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UCSB startup builds software to speed drug discovery

A team of UC Santa Barbara engineering and molecular biology graduate students has developed software to accelerate the discovery process for therapies aimed at treating Alzheimer's and other diseases. By allowing users to design, screen and test new antibodies, the platform reduces the time and cost required to identify promising drug candidates and advance them to clinical trials.

And now they're launching it by way of their startup, ProFoldBio — one of nearly 70 startups that have emerged from UCSB's New Venture Program — making the software available to other researchers in industry and academia, and using it themselves to seek out potential therapeutics for Alzheimer's disease.

The software helps to overcome several issues that arise when studying diseases, such as Alzheimer's, in which amyloid proteins play a role. Testing potential therapies that act on amyloid proteins typically requires the proteins to be extracted from human tissue. But the tissue can be challenging to obtain and often provides insufficient amyloid protein, "making it really hard to test potential drugs," said Sam Lobo, chief scientific officer for ProFoldBio, and a recent Ph.D. graduate in chemical engineering .

Other hurdles await even after an antibody has been designed to target a specific protein. For example, "sticky" antibodies tend to bind to each other and to surrounding surfaces, which can make them challenging to manufacture and ship —

which, in turn, can prevent the treatment from reaching patients.

The ProFoldBio platform addresses both of these issues by providing a way to model amyloids and other proteins regardless of sample size, while also making predictions about which antibody designs might work best in practice. “The software can flag antibodies that might bind well but have downstream issues,” Lobo said. “We catch those early to lower the risk and cost of drug discovery.”

“Treating amyloid diseases has been arguably one of the most challenging problems in modern medicine, with decades of research and pharmaceutical efforts” resulting in remarkably few therapeutics, said M. Scott Shell, a professor of chemical engineering and Lobo’s advisor. “What’s incredibly exciting here is that modern computational-modeling tools, advances in machine learning, and systematic engineering strategies now make it possible to approach these systems in a predictive way that drives molecular-scale characterization and discovery.”

The ProFoldBio team intends for their software to broaden access to such discovery methods. “These sorts of computational workflows and infrastructures are typically available only to larger biotech companies,” said Erica Keane Rivera, a molecular biology Ph.D. student and the company’s CEO. The software could be a boon for smaller companies and independent researchers, as the team has brought together generative AI tools in a publicly available platform that allows researchers whose strengths lie in experimentation, rather than programming, to quickly begin designing. “There’s a pretty low barrier to entry for using our platform,” Keane Rivera said.

New Venture Program sparks start-up

The ProFoldBio team formed in 2023 via UCSB’s eight-month New Venture Program, which brings together teams of undergraduate and graduate students in any discipline to develop and refine business ideas, with the guidance of faculty and industry mentors. The program culminates with the annual New Venture Competition (NVC), where finalists vie for up to $40,000 in cash, startup grants and support.

Inspired by their shared interest in amyloid diseases. Lobo, Keane Rivera, chemical engineering doctoral student Devon Callan, and Ventura Rivera, a chemical engineering alum from UC Berkeley, joined forces to develop their software

platform.

Keane Rivera and Lobo had been working with Kenneth Kosik, the UCSB Harriman Professor of Neuroscience Research, co-director of the UCSB Neuroscience Research Institute and a leading expert in the field of neurodegenerative diseases.

Several proteins are linked to Alzheimer's disease, including tau, which forms fibrils. The fibrils, in turn, form clumps and tangles inside neurons that can lead to cognitive decline. The students also collaborated with Shell, chemistry professor Joan-Emma Shea and Northwestern University chemistry professor Song-I Han, who was previously at UCSB, to test how new generative AI models can be used to design therapeutics aimed at neurodegenerative diseases.

Together, the team built a platform that can produce 3D renders of protein-structure files, specify target regions, configure a design strategy, then employ generative AI to help researchers develop and select promising antibodies to produce and validate in the lab. In addition to the technical work, the graduate students interviewed biotech leaders to learn more about gaps in drug discovery that their platform might fill.

The team has received recognition from multiple sources. Initially called DeNovo Therapeutics, it earned second place and a $7,500 prize at the 2024 NVC. Since then, the company has been invited to UC Berkeley SkyDeck's Pad-13 incubator program. In 2025, their hydrophobic interaction chromatography model took third place in the Ginkgo Bioworks Antibody Development Competition, based on the platform's ability to assess a drug's hydrophobicity — a measure indicating whether the drug would be both suitable for manufacturing and able to reach its target effectively.

Targeting Alzheimer's

While launching their software to support others' discoveries, the ProFoldBio team continues to use it and other tools to develop potential therapeutics for Alzheimer's disease. So far, they have designed thousands of peptides that could target tau amyloid fibrils, the tangled proteins that are a hallmark of the disease.

To enable high-throughput testing without relying on scarce and fragile patient samples, the team creates synthetic replicas of disease-associated amyloid

structures, which serve as standardized experimental targets for screening potential therapies. Even when patients' tissue samples are available, they are difficult to work with, Keane Rivera explained, because "the extraction itself highly alters the structure of the protein you're trying to study due to the biochemical modifications needed to remove it from the samples." By contrast, these synthetic amyloid replicas can reliably match the atomic-level folds that the proteins adopt in the disease. Those replicas then serve as the foundation for the team's experimental screening pipeline, including a yeast display library Keane Rivera is building to test potential therapies.

Kosik expressed promise in how the company combines hands-on experimentation and generative AI design. "Having worked with both Erica and Sam over all the years of their graduate training, it is now quite satisfying to see how they have begun to transform their academic work into a discovery engine geared toward solving Alzheimer's disease," he said. "I am very optimistic about their success."

While the group's focus is finding targets for amyloid diseases, their software could also be used to design antibodies and other proteins for an extremely wide range of uses, from treating venomous snake bites to creating new therapies for cancers. The team's goal is to make the process accessible to more researchers. "Protein design can be fun, and the process should be beautiful," Lobo said.

He and his colleagues hope that it will lead to something even more appealing: better health.

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