THE BIOLOGICAL REVOLUTION

A convergence of technologies is letting biotech firms disrupt how drugs and vaccines are made.

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Malcolm Borthwick (MB): Hello, and welcome to Disruption Week. I'm Malcolm Borthwick, Editor of Intellectual Capital at Baillie Gifford. During Disruption Week, we are going to talk about four sectors which are going through transformational change, agriculture, transport and mobility, payments and the subject for the first day of Disruption Week, which is healthcare.

The journey of medical discovery has been arduous. For example, it took over 300 years to get rid of bloodletting after the theory had been discredited in the 16th century. Throughout history, the world's finest scientific minds have struggled to develop vaccines for plagues and pandemics. But often during a time of crisis comes innovation and disruption. And COVID is no different.

And without wanting to distract from the human cost of the virus, it has shone a light on the spectacular advances in medical discovery, and also the convergence of data, technology and science. For example, it took just four days to sequence a genomic code and design a vaccine for COVID. Just four days. And to discuss the spectacular advances in medical discovery, I'm joined by Rose Nguyen, who is an Investment Manager at Baillie Gifford. She joins us here in our studio in Edinburgh. And it's a bit of a damp Edinburgh, as you can see outside, which isn't unusual for October. Rose, great to have you with us.

Rose Nguyen (RN): Thank you, Malcolm, for having me.

MB: And in terms of the structure of the webinar, it's 45 minutes. Rose will set out the case for disruption for the first few minutes. After that, we'll have a conversation. And we really hope you, the audience, will have plenty of questions as well. So for the last 15 or 20 minutes, we'll open it up to questions from you. So if you do have questions, please use the Q&A function, which you can find at the bottom of your screen.

But let's start with a poll, because there's something else that we're interested in your views on, and that's the cost of genome sequencing. So the question that we have for you is the cost of gene sequencing was $100 million in 2001. How much was it in August 2020? So that's nearly 20 years later. Was it $70 million, $7 million, $700,000 or $700?

So if you could choose one, and we'll come back to the results of the poll later in the webinar. But we'd like to start the discussion now and set out the case for the disruption of agriculture and the biological revolution. Rose, over to you.

RN: So thank you, Malcolm, for the introduction, and thank you, everyone, for tuning in to this webinar today. So to start off today's conversation, I just want to spend a few minutes to explain what I mean by the biological revolution, and how and why I think this is going to transform healthcare and also the world that we live in.

So when we look through modern human history, we as a society have gone through several periods of great innovations that have fundamentally transformed our lives. As we know, the invention of the steam engine led to the first Industrial Revolution, and for the first time, productions could be done by machines instead of human labour.

The second Industrial Revolution took a step further by using electric power to create mass production of consumer goods, transport and many other manufactured products. And then the second half of the last century was completely dominated by another type of revolution, the Digital Revolution. We witnessed a massive shift from mechanical and analogue to digital electronics. And this was thanks to the invention of semi-conductors, computing and the internet.

But when you think about it, all of these technologies mostly impact the physical aspect of our lives. We are still dying of cancers, heart diseases, dementia and so on. And the reason is because there's nothing more complex, more sophisticated and intricate than the human body. So if the previous revolutions were about inventing new things to make lives better, then the Biological Revolution is about pushing our understanding of biology and unpacking millions of years of evolution.

For many people, biology may seem like a magic black box, but over the past two, three decades, the pace of innovation has been increasing extremely fast, and now we have a wide range of tools and technologies available that allow us to start opening that box, and studying biology at a scale and depth that was unimaginable before.

You mentioned gene sequencing in the poll. For me, that's one of the most important technologies in life sciences, and it's also the one that I believe really propels our knowledge to a new height. We all know that gene sequencing allows us to read the code of life, but what's fascinating is that despite all of the complexity of biology, the code of life is written with just four DNA letters, A, T, C and G.

So hidden behind all of this chaos, and unpredictable properties of biology, is actually a rather organised and orderly information system. What that means is that we can turn biology into an information science. Now, how do we do that? By using many experimental observations and advanced tools like machine learning, gene editing and so on, we can start mapping out the genetic circuits within a cell to understand how different genes relate to each other.

For example, if we turn on gene A in a cell and we observe that gene B and gene C are also turned on, then we can translate that observation into a mathematical expression, if A, then B and C, and we can feed that back to our computing model. Now, this is a very simple example, but the point is that we have the tools available that can allow us to understand the computing language of biology.

