

Seeing double: Using virtual twins to help personalize medicine

June 8 2022, by Kris B. Mamula



Credit: CC0 Public Domain

Digital twins—virtual doubles of things in the real world—was an idea born in 2002 as a way of looking at the lifespan of products, like space rockets and jet engines, enabling repairs remotely and helping to predict when things will break.

The idea has caught on.

Barcelona, Spain, recently made a data-based replica of itself to do trial runs of city planning projects before actually implementing improvements to urban layout and design. NASA uses digital twin technology to remotely diagnose and fix spacecraft.

But the concept can be applied to more than roads and rockets.

At Highmark Health's Allegheny Health Network, predictive modeling, which is an element of the virtual replica idea, is being used to forecast a patient's response to certain cancer medicines. UPMC Health Plan is exploring the use of digital twins to create simulations of patients, with the goal of creating personalized care plans.

Now, a University of Pittsburgh spinout company aims to apply the idea of digital twins in a Star Trek-like path to the day when medicines are matched to the individual, with the aim of shrinking costs while targeting [medical care](#) with precision. BioSystics Inc. is an 8-month-old database and analytics outfit that serves research institutions and Big Pharma clients by managing and modeling [complex data](#)—the raw materials for creating digital patient twins.

It's the stuff of science fiction: among the data that BioSystics manages and uses to create computational models is information retrieved from digital chips that replicate liver and kidney cells cultivated with the patient's own stem cells. It's not as far-fetched as it sounds: so-called liver on a chip or kidney on a chip research is underway at Pitt and other academic medical centers.

Instead of working with digital wind farms and aircraft engines, BioSystics would use the elements to create patient digital twins to help treat disease in new ways.

"That's the excitement now," said company co-founder D. Lansing Taylor, the longtime director of Pitt's Drug Discovery Institute, whose teaching career included stints at Harvard and Carnegie Mellon universities. "Ultimately it'll lower health care costs and improve care for the patient."

BioSystics' business model is based on 10 years of research. It's also the sixth outfit co-founded by Taylor. BioSystics, which was formed in September, employs seven people and has started soliciting seed round funding.

The company's goal is to raise \$1 million in the [second quarter](#) to support operations until a Series A funding round, which is planned for the fourth quarter. Taylor said he has already received an offer to purchase the company.

He declined. He said he wants to keep the technology in Pittsburgh, which is poised to become a leader in the field backed by the combined heft of Pitt and CMU and hospital giant UPMC.

BioSystics is Taylor's latest foray into applying artificial intelligence to medicine. In 2017, he co-founded Bellevue-based SpIntellx Inc., which uses machine learning to identify abnormalities in tissue samples, catching problems the human eye may miss. That Pitt spinout, which employs four people, has raised \$1.7 million from Innovation Works, AlphaLab Health and other seed round investors.

SpIntellx data is the kind of information that BioSystics will include in the huge batches of data it will manage for [research institutions](#) and [drug makers](#). Other data sources include experimental human organ on a chip findings, patient medical records, even heart rate and other vital signs recorded by patient-worn devices.

From all that information, BioSystics will develop simulations that predict the patient's reaction to a drug or treatment.

Here's the issue: research shows medicines don't work for between 40% and 70% of patients taking them for the most common diseases because of complex differences in individual human biology and Big Pharma's one-drug-fits-all approach to manufacturing.

For example, a restructuring of Germany's drug market in 2010 included comparing the effectiveness of prescription drugs. As of 2014, 66 drugs had been evaluated, with 27 showing no benefit, according to Daniel Bahr, German federal minister of health from 2011 until 2013, who was writing for the Center for American Progress, a independent, nonpartisan public policy outfit based in Washington, D.C.

The wrong drug can hit the pocketbook as well: spending on prescription drugs in the U.S. ballooned to \$335 billion in 2018 from \$30 billion in 1980, according to the Congressional Budget Office.

Patient [digital twins](#), virtual replicas of real people, will integrate individual physiology and immunology information and other clinical data to predict the patient's reaction to medications or allow smarter choices for drug trial subjects, based on an individual's genetics and medical history.

Cancer treatment seems like a natural choice for application of patient digital twin technology, allowing doctors to try out different chemotherapies in the virtual copy of the patient to find which one works best before it's prescribed. But cancer cells have a remarkable ability to mutate and multiply, which could frustrate use of the tool, according to Peter Ellis, a retired oncologist and president of the Allegheny County Medical Society.

"It's pretty powerful," he said about patient digital twin technology, which he said could be invaluable in drug discovery. "It will find new drug targets to look at, but it's not going to be a panacea. The fly in the ointment is the complexity of the biosystem."

Moreover, BioSystemics is getting off the ground at what could be an uncertain time for startups, with rising interest rates, inflationary pressures and global supply chain issues.

The first quarter was the "most active quarter for angel and seed deals in our dataset," according to an analysis by PitchBook, which tracks funding. "When the next round of funding is needed, the increase of companies could be looking at a much more difficult fundraising market."

In the first quarter, venture funding in the United States fell 8% from a year earlier to \$71 billion, according to PitchBook.

Instead of potential headwinds, Taylor focuses on the day that medicine tailored to the individual patient becomes the standard of care as the cost of care declines with targeted treatments.

"There is a huge and increasing amount of medical data from patients," he said. "The ability to do precision medicine to treat patients as individuals—it's a huge effort. This is the next dimension. It's not going to happen overnight, but we're going down this path."

(c)2022 the Pittsburgh Post-Gazette
Distributed by Tribune Content Agency, LLC.

Citation: Seeing double: Using virtual twins to help personalize medicine (2022, June 8) retrieved 3 May 2024 from <https://medicalxpress.com/news/2022-06-virtual-twins-personalize-medicine.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.