SCOTTISH MORTGAGE INVESTMENT TRUST

Moderna: from Covid vaccines to cancer cures

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Stéphane Bancel (SB): So at the end of January of 2020, I literally woke up in sweat and I'm like 'Oh, Jesus it's like the 1918 flu pandemic. It's going to be everywhere and it's going to kill a lot of people.'

Tom Slater (TS): What we saw in Moderna was that if you could prove that the technology worked in one setting, then it ought to substantially improve the likelihood of success in lots of other settings.

SB: I believe we're going to see in our lifetime for all of us, and I'm 51, cancer moving from a death sentence to a disease that most of the time you can manage.

TS: There are huge areas of unmet clinical need that cause untold human suffering, that their technology will be able to address.

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Claire Shaw (CS): Hello and welcome to season two of Invest in Progress, brought to you by Scottish Mortgage. I'm Claire Shaw, an investment specialist in the team. In this podcast we take you behind the scenes to hear the conversations that take place between the Scottish Mortgage managers and leaders of some of the world's most exceptional growth companies. As we are a UK investment trust, we can only market Scottish Mortgage to certain audiences and in certain jurisdictions.

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Throughout history, the world's finest scientific minds have struggled to develop effective vaccines to cure plagues and pandemics.

Traditionally, it can take up to 15 years. On today's episode, we welcome a company widely known for designing a Covid-19 vaccine in a mere two days and then rolling out hundreds of millions of doses to fight this deadly disease that was sweeping the globe, claiming millions of lives.

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This company is Moderna and its skill, speed and efficiency in what was truly a desperate time was nothing short of extraordinary. But the true essence of our investment case for Moderna lies far beyond Covid- 19.

At its core, this is a software company using ground-breaking technology to develop vaccines for some of the most problematic viruses affecting human health worldwide.

Covid is just one example of Moderna in action. We're thrilled to welcome the company's CEO, Stéphane Bancel, to tell us just what this company is capable of. But first, I'm joined by investment manager Tom Slater. So firstly, welcome, Tom.

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TS: Hi.

CS: So we get a lot of questions about Moderna. Rarely a meeting with the shareholders goes by where Moderna's not discussed.

But before we delve a little deeper into Moderna, can we just maybe simply ask you, Tom, what is it that Moderna does?

TS: So Moderna uses messenger RNA to build drugs. Messenger RNA is a molecule that takes the code from your DNA and instructs the cells to build proteins. And so if you can create synthetic RNA, then you can instruct your cells to build proteins that have all sorts of useful functions.

And so, what they are doing is using this completely novel way of developing vaccines, of developing drugs, and using it to address a whole host of unsolved clinical problems.

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CS: And Moderna is obviously a large position in the portfolio for us. Why is that?

TS: Well, I think hopefully that will come across from hearing from Stéphane. But what seems to me to be most important is just how transformational this technology will be if they're successful with it.

We saw the impact that it had in freeing us all from the captivity that went alongside the Covid pandemic. But I think that can be applied across a whole host of respiratory diseases, which provide a huge burden to healthcare systems.

And I think it will be used to address a whole host of viruses, which we haven't had vaccines for before, and that lead to all sorts of health complications later in life. And then I think it can be deployed as a really effective tool against cancer. So there is such an enormous impact if they're successful.

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CS: Okay. Well, thanks. I think that sets the scene very well. So without further ado, let's welcome Stéphane on.

SB: Well, hello, Tom. Thank you so much for having me. It's really a pleasure to be here today. Thank you.

TS: Thank you for coming. You're such an important company. And I'm delighted that our tens of thousands of shareholders get the opportunity to hear directly from you about what you're doing and what you're trying to achieve.

Moderna is a company that that most of our listeners will have heard of, given the integral role you played developing the vaccine for Covid. However, today I think we want to bust some myths around the company – that it's not just a Covid story.

So maybe to start off with, could you just tell us how you would define Moderna and what is the problem that you're trying to solve?

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SB: Right. Well, thank you for having me. So as you know, Moderna started on the premise of using messenger RNA to build a new class of medicine. We never thought this would be a one-drug company. We actually said to all our early investors it would be zero or a lot. One drug would make no scientific sense.

