Built for Change Episode 8

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00:00	**Chris Gibson**: We probably understand like 2% of biology or less. Who knows? **Josh:** This is Chris Gibson. **Chris:** It's super complex. Inside of every one of our cells, we've got around 21,000 genes that are encoding hundreds of thousands of proteins that are interacting with millions or billions or trillions of other proteins. This idea that we can draw on a whiteboard, a bunch of arrows and boxes and understand it, to me, always felt pretty arrogant. **Josh:** He's the CEO and co-founder of a drug-discovery company called Recursion. But back in 2009, he was in medical school, working in a lab at the University of Utah, focusing on drug discovery. **Chris Gibson:** People would go up to whiteboards and they would draw these pathways of genes and proteins. It felt like there was this false precision associated with drawing biology on a whiteboard with arrows and boxes. **Elise:** Chris's lab was using that whiteboard method to

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01:00	develop a drug for a disease called Cerebral Cavernous Malformation or CCM. **Chris Gibson:** Most people haven't heard of it, but it affects more people than cystic fibrosis. And people get essentially like little aneurysms in the blood vessels of their brain and spinal cord. **Josh:** After four or five years of studying CCM, the team thought they'd figured out what was leading to the disease. According to their white-board calculations, a well-known cholesterol drug called Simvastatin looked like it may cure CCM. **Chris Gibson:** We were super surprised when we unveiled the results in a lab meeting. And I remember the person who was leading that study, standing up there and saying, we actually made it worse. **Elise:** It was exactly the opposite of what they had expected. And it was a humbling moment for Chris and his team, where the depths of what they didn't know about biology became readily apparent. **Chris Gibson:** And ultimately in that failure was born the opportunity.
02:00	**Chris Gibson:** We were sitting around one day after a talk by a professor. And he had shown this study where they looked at images, called a phenotypic screen. You essentially identify things that look sick and then find a drug that makes them look healthy. So we took about 2000 known drugs in our academic lab. We added them to cells that were sick with this disease. And we took microscopic pictures. And rather than saying, let's use our eyes to look at the pictures, I said, why don't we also train a very basic machine learning classifier and let's actually go head to head with people and computers. **Elise:** The human scientists developed a scoring system to say, these cells look healthy, or these cells look sick. And then the team trained a machine learning program to use the same scoring system. **Chris Gibson:** And at the end, we picked the best drugs that the machine identified that made the cells look healthy and the best drugs that people identified. And I remember unveiling the results and the

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03:00	machine was picking medicines that made the cells look really weird. And the people were picking medicines that did make the cells look healthy to my eye. **Josh:** Then, Chris analyzed the results. Even though they followed all the rules to identify what appeared to be healthy cells, the humans only picked one drug that actually looked like it worked. And that was the cholesterol drug that Chris' team had already tested and failed with! In comparison, the machines were identifying cells that looked pretty weird to the human eye. But despite that… **Chris Gibson:** The machines picked, if I recall I think, 7 or 9 … **Elise:** 7 or 9 drugs that actually worked. **Chris Gibson:** That was the moment I think, where we felt like there was something the computer was seeing that we weren't. And there was this freeing moment of realizing that the mechanisms of these drugs were acting in ways that we would not have expected. These were totally surprising.
04:00	And we asked, could you use robots? And software and really smart people and tools like CRISPR. Could you like shake them all up and do this, not once for CCM, but could you do this 10 more times for 10 other diseases, maybe a hundred, maybe a thousand? Maybe one day we could explore all of biology with this kind of approach. The idea for Recursion was born in that lab meeting. And Recursion, actually the company we ended up founding, now has one of those drugs going into a phase two clinical trial for patients with CCM. **Josh:** I'm Josh Klein. **Elise:** And I'm Elise Hu. **Josh:** And this is Built for Change, a podcast from Accenture **Elise:** There are so many diseases for which we still don't have known cures like cancer and Parkinsons where I wish drugs would be discovered but obviously biology is super complex. **Josh:** Yeah, but I feel like we're hitting this point in time where the technologies

