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Anne Wojcicki, co-founder and CEO of the popular DNA-testing company 23andMe, discusses how providing people with their own genetic data empowers consumers to make better health decisions and advances science. In conversation with Stanford Professor of the Practice Tina Seelig, Wojcicki explains how the intense scrutiny that the DNA-testing company has received is a sign that it is disrupting the status quo.



Transcript

- [Interviewer] I would love for you to tell us your story of what happened from getting from being a biology major, do we have any biology majors here? Okay, a handful of biology majors.. I was actually, I did my PhD in neuroscience so I'm a biologist as well and how did you go from that to starting 23andMe? Can you give a little bit of a snapshot of your story? - Sure so I.... I think that really, this is the advice I give to young people now like the reality is what whatever you think your life is gonna be at the age of 18 to 22.. Your life will not be that.. In some ways, the best thing you can do is just really push yourself to keep learning and I was really lucky because my parents were people who really didn't worry about like, oh you have to find what you wanna do right away and they were really supportive of; you should find what you're really passionate about.. So I graduated, I was a biology major.. I always dreamed, I was like, "I should still wanna be a doctor." I loved my pediatrician.. I like sick people.. I love medicine.. I love molecular biology..

I find it so fascinating but there was something that just didn't feel right and so I graduated college and I was one of those people I graduated with no job plan.. So I drove across country.. I was a nanny.. I nannied actually for a Stanford professor, John Donahue and his wife in the law school and my mom made me go to a job fair and in some ways it kind of shows how random life can be at times but I went to this job fair and I gave my CV to someone and they took my CV and it ended up being for Montgomery Securities, and she then knew somebody which ended up being the Wallenberg Family in Sweden.. And I know there's a bunch of Wallenberg buildings and lo and behold they interviewed me.. I only took the job interview because I wanted the frequent flier miles.. (interviewer laughs) I was a good scrappy, Stanford brat should and then I took this job and I had no idea.. I didn't even know what a balance sheet was and here I was the Wallenbergs and I met.... Marcus Wallenberg came out to interview me and I like, I didn't know who he was and he had to meet me at Printers Inc.. I was in flip-flops and a skirt and I was like, "You get your own bagel over there." In some ways, life is very random..

And I ended up on Wall Street and for 10 years I was investing in healthcare companies.. I didn't know anything.. I didn't even know what Wall Street was but I knew that it was super interesting and I was learning every single day and learning about how, I had this passion for molecular biology and for me to be able to meet with these amazing CEOs who were pioneering the world.. My first project was transplantation and I would fly around the world and meet with great academics who were trying to understand whether or not you could transplant animal organs into humans.. At some point I realized I wasn't, not that I wasn't learning but I felt like the healthcare system was not reflective of my values and I got into investing and I got into the whole business because I was learning, it was so interesting and I love the potential of we're all gonna live better and it's gonna be better, healthier lives, and then after a while I started to realize that healthcare is this amazing money machine.. It's \$3 trillion, it's the largest part of our economy for a reason.. There's so much money in healthcare and I would have meetings with people who were CEOs who were like, "Oh yeah, we're seeing marginal expansion "because we're really good at collecting "from the uninsured." And you're like, "Oh that." Marginal expansion is good but the fact that you're squeezing poor people doesn't sound great.. I just felt there was this ethical debate for me and so in some ways, 23andMe came out of this frustration that I saw that the healthcare system was not reflective of me and I spent probably a year just shorting stocks in your anger.. I was I'm just gonna short everything.. Everything fails..

It all sucks.. And I sat with this one professor and we were talking about you know, it was obviously at the early days of Google and that was on my mind and had sort of this discussion like, what if you just had the world's health information, what could you do? He's like, "Well, you could solve everything." I was like, "Well then, we should do that!" And it was the

beginnings of the social networks and you know crowdsourcing and you know MySpace and was this idea what if everyone, like we all have a common interest in our health.. If you look at Livestrong and Susan G.. Komen and all these groups, people come together and they care so why don't we just all come together with our health information and I don't need format and I don't really need all the specific academic.. We can crowdsource the world's largest study and empower each of us with our information like let the people rise and why is it that your healthcare system is like, why are they all telling you what you want.. No one ever asks you.. 23andMe came out of a rebellion and in some ways we've always meant to be a rebellious brand.. It was always about like, I want to change the whole system and the beauty of Silicon Valley is that you can be totally unrealistic with your expectations of what you can do and I really believe, I tell people in the company all the time, I'm like, "We really can topple a \$3 trillion industry.. "It's gonna be amazing like little old 23andMe," but that's what we're trying to do like start a revolution and 23andMe came out of that sense of I was super frustrated with the industry.. I was very clear seeing that the consumer has no power, that there's a potential for crowdsourcing and I was fortunate to have the Stanford upbringing and the Silicon Valley community that was really supportive of think crazy thoughts and follow your passions and it's okay to fail like everyone fails at different times..

Do it and I think that, you know, then came 23andMe.. - [Interviewer] I love this.. I love your passion.. And this is such a fabulous story first of all about the serendipity but also how once you found your passion, you dug in deep.. Now, 23andMe was such an early early player in this game.. I remember when it started and this was sort of in this gray market.. There were the regulations weren't there yet.. Maybe even the science hadn't quite caught up with what you were trying to do.. The market certainly wasn't there.. Which was most difficult and how has that changed over time, the technology, the market and the regulations? - So the thing that has changed the least ironically, is the technology..

