CIO CONVERSATION SERIES

CARY STREET PARTNERS

Episode 4

INNOVATIONS IN HEALTH SCIENCES

Tom Herrick: Welcome to the CIO Conversation Series, I'm Tom Herrick, Cary Street Partners Chief Investment Officer. On this episode, we will examine a sector that makes daily headlines and has an everyday impact on all of our lives – health sciences, an industry that's been constantly innovating and evolving since the pandemic created an enormous urgent need, of course, but really, since the birth of modern medicine.

Brian Dausch: You know, much as the internet was kind of around for a long period of time before we were really able to unlock its power, the same is true in the health care space.

Tom Herrick: My guest today is Brian Dausch, Vice President and Portfolio Specialist in the US Equities Division at T. Rowe Price. Brian covers a variety of sectors, but health sciences is his specialty. A firm that is one of Cary Street's important strategic partners, T. Rowe Price has one of the deepest analytical benches in the world. In our time together on the podcast, Brian and I will talk about the march of science and innovation ideas, from the Human Genome Project to the amazingly effective COVID-19 vaccine and future technologies. We'll try to keep the science itself simple while surveying the advance of our knowledge of human biology, which has been almost exponential in recent years. Overall, we'll put the newest health science developments into historical context while exploring this vital sector and where it's heading.

Brian Dausch, thanks for being here.

Brian Dausch: Thanks so much for having me, Tom, and for the warm welcome as well.

Tom Herrick: So we're recording this the third week of May, a time when health science routinely is leading the news because of the unprecedented rapid roll-out of the COVID-19 vaccines, multiple vaccines, as I just mentioned. I want to know how big an inflection point this is. We're going to talk about this later. But the mere fact that we have a vaccine is major news. So let's start with that. How big of a moment are we in for this health science sector?

Brian Dausch: Yeah, thanks, Tom. You know, COVID has certainly been the focus for many people in terms of their personal lives, but also thinking about it from an investment context. And I think you're right to frame this as a very big moment when you consider how significant it was to develop a vaccine in less than a year. You know, when vaccine development typically takes many years, is certainly a big moment for the sector. And obviously, the biotech and pharmaceutical space was very key in terms of getting us, you know, through the pandemic and hopefully now starting to get on the other side of it.

Tom Herrick: So I'm going to take our audience, you know, kind of beyond the headlines back in time, put the COVID chapter of health science history into a little bit longer-term context. You know, explore what the real story is behind this innovative vaccine. What's the short history of, you know, this medical science innovation? Was there a sudden burst all of a sudden last year, or is it a more nuanced and longer conversation in that?

Brian Dausch: Yeah, it's definitely more nuanced. You know, a lot of the innovation that has been pulled forward just in the context of the pandemic was really started back when we sequenced the human genome, which actually occurred in late 2000, there was the big Human Genome Project and Human Genome Sciences was one of the preeminent companies in terms of getting the genome sequenced. That really allowed us to unlock much better understanding of human biology and ways to consider innovating on medicine and treatment of individuals. But the truth is, as much as the internet was kind of around for a long period of time before we were really able to unlock its power, the same is true in the health care space where we had this knowledge in terms of the sequencing of the human genome. But it was very expensive to run experiments and it took, you know, a lot of additional

technological innovations along the way to create the tools that allowed us to actually be able to run experiments much more rapidly in a much more cost-effective manner. And, you know, ultimately led to the innovation that we're seeing today, which was, you know, kind of having a vaccine developed in a very quick period of time.

Tom Herrick: Regarding the human genome and the Human Genome Project, maybe we could put that into terms that I can understand a little bit better. What exactly is that? Why is that such a key to unlocking the understanding of biology in all these targeted medical practices that we're now seeing come to the forefront?

Brian Dausch: It essentially allowed us to decode the human genome and our gene structure. So allowing us to understand ultimately what the linkages could be to diseases that were manifesting itself and how to go after treating them to get the body, to produce certain proteins, to fight off diseases. You know, you could think of it as effectively we're able to create a blueprint for the human body that medical researchers and companies were able to see more clearly as to, you know, how the therapies that they were developing impact the human body and then ultimately fight diseases which create some kind of irregularity in the body that need to be fought against.

