 hospitals? They're all community hospitals and what's unique.

01:01:31 Speaker 4

About a Community Hospital is the patients are sticky. That is, they stay with the same doctor and the same hospital.

01:01:39 Speaker 4

Middle their entire life, so those are the ideal context in which to operate, and in fact it's these academic centres that bring a patient in for two or three years, and then they, or maybe a year only, and then they.

01:01:54 Speaker 4

Go off so.

01:01:57 Speaker 4

I think academic centres are really going to have to rethink some of the things they're doing now, and that's those are the kind of expected unexpected results that that come out of all of this.

01:02:10 Speaker 1

Thank you, I have a question from the audience.

01:02:13 Speaker 4

It's for him.

01:02:17 Speaker 1

Yes, if you.

01:02:18 Speaker 1

Could just wait for the.

01:02:19 Speaker 4

Oh yeah, it be great if.

01:02:20 Speaker 4

You speak into the microphone, yeah?

01:02:21 Speaker 1

My cell phone.

01:02:25 Speaker 1

OK, sorry it was the person in front of you.

01:02:28 Speaker 1

Sorry about that.

01:02:29 Speaker 5

Thank you great talk.

01:02:31 Speaker 2

Would you mind just?

01:02:31 Speaker 5

Saying, hey, 'cause I'm Rahimi, I'm the director of Oxford Martin Deep Medicine programme and what you just.

01:02:41 Speaker 5

Presented resonates very much with our thinking and our work.

01:02:45 Speaker 5

And my question was actually was going in the same direction as what Charles ask.

01:02:48 Speaker 5

And I think.

01:02:49 Speaker 5

You partly addressed that.

01:02:50 Speaker 5

I think the business model in this is.

01:02:52 Speaker 5

Going to be.

01:02:53 Speaker 5

Key given that in most healthcare systems the payer is not the same as the decision maker, as is not the same. Who's going to benefit.

01:03:02 Speaker 5

On this and I think even with integrated care of care solutions such as Kaiser, there would still be the challenge where the frequency is paid for.

01:03:09 Speaker 5

I think as you just described that is your 4th P and the major challenges for us to think about it.

01:03:15 Speaker 5

But given that you've answered that question, I take the opportunity to just ask the next next question and whatever found fascinating about the.

01:03:22 Speaker 5

Project was.

01:03:23 Speaker 5

Is that it? It's not just about discovery, it is not about coming with new solutions, new drugs.

01:03:29 Speaker 4

It's about returning results to patients absolutely, and that makes them different from all the million person projects out there.

01:03:37 Speaker 5

Yeah, but will it have a component of 'cause you know what we have seen before? With many of these large scale products programmes, ultimately they lead into search for new compounds targeting uh?

01:03:48 Speaker 5

A smaller set of population, whereas here it is about saying these are the interventions that we have already available to us. Let's say starting.

01:03:55 Speaker 5

And lifestyle interventions, and we primarily focus on the sub segment of the population that is going to benefit from that most so that is roughly, I think what I understood is what you're aiming

for and the question in this is what we have seen before is that is almost impossible statistically. To this dichotomize things.

01:04:15 Speaker 5

Responder versus non respondent and in many settings let's say you brought the example of polygenic risk scores.

01:04:21 Speaker 5

The challenge that be facing that you have to set some sort of a threshold. There's almost no group within that population that would not benefit from it, so we get exactly to the same point about cost benefit, so it becomes the business model.

01:04:34 Speaker 5

So the two are intertwined and I was wondering whether you have thought about that and how would.

01:04:38 Speaker 5

You want it list that.

01:04:39 Speaker 4

Well, you know one of the things.

01:04:42 Speaker 4

Or joint is taking a really beautiful polygenic score programme and attempting to convert those data.

01:04:52 Speaker 4

And translate them into functional networks and we can do that beautifully by identifying in various ways the genes that they modify and things like that. If you do that, you end up coming with up with very compelling arguments about just what.

01:05:12 Speaker 4

What it means and what you can do, and a beautiful example of this is we're still.

01:05:17 Speaker 4

Adding five generations of a family where the more that the three earliest generations we have complete genome sequencing on and we've got little phenomic information on, and what we can show this family has an enormous propensity.

01:05:38 Speaker 4

For Alzheimer's, OK, what we can beautifully dissect is.

01:05:44 Speaker 4

The dominant gene that causes Alzheimer's April we four and its effects from the polygenic scores and with the distribution of the individual variants and their families within you can begin to seg segregate out just what individual things?

01:06:03 Speaker 4

They're doing and map it to phenotypes of the individual.

01:06:07 Speaker 4

Phenomic and or genomic and so forth. So in in the future.

01:06:15 Speaker 4

Families are going to really be an important part of the million person project, because if you're a member of a family, I can give you enormously more about your proclivities for Wellness and disease that I can. If we take you as an isolated individual, it is kind of the same as converting.