And once we figure out the inner workings of a cell, we can start building a communication network for different cells at the tissue level, organ level, and eventually for the whole organism. All of this is really exciting. And it's because imagine if we can master human biology the same way that we configure a car or a computer, then if anything goes wrong, we will know exactly why and how to fix it. In 30, 40 years' time, making a drug to treat a disease could be as simple as writing a new software to fix a computer virus.

Even beyond healthcare, biology can be applied to transform other industries such as agriculture and energy. So the possibilities are endless. And I believe that within this century, we will be witnessing our lives being transformed once again, thanks to this Biological Revolution.

MB: That's great. And we'll be coming to agriculture actually in Disruption Week on Friday, so thanks for mentioning that. But let me go to the results of our poll. So an overwhelming 68% have gone for $700. Are they right?

RN: Yes. Yes, they are right. So I see that our audience is very up to date with the current information. Yes.

MB: And I think it's really hard to picture this without actually looking at it. So up on your screen at the moment, you'll be able to see a graph that shows the declining cost in gene sequencing. And it compares that to Moore's Law. Perhaps, Rose, you could explain the significance of Moore's Law in that graph.

RN: Sure. So Moore's Law refers to the observation and the prediction of Gordon Moore, who is the founder of Intel. And his prediction is that every two years or so, we can double the number of transistors that we can put onto a microchip. And what that means is the computing power can double roughly every two years, and the relative cost of computing can half over the same period of time.

And this has underlaid the exponential increase in computing power over the past several decades and is the reason why your smartphones today have more computing power then all of NASA combined back in 1969, when they put the first man onto the moon. So it is incredible. And you see, thanks to that reduction in cost of computing, new industries, new businesses have been able to flourish, like Amazon, Facebook, Apple, and so on.

But what you see on the chart, the cost of sequencing has declined at a much more dramatic rate, more than Moore's Law. And this was thanks to the convergence of many different technologies, computing being one of them, but also advances in other fields like imaging and physical sciences. And again, similarly to how the reduction in computing cost has transformed many other industries, I believe that the fall in the cost of sequencing is triggering a revolution in life sciences.

MB: And it's good that we're starting here with gene sequencing because what I wanted to ask you about is what type of companies are driving this disruption and innovation?

RN: So in terms of sequencing technology, Illumina is a US-based company that has been critical in terms of driving down the cost and building out this infrastructure. However, as I mentioned earlier, being able to read the DNA letters is the first step. Our job in this century is to understand how all of these genes relate to each other and to make sense of the words and the sentences of our genome. And to do that, we need to be able to get down to the cellular level.

So there's another company called 10x Genomics. It's also based in the US. It's developing single-cell sequencing technology to allow us to sequence the genome of an individual cell. So now we can compare the genome of a healthy cell versus a diseased cell, for example, to know exactly what genes are causing the disease. The company is also building a visual spatial map of the cell's location in the tissue. So then we can start connecting the dots to build out how the cells talk to each other, and they do talk to each other, to see the cell-to-cell interactions. And from there, we can build that communication network.

MB: And what's interesting in the examples that you're giving is we're seeing a disruption of the traditional drug discovery model, aren't we?

RN: Yes. So in the life sciences industry, there are areas where we have witnessed new technologies displacing old technologies. And that is very typical of the disruption innovation cycle. I think one area that we are seeing that most vividly right now is in the vaccine industry. So the traditional way of making a vaccine is using either weakened virus or inactivated virus, injecting them into the body to trigger the immune reaction. But that process is very time consuming. It can take up to ten years. And it's also very costly because we are dealing with live, dangerous viruses.

And then comes the likes of Moderna and messenger RNA. It took Moderna only two days to design the messenger RNA vaccine on a computer after they diluted the genetic blueprint of the virus from the internet. They didn't even have the actual live virus in the lab at the time of making the vaccine. It was incredible.

MB: And to set that in context, because two days is extraordinary, if we go back ten, 20 years, how long would it have taken?

RN: Well, if we go back ten, 20 years, it would probably have taken us at least five years, probably up to ten years, to go through all of that process of firstly obtaining the live virus and understanding how it caused diseases in the humans, and going through all of those research phases to be able to get to the final product. So two days is nothing short of miraculous.