We're actually still using the same platform.. One of the things that happened when I was.... When we were looking at starting the company I would do calls with experts and I called somebody at The Broad and I remember him saying, "You don't understand.. "The enthusiasm we felt in 1999, let me feel it again." The whole world's gonna change and it was because Alhametrics had introduced this whole genome chip and suddenly you could get all this genetic data and was somewhat affordable.. It was \$1000 a chip, it was cool, it's like we're like kids in a candy store.. It's like the potential is all there and so that in some ways, hearing that enthusiasm, the potential, that to me was a sign we should start the company now because it's cheap enough and you can really get all this information.. So the technology is the one thing I'm really grateful for.. Illumina has an amazing product.. It is reliable.. It works..

They drive the cost down.. It just gets cheaper and cheaper but we're on the same platform that we started with.. The regulation in some ways, the regulation in the consumer market, those are two things.. It's almost.... I was lucky from the investing world, I learned Amazon back in 1998, we used to have these discussions all the time will consumers really put the credit cards online and in some ways that seems so crazy now but that was the discussion.. We would debate, will they change their behaviors? People wanna see a good.. How would you buy something online? In some ways I had this support when 23andMe launched, the consumer was not ready and into this day, after 11 years, the consumer is now starting to get it but people have no idea why you would want your genetic information.. And our society trains people in that sort of communist sense of like, you should wait for big brother to tell you what to do.. If it's important then your doctor will tell you what to do.. So we've been and this is one of the things I've learned..

If you're changing society and how people think and how they work, you have to have patience and so it's part of it is that you can't do a marketing study and I can't go and have marketing people out there trying to figure out what do people really want.. They don't even know what they want.. We have to try and fail and try and fail.. And I can see in my mind this world of consumer-driven affordable healthcare and so we have to sort of create that.. So we have to teach the consumer.. The regulatory side.. When we launched, we believed really simply, I own myself.. It's my body and my genome is just the digital representation of me and so of course I can get access to it.. Why would I not be able to? That seems crazy like why would there be any prohibition and then my taxpayer dollars go to all this genetics research.. So why won't I be able to get access to that? All I wanna do is connect my own body, my genome and understand what's happening with all this research and I already paid for that research..

I wanna see what it is.. So the idea was we're not interpreting.. We're connecting the dots for you.. Sorry, it was the cold.. And so.... We just felt like it was information.. It was almost like this is your first amendment right like you can see and from a lab perspective, we felt like we fell under CLIA which is the Clinical Laboratory Information Act managed by Medicare as a laboratory developed test.. And lots of blood tests today and most genetic tests are all LDTs.. So we felt like we were under that pathway.. Clearly like one of the things that's interesting for me especially from an academic perspective, the history of medicine is so interesting and you know, birth control tests used to be super controversial and any time the consumer is at the point of interaction like it's a direct to consumer, that's really controversial so we realized that we were just getting....

Like there's a lot of controversy around us because of the direct to consumer and so we did have sort of what's now known as the most well read ever warning letter by the FDA's history, which I actually, in some ways, I'm really proud of.. I think that that was a sign that we're doing something really different.. It was sort of radical.. It's the change that we want.. And our approach to it has been to work with the agency and say you know what, like trying to fight with the agency or sort of that arrogance of we'll show you.. Part of it is that you, to really drive change, you have to change the system and so for me, the best thing that we've done is then partner.... Partner is not the right word, but that we actually listen like we listened to the

FDA and we said we're going to do all the things that you've asked us to do and we're gonna get a direct to consumer approval for our test.. - [Interviewer] Okay.. This all sounds great.. And I'm all in but there will have to be some interesting ethical considerations here..

I mean, once you give people this information, first of all, the question of what do you do with it.. You've mentioned several times, essentially there's data is also going into some central place and being used for research so there is who owns that data and do you own the data? And also then, what happens with people who get information that they don't actually, maybe it's not actionable.. Maybe they get things that scare them.. What do you think about that from an ethics perspective? - So we, is Hank really here? - [Interviewer] (laughs) No.. He's across campus.. - He's across campus but you know him.. So Hank is a Stanford ethicist.. It was funny because in the early days we recognized there was gonna be all these ethical issues and we couldn't get an ethicist to work with us and you know, in some ways ethicists were like, no, no, no this is like groundbreaking.. We're gonna just comment from afar and it's true there's been a lot of really interesting sort of ethical questions that have come out of this.. My approach to it has been....

There's a real.... There's like truth that comes with your DNA.. I can tell you whether or not you are related to your family members.. And so the same way, it's not fun to get a cancer diagnosis and there's no easy way to coach that.. Sometimes you just tell people or we make the data obvious like you're not related to your father.. And is there an ethical debate about whether or not you should or shouldn't do that? I'm just a big believer that that was consumer choice and I feel there's truth about you that you should just be empowered to learn that about you.. There's really interesting ethical debates in that you share DNA with all of us.. You're share DNA with me, you share DNA with your whole family and so you might wanna learn something but your sister might not.. And so, how do you.... You might learn that you are a carrier for the BRCA mutation and your mother learns that she's a carrier for the BRCA mutation and now your sister knows she has a risk factor but she didn't wanna know..

