The Big Idea

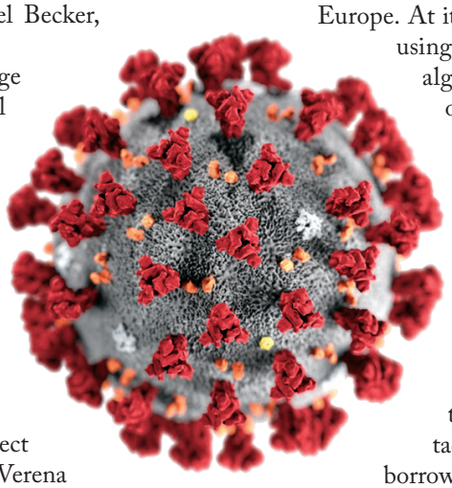
Q: How can scientists identify bats that are prone to carrying diseases like SARS?

A: Algorithms to the rescue.

By Chip Minty

Easily overlooked next to the massive Physical Sciences Center, Sutton Hall was named for George Miksch Sutton, the former University of Oklahoma professor and world-renowned bird expert who retired in 1968. Inside the building is a dusty, second-floor corridor leading to the small office of young biology professor Daniel Becker, only in his second year at OU.

A secondary facility for OU's huge biology department, Sutton Hall is well within the confines of OU's main campus, but the former College of Pharmacy building still seems like an outpost, and that's just fine with Becker, who is used to working on the weird fringes of science, far from the spotlight of notoriety. But 2020 changed that, and now he finds himself on the front lines of the greatest public health crisis of the 21st century.



The 33-year-old is part of a select international research group called the Verena Consortium, which uses artificial intelligence and advanced algorithms to catalog novel viruses like a librarian would organize a room full of books. But Becker isn't in a library and he's not dealing with books. His work takes him to caves, and his targets of interest are bats.

Becker has been studying bats and the viruses they carry for a decade, first as a graduate student, then as a post-doctoral fellow, and now as an OU professor. Established in 2020, the Verena Consortium is composed of researchers from more than a dozen universities from across the U.S., Canada and Europe. At its disposal is enormous computer power, using artificial intelligence to drive multiple algorithms that crunch big data in a variety of ways.

"One of the most important things our study gives us is a data-driven shortlist of which bat species should be studied further," Becker says.

That's what makes the Verena Consortium so important, he says, because there are more than 1,400 species of bats in the world, and it would be too expensive and cumbersome to field test all of them for viruses. To tackle the problem, the consortium has borrowed a page of technology from a source known more for retail than for research.

To increase sales volumes, Amazon uses heavy-duty computer power and sophisticated algorithms to track individual customer purchases and to identify and pitch other products those people might also be interested in purchasing.

Sherri and Brock Fenton

OU Assistant Professor of Biology Daniel Becker and his team have studied desmodus rotundus, or common vampire bats, since 2014. He says that although scientists have studied them for decades, there is no solid explanation for how viruses transfer from bats to humans.

Amazon has nearly 200 million customers, so the prospect of tracking the product interests of each one is enormous, sort of like cataloging viruses in all the bats around the world.

"These algorithms aren't trademarked," Becker says. "There are different software packages, and a lot of them come from computer science or from other problems in ecology. You tweak them here and there to customize them. Anyone with a computer could do this kind of work."

Scientists who have been studying bats for decades still don't have a solid explanation for how viruses can transfer from bats to humans, but they suspect there's something to the fact bats are the only mammals that can fly, Becker says.

"There's something different about their immune systems," he says. "Since they have to fly, there are different things going on physiologically that might allow them to carry some of these viruses without getting sick themselves, and then somehow those viruses get into people."

Scientists have been studying viruses and bats for decades, but interest has been picking up the last 20 years, starting about the time of the SARS pandemic in 2003. That interest has

only intensified since the COVID-19 outbreak. Becker says there are researchers in Southeast Asia now doing surveys to figure out where the COVID-19 virus originated, whether it was from a bat or some other wildlife, and how it got into people. Meanwhile, he and his colleagues have launched their high-tech cataloging effort to help streamline future investigations.

The idea is to use artificial intelligence and algorithms to differentiate bat species with viruses they're known to carry from bat species without viruses, using biological characteristics such as size, diet and other variables. The work suggests that bats sharing similar biological characteristics might share the same viruses, which could be helpful information in the event of another novel-virus outbreak. Scientists could use the consortium's inventory to narrow down potential carriers within the hundreds of bat species by assessing characteristics of the virus and identifying bat species known to carry similar diseases.

"Using our system, people might only need to get samples from five bat species," Becker says, "because they're more likely, based on their biology, to carry a certain virus than the other 40 or 50 species in the general habitat. That would represent a much different effort than staying up all night, every night, trying to sample every single species, because you just can't do that."

Richard Broughton, professor and chair of OU's Department of Biology, says, "Scientists have known about the problem with bats and viruses for a long time, but no one has done anything about it, and we're excited about what Daniel is doing. It is rare for someone his age to already be established as a leader in a field internationally. It's common to see Ph.D.s or post docs showing potential and upward trajectory, but this is on another level."

Part of Becker's success comes from his established reputation for doing good work, Broughton says. He's also organized symposia, which is normally the domain of more senior professors. He's driven and clearly self-motivated.

"I like bats," says Becker, who has spent countless nights in South America, Central America and the United States capturing bats, taking samples, tagging them, and returning them to the wild. He enjoys the close community of biologists he refers to as the "the weird ones" who study bats. He's also an advocate who uses his platform as a scientist to talk about threatened bat species affected by habitat fragmentation and even possible extermination.

"When the Ebola outbreak hit West Africa, you had a lot of indiscriminate killing of bats, because people thought they were responsible for the outbreak," Becker says, "but there's lots of evidence that bats benefit us, so trying to control bat populations can backfire."

Becker is a member of the Verena Consortium, a select international research group that uses artificial intelligence and advanced algorithms to catalog novel viruses. The consortium includes researchers from more than a dozen universities throughout the U.S., Canada and Europe.

Becker had not been born when George M. Sutton died in 1982, but the two scientists share an inherent passion. Sutton reflected the beauty birds bring to the world through his writing, drawings, paintings and advocacy. Becker has invested his young career in understanding bats, reducing risks they pose and speaking out about the good they do. And, at least for now, he and Sutton have one other thing in common: that biology station on the edge of campus, named to honor a man who loved animals that fly.

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