So mRNA is an information molecule. It's the molecule of life. We have it in all our cells. And if you think about using mRNA versus an analogue molecule, which is a small molecule, like a Prozac or Lipitor are, or a large molecule, like an insulin or growth hormone are, they are analogue molecules where every time, if you think about it from a pharma standpoint, you have to do research, development, manufacturing different factories.

Here, mRNA is with four letters, like zeros and ones with software. You code everything. And so that's what we always set up to do, is to build a company that would be a platform that would have many verticals – think like Amazon with its different apps in terms of verticals. And the vaccine is just the first vertical getting to market.

Covid-19 is just a first vaccine of that vertical. But now a lot of things are coming for patients.

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TS: And before you get into that and some of the exciting opportunities that are ahead of you, I think it be useful to take a step back and look at the history around your role. You've been the chief executive since 2011. And at that point, you left a stable job at an established company, to join what was essentially a start-up. And so could you just tell us the story of how you came to be at Moderna and a bit about that founding team?

SB: Sure. So I was indeed, you know, running BioMérieux, a medical diagnostic public company, probably around 6000 people.

And I was asked regularly to be the CEO of new start-ups in the biotech world. And most of them were not very exciting because they were those one-drug companies. That's like going to Vegas and I'm not a gambler. And so I passed those always very quickly. But then one day, the founding the team of Moderna, three academics, one MIT, two Harvard, an NVC flagship, reached out to me, and said 'Hey, we're going to start this new company using mRNA to make drugs.' And my first reaction to them was, 'You're crazy, right? This is never going to work.'

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And after a bit of thinking and a bit of data and I ended up deciding that actually I had to join this company because it was one of those companies that will most probably happen once in your career. That if you can find the path to make it work and in that case, it was getting one drug to market, because as I said, it was going to be zero or a lot from a scientific standpoint, then you can really have a profound impact on humanity, on society, developing a lot of medicines that are just aren't doable, using overall analogue technologies.

And this notion that you could be at the beginning of what was basically, you know, genetic and Amgen in the 70s, that basically created a new field of medicine that is called the biotech or recombinant industry. Look at the ClearPoint products now. They are coming from, you know, that technology, the insulins, you know, the checkpoint inhibitors, PD-1, you know, [unclear] cancer and so on.

So I think about it in the same way, which is if you think about the next 20 to 30 to 40 years because the 70s is 50 years ago now, the impact that these technologies are going to have on humanity is profound. I don't even know what drugs we're going to invent in five years from now. And the best example of that, that

sometimes gets people looking at me funny is, you know, we never planned for Covid.

It was part of none of our business plan, not a long-range plan. But when this virus happened, you know, in a weekend, the team designed the vaccine, which is exactly the same molecule that was approved that many people got in their bodies. And that's having the power of these technologies. We have no idea where it's taking us, but it's going to be very, very big.

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TS: So I'd be interested to explore a bit around the circumstances of Covid. So since you mentioned it, let's go back to December 2019. You talked about designing the Covid vaccine in the space of 48 hours. So could you just, in non-technical terms, explain how you did that?

SB: Sure, so I was made aware of a virus and new cases of a pneumonia-like disease in China between Christmas and New Year 2019.

And so I was in contact with the NIH, Dr Fauci's team, daily, sometimes several times a day as we were learning more. And when the sequence of a virus, which is basically the instruction of all the protein of a virus, was put online by the Chinese, our team jumped on it and literally copied and pasted the spike protein instruction, the genetic instruction of a spike protein of the SARS-CoV-2 virus, online with a mouse, and then opened an app that's called the Drug Design Studio at Moderna, where we design all our drugs, and then pasted over that instruction.

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And then they dissected a few technical specifications, input our menus, and they were done actually in 10 minutes. The reason we told the media it took 48 hours, which is the truth, is after 10 minutes, we were like, 'Are you sure?' And we freaked out everybody because they thought 'What do you mean?' and I'm like, 'Well, it's in a human in 60 days, so we need to make sure you picked the right protein and that the vaccine is designed correctly, because if not that clinical study will fail.'