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05:00	that we have at hand are starting to be up to the task.
	Elise: Yeah.
	Josh: So we're living in a world where advances in science and medicine are happening faster than ever.
	Elise: But all of these miraculous breakthroughs come with a financial cost. And more than ever, patients, regulators, and even governments, are putting pressure on pharmaceutical companies to develop great treatments at affordable prices.
	Josh: Exactly. So, in this episode, we're going to talk about how to do just that. We're gonna learn all about this rapidly evolving field of pharmaceutical research and development and focus on those breakthrough approaches that are quickly pushing the field ahead. Those novel techniques and technologies make up what Accenture calls New Science. And then, we gonna talk to two business leaders whose companies are proving that the pharmaceutical industry can bring revolutionary treatments to patients at an affordable cost.
	Stuart Henderson: We are, without a doubt in a miraculous moment.
	Josh: This is Stuart Henderson. He's Accenture's global industry lead for their
06:00	Life Sciences team. He says that the industry is creating solutions to address the historically challenging and complex process of drug discovery.
	Stuart Henderson: Over the last few decades, it's been about producing medicines that are applicable to broad populations.
	Josh: Scientists will look at a particular chemical or biologic, and see if it'll improve a particular treatment for a disease. This can take years. After that, a drug will go to a clinical trial, then through review with regulators, before finally making it to market. And this process, on average, takes 10 to 15 years. Plus, you usually have to try a bunch of different approaches before you get the drug totally right.
	Stuart Henderson: You know, the traditional process of discovering a new medicine is that if you have a hundred potential candidates at the beginning of the process. The traditional metric says that maybe six of those make it to market.
	Josh: Let's underline that for a second. 6%

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07:00	of medicines that are tested actually make it into the hands of consumers. And that means that 94% fail for one reason or another. And all those failed attempts end up costing a lot of money. **Stuart Henderson:** So you imagine you've spent over a billion dollars to get a drug into phase three, which is the last step in the process before you submit to a regulator. You could have spent over a billion dollars working on that, and you could find that it has a toxicity issue. Immediately that medicine is not something the company will take forward. **Josh:** That cost of failure is a big part of what makes traditional drugs expensive. **Stuart Henderson:** If you can reduce the cost of failure, then you can reduce the cost of medicine. **Josh:** "New Science" takes a different approach. It's all about rejecting the traditional processes, and using new technology to create novel treatments. **Stuart Henderson:** We coined this term, New Science to reflect what is the fastest growing part of the Life Sciences. We classify it as treatments that feature very highly on the indexes
08:00	of scientific novelty. When we say scientific novelty, we're talking about a brand new mechanism. If we look at some of the major advancements in oncology over the last few years, it's the things like immuno-oncology where we're using assets that are using people's own immune systems to fight cancer. Something that maybe 10, 15 years ago was just a very early research idea. So now that's the mainstay of some of the core aspects of how we treat cancer, that's scientific novelty. **Josh:** New Science approaches include bio-marker based treatments, vaccines developed using mRNA technology, or a treatment called CAR T - which involves removing blood from an individual, reengineering it in a lab and then bringing it back to the patient. **Stuart Henderson:** They're the ones which are going to go after the diseases where we don't have good treatment. And guess what, technology is part of all of these pieces of New Science. **Josh:** But because New Science treatments are built on advanced technology with a highly-specialized approach -- they can be expensive.