Tom Herrick: What I find fascinating about this whole subject, and I know more about history than I know about biology for sure, you know, it seems to me as an observer that these advances, particularly being pulled forward, the phrase used earlier by the pandemic. In a way, it relates to what happened during World War two, where you had advances in antibiotics. And I just think of the history of medical science pre-World War II. It was almost the dark ages. I mean, it was carpentry and good luck, and you couldn't do surgery without antibiotics with infections. Is this a similar sort of moment, you know, this is certainly an advance, I can see that, but is it looked to be a similar type of thing. Can we draw that conclusion?

Brian Dausch: Yeah, I think that is a fair analogy. The emergence of antibiotics, like you say, it totally changed the way that medicine was being administered and the way that patients were being treated and obviously had significant enhancements on just the quality of life and also the duration of life in terms of people being able to overcome diseases that they could not previously. So when you put that in comparison to the situation that we're in today, our more nuanced understanding of human biology and the ability to actually develop medicines that are far more customized and targeted. I think that COVID vaccine would be one example where effectively by using messenger RNA, you're able to get the body's immune system to create the response to fight the disease in a very targeted way that comes with very high efficacy. So the end results are very positive in terms of being able to fight off disease. And, you know, COVID would just be one example of that.

Tom Herrick: Let's go right to that. So the mRNA platform, you already alluded to it somewhat that you know how that varies from the more traditional platforms, which, again, in my minimal understanding of biology or chemistry, is basically a weakened virus, as the more traditional vaccine platform. These have been the way we've developed vaccines in the past. The change here is the efficacy of those vaccines, while good, is not revolutionary like the mRNA entrance. So maybe you could just talk to that a little bit.

Brian Dausch: Yeah, you're right. You know, the way that we have treated influenza in the past is through those mechanisms which, you know, the flu vaccine is 50 to 60 percent effective, which is great, you know, it's helpful for people to either not get the flu or if they do get it, it's much reduced. But you're right, it's a different situation here where the messenger RNA vaccines, you know, effectively it's sending the coding into the body to say, actually, you need to make more of this specific protein to fight the disease. And we can see that the impact is that the vaccines are very effective, you know, 90, 95 plus percent effective. For all intents and purposes, it really prevents the vast majority of cases, it prevents, you know, serious disease, you know, prevents death etcetera. So the efficacy that has come by a much more targeted approach is just unheard of. And then, of course, the speed with which we've been able to develop these vaccines is also far more quick than what we've seen in the past. I know that's a topic that we want to delve into a little bit more.

Tom Herrick: As every night on the news, you get sort of, you know, if it bleeds, it leads we have a miraculous vaccine. But there's all these variants all over India, Brazil, South Africa or whatever, and, you know, will it work on the variants? And I know all vaccines can be boosted and retooled to deal with variants. Are the mRNAs more effective or faster in that regard?

Brian Dausch: There's a couple of things there. One of which is that actually because the immune response is so strong, the body produces, you know, such a large amount of antibodies that what we're finding is that people are generally able to overcome the

variants. It's still possible that you may get sick, but the severity of the diseases is far less. And the, you know, adverse outcomes are far less. But you bring up, you know, kind of a point secondarily, which is to say that because the speed to market of these vaccines is so fast, you can actually turn around and create effectively another vaccine over the span of several months that, you know, targets that specific variant in order to effectively inoculate it, right. You know, that's kind of what we're seeing when you think of the variants that have come from, you know, different places around the world, that's really going to be the approach. Is that we'll get boosters, but they may be slightly different makeup, given that they're trying to target maybe a problematic variant that has emerged like the India, you know, variant could be an example kind of current time.

Tom Herrick: Without going too far into the biochemistry, I guess, you know, maybe we can turn to the future of these advances, what it means for people in medicine going forward. You know, maybe we just continue with mRNA, for instance. What else can that technology deliver?

Brian Dausch: Messenger RNA technology can be utilized in a variety of different ways. You know, obviously thinking about infectious disease, which is what COVID is. But there are other respiratory diseases that, you know, could be even potentially packaged into one vaccine, like where some of the companies are working on vaccines that could inoculate against COVID, against influenza, potentially against RSV, which is a serious disease, usually for infants or smaller children. But as we think beyond infectious disease, there are a number of other interesting applications for messenger RNA technologies, including things like rare diseases. So oftentimes there are diseases that affect, you know, small amounts of the population, but they can be catastrophic and ultimately cause death. There's opportunity for this to be applied there. And then maybe the other area that might be of interest to people is recognizing that we can potentially develop personalized cancer vaccines by utilizing messenger RNA technology, which is something that a number of companies are working on as well

Tom Herrick: So are you suggesting we may be heading into an era where there's a cure for cancer? I mean, a vaccine for cancer? Does that mean we prevent cancer? Does that mean we catch it early and cure it that way? I would assume vaccine means ahead of time.