So I've just kind of put that all in the bucket.. You have a choice to learn about yourself the same way that you have the right to ask about a family history.. You have the ability to learn other things about like go and get a test on your own.. So the reality is like we all share DNA in common but we're about empowering you and there's definitely considerations that I need to empower you with so that when you are getting this genetic information that you are aware and we spent over a year with Hank and others on the consent form, you know, making sure that we were as thorough as possible, helping think through what are all the different things that come about with it.. And I would say after 11 years of doing this, the number one thing that is with it, is with family, is you know you might not wanna know something but your sibling does or you find out that you're not related to, you know, there's a lot of secrets that went to the grave that suddenly are unearthed and you realize, oh Uncle Joe is actually just Joe and.... (audience laugh) There's all kinds of things like that that people start to, people start to learn and we've always just kind of that approach.. The best way to do is just to be really candid and I think we have a brand that is very direct and very honest.. And is what I've always said when I worked in hospitals.. There's no easy way to tell someone, "You have stage IV cancer." The best thing you can do is be sort of you know, factual and then help make those decisions and for me, what we try to do is give people information and then create a community around it so people can start to understand what to do.. - [Interviewer] But let's just talk about privacy then because now the information is out there..

It exists in the world.. Who owns it and the consequences for me might be one thing but if the insurance company knows or if the government knows or my employer knows, there might be some interesting consequences that are unintended.. Can you talk about that? - So we do everything we can right now to protect your privacy.. The reality is like I'd love to see your genome.. I'm sure it's wonderful and beautiful but the part of the reality is that your bank account is a lot more interesting.. And the banking ethic, (interviewer laughs) When I think about people, the desire to hack in and see like, oh, you might have blue eyes or you know, you might be the hot-most alien, you might have a high risk factor for Alzheimer's.. It's just not such a motivation to hack in and it gets back to in some ways, some of the ethical questions is that it's, potentially more within a family.. Even the insurance companies like when we talk about insurance like one.... Right now, we will never give your information out without specific individual level consent, but we have the question; will insurance companies hack in? I'm like, what? It would be unusual for an insurance company to break a law to try to get information about a risk factor that they don't really have any great models built around.. Plus, we also have this thing, we don't have a legal chain of custody on our customers so meaning that if you ordered five kits, I have no idea if you ever spat..

So from a privacy perspective, I don't actually know that you are you.. Like I didn't actually see you spit.. It could've been you know, your five friends spat, it just went to your address and so I don't actually have a legal chain of custody on my customers.. So I think that actually give a fair amount of, you know, like I said, we do everything we can to protect the privacy of customers, but again, we spent a lot of time with privacy experts and it was really ingrained in me that or hammered into me that privacy doesn't mean not sharing and that privacy actually means choice and that people say like, "I want to have the choice "to say, 'No one sees my data,' "or I wanna have the choice to say, 'All my family "sees my data or make it public'." That we want to enable choice.. And we need to do everything we can to respect your choice.. I don't want to share it with anyone and we need to respect that but I also need to respect your choice of saying, "I wanna share it with my whole family and so we've enabled those kinds of sharing abilities with all of our customers.. In terms of the research, we do consent.. We ask our customers if they want to consent for research so it's an opt in.. Over 85% of our customers today are in fact, opting in.. And what we find is similar to the sort of goodwill nature of Susan G..

Komen like people wanna help.. You know there's no such thing as a healthy person.. Everyone has something.. Everyone has allergies or migraines or I have Hashimoto's.. Everyone has something and so we all wanna help each other and we can all be empathetic to this fact that like, you know, one of my good friends has cancer.. Everyone has a story.. Everyone has a friend who has something.. You've all seen other people suffer and we want to help.. So the consent for us is like an opt in.. We ask people than to take questions, if you want, but it's always that ability, you have the ability to say, "I don't wanna take this set of questions," or, "I wanna withdraw my consent." So everything for us is again, it goes back to that definition of privacy..

It's about choice and so, if you want to participate and take every single survey question we have, do it.. And then we will tell you what you participated in.. If you don't want to, then don't do it.. - [Interviewer] So do you consider yourself a biology company or a data company? - Data.. - [Interviewer] Data company, so what do you do with all this data, I mean I'm gonna guess you have how many data scientists do you have working with you? - [Man] A lot.. - He's my head of people.. - A lot, a lot.. - The answer is a lot, okay.. - Well, I think it's probably, it's fair amount.. I mean we have over 100 PhDs..

We're over a third sort of PhDs.. Sorry, I hate to buzz someone.. I just have to get more water.. - [Interviewer] There's some right here.. - Yeah, I'm just gonna go through that, just wait.. - [Interviewer] There is more water on campus.. Super.. So great, hydrate, hydrate.. - Sorry, I don't wanna start coughing like crazy.. So we have, I mean what we do, we see ourselves as a data company and I think, especially speaking to this kind of crowd, you know the whole new world is about how do you use data..

We see what Google can do.. We see what Facebook can do.. We see what you know, Netflix and Amazon.. All these things are based on data of customers and so, in some ways, I look at this as a tragedy that the most important thing is not what movie you really want, which is very important but when you go to the doctor, use your data to tell me what's likely to happen to me.. I find it crazy that we have this mentality where we absolutely accept you're diagnosed with something like my friend diagnosed with cancer.. Let me go and get five different opinions because there's not consensus.. We don't actually have the data to know what is the right thing to do.. What we wanna do is like use our data to really transform healthcare and so we have, I see us as like we're a data company.. The first thing we started doing was publishing.. We have over 80 publications..