MB: And Moderna is a very different type of company. Because I think what's interesting is, often when a company reaches scale, it might be focusing on one or two different drugs and will often get taken over by another company. But Moderna seems very different in the sense that it's developing a platform, isn't it, across multiple different drugs and vaccines and cures potentially?

RN: Yes, indeed. Yes, exactly. And I think the key reason for both why Moderna was able to design the vaccine within only two days and why the company is able to build such a broad platform is because the technology that it is using, messenger RNA, belongs to a new class of drugs which I will refer to as the information molecules. Now, let me explain what I mean by that.

So information molecules are just pieces of genetic information that are delivered into the cell to instruct them to behave in a certain way. So to explain the inner working of a cell in a very simple way, we have the DNA hardware being stored in the nucleus of the cell. So this is like the original recipe book, if you like. And then to make a protein, which is the workhorse of life, we can turn to the exact page in that DNA book, take a copy of that recipe page, and that copy is the messenger RNA. Then we take that into the kitchen of the cell, which is the ribosome, and start assembling proteins as described.

So this is a very distinctive information flow process. And so most of the time, diseases occur because there are some problems with the information flow. And so what do we do? We send the information molecules to fix exactly that problem. So with messenger RNA, it's just a piece of genetic code, and we can send it to the cell to instruct it to produce any protein that we want.

Historically, the problem has been the delivery because our body is trained to destroy any foreign materials, that seem as foreign to us. So it has been a challenge to be able to get the messenger RNA to the right cell. But once you are able to do that, you can scale very quickly and very fast. You can just change that genetic code to treat a different disease of the same cell type. And that is the reason why companies like Moderna are able to build such a scalable and broad platform across so many different diseases.

MB: And Rose, you talk about hardware and software and, earlier in the introduction, an orderly information science. Is the expertise that's required at the top of these companies now more of a technology software expertise alongside healthcare scientific expertise?

RN: Yes. So when we look at companies that are operating at the intersection of biology and computing and data science, we often find that at the executive level, the management team needs to have understanding in both worlds. It is not an easy job to make the computer scientists and the biologists sit together in the same room. So you need to be able to foster a culture in the company that is collaborative and that is respectful of each other's work.

And it's not easy to do. We have seen quite a few examples of companies that have failed because they cannot foster that sort of collaborative culture. And so it starts from the top. You need the executive teams to be able to understand what it takes to do research in biology and what it takes to do research in computing and what it takes to bring the two worlds together.

MB: And what are you looking for, are the qualities of a good management team? Are they particularly different in this sector from others?

RN: So at Baillie Gifford, we have always placed a very strong emphasis on management and culture and people as they are the backbone of the business. But when it comes to biopharma and drug-making business, I think the importance of people and culture is even more so than perhaps some other businesses in the consumer goods or other industries.

And it's because it's really the people who are driving the science and the innovation forward. And so when we analyse the people and the culture, we really try to identify the teams that have a long-term vision that is aligned with our long-term interests, and a team that is able to build a culture that is conducive to innovation.

I believe that most people who go into biotech do want to make a benefit to patients and society, but they may take different routes to success. Some may be focused on building a long-lasting, independent company that can bring multiple drugs to patients, but others may prefer to achieve a quick exit route through selling their company to a larger entity. And both are necessary for the health of the ecosystem. But we believe that the former type has a higher chance of becoming outliers in terms of both the benefits they can bring to patients and also in terms of their financial returns. So those are the types that we want to identify.

MB: And how does a successful company like Moderna challenge itself? Because you talk about a culture of innovation. But one of the key things is ensuring, I guess, that you don't rest on your laurels and you continue to challenge yourself in terms of innovation. Do you set up separate innovation units, or how does that work?

RN: Yes, that's a great question. And actually, there is a recent book that I read. And it's called Loonshots, yes. So it's a great book that I would recommend everyone to read. It's about how you can set up an organisation structure such that you give yourselves the best chance of being innovative, even when you have become a larger entity.

And so the recommendation from the book is exactly what you mentioned. That is, the best chance for companies to do that is to set up an independent entity that is free from all of the bureaucracy and perhaps committee decision-making, and so they are free to pursue research and innovation in any areas that they want. But then you also need a senior executive team to be able to bring their ideas and translate that into products and feed that back into the commercial machine of the business, so to speak. Because if you don't have that, then many of the ideas may just get abandoned and they may never come to finish.