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09:00	Sometimes, as much as three to five times more than traditional medicines. **Stuart Henderson:** You know we have to remember that the price of innovation does come with a premium. Now the price component is very complex in the US. It's very complex because there's a whole range of different pieces in between the manufacturer and the patient. There's your insurer, there's your pharmacy, there's your pharmacy benefits manager, there's your distributor. And so as patients, we often see rather confusing numbers when it comes to the cost of medicines. **Josh:** Stuart says pharmaceutical companies are facing a new economic reality. There's increased pressure to develop highly personalized (and also expensive) New Science treatments, but with increasing pressure from regulators and patients alike to keep costs affordable. And the pandemic has only heightened this pressure. **Stuart Henderson:** The key is if pharma companies can reduce the cost of researching, developing and discovery in commercializing new medicines, then there's a path to much, much less expensive medicines. **Josh:** To avoid passing on the price of innovation to customers, Businesses must deploy
10:00	New Science approaches with more efficiency and more speed. So, the billion dollar question is... how? **Stuart Henderson:** 80% of the way we do discovery is what we call in vitro. Basically, you're using wet chemistry, wet biology to discover a new drug. **Josh:** You know, petri dishes, cells, pipettes... **Stuart Henderson:** So, and then 20% of that is using technology to support that process. **Josh:** Stuart proposes flipping this equation on its head through what Accenture calls: data-led drug discovery. **Stuart Henderson:** Let's use the vast amount of data we've got, let's use AI and machine learning, and let's do 80% of our work to identify where the needles in the haystack might be. And then we'll use wet chemistry and wet biology to validate that target and say, did we actually find something? **Josh:** The New Science method of drug discovery uses AI and machine learning to ID those needles in the haystack: the drug therapies that have a higher likelihood of actually working on a particular condition. And the larger the haystack, the more needles you find. That cuts down on the cost of failure and thus,

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11:00	the cost of new medicines. **Stuart Henderson:** We're talking about companies being able to develop new drugs in half the time, half the cost, much more quality. Essentially going from billions to millions in terms of drug discovery and development. And that means ultimately they'll be able to produce medicines, which are less expensive for patients. **Josh:** Stuart says business leaders need to invest. Both in technology, and in the digital culture of their organizations. **Stuart Henderson:** Companies that have a larger portion of new science in their portfolio, they're investing six to seven times more in digital and technology than those who have a lower proportion of new science in their portfolio. And with that 6 to seven times investment in new digital technology, they're also investing in the cultural changes associated with making their leaders and their employees more tech savvy. Everybody needs core data science skills. Everybody needs to understand how to use digital technology. Everybody needs to understand and have a digital-first mindset. How is your
12:00	organization going to take advantage of those digital technologies that enables them to be able to do things the new ways? **Elise:** Okay so if I'm understanding New Science correctly, it is using techniques and technologies that are novel, legitimately novel, to create more specialized treatments by using tech, right? **Josh:** And hopefully lets us do things we couldn't ever do before. I've got a friend who was diagnosed with cancer **Elise:** Hm. **Josh:** and one of the things that he's doing about it is he's getting his genome sequenced. He has a relatively rare kind of cancer and one of the best treatments is to make a therapy uniquely for it. And it turns out that that's something that we can do now. **Elise:** Yeah **Josh:** It's not always cheaper. **Elise:** Yeah, I mean the cost is the big question, right? How do we deploy these novel technologies while still keeping treatments affordable? **Josh:** Right, right. But the key to discovering these drugs is just… diving into the deep end of the "gene pool" so to speak. With the right technology to help you, of course!

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13:00	So, next, we're gonna learn how one company is using data-led drug discovery and AI technology to plumb the depths of human biology-- leading them to discover new drug therapies faster than ever before. **Chris Gibson:** If you were here today, sitting with me, you could look out over to my right and you'd see this giant factory full of robots that are doing 1.5 million experiments every week. **Josh:** Here's Recursion's Chris Gibson again. And yes, he said robots. In that 40,000 square foot lab, Chris works with a team of over 200 to use an unbiased, tech-forward approach to-- as Chris says-- build a map of biology. **Chris Gibson:** We harness the complexity of biology, the system of biology to tell us, are there low hanging fruit of new biology that nobody's really explored anywhere that we can pick, and could those have relevance in human disease? To date at Recursion,
14:00	we've done nearly a hundred million experiments in more than 37 different human cell types across the entire genome and hundreds of thousands of molecules. And we use algorithms to explore that entire thing and make a map of biology. **Josh:** Recursion scientists can use that map to see relationships between cells. Basically, to explore biological connections and identify potential drug therapies. **Chris Gibson:** We call people at recursion Bioneers because they're like, exploring biology in unexpected ways. It's like Lewis and Clark floating on the river and they come around the corner and there's a waterfall. The way our pipeline works is that scientists sit at their desk. And they explore the map. So they say, you know, it's well-known in oncology that patients with lung cancer who have a mutation in a gene called STK 11 are beneficially affected by a certain class of drugs. And they say, that's interesting. Well, I wonder what the map can tell me about this. And so they go exploring.