01:06:36 Speaker 4

Single bits of data into networks where the components within a network all confirm.

01:06:43 Speaker 4

So that this component here has behaved in the same way as the rest of the network, and you don't have to worry about multiple hypothesis testing isn't real.

01:06:53 Speaker 4

And all those.

01:06:54 Speaker 4

Kinds of things with assistance approach you can show it's real and the really important part of that is it reduces.

01:07:03 Speaker 4

Enormously, the dimensionality of clinical trial numbers that are required to get really compelling data, and this example I gave you of parsing.

01:07:17 Speaker 4

For clinical markers that will allow us to segregate diabetes patients poised prior to.

01:07:26 Speaker 4

Transitions or to the identification of subtypes and and convert them into a four or five year clinical trial with four different examples of transitions.

01:07:39 Speaker 4

Something that in the Natural History of the disease could take 20 years to do that say it changes the time dimension.

01:07:47 Speaker 4

And it changes the number dimension. If you have have all of these different dimensions and you know.

01:07:55 Speaker 4

Classic population geneticists really have a hard time with that, but I'm a great slide, but I figured it was so complicated to show here.

01:08:05 Speaker 4

That you know.

01:08:06 Speaker 4

Kind of built straight. Some of those kind of things, and actually I'm writing a commentary for for nature on that. We'll see if we get that published, but.

01:08:17 Speaker 4

But in Coffeed we did unbelievable things with a.

01:08:24 Speaker 4

Year and a half two year clinical trial on 300 patients. We gains enormously deep insights into immune trajectories, disease trajectories, drug trajectory's in ways you just couldn't do with conventional clinical trials now.

01:08:44 Speaker 6

Thanks so much David. Hear it. Share it. I'm a genetic system biochemist here in Oxford and early in the talk you talked about the plasticity of young minds and young bodies. So how do you get your views and thoughts into medical schools and medical training?

01:09:01 Speaker 6

Because that's the crux no.

01:09:03 Speaker 4

It is the crux and I'll tell you.

01:09:07 Speaker 4

If you go to the really good places like Hopkins and I went to Hopkins three different times about two or three years ago, trying to persuade them one to think about adopting this kind of systems view of medicine, but two trying to think about reformulating.

01:09:26 Speaker 4

Medical courses and the course they need most is precision population genetics.

01:09:34 Speaker 4

Could they could learn so much about all these things that we're talking about and Hopkins tell me what I when I was a graduate there they you know they they loved me.

01:09:45 Speaker 4

They think I'm one of their big successes, but they were totally indifferent to doing anything with me, so I went to.

01:09:56 Speaker 4

Uh, 2-3 weeks ago and talked with a very young academic medical centre there.

01:10:04 Speaker 4

And I have the Dean so excited that he's agreed to do the one thing I told you about. He's willing to take family practise and bring in the science of well, well, this data driven approach to things.

01:10:17 Speaker 4

And then the science of Wellness and prevention. But he also wants me to help design a medical school course.

01:10:24 Speaker 4

And we've just finished a textbook.

01:10:27 Speaker 4

That will probably be.

01:10:28 Speaker 4

Published in the next year or so called Systems biology and Systems Medicine that has some great chapters on.

01:10:37 Speaker 4

Some what systems medicine is precision medicine and what people?

01:10:42 Speaker 4

Health is and.

01:10:43 Speaker 4

A lot of the population stuff that we.

01:10:45 Speaker 4

So that's an ideal kind of book to start the students out, but the population health thing it it would all be taught by papers 'cause that's all contemporary.

01:10:57 Speaker 4

Stuff and there are no textbooks out there for it, so I I think you know the arrogance of excellence is palpable and you have to just move away from the organs of excellent.

01:11:12 Speaker 4

And go to good places and and and you know these excellent urban places may not be excellent all that much longer if they continue to be resistant. So we'll see.

01:11:25 Speaker 1

A good lesson for us.

01:11:26 Speaker 1

Well, I think.

01:11:28 Speaker 1

I'm going to go to an online question from Simon Gryphon.

01:11:33 Speaker 1

And and someone points out that trials or provision of genetic and phenotypic risk information and actionable advice has very frequently lead to know stratec sustain change in environmental acute health behaviours such as diet and physical activity. So even.

01:11:51 Speaker 1

Though you know.

01:11:51 Speaker 1

What's wrong, it's very hard to get individuals.

01:11:54 Speaker 1

To act on that.

01:11:55 Speaker 4

I can't argue with that in this slide. That's why the that's why the participatory is is so key and.

01:12:08 Speaker 4

I think.

01:12:10 Speaker 4

Education in various sorts is the only solution you have to give them a real sense of what they can do.

01:12:19 Speaker 4

I mean, I mean, I gave a commencement talk down at at at University of Tampa and you?