We try to collaborate with as many different academic and formal groups as we can because we feel your data is really valuable for you, and it's valuable for one study, but you could participate potentially in 100 studies and our customers, we've actually seen that the average customer has participated in over 200 different research projects.. So we're really about trying to empower people to participate in more and more research.. So one of the next things that we do is data is we hired Richard Scheller who used to be at Stanford-- - [Interviewer] He has sat in that chair-- - Oh, did he? - A few years ago, yeah-- - At this talk, oh did he, when he was at genetic.. - Yeah exactly.. - Aw, so cute.. Richard (laughs) so we hired-- - He was my professor when I was a student.. - Oh really? - Yeah.. - Richard is a lot of fun.. He tortures me all the time.. One of the things like also really frustrated me when I was on Wall Street is that, we have this horribly inefficient drug discovery process..

It's potentially the only group I know that actively promotes how they get worse every year.. When I started investing, it was 700 million to make a drug and now it's \$2 billion to make a drug like it's crazy.. It's crazy that, I mean this is where it reminds me of the communist era of like where you actively promote how much you are worse every single year.. So something is wrong in the system.. The whole approach, the methodology.. Something's wrong.. So my hope was that if we actually started with a giant human data set and you're getting insights from humans instead of potentially animals, would you actually have a higher likelihood of success? And I think that's where we've actually.... I don't have the ability to say yes yet but my hope that is in 10 years, I'll be up to say, "Hey, by starting with a massive human genetic database, "I was able to develop drugs faster, better and cheaper "with higher outcomes than the rest of the industry." And so that is like one of the main things we're trying to do this data is like how do we actually develop insights in our biology and then turn that into potentially therapeutic, like we publish papers and then also develop therapeutics and one of the other things I'm also frankly most passionate about is that, no one really pays for prevention studies so like the whole question you're a neurologist.. How do you prevent Alzheimer's? If we actually really figured out how to prevent Alzheimer's, who's gonna make money on that? No one so, the question there was like, who's gonna fund that study? And that's kind of the reality is like every single one of us in the room cares about preventing Alzheimer's but if I had a whole group of pharma execs, not that they're bad but no one's gonna make money off a prevention unless it's the pill.. And so that's what I'm really passionate about like are there lifestyle interventions? Is it food, is it diet? What is it we can do? Oh amazing, thank you..

- You're welcome.. - Oh, and a cough drug, thank you.. So I think that's where.... That's where I think there's like.. I've lost my train of thought on that one.. - [Interviewer] No, it's okay, it's okay but did you actually say that you wanna get into the business of actually developing therapies or are you just partnering with companies that do that, giving them, using your data and your insights-- - Oh no, we're developing drugs.. - You are? - Yeah, we are developing, like people it's funny because I meet people sometimes and like.... Now, we hired Richard Schaller, who spent 15 years at Stanford and 15 years at Genentech, something like that and we hired him, specific was we wanted to develop drugs so we currently have seven compounds or seven targets under development and we get the question all the time, where people are like, "Well, did you buy them?" I'm like, "No, no, no.. They came from the data." "Did you acquire it?" I'm like, "No, Again, came from the data." Like it's literally, it's all from our data and so we've developed this whole pipeline of our data site.. My consumer team, we bring customers in, we ask questions, we have a whole team of PhDs and survey methodology who figure out how to ask

questions in the right way, we analyze the data and then we work with Richard's whole team about how do I translate all these insights into potentially drug targets..

- [Interviewer] So can you give an example and of that pathway because that's super interesting.. - It is super interesting-- - Where did you start, what kind of insights you got and what sort of therapy are you developing? - So the thing that's interesting about what we have done is that we don't do phenotype specific research.. For instance, I don't say, "I'm gonna go find people "with Alzheimer's and I'm gonna do a study on Alzheimer's," I take everyone, like every single person in this room is interesting to me and all of you have something to contribute, so we follow the data and it's in some ways, like it's really hard for people to grasp that.. We have compounds in all kinds of it; the cancer, asthma, autoimmune, and we picked those compounds or we pick those ideas because that is where the data was most interesting.. And we look at the whole story where we can do a genomewide association study and then we can look in to see, is this genetic variant associated with these diseases and then we can look at at this genetic mutation, people with that mutation, what all the different conditions they have.. So we can do all kinds of interesting, you know, analyses of the data that we have and we're using that then to develop these compounds but we don't start with a specific hypothesis and in some ways, like when we started the company that was one of the most controversial parts.. Like I would meet with scientist and they would say, "Oh, this is a fishing expedition.. "You get enough data, then you can find anything." And I think that's where, in some ways for me, not having a PhD or an MD was helpful because you can think, like I wasn't trained in a certain specific way.. I just have this idea like a lot of data sounds good and we've been able to show now that a lot of data especially when it is collected and I have this appreciation now for the survey methodology team.. Data that's collected well, analyzed in the right way..

we really can get a lot of really fascinating insights.. - [Interviewer] Cool.. In a few minutes, I'm gonna open up to questions from the audience so think that your burning questions about the industry.. the company and anything else you have.. I'm curious.. Let's zoom out to the whole industry.. Because things, the technology is changing so fast in so many different disciplines.. What are you most excited about in this area of healthcare and prevention and genomics? (coughs) - What I'm excited about us-- - [Interviewer] And we are too.. - I'm excited.... What I enjoy, I think Silicon Valley is....