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15:00	They literally sit at their computer and they type in STK 11 enter and then, a whole universe of biology and chemistry pops up where we've predicted maybe things that have never been shown in any paper ever written, genes that are related to STK 11 or drugs that seem to be interacting with the pathway that STK 11 is in. **Josh:** And then, right at their computer, the scientist can order an experiment to test out their hypothesis. **Chris Gibson:** We have created this idea of a factory of data creation. And so in the case of that particular project, STK 11, six months later, we had done a study in mice and shown that that drug from that prediction was having an extraordinary effect at mitigating the lung cancer model in these mice. **Josh:** That's six months. A far cry from the many years it usually takes to bring a drug along to that stage of testing in animals. Not only does this approach allow drug discovery to happen faster-- cutting down
16:00	on the ultimate cost of the drug you end up with-- but doing millions of experiments per week creates a ton of data. And that's great news for the biopharma industry overall. **Chris Gibson:** During the early days of the coronavirus outbreak, we generated a really big image-based dataset of what live human cells look like when they're infected with SARS coV 2, which is the virus that causes the disease. We were doing this in April of 2020, and we actually released 300,000 images of human cells infected with SARS, coV 2. **Josh:** Recursion was able to give that data to scientists to use in coming up with vaccine candidates. **Chris Gibson:** There were seven or eight medicines in that data set that we explored that people have taken into randomized controlled trials in people. Our algorithm had predicted that they would be good or bad seven out of eight times correctly. And so what that might mean is in the next pandemic,

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17:00	maybe the drugs that we say would be best might go into a clinical trial earlier. **Josh:** Recursion's success in using machine learning for data-led drug discovery is an early proof of concept for how we may treat patients with rare diseases. Which historically, has been a really challenging market for traditional biopharma businesses. **Chris Gibson:** Could we build drugs for a thousand diseases that each affect 400 patients? All of a sudden, you're talking about half a million patients, but the challenge is you've got to build an individual drug for every one of those. And that only really becomes economically feasible in a for-profit way if you can do it really, really efficiently. **Josh:** So all this scaled computing that makes up the core of what Recursion does-- honing algorithms, collecting data through experimentation, building that map of biology-- It swings the door to the future of medicine wide open. **Chris Gibson:** I think if you were to look out many decades from now,
18:00	we should be able to identify for anybody the right way for them to become healthy again. It may be that there's a medicine just for you, just for your genetic makeup, just for the disease you have, just for the environment you live in and the life you lead. And the question is, can we make it 30 or 40 years from now instead of 80 or a hundred years from now? **Elise:** This story is so cool because of the incredible amount of data that they're using, right? **Josh:** Yes! **Elise:** Mountains and mountains of data... **Josh:** Mmhmm. **Elise:** So that scientists can avoid having to use human labor or energy or heart to test all these different interactions. And it makes it easier to fail fast and move on. **Josh:** Yeah, and it does it in an unbiased way. Right? Like the technology is looking for what the data suggests, not what the human brain thinks might be there. **Elise:** Yeah, and I know our brains have certainly been there, right? Where we're just really stuck on an idea or married