So in the case of Moderna, it's really exciting because there is the Head of the Research, Stephen, and we have had quite a few conversations with him, and he told us that he was given full autonomy to pursue innovations in terms of messenger RNA, or even other technologies such as gene editing now that Moderna is also trying to expand into that area. So the team underneath him is able to innovate and come up with new ideas.

And then you have the man at the top, Stéphane Bancel. He is a very astute person, able to spot which ideas can be great to translate into the final product. So he is that leader than can bridge both worlds. So that's the model at Moderna, that I think many companies now are also trying to create similar structures to allow them to stay innovative even though they get larger.

MB: It's an extraordinary skill set that's required to run these type of companies. And my next question is, and it relates to, your colleague wrote a paper a few years ago, The End of Cancer. So I guess my question is, how big can we dream with healthcare?

RN: So I think we are standing at the inflection point of the Biological Revolution journey. And as we get closer and closer to mastering human biology, the impact on humankind would be tremendous and many diseases that we are suffering from today, such as cancer, could become a thing of the past. So when we think about cancer, we know that it's a disease of the genome and it's really the failure of the immune system surveillance. And over the past decade, we have made great strides against cancer, and now many of the blood cancers, for example, can be cured from innovative cell therapies.

So I think when we look out ten, 20 years from now, there is a very strong rationale to believe that cancers, most cancers, can be cured, eliminated, or turned into a chronic condition. And I think there are two key angles to that. So one is we must be able to catch the cancer at a very early stage because that will increase our chance of eliminating it. And the second is we need to be able to develop therapies that can get rid of all the cancer cells in our body and prevent them from coming back.

And so for the first point, we have companies like GRAIL, for example, that is developing liquid biopsy cancer screening based on a single blood test. And they have made great improvements on that. And then on the second front, we have many companies also working on curative cell therapies like CAR-T and other types of cell therapies. So when you combine these two together, I do think that 30 years from now, cancer could become a thing of the past.

Curing cancer is pretty big, but that's not even the biggest dream for me. There's one topic that I'm really excited about, and that is aging. So we know that aging can come with many illnesses, cancers, dementia, heart disease, and so on. And if only we can figure out the process of aging, why we age, how we age, then we can even prevent many of these illnesses from happening in the first place.

And nature is incredible. Nature is marvellous. If there is a programme in the cell that's trying to tell the cell to age, then there is also a back-up programme in the cell that allows us to turn back the clock. And it's exactly what happens with fertilisation. After fertilisation, the human germline cells appear to be able to reset the clock in the embryo. And that's why babies are born without the damages that aging has done to the genetics of the parents. If this is not the case, then the human species' lifespan will get shorter and shorter after every generation.

So if nature is able to reset the clock, then there must be a way for us to figure out how. And we did, 15 years ago. There's a Japanese scientist called Yamanaka. And he later on earned the Nobel Prize for discovering a remarkable thing. That is, we are able to take any cell in the body, be it heart, lung, brain, and we can reset it all the way back to age zero, and zero identity, so back…

MB: Wow.

RN: To the embryonic stem cell. That is great news for regenerative medicine. But that's not even the most exciting thing. About two, three years ago, there were scientists that had been coming out with some research saying that we can even do partial reprogramming. So now there's a way that we can turn back the clock, but retain the identity of the cell. So imagine if we can just take out the immune cells in our body, return the clock to maybe age 15, 20, when we are most healthy, but still retain the identity of the cells and then just put it back into the body two days after and we get a rejuvenation of our immune system. That is the dream that I'm thinking about.

MB: Great. That means I can just rewind and run as fast as I could ten, 15 years ago.

RN: Exactly.

MB: So I want to get on to questions from you, the audience, because there are loads of questions that are coming in here. This is a good one. I gather routine DNA sequencing in the doctor's office is still many years away. Do you think we will see large medical centres using sequencing to detect and treat some diseases?

RN: Absolutely. I think, in ten years' time, the cost of gene sequencing could be as cheap as a blood test. And it will become a commodity product and it will be used ubiquitously, whether it's in the research labs or also in the clinical settings. So I think the way that we practice medicine will be very different ten years, 20 years from now.

It's probably the same as when we look back to the past and we thought that bloodletting was shocking. In 20 years' time, we will probably think, why is everyone not getting their genes sequenced at birth and then updating that every year? So I think you are already, the audience is already very forward-thinking and probably ahead of many people, but I think the rest of society will catch up.