And the team kind of freaked out on us because they thought they had time to do animal testing. And I said, 'Yes, we'll do animal testing, but at the same time, not in sequence.' And so that basically is what happened in January of 2020.

TS: And that idea of designing a drug on a computer digitally is just something that we have not been able to do before.

SB: Correct. And it goes back to this very basic, you know, feature of mRNA. mRNA's instruction, that life and our body uses – but the power of it, again, it's in plants, it's in animals, it's in anything that lives on this planet – uses that same information system. And so basically because mRNA uses information and your body will read that instruction and make the right protein, the protein of a virus, in the case of a vaccine, versus a protein of your own genes, or genes you don't have if you have a genetic disease and so on, is we make everything with the same chemistry, the same molecules.

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And so because as we think about drugs, we think about what code we want to code in your body, then we literally developed an app which allows us to design a drug in silicon on the computer.

TS: And you talked about Covid taking you by surprise. It wasn't part of the business plan, as you say. So what was going through your mind at that time? How quickly did you realise the scale of the problem? You talked about doing the animals and humans in testing which suggests that the urgency was clear right from the get-go.

SB: Yes. So earlier in the what is now a pandemic, so December 19, most of January 2020, I thought it was going to be an outbreak like SARS or MERS and so we wanted to move fast because I've always felt this platform could be positioned for a pandemic extremely well.

But to be honest, you know, in December 19 and most of January 2020, I saw it as an outbreak. But it was a good opportunity for us to understand how this platform could behave in the future for a real pandemic.

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And so I really wanted to show ourselves and the US government. Dr Fauci's team, that we could really go from a sequence of a virus put online by governments to the first human injection of a phase one clinical study in 60 days. I told that to Fauci in September 2019. And I think he and his team laughed for a long time because it took them 20 months for SARS to go from the virus identified to starting a phase one study. 20 months.

And I told him, this funny French guy with a French accent telling him that we could do that in two months, versus 20 emails. And so it was our desire to be able to show we could do it for a potential pandemic down the road.

And so at the end of January 2020, Tom, that actually when I was at the World Academic Forum in Davos, around mid-week after talking to a lot of scientists like

Sir Jeremy Farrar, who used to run the Wellcome Trust, and a couple of other scientists.

And being on my own Excel model on my laptop every day with cases in different countries, I started to realise, 'Jesus this is going to be like the 1918 flu pandemic'. I've been in infectious diseases all my life. BioMérieux, my previous company, was a leader in infectious disease diagnostics. So we were part of the flu scare. It was 2009 if you recall, out of Mexico. I was part of a big, big food poisoning issue in Japan early in my career.

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So I've always been, you know, very attuned and always keeping an eye out for infectious disease. But it was around the, I think, 27th January that I literally woke up in sweats one morning at 4am and I'm like, oh, Jesus it's like the 1918 flu pandemic. It's going to be everywhere and it's going to kill a lot of people.

TS: And I guess with that realisation and then, you know, world leaders were increasingly making a path to your doorway, and you had whole populations looking for a solution. There's just a huge amount of pressure on the company, and on you at that point. The stakes were so high. Can you talk as through just how you managed to deal with that, how you stayed focus on bringing the vaccine to market?

SB: Yeah, it's interesting. I mean, my wife Brenda will tell you that I was actually made for a moment like this. I don't if it's my education, my genes, I have no idea, my training.

But from a personality standpoint, the higher the stake, the more my brain focuses on 'What is the one or two things, not 50, that we have to do?'. And I can keep kind of the background noise out of bothering me. And, the piece that was clear for me, again, being a student of infectious disease of history, I was very familiar with what happened in 1918 from a flu pandemic.

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And it became very clear in my mind that millions of people were going to die. And I really believed, because we had done nine vaccines before COVID, I really believed that our technology had a very solid shot of making it work. I knew were going to be faster than analogue technology, like protein technologies and so on.

And so I just kind of zoomed in very quickly to say, 'Hey, we have to make this work and we have to behave in a way where we're going to try to save every hour we can, because if you compound this over what would usually take years of development – as you know, the fastest vaccine before us was four years to launch

– but that if we really focused and collaborated with governments, official regulatory bodies and so on, we had a shot of saving a lot of lives.