We have such a culture, there's brilliant people all over the world but the thing that's really unique about Silicon Valley is we have a culture of risk and innovation.. And it's just helpful because that becomes infectious.. Like people are it's okay to fail.. It's okay to start a company and fail and it's not okay in all areas.. So what I enjoy is, there's really smart people who have been through sort of the startup culture and have done really successful companies and they hit their 40s and they start to get sick or they know people who got sick and so suddenly they become aware of health and there's really good enthusiasm right now from people who I believe are willing to take risk and really willing to know how to innovate and build companies who are trying to build companies for sort of like the next generation of healthcare.. And I'm optimistic like I'm really optimistic about 23andMe being able to partner with a number of these groups that can really be able to quickly get you data.. So like some of them that I find fascinating like the ability to look at all your radiology and can you scan it like is there machine learning that can potentially help scan them in a much better way.. To me that's super interesting.. There's companies like Grand Rounds where you can get, you know, expert opinions online.. I'm really excited about....

So I'm excited about all this are this sort of like there's Health 2.0 world and what's happening and the enthusiasm from Silicon Valley going into that.. I'm also really excited and I think this is odd.. A lot of people don't get this sequence.. 23andMe has almost no partnerships with with hospitals like we have no partnership with Stanford almost.. We have one partnership in Nevada with Renown but I have a partnership with every single retail group so Target, Walmart, CVS, Sam's Club, and I look at that because the future of prevention is not with your doctor, but the future of prevention is with Walmart.. And the reality is like you, your health and the status of you today is the accumulation of what you have done every single day.. So I tell my kids all the time, every single day you're making decisions that are cumulative and they impact your health.. If you want to prevent disease, you need to take responsibility on a daily basis and where do you live out your daily basis? It might not be in this room but most of the country lives it out at Walmart.. The average person goes through it three times a week.. So if I want to drive real change in this country, I need to work with Walmart and I need to be where people are going..

The reality is no one wants to go and hang out on the doctor for fun.. I don't happen to randomly stroll by Welch Road and see my doctor.. It's not in your item.... I mean it's near Stanford Shopping Center but it's like not part of ecosystem.. And that's for me one of the big things.. I think retail is gonna become really interesting as they partner with healthcare and I think that's gonna become more and more of an ecosystem for us to actually get a lot of our care.. - [Interviewer] So it's interesting because.... Really, really interesting insight and I think that'll be fascinating that play out.. Genetics is only one thing you can look at, right? There are lots of other things in our systems that aren't necessarily embedded in our genome.. It might be in our blood..

It might be in other bodily fluids.. Are you thinking about going in that direction as well or looking at being able to measure other things? - So we joke in health like we always want more - [Both] Data.. - So we have this debate in how, it's almost for 10 years now about two hot topics; the microbiome and telomeres.. So the challenge here is like when I talk about genetics and the technology I have, my technology platform is spectacular like I can't.... I'm so grateful to Illumina that they have this great platform that's incredibly reliable and robust and, I know that when I give you a result, I feel good with those results.. Microbiome, I don't quite have that yet.. There's a lot of debate in collections.. I mean, the discussions and my research team, they love the debate like do I need the entire sample or do I need part of the sample or what part.. I mean, the

debate is the kind of fascinating and so I just don't think it's quite yet there.. There's other stuff I met of late like there's a whole other world of other technologies that I think would be interesting..

The thing that I'm actually most interested and again, it goes with some of the prevention work in somewhat of our rebellious brand and even just my spirit, and also being in Silicon Valley where people talk about organic and are far dates really good for you, are they bad for you? I would love to do environmental testing and I did, in 2008 I did a test called the body burden study where I was tested for 80 different chemicals.. And It was really interesting and I was like super high in fire retardants and it was environmental working group who did it and they were like, "Oh, you must fly a lot in coach." And I was like, "I do," and they were like, "Yeah, that's circulated air and fabric seats, "you absorb more than in leather seats." And so, I was like, "Oh, that's great." (laughs) And I was really high also in mercury so I stopped.. I did a couple of things.. One, I changed out all of our furniture to get rid of the fire retardants.. I stopped eating tuna but it was really interesting to just know that that was in my body.. And I think there's a huge potential for 23andMe to bring truth to a lot of these hypotheses.. Like we all know.... There's data out there to speculate like some these chemicals are bad, but we don't really have data to say exactly how bad or are the really bad in your life.. They might be horrible and rats at 150 times our concentration but I don't know, what does that mean for us? So I would love to actually bring truth to some of these questions that are out there or some of these, like is it a hypothesis or like some the stuff that's about our, you know, what we do every day and can we actually bring some real science to that.. - [Interviewer] Very cool..

