Biotech

The start-up striving to accelerate drug discovery

Insitro is attempting to create an equal partnership between the life sciences and computer sciences

Insitro founder Daphne Koller's mission is to transform the long and costly process of drug discovery through machine learning © Winni Wintermeyer/FT

Hannah Kuchler YESTERDAY

Daphne Koller starts by showing me the logo of Insitro on a sticker on her smartphone.

The Stanford University artificial intelligence professor turned biotech entrepreneur is excited about what it symbolises: the joining of "in vitro" — the world of the test tube — with "in silico" — the world of the computer chip. At first glance, the strands look like DNA, but one is made of grey pixels and the other of green, round cells; they culminate in a small molecule.

"Because ultimately, what we want to produce is drugs," she says.

Sitting on the campus belonging to Alphabet's company Verily, in South San Francisco, Insitro's new office and lab are spookily quiet — waiting to be filled with machine-learning experts and scientists. Ms Koller launched the start-up last year and now has 25 employees. But with more than $100m in funding from investors, including Andreesseen Horowitz, Alphabet's venture capital arm GV, the Amazon founder's Bezos Expeditions, and a partnership deal with Gilead Sciences worth up to $250m, she plans to recruit many, many more.

Ms Koller was Stanford's first ever machine learning hire — long before it was fashionable. Joining the faculty in 1995, she stayed for 18 years, working on biological data whenever she could. But in 2012 she left the university to co-found and lead Coursera, the mass open online course platform.

After a year and a half at Calico, Alphabet's biotech unit focused on increasing lifespan, she decided to start Insitro, with a mission to transform the long and expensive process of drug discovery.

"Is there a reason why it should take 15 years to develop a drug? Why are the chances of success, depending on which stage of the pipeline you begin in, at 5 per cent? I mean, it seems like we ought to be able to do better than that," she says. "Perfect is hard, human biology is hard, but can we improve on where we are? It would be so sad if we couldn't."

While many new start-ups and even large pharmaceutical companies are talking about using artificial intelligence to discover new targets for drugs, Insitro is committed to creating its own data set using robot-driven laboratories. Ms Koller says there is a "perfect storm of data production" in the life sciences that makes it worth investing in creating data from scratch, rather than "trying to take piles of crap and massage it to try to make it useful for machine learning".

"There's a huge need for identifying what to go after in terms of the drug target. What do you modulate to really have the right effect on human biology? I think most drugs fail right now because we are going after things that just don't work," she says.

The lab on Alphabet's campus, San Francisco, US. Ms Koller uses AI and robots to discover new targets for drugs © Winni Wintermeyer/FT

Ms Koller points to the recent high profile failure of Biogen's clinical trial for an Alzheimers' treatment, where many criticised the company for pursuing a theory of the disease already thought to have been disproved.

As high drug prices become an election issue for politicians in the US, Ms Koller also believes her approach could cut costs. "The cost . . . is not zero but it is negligible compared to the cost of one failed clinical trial," she says.

Ms Koller has seen the impact of allowing algorithms to discover random associations first hand. At Stanford, she worked with a PhD student to use machine learning to predict the recurrence of

cancer. By throwing out the pathology rule book, they hit upon a discovery: the state of the stromal, or connective, tissue that surrounds the cancer is absolutely critical to prognosis. Today, patients are benefiting from powerful immuno-oncology treatments.

But even that discovery was based on small data sets, with only hundreds of data points. Machine-learning experts are attracted by larger sets, such as photos proliferated online and language processing as more people use online translators.

Ms Koller was lured to a very different mission: education. “I thought, this way, I can touch the minds of what I thought at the time would be hundreds of thousands of people, and turns out to be millions of people, in a relatively short timeframe. And life is all about making trade-offs,” she says. “Fortunately, I had the opportunity to have a second chance and come back to data-driven biology today. Honestly, this is a much better time to start this company,” she stresses.

Coursera taught Ms Koller about starting a company — and about the world outside academia.

“This [Insitro] feels a lot more organised and less frantic,” she says. “I’m not saying I have it all under control, one never has it all under control, but at least I know what needs to be done.”

For Insitro, creating an equal partnership between the life sciences and computer sciences will be “critical” to its success, she says.

Finding new drugs has traditionally been the business of pharma and biotech, so why aren’t they adopting Insitro’s approach? Ms Koller believes they have a “completely different” way of thinking about data. Pharma thinks of data as a “byproduct”, Insitro believes it is a “foundational asset” that decreases chances of failure.

Insitro wants to be a drug development company, not a service provider to pharma, ultimately making its own branded drugs. But like many biotech companies, it will partner with pharma on some drugs. The company signed its first partnership in April, working with Gilead to find new drugs to treat NASH, a severe form of fatty liver disease.

Ms Koller says they chose to work with Gilead because it has some important data from recent large clinical trials, which Insitro’s machine learning approaches can use to look for new ways of understanding the disease, and new drugs or combinations of drugs to treat it.

She describes the beginning of what she believes is the “next epoch of science”. Each era made breakthroughs: chemistry in the 1800s, physics in the 1900s, computer science in the 1950s. In the 1990s and 2000s, she says, two disciplines evolved in parallel: quantified biology — the ability to measure life with precision — and machine learning.

"Right now, we see those threads combining together . . . to create new capabilities that help impact not only human health, but also the environment and biologic manufacturing; not only therapeutics, but also better agriculture, biofuels; and the ability to create plants that suck in carbon dioxide from the air and help clean up our planet," she says. "It's all because of the nexus between measuring biology, interpreting data and engineering biology."

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