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19:00	to an idea and can't get fresh eyes to move on because of our own human biases.
	Josh: Yup, yup, that was my theatrical career.
	Elise: [Laughs]
	Josh: So the question I've got is, what happens after we discover all of these amazing drugs?
	Elise: Yeah.
	Josh: Like, there are some pretty costly and time intensive steps between experimenting with a new treatment and bringing it safely to the masses.
	Elise: Totally. You have to crash-test a car to make sure it's safe before you let a bunch of people drive it right?
	Josh: Mhm.
	Elise: And it's the same with creating new drugs.
	Josh: But guess what? The technologies of New Science are making the process of conducting clinical trials quicker and more efficient too. So next, we're going to learn a little bit about the clinical trial process, and how our next company is using New Science to totally reimagine how drugs are tested and brought to market.
	Stuart Henderson: In the old when, you ran a clinical trial: you recruit a patient. They carry the burden of having to travel to the doctor or the hospital consistently. And so
20:00	just imagine what it's like going to the doctor for a normal visit. You have to take time out of work, you spend time in the waiting room. It's disruptive.
	Josh: That's Accenture's Stuart Henderson again. And he's right. In fact, the typical clinical trial patient has to drive 26 miles in order to make a doctors' visit.
	Stuart Henderson: The ability for you to sign up for that clinical trial is relatively simple. The ability to stay in that clinical trial immediately becomes quite difficult.
	Josh: This results in a high drop-out rate for patients in clinical trials. And the higher the drop-out rate, the longer it takes to make sure that the new drug you're testing is safe and effective in a representative population. That means more time and money are poured into the trial as patients enter and exit. But imagine if clinical trial participants weren't limited by geography or circumstance. This is where a new way of developing New Science comes into play. Virtual, decentralized clinical trials.
	David Coman: More than 90% of our patients maintain

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21:00	continuity throughout the entire clinical trial, that's compared to 70 to 75% in a traditional model.
	Josh: That's David Coman. He's the CEO of a company called Science 37. And the reason so many patients stay in Science 37 trials is because they don't have to make that 26 mile hike to a clinical trial site every week. They participate virtually. You might think the idea of participating in a virtual clinical trial is a relatively new phenomenon. But Science 37 was actually founded back in 2014.
	David Coman: The company had done tens of trials, and they were all sort of one-off experiments to figure out 'can this model actually work?
	Josh: Then in March of 2020, COVID hit.
	David Coman: The old way of doing clinical research went out the door because patients essentially couldn't even make it into a clinical trial site.
	Josh: And you can imagine, that came with a hefty price tag for pharma companies who'd already invested millions if not billions of dollars into these clinical trials.
22:00	David says one of Science 37's pharmaceutical partners shut down all of its trials completely... except for two.
	David Coman: And those were the two that Science 37 was running for them. So it was really a catalyst to initiate a whole new way of thinking. It's really led to the success of our business, but more importantly, a new paradigm for patients to be able to reduce a massive amount of burden that they otherwise had to experience in the old clinical trial method.
	Josh: That old clinical trial model wasn't just a burden on patients. It was a burden on pharma companies and clinical research organizations trying to coordinate clinical trials on-the-ground over hundreds of individual sites: in various clinics and hospitals.
	David Coman: Now each one of those clinics, hospitals, or what we call sites, have their own people, processes and technologies.
	Josh: That means a ton of variability in terms of how each site collects and maintains patient data and clinical data. Some sites might use excel