Who wants the first question? I have a preference for students.. If you're a student, do I have any students who wanna raise my hand, there you go, there you go.. - [Jenna] Hi I'm Jenna, mechanical engineering and I was wondering, you talked about the transition from going through undergrad to whatever you're doing right now and then later on you talked about kids.. How do you manage family and being able to invest 10 years of your life on the same project? - [Interviewer] So I'm gonna repeat the question for the audience.. It essentially is, okay, you're working really hard.. How do you balance your work and your family? - I'm lucky because my sister.... My sister's life is more crazier than mine because I have two kids and she has five and we both run companies and her company is even bigger.. So I think the thing is like, one of the lessons you have as a company is that you have to.... Our product's success depends on our prioritization and my life also depends on my prioritization and so there's some rules I've had like I stopped traveling for conferences.. There's kind of a crazy conference world, you can go to endless conferences..

I only do stuff that's local or people can come to my office now.. Otherwise, it's just suck of time.. Dinner meetings are also usually a total waste of time because you.... I mean it's the reality, people usually want something from you and you can just like ask in 15 minutes and then you're done.. And so I'm really kind of strict like I have to prior.... Like my kids want me like they want me around and so I have to be really disciplined about it and the thing that's been hardest for me is I love, like when I first moved to New York I had this mantra, I was like I'm gonna do everything.. Every opportunity that comes my way, I'm gonna do it and it's really hard now because I must get a handful of invites everyday and it's not in my nature to say no in everything.. I'm also like the Energizer Bunny like everything looks fun and I can see the potential in everything.. I'm like, "Well, I don't know.. "Maybe going to Sweden in winter is fun." And it sounds really interesting..

So I've had to learn and my team has been really helpful with me of like saying, no.. Like, "No more traveling.. "Sweden in the winter is not good." So I think you have to just be super disciplined with it and recognize that there's some things that are fun and some things that are not.. Running a company, the most important thing, my company is also my child and so for CEOs who are traveling all the time, you're missing, it's not functioning well then.. You need to actually be there.. I need to meet with people and I need to spend time with my kids.. So it's just about you gotta run it straight.. - [Interviewer] Great, do you another question.. Back there? (muffled speech) Can you please speak up? - [Lady] (muffled) so I speak half French and I think you're doing amazing things.. I have two questions to ask you..

The first question is, down the line, when I think you have these stories of being successful.. Do you have any plans to provide ripple effects to the patients whose genetic data went into discovering a drug? - [Interviewer] So let's just save that question first, do you plan to essentially give some sort of compensation to the people who contributed data to, if there were some drugs that came out of it and the second question? - [Lady] Second question was, what was the process of starting such a capital intensive business like for you in terms of raising money.. Did you find it at all challenging to get people to get people to even the risk and how much you had to.. (phone beeps) - [Interviewer] So the question is the challenges of starting a capital intensive business.. - So I'll get the first one first.. So I think a lot about that.. I'm frankly like kind of disgusted the way the research environment today treats participants, like you're called a human subject.. Like at what point in time do you ever wanna be a subject? It sounds horrible and I think there's kind of this mentality of like I'm gonna get you to consent.. I'm gonna take everything I can from you and then I'm out and I just like.... It's so dirty..

So 23andMe is like totally built around.... You're a partner.. If you don't what were doing, you're gonna delete your data and that's gonna screw us.. We have totally set this up to be a balance.. I feel compelled, every time you answer a question and then there's a publication, I need to give you that data back.. So I don't know what it is.. Like Richard and I sort of talk about this.. We have to do something for the people who have participated in some way.. There's a long.... We have some studies; like our depression study was 400,000 plus individuals who participated in that study so there's insights from there but then there's gonna be 10 years of work to do so I don't know what the right plan is..

In some ways for people, and I hear this all the time.. If you're severely depressed individual and you participate in the study and then we discover something and I come back and I'm like, "I'm gonna give \$15 for what you've done," it's insulting and even for people who have a terminal illness, it's not about the money.. They're not doing it for the money.. They're doing it for the respect and that they want to move it forward.. So I think there's things that we should do.. We recruit from the 23andMe community all the time for studies and so I should definitely, if I recruited you for a study like a phase two trial, should I do something special so you don't have to pay for drugs or something like that? Without a doubt.. There's things that we should do.. I just think it's, and I don't know what it is but our approach is always like I don't know but we should do the right thing and whatever it is today, is not the right thing.. We're gonna definitely innovate on it.. - [Interviewer] And the second question had to do with starting such a capital intensive-- - We were totally naive..

You can never start a business saying like, "Oh I need hundreds of millions of dollars." We were totally naive with what it is and like the beauty of being early as you're just naive and the reality of venture capitalists have seen it before so they know you're naive.. We started a business knowing that... We outsourced as much as we could.. So our capital really went to just hiring people and in some ways we had built a plan where I was like all the really expensive things we outsourced.. Even now we just did a big fundraising.. We raised \$250 million, but that was because I have this machine that's built and that money is gonna go for potentially funding R&D with Richard's team on the therapeutics and a lot for marketing and for potentially, acquisitions.. So we didn't need the capital.. - [Interviewer] Other questions? There you go.. - [Man] I was wondering if there was a plan for like proactive and preventative measures maybe using additional data sources like smartwatches and then you can start to also use that with the data that you already have to give people proactive insight.. - [Interviewer] So the question is, are you thinking of using other source of data such as smartwatches to augment the data you're getting from your existing tests..