MB: And here's another question that's come in. And I know we've talked about a lot of US companies in terms of Moderna and Illumina. Are there companies outside the US producing such innovative, potentially investible companies in biotech? Why not Scotland? So why not anywhere else, I guess?

RN: Yes.

MB: Yes.

RN: So when we look at where innovation is coming from in the world in the life sciences industry, there are some particular hubs of innovation. In the US, we have the Boston area, the San Fransisco area. But in Europe, we also have the region near Belgium, Denmark, Germany, France. And then there's also another big hub forming in China. So we have seen more and more companies, innovative companies, emerging from these hubs outside of the US, and even in the UK.

So to give you an example, there is a company called Exscientia. It is based in Oxford in the UK. It actually just went public last weekend. Baillie Gifford invested in the IPO round. What the company does is that it is using AI algorithms and machine learning to do drug discovery in small molecules. So small molecules are synthesised chemistry drugs and they are the biggest classes of drugs today. Things like from aspirin, penicillin, Viagra and so on, they are all small molecules.

But the traditional way of making small molecules has been mostly through random screening, and there's a lot of luck involved in that. For example, Viagra was initially intended for a heart condition, but then we saw the side effects in male patients that led to the drug being used to treat erectile dysfunction. So there's a lot of luck involved in that process.

And the question that Exscientia was asking is that can we make this more automated, more rational, and more industrialised? And the answer is yes, by using AI and data science. There has been lots of data that has been generated from small molecule drugs, the way they interact with our bodies and so on. And by using AI, the company is able to spot patterns and be able to predict which drugs will work best for which condition. So that is one that we are very excited about. You can tell. And it is based in the UK. So innovations are coming from many other places outside of the US.

MB: Alive and well in the UK. And I think your references to the future has caught the imagination of the audience. Here's a question here which I can imagine you can take in all sorts of different directions. It can sometimes be difficult to understand how advances like this translate to real-world experiences. What will our journey as patients look like in 20 or 30 years' time?

RN: So I think this is really up to one's imagination. Like I said, I think in 20, 30 years' time, many big diseases such as cancers, heart diseases and dementia will be cracked. And by that, I mean they can be cured, prevented or turned into some chronic conditions that we can live with, but still with a good quality of life.

So for example, take heart diseases. It's a very big killer in the world today. And it's a complex disease because it also comes from lifestyles and diet and so on. But through many years of research, scientists have discovered that there are some particular gene variants that seem to protect some populations from getting heart attacks and heart diseases.

And this is amazing because that means there is a way that we can introduce these protective gene variants to the general population to give them that protection and that prevention from getting heart diseases down the line, irrespective of their lifestyles. So I think the patient journey in 20, 30 years' time from now will be much better than what we are currently having, and the attention that we can get from our doctors and the access to innovative treatments, I believe, will be much better as well.

MB: We've had a few questions on ethics come in, Rose. To try and encapsulate all of them, the ability of regulators in societies, I guess, to keep up with developments from an ethics' perspective.

RN: Ethics is a very important topic in life sciences, because as with the case of any innovative technologies or science, there could be different ways to utilise them, either for good or for bad. And I think there will certainly be some unintended consequences. But the Biological Revolution is not going to stop. So right now, communities and societies are getting together with industries and companies to try and build some sort of framework or guidelines around what should be allowed and what should be not allowed.

But the thing is, these guidelines are not static and they also differ across different regions of the world. For example, in the UK, research on embryonic stem cells is permitted, but it is banned in Italy, for example. And I guess some other countries like China may also have a very different viewpoint about ethics compared to the US.

So that is to say that this is not a black and white matter. It does require effort. And we as investors engage with companies and try to help them maximise the benefits that they can bring to society while minimising the harm. And that means trying to make them focus on treating the big problems, the big diseases first, things that we as a society all agree, that if they go away, our lives would be much better. So that is the primary focus, before we're turning to things that are maybe less serious.

MB: And this is a topic that you touched on earlier. Some really good questions coming in here. Which are the leading companies in regenerative and rejuvenating biotech?

RN: Sorry, can you repeat the question?

MB: Which are the key companies in regenerative and rejuvenative biotech, in terms of the products that are currently in commercial production?