That for me was ‘How do we shave every day that we can?’

TS: I guess that challenge changed massively over the course of that process. You know, at one point it was scientific and based around the studies in humans. And then when it got approved, it was managing almost instant global demand. And so a manufacturing scaling challenge. So just how did you deal with that?

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SB: Yeah. So actually, thankfully, having worked at large companies like Eli Lilly and BioMérieux, from the very beginning I had two big tracks of work that needed to be accomplished. The clinical side of the house that we talked about briefly and that, I think, has been pretty well-reported by the media as people were locked at home and so on through 2020.

But at the same time, it was clear to me that we needed to do a massive almost miracle of scaling manufacturing. And again, you know, I'm an engineer, I've worked at Eli Lilly manufacturing, I was in charge of supply chain planning and stuff like that, which was kind of handy in a pandemic. And so literally as I came back from Davos and I started to really spend a lot of time with my team on the phone from Davos, just connecting the dots for them, because what we have not talked about yet is that there was actually quite a number of members of my team that didn't believe it was going to be a pandemic.

And one, who now is retired but was the head of manufacturing, I remember going to his office and asking him ‘Hey we need to make 1 billion doses next year’. And it was in January 2020 and he’s like ‘You know we made only 100,000 doses last year through clinical trial studies?’ And I told him, ‘I know, but you're wasting time right now. How do you make 1,000,000,000 doses next year?’

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And so we actually started this manufacturing scale up journey at the end of January 2020. And it was an incredible, incredible achievement from the team and all partners. This notion that you could go after 10,000 times more products in such a short timeframe, especially as you know, it's a regulated industry with very important FDA and regulatory oversight.

And that's the story that has not really been told in the media. That I think for me is as significant, if not even more significant than the clinical story.

TS: And I don't want to dwell on this, but I do think it has been the area of almost singular focus for stock markets in the past year or so – what demand looks like for Covid vaccines as we enter an endemic phase. And what's your reflection on that?

SB: So a few things. First, I think we collectively, I included, and other vaccine players. have been surprised by the pace of the drop in demand. I think everybody was surprised by how quickly the demand will be reduced.

And I think it's accentuated in the US where I think the political environment and the politicisation of Covid and then vaccines in general – which as you might know, is leading to some parents not getting their kids vaccinated against measles and other things and a lot of cases popping up, which is a really, really sad – is the piece that has been the most surprising, and sort of Covid fatigue.

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I mean, a number that I find the most surprising in the US and you know, we are currently still in the middle of a season, so I don't know what you look like at the end precisely, but you have around two out of three Americans who are getting a flu shot to be protected against flu infection and hospitalisation, who are basically saying 'I don't want a Covid shot.'

If you look at the numbers, 50 million Covid shots compared to 150 million flu shots. And that's really surprising given you have three times more risk of being hospitalised by Covid than flu. And that's one of those things that I think sometimes being in the middle of something has benefits, sometimes has liabilities and I think the liability of being maybe too scientific, too rational about it's made all of us blindsided by how many people would be willing to take another booster.

TS: So let's move on from Covid, because I think it's validated mRNA as a technology. 10 years ago Moderna was unproven and capital constrained. But 10 years on and you've received that validation and you've got billions of dollars of cash on the balance sheet and you've been able to deploy that into R&D. You now have a very rich pipeline of candidates.

So can you talk about the opportunities you have firstly in respiratory diseases and why mRNA has a better chance of delivering more effective vaccines than we've been used to?

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SB: Sure, so on the respiratory side of vaccines. The exciting part, I think, is combinations, because there's around ten viruses that gets people with flu-like

symptoms. You know, RSV is one of them that people are starting to hear more about.

But there are more. And a lot of them, as you know, people think they got a flu shot, but that it didn't work because they get a flu shot, then they get flu-like symptoms disease, but because most of the time, they've never run a PCR, they don't know what bug they've got inside their body.

And so we think the ability to combine like Flu/Covid, Flu/Covid/RSV in a single annual shot that you adapt for every strain is the way to go.