- We would love, we're not doing it yet but we would love to start doing that.. So you can, like we will... That's the kind of data source like is relatively reliable and so I would love to start actually getting you know, I think about movement and sleep like those are some the best.. Diet is really hard to get but movement and sleep would be great.. - [Interviewer] Super.. Another question back there, yes.. - [Lilian] Hi, Lilian Cold Joy.. You talked about preventative healthcare and how a lot of what 23andMe can offer some better lifestyle changes.. Lots of lifestyle changes come with pressure, positive pressure from a community.. So if you go, you've active friends, you got to the gym with your friends..

If you have friends that need hamburgers, you eat hamburgers.. There was a time with things that you talked about 23andMe building a good community of users that contribute their data.. Are there any plans to build a more active community of, you know, people that are interested in exercising more or eating better, cooking recipes, you name it but leverage that community in some way.. - [Interviewer] So the question is; are you interested in leveraging the community to change better lifestyle choices.. - I think we wanna leverage a community when it's really targeted towards something that's genetic or something that like it's a real insight in you.. For instance, like you're a higher risk for Alzheimer's and you know those are people in their 30s, higher risk for Alzheimer's community of them.. We potentially would engage individuals to say let's do a lifestyle intervention study and see if we can change outcomes.. We have forums right now on the site.. I think that that's an example of potentially where we would partner with groups if we felt someone else is gonna do that better than us like if you really want to start to exercise better or lose weight, there's so many other people who really are experts in that and what's the right way then we could connect you.. So we look at a lot of what our communities and our partnerships..

It should revolve in some way based on something that's really personalized to you and I re-deal your genome.. So we think about communities and that.. It's always like we're such a unique company.. Everyone talks about diet and weight loss.. But if I have, for instance, very specific recommendations for you and then there's a group of people and they're pulling in information there, that, 100% hundred percent, I can envision a world doing and we are specifically starting to do a bunch of wellness studies so it would be sort of the diet and exercise.. What is it like, you know, is there a certain diet that's better for you than, you know, other people in this room? And so then, you could imagine specific communities there.. - [Interviewer] Great.. Yes.. - [Andrew] Hi.. My name is Andrew..

First of all, thank you so much for doing this talk, it's awesome.. I have a question that concerns what happens with all this data is crunched so I think it's really cool that 23andMe right now is like making drugs using this data but down the line, as you said, I think it's really interesting that theoretically the genome it's like has infinite power because we can find out like everything about like what genes control what things.. so could this pave the way towards intelligent design and my question is more like, what happens to the people who can't afford to have 23andMe now especially if it leads to things like intelligent design where we can make designer babies as a result of this data because people who can pay for this they can use their data and figure out what genes they can change so that you can improve future generations because that theoretically, it's what possible, down the line.. - [Interviewer] So I think the primary question is how are you dealing with people who can't afford it who would benefit tremendously from having this information? - So I'll answer it to this aspect.. People who can't afford it, we do a number of programs trying to enable access so we give away a lot of kits for free, we try everything we can like right now we have an offer.. It's two kits for \$99 so \$49 each.. So we're doing as much as we can to drive down affordable price.. The second part in terms of intelligent design and whatnot.. I think there's a Gattaca world that is more science-fiction than the reality like we know CRISPR, I know cystic fibrosis but I can't cure people yet with cystic fibrosis so there's a long world before I'm gonna like have it, you know, a homogenous society of like everyone choosing this one set of phenotypes.. That said, like I think this is the ethical discussion..

I look at 23andMe, part our mission, I want to understand the genome.. It keeps me up at night it's like we have this code in us and we don't understand it.. How can everybody sleep? Like it's, like I really.... I really wanna understand.. It's so interesting in the fact that it goes back to the beginning of time, that's so cool and so I.... I want us to be the one who are understanding and deciphering the genome.. There's all kinds of ethical questions about CRISPR and how are you gonna use this information and there are realistic, you know, issues that need to be discussed, but I look at our job as like I wanna understand them.. - [Interviewer] So I wanna build on that because one of the concerns that I've had earlier really in the early days, I was offered to participate in and get my genome done which I have not done yet.. - We'll give you a kit.. - [Interviewer] Okay, here's the issue is I'm concerned that do we actually really understand it enough to be giving meaningful data it? Like at what the rate of knowledge increase of them in this world is is superfast and we still are quite far from really understanding it..

I mean you're saying how can we sleep at night because we don't understand it and that's my concern is, we understand it and am I getting information that is really accurate? - There's information we toggle in some ways like this was a regulatory question, in some ways like we toggle between, oh my God, your data is so actionable and so scary.. How could you give it to people? And then, "Oh my God, you know nothing "and it's meaningless." Well it's like, pick an argument people like either we're too scary or we're meaningless.. The reality is like it's the early days like we know cystic fibrosis mutations.. And I know BRCA mutations.. And I know some of the familiar hypercholesterolemia mutations.. There are certain mutations we feel really good about.. There's an entire world in the whole genome sequencing department that makes me nervous and it's very versus, you know, variants of unknown significant.. So I might.... Like I used to give this talk that was called deleterious me.. When I got my whole genome like all the different ways, I should be dead but I'm not..