01:12:28 Speaker 4

Know you have to.

01:12:29 Speaker 4

That 8 minutes or whatever it is. So I said the first thing you have to learn is you're responsible for your health and then I talked about what health was and it's got these three types and I said what's well, listen and then at the end I said what are the things you can do and you know there are lists of things you can do.

01:12:49 Speaker 4

And there is an infinite list of things you can hope for in the not too distant future. If you're you know, close to some of the places that will adopt some of these data driven Wellness kinds of opportunities and so forth. And I'll, I'll tell you.

01:13:06 Speaker 4

I got a really terrific reception from, well, a sub. A small subset that returned at the problem there. 3 or 4000 people out there but people understood.

01:13:18 Speaker 4

It and they.

01:13:19 Speaker 4

But it's one thing to say, oh Gee, I really like that. It's another thing to practise it and and.

01:13:26 Speaker 4

How you change behaviours of you know, I think one of the ways you change behaviour is we teach kids in school what this is all about. So we've recently designed we have.

01:13:41 Speaker 4

Six people at ISP that I set up many years ago. Now that teach K through 12 education and they're utterly superb.

01:13:50 Speaker 4

And what we've done the last year and a half is use select teachers and students to create a 20 module course on what?

01:14:01 Speaker 4

Systems medicine is all about and it's for juniors and seniors and health or biology or whatever it is and is absolutely a terrific course.

01:14:12 Speaker 4

And that course would be great for most physicians, although the kids would probably get it better than most physicians.

01:14:19 Speaker 2

Would get it.

01:14:20 Speaker 4

But right, I think education is really a critical thing. The other thing that we're doing now is we've got really a professional film organisation in Seattle that we're designing. Very short vignettes to give you what's in genome, what's he known?

01:14:40 Speaker 4

What's an actual? You know what's got micro and we want to put together a whole cadre of these things and make them very interesting and accessible to people that may be thinking about taking on programmes like this.

01:14:55 Speaker 4

And they actually can be modified for physicians. I think they'd be tremendously useful for them as well.

01:15:02 Speaker 1

OK, we have time for one last question.

01:15:04 Speaker 1

This is a gentleman.

01:15:05 Speaker 7

That the director, John Todd directed the welcome Centre for Human Genetics here in Oxford. There are effective altruism organisations nonprofit like 80,000 hours.

01:15:15 Speaker 7

That are coaching motivated and caring kids and educating them and training them to to tackle major impactful global problems.

01:15:25 Speaker 7

Including health care. My question was we have an NHS 50 million people second largest workforce to the Chinese army.

01:15:36 Speaker 7

There's a, uh, a new cohort. Our future health of 5,000,000 people, 1/10 of of the NHS patients.

01:15:45 Speaker 7

Why don't you join forces with our future health as well as the larger?

01:15:48 Speaker 4

Well, we talked with the director of that programme and he's agreed. It'd be great for us to join forces.

01:15:55 Speaker 4

That's exactly why I'm here. Now I'm trying to create partnerships that are real and I think that's spot on. We I totally agree.

01:16:04 Speaker 4

With you, yeah, I mean you know the question is.

01:16:09 Speaker 4

What we can give them is really obvious. It's partly what can they afford to pay for at this point in time.

01:16:18 Speaker 4

That's that's the challenge, but one of the great things, and maybe I already said this is the 10 year programme. Will really drive down.

01:16:29 Speaker 4

The cost of phenomics by orders of magnitude over the next 5 to 10 years. So now.

01:16:35 Speaker 4

That's just as the first genome project, but the cost of genome sequencing down you.

01:16:42 Speaker 4

Know 10 to the 6:10 to.

01:16:44 Speaker 4

The 7th kind of thing.

01:16:47 Speaker 1

OK, I we could go on talking for ages. This is so fascinating. I'm afraid we have to bring it to a close now.

01:16:52 Speaker 1

Just before thanking Lee, can I say that our next event here is in our nearly two weeks time on Wednesday the 8th of June?

01:17:00 Speaker 1

Soon, Claire Craig, the province of Queens and someone who's on a lot of work in science, advice to government with Sarah Dillon, will be talking about their book storytelling, which is around narrative evidence and policy advice to to to government.

01:17:17 Speaker 1

Uhm Lee, I enjoyed your talk immensely.

01:17:22 Speaker 1

Apart from one sentence and that was the sentence where you said no good ideas come from old institutions.

01:17:31 Speaker 1

And we are proud.

01:17:32 Speaker 1

Of our 1000 year Heritage at Oxford, but we clearly need to.

01:17:36 Speaker 4

Know the only point I'd make is Oxford Martin is really a young institution.

01:17:44 Speaker 1

Well, that is even better. That has very much.

01:17:47 Speaker 1

Please please join me in thanking.

01:17:51 Speaker 1

Doctor Lee Hood for a really fascinating.