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23:00	to input patient data. Some might write the data on a physical piece of paper and put it in a filing cabinet. The other complicating factor? Oftentimes, trial sites are in affluent, predominantly white neighborhoods. And so, the traditional trial model misses out on a massive amount of the patient population. **David Coman:** Only about 8% of anybody with a condition are ever contacted to be part of a clinical trial. **Josh:** In the Science 37 model, the company goes out to find patients through social media and their connected database, rather than having patients come to them. When you can recruit a patient from anywhere in the world, that means your patient population is larger AND more representative. **David Coman:** Science 37 could get to the 92% of the rest of the population, which means we can get them in to the studies quicker, we manage them throughout the clinical trial process and they don't drop off so we can maintain them, which means you have to have less patients in the front door to begin with. **Josh:** And that means larger trials that catapult science ahead way faster.
24:00	For example, a recent study that Science 37 ran to see if a blood sample could predict if a patient had colorectal cancer. **Josh:** The company Science 37 worked with began the trial using the old model: partnering with a traditional clinical research organization. The organization set up a network of sites around the country. **David Coman:** And a couple of months into the study, they were at about 200 total patients. The problem is they needed 14,000 patients in order to ensure that they had enough of a sample in order to determine whether or not the blood test was predictive of colorectal cancer. Obviously it put them into a bind and so we had a conversation and they said, can you help? And we said, of course. **Josh:** The first thing Science 37 did was look at the sites where the trial was located and do a zip code match. They found that less than 3% of the total patient population was covered by the current sites. So they set out to close the 97% gap. **David Coman:** We found patients through social media, through typical media through providers. In this case it would be GIs. **Josh:** Science 37 even contacted the Colorectal Cancer Alliance to put the word out about the clinical trial

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25:00	opportunity. And all of this was possible because every bit of data-- about these patients and their doctors-- was accessible through Science 37's virtual platform. **David Coman:** We connect them directly into one of our study coordinators. They would consent to joining the clinical trial through our app. So they sign up. The platform triggers a phlebotomist to go directly to their home in order to do the blood draw. It gave us the ability to not be restricted by geography. **Josh:** With that restriction lifted, Science 37 enrolled 2000 patients in their first full month of the study compared to the 200 that had signed up over a matter of months with the traditional method. **Josh:** Science 37 manages all of this through what they call Metasite, which runs on cloud technology. It takes all of the different parts of the clinical trial process-- from providers entering in patient data to a nurse going to your house to take a blood sample-- and puts all of that information on a single, web-based platform.
26:00	**David Coman:** Just think about the magnitude that has in terms of the ability to get into market faster. The technology enabled the workflow of those individuals to be able to touch base, to be able to exchange information, to be able to put in all of the data, the clinical data evidence that is required to determine the efficacy or safety of a drug. **Josh:** Because of this technology, Science 37 has been able to find a more representative patient population 15 times faster and keep a higher percentage enrolled throughout the duration of a trial. Companies can test drugs more quickly leading to cost savings, and consumers can then get access to these drugs in a shorter period of time and at a lower cost. **David Coman:** The focus for Science 37 is investing on technology to be able to collect the data and on infrastructure to be able to manage the orchestration of that clinical trial as effectively as possible. Ultimately it comes down to speed. Because the faster you can bring it in the faster it can get into the patient's hands

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27:00	You're getting rid of redundancies in the old process. You're making an investment in technology in order to be able to realize the potential of speed. **Elise:** One of my big sticky wickets in medicine is that underrepresented communities like women, like people of color, are so underrepresented also in clinical trials. **Josh:** Yeah. **Elise:** And ideally Science 37 would make that different, right? Because it would make a more representative patient population available to testing. And especially in the age of COVID right now while we're still in a pandemic, it'll make drug development more equitable. **Josh:** Hopefully. So-- these New Science techniques are helping us find faster, cheaper ways of discovering, developing, and marketing new, specialized drug therapies that'll help more people in the future. **Elise:** Exactly. And technology is the lynchpin in that, right? Both of the business leaders
28:00	we heard from today are relying on radically new approaches to make these dreams a reality. **Josh:** To learn more about the trends in today's episode, check out the New Science report at Accenture dot com slash Built For Change. It talks about more innovative strategies to fuel business growth through New Science-- like regulatory innovation and virtualized selling-- so that your business can harness the power of New Science to thrive. **Elise:** Thanks to Accenture's Stuart Henderson. **Josh:** And to Chris Gibson and David Coman for talking to us. **Elise:** Built For Change is a podcast from Accenture. **Josh:** More episodes are coming soon. Follow, subscribe, and if you like what you hear, leave us a review.
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