The one place where I think we're going to do things that have been impossible to do before is in the latent virus. Those are virus that once in your body never leave your body. People are familiar with a few like HIV, like HPV, that is one of a few that has a very good vaccine on the market or that prevents cervical and head and neck cancer.

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But there's a lot of viruses that most people have never heard of, like CMV, but it's the number one cause of birth defects in the developed world, like Europe, in the US and Asia. EBV is the virus giving mononucleosis and is the number one cause of multiple sclerosis, most probably the number one cause of blood cancer. And so there's a lot of viruses for which there is no vaccine available today because the viruses are just too complex.

To give you a sense of CMV vaccine, a six mRNA molecules per vial. So that people can make a lot of antibodies that are necessary to protect them because the virus are very complex. And everybody tried to do those using recombinant, Amgen, Genentech, older technology and they all failed in the clinic. And so I think we're going to be able to do a lot of vaccines against virus that hurt people for which existing technology is just not good enough.

TS: So let's explore both of those. So on the respiratory side, if you're able to target more of those ten different viruses that we sort of collectively think of as flu with combined vaccines, what will the impact of that be? What will be the benefit of doing that to the healthcare system?

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SB: So, I mean, the easy one, of course, is death in the in the elderly and the young kids. Hospitalisation, you know, we are building a plant in the UK to customise vaccine for all for consumers in the UK. And as we're looking at building these plants, you know, the government told us that one of the many ways they got convinced that there had to be such a plant in the UK was that if you look at the

ageing population, if they didn't get such technology doing combination, they would over time have to be more hospitals in the UK just to deal with the ageing population.

And the math, if you look at the epidemiology of how many people are going to need to be hospitalised for a winter season if you didn't have such a manufacturing plant.

And so, I think the big impact of course is going to be hospitalisation, but also just kind of productivity. You know, if you look at economic factors as we have ageing population, that has an impact on people getting older and getting more disease. But it also has an impact on the workforce, which as we know, there are a lot of issues driving inflation, driving productivity. And so I think those are all the benefits that we're going to see as a society driving this type of technology.

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TS: These are areas where we've had an existing approach. But what you're doing is going to lead to a much more effective vaccine from these flu-like symptoms.

SB: Correct. Because if you think about it today, respiratory diseases, depending on countries in the developed world, is the number fourth or fifth cause of death. And if you think about it, we have the technology. We don't have a technology yet for, and I'm sure we'll talk about cancer or cardiac disease and so on. But that should be the number 20 cause of death.

It should not be top four, five or six, depending on the country. And so I think this is one of those rare opportunities in science where if you can push hard and bring those innovations to consumers, you can really transform their lives and transform the quality of our lives, which I think is going to be even more important with ageing population.

TS: So that's a big market and growing because of that ageing population dynamic.

SB: Correct. You have both a growing population in the developed world. You have, as we know, growing population in developing world. As we read a lot, China is going to get older very, very quickly and then you have a severe increase of GDP per capita in the developing world because as people, you know, in India and many countries around the world have more and more income, they want the same things we want. They want the TV, the car, they don't want to get sick. They don't want to die, or their parents to die of a cold, which would be, of course, terrible, which happens, of course, in the developing world.

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TS: And this might be a useful point to just dig into what is Moderna's competitive edge in going after these marketplaces?

SB: Yeah, I think a few things. One is our sole focus on mRNA. You know, this is a new field, there's a lot to invent and that's all we do. And I think this focus is really important. If you try to do something very different at a different pace, at a different scale.

One maybe mundane example of that in the real world is, you know, in the US we have been through this '23 season, you know, able to increase our market share a lot versus the other mRNA vaccine and one of our reasons is because we have a pre-filled syringe.

So it's very easy for pharmacies which have workforce issues. You just vaccinate people at very big throughput. And why we're able to do that at scale earlier is because, as you know, freezing water makes water expand and you can either use a glass syringe or a plastic syringe. If you have water expanding it's not going to be good, except if you figure out how to do it right. This is what drives product differentiation and drives basically sales.

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TS: So coming back to latent viruses, you touched on some examples. Now as I understand it, there is really quite a large number of these latent viruses. And I guess the name is almost wrong, isn't it, that latent viruses might give people the impression that they don't matter, but they can have a huge impact to clinical outcomes.