Brian Dausch: Yeah, and it kind of goes back to the conversation that we were having about the human genome and our better understanding of human biology. If we can detect some markers, so to speak, in people's DNA, we may be able to determine actually this person is predisposed to a particular type of cancer. And, you know, the messenger RNA technology could be utilized to actually help correct that person's genetic makeup, if you will, so that, you know, hopefully they would not develop the cancer. So, yes, it could be used preemptively, you know, there's possibilities where it could be used, you know, even in earlier stage where a cancer has emerged for a patient. But obviously, there are a large number of cancers out there so it's going to be difficult to cure everything and I don't know that messenger RNA is going to be capable of doing that across every type of cancer.

Tom Herrick: How fast do you see these things coming about? I mean, clearly, it's an unanswerable question to some degree, but what does it look like? I mean, 20 years in the future or two, or is there an answer to that question or a guess?

Brian Dausch: Well, somewhere in between, you gave me a nice large range, so I think somewhere in between.

Tom Herrick: Yeah, zero to one hundred.

Brian Dausch: I think it's fair to say, probably several years down the road. Obviously, we need to assess the safety profile of something like that. But the process to actually create a vaccine is very quick. We kind of alluded to this before, but you know, the prior vaccine, if you would ask a vaccine expert, you know, how long does it take to properly develop a vaccine? They would tell you 10 years, you know, is the typical average. And the fastest vaccine that was ever made up to this point was Ebola in five years. And, of course, COVID was less than one year. So I think it's fair to assume that in a number of years we could be looking at the possibility for cancer vaccines. But there is a lot of study that needs to be done in the interim.

Tom Herrick: We've talked a lot about the mRNA technology, you know, obviously in the news. Less in the news are other innovations that might be on the horizon. Maybe you could wet our appetite with some of those as well?

Brian Dausch: Yeah, there's quite a number of things that the industry is working on. Your audience has probably heard of things like gene therapy, gene editing would be things that companies are working on to kind of utilize the new technology in order to basically

create therapeutics that allow the body to course correct, if you will, from genetic mutations that can cause things like cancers. Maybe a couple of other areas that I would point to is the use of artificial intelligence and machine learning in the drug discovery process. A lot of what happens is companies are trying to figure out how to properly formulate a drug to, you know, kind of target a certain disease area, is that they have to run a multitude of experiments to determine, you know, whether the formulation is correct and whether the safety profile could be good. You know, having that type of technological advancement is very compelling in that regard as well. And then maybe the final thing that I would say is an area that is budding and growing very quickly, but still early. The challenge that we have with most cancers is that by the time we're able to see that the patient has a problem, it's because the tumor has developed and you go to the doctor and they do a biopsy and they say, I'm really sorry to inform you, but you have stage three, stage four, of whatever cancer it may be. And you know, the likelihood of overcoming that is much more difficult than if you catch it early. So there are some interesting things being done around blood testing and screening. Liquid biopsy is kind of what the term that people utilize, basically where you're able to determine through a blood test, you know, very early stage whether there could be an abnormality or a cancer forming and then ultimately how to treat it where you could have much better success treating it earlier.

Tom Herrick: So I want to turn now to basically how all this happens, how all this innovation comes about. What's the ecosystem? I like to use that phrase for this because I think there's a lot of confusion around this, where one group of people thinks it's all in one lab. You know, there's a progression of development – academics are involved, the universities are involved, private sector is involved. I'd love to learn more about that. Maybe you could give us sort of an overview of that.

Brian Dausch: Yeah, you're right. There's an entire ecosystem that kind of has to work together in unison to get the types of innovations that we're seeing. Certainly, there are, you know, government agencies, NIH, National Institutes of Health would be one example. There's a number of those that are, you know, focusing on specific disease categories or types. And they're conducting research in the lab, so to speak. As you articulated, there are a number of things that happen to in the academic hospitals where, you know, you could have somebody that's working on a PhD or, you know, a specific field that they're studying in great detail and they're working on very important research that often will spawn maybe a drug discovery or maybe some kind of insight as to how to treat a specific disease that then ultimately companies that are working in the drug discovery process can then kind of utilize that to, you know, develop a drug and a therapy to fight the disease. And then, of course, you have the companies themselves that are working very hard to run a multitude of experiments targeted at different disease areas, develop drugs and then be able to commercialize this drug. So it's really a very large system from governmental agencies to academic hospitals, researchers and the companies that are ultimately developing drugs and helping to commercialize them for patients.