RN: Right. So in terms of products on the market, this is still a very early stage area of science so we haven't got huge commercialisation of this area of science. However, there are some very interesting companies that are doing work on them. And one is called Lyell, L Y E L L. It's named after a Scottish geologist, Charles Lyell, actually. It's a US-based company and they are developing curative cell therapies for solid tumours.

At the same time, they are also doing research about cell rejuvenation of the T cells. So they are the immune cells of our bodies. And the idea is that if we are able to rejuvenate those T immune cells, then they could be much stronger to go after the cancer cells without getting exhausted or without getting stopped by the solid tumour environment. And so that can play a major role in future cancer treatments, and also in the topic of aging that I mentioned.

MB: And here's a question about our investment process. How does our investment process differ from dedicated biotechnology managers?

RN: For us, our approach is trying to identify companies that have potential to be outliers. And what that means is that identify companies that have ability to repeat success over time, because we believe that success repeatability, yes, is really key to both commercial success in the financial sense, but also key in terms of impact that they can deliver to society.

And so we identified a few areas that we think can really help a company increase their chance of success, like science people and capital. So those are some of the fundamentals that we focus on. And when it comes to science, in particular, we differ from other biotech-focused funds or people who use their expertise in that area to try to identify maybe the single drug that may have a good chance of success. Our approach is that we are trying to identify companies that have a scalable technology platform that can be applicable to many different diseases and many different indications. And that requires a different thinking.

It's very interesting because the Harvard Business School actually just published a case study on Moderna. And there is an interesting quote from the IR in there, saying that when we first talked to traditional pharma investors about our company, they didn't fully appreciate the power of the technology platform. But we had a very different conversation with generalist investors, who had experience of investing in many tech platforms and they can see how this type of biotech businesses can be very different from the traditional pharma businesses.

And so I thought that was a very interesting quote coming from the IR of Moderna. And that's exactly what we do as generalist investors. We are trying to identify companies that can scale up, like a technology company.

MB: And you've answered a couple of other questions in that answer as well about how you identify winners and losers and things like that, which is great. So I'll go to this question about specifics of E, S and G factors. Which are most relevant in healthcare companies, both from a material and a non-financial viewpoint?

RN: So we take into account all of those ESG factors into our framework when trying to identify companies and analysing them. For us, impact comes in twofold. The first is the impact that the company can deliver for patients and societies through their products. But the second is the impact that we as investors can bring to the companies. And that is through being a supportive, long-term shareholder and it's also through our network that we have managed to build over the years.

So we can actually introduce some companies that we hold to other partners that we think could be additive to their processes. And that's something that we have done on a very regular basis. For example, we introduced argenx, which is a Belgian biotech company, to a partner in China called Zai Lab, for them to bring their drug to China.

So that's just one example of the sort of impact that we aspire to create as investors. And as regarding to the other factors in the framework, such as environment, social and governance, those are also factors that we have incorporated into our investment process through our different questions that we… Yes, so we have to answer all of those questions if we want to bring ideas into the portfolio.

MB: That's great. So we're out of time with the questions, but we will get back to some of the questions that we haven't had time to answer in the Q&A. And just a reminder, the book that Rose mentioned earlier is called Loonshots, by Safi Bahcall.

RN: Yes, that's right.

MB: That's correct. So I wanted to just finish, Rose, by giving you the opportunity. If you were to sum up what you'd like to leave the audience with in no more than a minute, what would it be?

RN: I believe that we are standing at an inflection point in the Biological Revolution journey. And this is thanks to the convergence of many different technologies from different fields, and they are all coming together now to transform life sciences. As we get closer to mastering human biology, the impact on humankind would be tremendous. And I think we can all be part of this journey as well by being supportive and long-term shareholders of the innovative companies that are making all of this happen.

MB: And, Rose, it's great to end on such an optimistic note. And I hope you, the audience, have enjoyed the conversation as much as I have. Thank you very much, Rose. And there'll be a recording of this webinar that you'll be able to find on the Disruption Week website in maybe about a week's time. And if you'd like to read more about Rose's thoughts, I'd highly recommend The Great Convergence of Medicine, which you can find on Baillie Gifford's Insights page on our website. That's bailliegifford.com/insights.

And tomorrow, we have payments. So I hope you'll join us there for Disruption Week. In the meantime, thanks for investing your time in Disruption Week, and goodbye.

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