SB: Yes. And if you think about it for a layperson, the way I would think about latent virus is those are virus that most of them will create short-term health impacts like mononucleosis for EBV. You know, birth defect and miscarriage in case of CMV.

But most of them, we believe, drive cancer. HPV is a great example. And the way to think about it for a non-biologist, is that if you have a foreign virus in your body forever, it's going to drive inflammation. And it has been massively documented that inflammations drive cancer. And so I think we should be able to have a huge public health impact by getting people vaccinated in their teenage years because most of those viruses and virus are transmitted through bodily fluids.

So when people start kissing is when those virus spread in terms of age range. And so I think many countries have done remarkable work with HPV, with a Merck or MSD vaccine, which is a great vaccine that I think every young boy or girl should have access to. In terms of prevention of cancer, it's very remarkable.

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And so I think for around, as you say, a thousand of those viruses that don't have a clinical solution, Moderna is very committed to take those to the market. And these are in phase three. We're just waiting for full data now, and it should have an impact on a lot of people.

TS: Let's move on to an area you mentioned briefly, but I think many of our listeners might be surprised by, and that is the advances that you're making in in oncology. And so can you just tell us about the concept of personalised cancer vaccines?

SB: We basically start by doing a next-gen sequencing. We read all the letter of DNA of your cancer cell. We then read all the letter of DNA of your healthy cell. We send both of them to the Amazon cloud (AWS), and then we compare where the mutations are happening in your DNA between the healthy cell of yours and the cancer cell of yours by just comparing every letter of a free gigabyte of information. And then we use an AI system that we developed with scientists and clinicians of the best oncology centres around the world to pick 34 mutations that are going to be the ones most visible to your immune system.

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And what we do, we basically code a pretty long mRNA that stitched together those 34 mutation that we inject to you in your arm to basically, if I simplify, reboot your immune system, not the entire immune system, but try to have your immune system see those 34 mutations that it missed before.

TS: And you talked about this for the individual and so surely that's going to be a very difficult thing to scale. It's not like the Covid vaccine where it's one vaccine, billion doses. This is one vaccine, one dose. So talk about what that means for your business.

SB: Yeah. And it's interesting because internally, when we saw the great data last year, I basically had a meeting with the manufacturing team and I told them 'You realise that after climbing Mount Everest, we're going to go for K2 now.' because we have to do, as you say, another scale up, but very different in nature because it's what actually internally we call a scale out, which is just daring to do a lot of the same things for different people at the same time.

And the scale up in terms of, or scale out I should say, in terms of numbers is very similar to Covid, because if you think about the number or capacity to do the phase 2 was 100 people, each of the phase 3 is around a thousand people, if I

round all my numbers and when you're going to go commercial, you're going to be hundreds of thousands of people and then into the millions.

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So if you look at scale from hundred to millions, that's the same type of scale up that we had to do for Covid. And so basically we have the same team doing it and we have a dedicated plant that we bought. We bought the shell to save time to market.

And we are developing a lot of robotics, a lot of digital tools just to be able to shrink and shrink and shrink the time it takes us to make one product for one human at a time.

Because you can do simple math, instead of taking five days to make the mRNA it took us in the phase 2, for every human, it takes you one day and you can do 5x more throughput.

TS: And I'm sure there are a lot of people who are listening who have been affected by cancer or have loved ones who've been affected. For them, could you just tell us what types of cancer this could potentially address and how far away are we from these products being available to patients?

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SB: Sure, so in terms of space. We think over time it will take a few more years. And the first one would be skin cancer, because that's where we have the most data. Over time, most solid tumours should be able to work. We believe that, especially with liquid biopsy, as you go earlier and earlier in disease, the number of tumours that will open is going to increase with time.

The time to market, the best path is potential launch in 2025. I used to say in 2020 when Covid happened, I said the best path was a year and launch, which is what we were able to execute. So the best path is 2025 launch. The critical path now is the manufacturing. I just spoke about manufacturing, but I think 25 launch for melanoma is something that is doable. And we're working very hard because obviously every week we can shave to that launch will, of course, help a lot of people.