Tom Herrick: I'd like to point out that it's kind of a global ecosystem too. Maybe you could comment on without necessarily talking about individual companies, but just from a stock market perspective, you know, a lot of those early development companies in biotech, do they tend to be single product companies? You know, where's the biggest play here? Is it there or is it in the mass market? Companies like the Pfizer, Merck, Lilly universe, as I would call it?

Brian Dausch: Yeah, much as the way we describe the research process being a large ecosystem, I think it's the same way when you think about companies and the investment opportunities and each of them play different roles. The innovation that is occurring in the therapeutic space, very often it is occurring in small companies that may be working in a very focused way, and they're developing one product in order to hopefully get it approved. And it can be very transformational to a very small company that, let's say, develops a COVID vaccine or develops a treatment for cancer or a treatment for diabetes, that maybe is a blockbuster drug, which would be a one billion dollar plus revenue drug, as you can imagine getting, you know, going from zero revenues to one billion plus overnight is very impactful to a small company. So the potential payoff to that innovation in the smaller companies, the biotechs and things like that can be quite large, whereas the pharma companies, they may have 30 or 40 billion dollar revenue bases and they have platforms of drugs across different areas. The scale and expertise in manufacturing that they bring to the table is very important, of course, in the commercialization of drugs. But any one drug is going to be sort of part of an overall platform. So the way that we kind of think about it is, you know, the pure play way to play innovation in the therapeutic space certainly orients a bit more toward the biotech companies. But there are a whole host of other areas within health care that we think innovation is very compelling. The life sciences tools, companies which are enabling this innovation to occur through either instrumentation or some of this R&D process stuff that we've been talking about. Also diagnostics, you know, that would fall within the life sciences tool space, the medical technology space, medical robotics would be another area in terms of robotic surgeries that is on the rise as well. So there are maybe to summarize as far as the investment opportunities across the health care space, we think they're very

diverse across a wide array of companies that can benefit from the innovation that we've seen in recent years and what we expect to continue. And I think as we look ahead to the market performance overall and health care's contribution to that, we expect health care to be a pretty strong area for many years to come.

Tom Herrick: That's a great answer. There's probably about nine podcasts in that answer right there. When you start talking about robotics and anything else. So, Brian. Where are investors putting their money right now, where is capital flowing to in the health care sector?

Brian Dausch: Yeah, it's been a very busy capital markets for health care companies just over the course of the last year and some. Maybe to give you one example, since the pandemic, we've seen over 120 IPOs of biotech companies. There's a much larger number than that in terms of the amount of companies that are already public that have done follow on offerings, you know, raising additional capital. And then even outside of biotech, there have been quite a number of IPOs that have occurred in the medical technology space, the life sciences tool space as well, too. So when you think of our opportunities as investors, there's a lot for us to choose from, you know, across a number of very innovative areas within health care from the therapeutic space, which would be the biotech companies or the companies that are helping to develop the technology and the tools that is enabling that innovation in terms of life sciences companies or medical technology companies.

Tom Herrick: Brian, thanks for your perspective and insights. It always is great speaking with you.

Brian Dausch: Yeah, thank you so much. I really appreciated the chance to come on with you and speak to your audience. We love talking about health care and this was a great experience.

Tom Herrick: So that was Brian Dausch with a healthy dose of important information analysis on health sciences. I mean, I'm never going to catch Howard Stern with that kind of writing, guys. Thanks to Brian and all our friends at T. Rowe Price for making it happen, and thank you for listening.

We'll be back next month with more thought leadership as we strive to maintain Cary Street Partners higher standard on the airwaves. We're already working on episodes to cover questions and issues that are front of mind for investors right now. Next month, we're going to discuss the red hot housing market. In the meantime, for more information, please visit our website at CaryStreetPartners.com. Subscribe, share the show, send us your feedback. We'd love to know what's on your mind. I'm Tom Herrick, talk to you next time.