THE AUTHOR FILE

Hasan DeMirci

The connection between snowboarding and getting more data from protein crystals.

The YOLO flip is a 1,440-degree snowboarding feat that only a select few can perform, says Hasan DeMirci, who is an avid snowboarder and a research fellow at Stanford University's Photon Ultrafast Science and Engineering Institute (PULSE). A YOLO flip, named for the meme 'you only live once', can easily be missed if one watches only the beginning and the end of a snowboarder's run. DeMirci hopes his newest work will one day help him achieve what he calls the "YOLO of ribosome research": recording a time-resolved series of intermediate protein structures, which could reveal how a bacterial ribosomal protein blocks an antibiotic from one of its binding pockets, leading to drug resistance.

Matt Beardsley/SLAC National Accelerator Laboratory

Hasan DeMirci

DeMirci feels one step closer to that goal. With the design of a concentric microfluidic electrokinetic sample holder (coMESH), he and his team have optimized a way to deliver a stream of microcrystals into a high-energy X-ray free-electron laser (XFEL) beamline. They captured multiple snapshots of the tiny structural shifts that have a role in ribosome plasticity. DeMirci hopes the method can complement others.

Structural biologists produce crystals from proteins to capture their atomic-level detail. With large crystals, they can use traditional X-ray crystallography. With microcrystals, they can try injecting them into an XFEL such as the Linac Coherent Light Source (LCLS) at SLAC National Accelerator Laboratory, with which PULSE is affiliated. With coMESH, microcrystals can remain in the same liquid in which they were grown, and a separate liquid sheath protects them as they enter the XFEL's vacuum chamber. Data can be collected for longer periods than with other microcrystal injectors, says DeMirci. Often, current injectors clog and tend to be wasteful with precious sample, which hinders data capture.

DeMirci is all too familiar with the pain of such events, which are not uncommon at LCLS. In 2013, he arrived with the result of four years' work: 16 milliliters of sample containing trillions of ribosome crystals. He delivered the sample into the beamline's vacuum chamber, but it did not yield usable structural information. The idea for coMESH was born. "I had to become a mechanical engineer in order to do what I wanted to do," he says.

DeMirci completed his PhD work and his postdoctoral fellowship at Brown University with biochemist Albert Dahlberg, who is DeMirci's gold standard for a "genuinely good person" and an outstanding scientist whose work included studying the ribosome. "I went to Brown just for Al," says DeMirci, who came to Rhode Island from his native Turkey.

Biophysicist Neşe Bilgin, DeMirci's undergraduate mentor at Boğaziçi University in Istanbul, had recommended that DeMirci join the lab of her friend Dahlberg. She had previously worked on ribosomes, and her passion was contagious, says DiMirci. He was also charmed by his biochemistry textbook's renderings of protein structures. "This is exactly what I want to do; I want to see atoms," he thought at the time.

"In the lab, he's fearless," says Dahlberg of DeMirci. No project was too big for him. "He was always exploring new areas and new techniques." As a student, DeMirci uncovered an endless string of scientific questions about the ribosome, which Dahlberg calls "a three-dimensional crossword puzzle." DeMirci, who is multilingual, is fascinated by the ribosome's language skills. "The ribosome thinks in nucleotide code, but it speaks in protein language," he says. He used mutations to probe ribosomal function, and his desire to explore the structural changes underpinning those functional distortions led him to Stanford. When he arrived, after driving cross-country with his child and pregnant wife, he learned that the scientist whose lab he was set to join had left for a position at a startup.

> "This is exactly what I want to do; I want to see atoms."

DeMirci was allowed to stay and given modest start-up funding. He furnished his lab exclusively with eBay bargains and did a little dance after each successful bid. An ultracentrifuge arrived broken, and the seller said, "OK, it's free, you can keep it, but you fix it," recalls DeMirci, who pulled out tools and did just that.

Developing coMESH is a personal milestone for DeMirci. Ribosomes are his big love, second only to his wife, he says. His wife and two children are his source of inspiration. His six-year-old son is a "bowl of curiosity," he says. "He just reminds me the questions are never going to end." DeMirci has always wanted to be a scientist, but if that dream had not come true, he would have followed in his father's footsteps and become a *chef de cuisine*.

Vivien Marx

Sierra, R.G. *et al.* Concentric-flow electrokinetic injector enables serial crystallography of ribosome and photosystem-II. *Nat. Methods* **13**, 59–62 (2016).