TS: And let's touch on Bancel Philanthropies, an organisation set up by you and your wife. So you disclosed publicly that the proceeds from your Moderna stock options you directed towards your philanthropic work. So can you talk a little bit about what that work is and the organisations you're involved with?

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SB: Sure. I mean, let me start by saying, yeah, my wife and I decided that, you know, we're going to give most of our wealth away because nobody needs that type of wealth and there's a lot of problems in the world that we feel very important to help.

We have basically three priorities to your question. One is around social injustice. Social justice around that whole spectrum is how do we help prevent people to get into trouble or help people in trouble?

The second topic is health, which won't come as a surprise given what I do for a living. There's a lot of overlap, obviously, in terms of health injustice. We talk about mental health. Another piece that I'm very passionate about is the health inequalities are tremendous around the world.

And the third topic is the climate. You know, I'm personally, as a chemical engineer, very worried about the negative feedback loops that I think the world is on right now.

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One of the things that I've seen in philanthropy, in the for-profit world is I believe a lot in what I call social entrepreneurs in the not-for-profit world, which is people that have set up not-for-profit organisation and are still running them. I think we have very similar traits as founder-led companies in terms of how much we sweat the detail, how much they care, how much we know, how much a dollar can do, and they really sweat every dollar. They don't usually have big, you know, fundraising teams and big organisations using a lot of consultants and other things.

And so we tend to try to identify social entrepreneurs that have already done remarkable things and try to accelerate the impact in terms of area under the curve by changing the slope of their impact through capital, but and through coaching.

TS: It's amazing, given how much of an impact on the world you've had in your day job, to hear that that what you're doing, what you're doing at the weekends as well.

And we ask all of our guests the same final question and maybe in Moderna's case it's more obvious than some, but what does the world look like if Moderna succeeds in its mission?

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SB: Well, how long do you have? I think in the next ten years, I think a time frame, five, ten years that is meaningful to people.

I think we'll really move the needle in terms of the respiratory disease as we discuss, you know, number four, five or six, depending on country, you know, should be, you know, number 20 on the list.

I think we'll prevent maybe 25 per cent to a third of cancer happening with the latent virus vaccines that we bring to market like CMV, EBV and so on.

And I think as we discussed, we'll change cancer care in a very profound way. You know, I told our team when the data came out last year for cancer products, I told them that in five years people will have forgotten what Moderna did for the pandemic, because I believe in five years people will know us as a company that was most disruptive in cancer care for this individualised product. Which makes so much sense because cancer is an individual disease at the mechanistic genetic level, which is a very important scientific realisation.

And so I think that this, combined with, as I said, the luck we have timing wise of liquid biopsy becoming better and better. I think you combine those two and you're in a world where most people should get a liquid biopsy every year through their blood work, like they're checking their cholesterol, and if they get a positive result one year, that means they have pretty recent cancer because last year they didn't get it, then we develop a product for them.

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And so between preventing cancer through latent vaccine and taking care of cancer early with high impact, I believe we're going to see in our lifetime for all of us, and I'm 51, cancer moving from a death sentence to a disease that most of the time you can manage.

TS: Well, that's certainly a mission that all of us hope if you have an enormous amount of success on.

And I feel guilty for taking an hour of your time and distracting you from that mission. But thank you so much for coming to talk to us today about what you're trying to achieve. That's been really, really great to listen.

SB: Thank you so much Tom, for your time and your questions. I thank you also for the partnership with Baillie Gifford. You guys have been instrumental in our success and are great partners and help us think and see around corners which we deeply value.

TS: Thanks Stéphane.

00:40:11

CS: So, Tom, you opened the conversation with Stéphane by saying you wanted to bust some myths around Moderna. That this wasn't just a Covid play. And I think that conversation did a pretty good job of shedding quite a different light on Moderna for our shareholders.

We finish off each episode by asking the managers the same questions about the investment case. And so I think maybe just taking a step back, Tom, you know, let's go back to the beginning. What was it about Moderna that initially attracted you to this company?

TS: The breadth of what they can do with the technology. I think in drug discovery, in biotech companies, you've had a situation historically where there was no indication from the success of a drug about the likely success of subsequent drugs. You know, they're completely independent.