You start to follow my mutations like I have this mutation and I look in, you can look in some of the genetic databases online and be like, wow, there's like all these like really terrifying diseases associated with this mutation.. So to me, the fact that we don't know everything is like symbolic of life.. We don't know everything about everything but it doesn't mean that we shouldn't have it.. To me, it's like the journey to actually starting to understand what the genome means is only gonna come by starting to actually explore it, and I really have this belief like everyone can be a scientist.. My dad, like my number one takeaway from the particle physicist is that in 1991, 1992 my dad ran something called the superconducting super collider and it got shut down by the government and it was gonna be the largest you know giant accelerator, smasher ever and part of the reason why it got shut down was because the physicist couldn't articulate what the value of proposition was and all the scientists, like I repeat all the time, you hurt yourself by wearing a white coat and using big words and talking down to people.. Of course, the average population believes more in one of Gwyneth Paltrow than they do at anyone at Stanford because she speaks their language and it's like it drives me crazy.. We have to empower people and be like, "You know what?" Be honest, we don't understand most of the genome but you can all still understand it, and it's beautiful and it's fascinating and the whole journey of science is the fact that we don't know.. That is what inspires all of us to be scientists is like to figure it out.. There's nothing better like my two great moments are like the birth of my children and the results of an experiment.. Did it work? Like same thing with my children..

Did they work? (laugh) But like, I just think for me, the fact that's an unknown is the beauty of it and like we're all gonna solve it and all of us like every single person on this planet should be interested in it.. It's about them and I really, I so want scientists to embrace this idea of like everyone can be a scientist.. You don't need a degree like we can all learn and the more that we actually get, like the person stocking shelves at Walmart to understand CRISPR and what's happening in gravitational waves, the more we're gonna get funding, the more we're all gonna be connected like the more we're gonna actually advance society.. So I really like, to me, that's an opportunity; we don't know.. And I think medicine and healthcare in general would be so much better if people actually just admitted like we just don't know most of these thing.. We don't know most of the things of how the body works.. - [Interviewer] But it's job security for all the scientists and all that thrill of discovery in front of us.. So it's interesting because a tremendous number of students at Stanford study computer science.. We know that there's the big sucking sound of CS department as people are looking at the opportunities there.. Can you talk about what where you see, you know, what sort of things do you think students should be studying? Should every student take a biology class just as they take computer science class..

One of the things that if you came out of school you go, "Everyone should have this type of baseline knowledge "in order to just live a fulfilling life." I'm biased so I would say computer science is definitely.... Like I wish I don't have a CS background.. I wish I knew more how to code.. I think that biology, having a basic understanding of biology and the thing that I think is great like the more people understand statistics like I love, one of the first books I gave my kids was How to Lie with Statistics.. Just because I think it's such a great.... You know kids always start talking about numbers and my son always quotes different stuff off the Internet and that book, again, it's like a really short book, How to Lie with Statistics and it really does a great job of just showing how numbers can be manipulated.. So I really, my dream hires are people who are computer scientists who have a degree also then in statistics and then a degree also in biology.. (laughs) It was funny because one day I was describing.. I was like, "I'd love to hire someone who's like; "anthropology, computer science, biology, stats." And they're like, "Oh, Pardis?".. And I was like, "What are you talking about?" They're like "Pardis Sabeti..

"She's a professor at the broad." I was like, "What?" And like, "She's a rockstar too.. "She plays in the band." So there are some of these people out there.. I was so surprised and I now love this woman.. Like I spent a lot of time with her.. But to me, that's like such a fascinating convergence of data, being able to code, the biology and really understanding the numbers.. -

[Interviewer] And anthropology.. - And anthropology, like that's to me, also the beauty of being able to relate to people and understanding the story that's behind it.. Like that's the most interesting aspect for me of your genome is like the story.. Like why do you have this mutations? Like I kind of love like people lost their dark skin for a reason.. Like you wanted to absorb more sun..

Every mutation has a story and that's like part of the beauty I want to show is how we're all connected to the beginning of time and how you evolve to be you, sitting here today.. - [Interviewer] So let's go back in time.. Okay, I'm gonna ask the last question.. Imagine you were going back to being a student and you're 20 years old.. What do you wish you knew when you were 20? - You know, I think there's a lot of things that I again, I think my parents really did a great job of encouraging us to take to take risk and not being afraid of trying something new and not being afraid of quitting.. Like one of the hardest things in some ways is to change.. So when I think back on that moment of when I graduated college and I remember leaving, getting the car and leaving and drove cross-country.. I think the number one thing I didn't realize is how every single experience of my life was cumulative.. Every experience, so long as I continue to learn, everything has become meaningful in retrospect so I can point back to you know, my first boss, Marcus Wallenberg who like then invested and you know, has been super supportive and every job, even when it was sometimes painful, added, because I was still learning, it all added to my experiences today and I think back on, I volunteered in Bellevue Hospital in New York which was like kind of a traumatic experience, but those experiences really formed me and I think the thing that I... my parents emphasized and I push other people on today is always quit, like leave if you're not learning and if you're not doing something new, if you don't feel stimulated and I think that is, at that moment in time, you sort of worry as a 30 year old, like my God, my life is so random..

But I think part of it is like eventually it all comes together and I think it's really important to just like.... The more you push yourself, at some point like there's not that pressure of you have to figure it all out this time but at some point the story comes together.. - [Interviewer] Well, your curiosity, your passion, your drive, your enthusiasm and of course, your intelligence are incredibly inspiring.. Please join me in thanking Anne.. (audience applause)..