But what we saw in Moderna was that if you could prove that the technology worked in one setting, then it ought to substantially improve the likelihood of success in lots of other settings. That it was a modality, a way of treating disease that had very wide application. And where you would see this, if they had success, it would beget more success.

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CS: And we talk a lot about company leaders, founders, management teams and the importance of them, you know, in terms of the company's chances of success. And I think we've got a great flavour of Stéphane's personality and what he brings to the table during your conversation. But I'm interested in actually the founding team behind Moderna and what kind of role did they play, first of all bringing Stéphane in and setting the company up the way the way we know it today.

TS: Well, I think the starting point is the academic work that had been done in this area. And then I think the crucial ingredient came from the venture funders and specifically flagship pioneering, and the chairman Noubar Afeyan in identifying just how significant this technology, this set of discoveries could be, and then the ability to translate that understanding of the opportunity into attracting somebody like Stéphane to what was essentially a start-up organisation. Because of the vision, because of the understanding of just how big this could be.

00:43:00

CS: Yeah. And you asked Stéphane outright, what he thought Moderna's competitive advantage was and he said this sort of sole focus on R&D. But I'm

interested from your perspective and from an investment perspective, what do you see as Moderna's competitive advantage?

TS: Well, I think that they don't come with the baggage of a traditional pharmaceutical company. They were designed as an organisation to bring this new technology to the world. And I think what came out in his answer is that not only do you need to have an effective treatment and effective vaccine, but there are all sorts of other technologies around that that can make the product so much more appealing.

And you know, I'll give you an example from COVID when we had the first vaccine from Pfizer, and it had to be stored at -85, I think. And so you had a vaccine, but it presented all sorts of logistical challenges. And Moderna's vaccine not only had better efficacy as demonstrated in the trials, but also it didn't require this cold supply chain that presented all sorts of logistical hurdles.

And that's not an accident. It's the accumulation of all sorts of small breakthroughs that Moderna has made through its life as a business in thinking about how it brings this technology to the world.

00:44:41

CS: And I think Tom you described the competitive advantage, you know, very clearly, but there's still a lot of scepticism around the company and it has faced a really challenging time post Covid.

What is it that you think the market is missing when it's looking at Moderna?

TS: Well, I think that there has been a massive focus on Covid and the demand for Covid shots in a post-pandemic world has been a lot lower than people thought. It's as simple as that, really. That's the immediate cash generator for the company and the pipeline of drugs haven't been approved. They aren't selling. We must attach some risk factor to them.

And the market has been concerned about the Covid-related revenues and attaches a much higher risk factor or risk weighting to all of those future products than we do. Back to this central insight that success in one thing makes success in other related areas much more likely.

00:45:50

CS: What do you see as the biggest challenge to Moderna from here, and how well-placed do you think they are to overcome those challenges?

TS: Well, the first one is that they have to develop more of the skills that big pharmaceutical companies have already, the commercial organisation, The ability to predict demand, to sell the product, to actually get out there into the marketplace.

And then I think the next set of challenges are engineering challenges. Personalised cancer vaccines are going to be... it's going to be a real engineering challenge to produce those rapidly and that scale. And this company has shown that they can do this. I mean, what they did with the Covid vaccine was remarkable.

But the personalised cancer vaccines is a whole different set of challenges and they're all big ones.

CS: And just to finish, Tom, final question from me. We talk about wanting to own exceptional growth companies. What is it about Moderna that you think it's got that chance to be one of those exceptional growth companies and what's the scale of the opportunity in your eyes from here?

00:47:08

TS: I think this is a company that is really obvious and pretty straightforward. There are huge areas of unmet clinical need that cause untold human suffering, that their technology will be able to address. And they will create a huge amount of value for society in doing that. And even if they take a small fraction of that value that they create, that will translate into an enormous business opportunity.

CS: I think that feels like a good note to end on. So thank you, Tom, for your time today.

TS: Thank you.

CS: So a huge thank you to our guest today, Stéphane Bancel of Moderna and Scottish mortgage manager Tom Slater. In the next episode, we welcome Christoph Gebald, the co-founder of Climeworks, whose mission I would describe as truly extraordinary.

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