Biophysicist in Profile

Taner Z. Sen

"I first met Taner at the stairs of the Engineering Building at Bogazici University," says *Burak Erman*, a professor in the Department of Chemical and Biological Engineering at Koc University, of Taner Z. Sen, Computational Biologist for the United States Department of Agriculture Agricultural Research Service (USDA-ARS) and Collaborator Assistant Professor in the Department of Genetics, Development and Cell Biology at Iowa State University. "He introduced himself to me, then asked me what he should do to become a great scientist." Coming from Sen, the question was perfectly natural. Sen's childhood brimmed with science experiments, encouraged by his mother, an elementary school teacher. She demonstrated that water expands when it freezes by filling two containers, freezing one, and leaving the other at room temperature. "After being amazed by this simple experiment, I started putting all kinds of mixtures in the freezer," Sen says. He froze everything from sugar to oil to fruit flies and observed the effects. He read insatiably, finding role models in Science and Technology, published by the Scientific and Technological Research Council of Turkey. "In each issue, there was a biographical section about famous Turkish scientists, and I thought I could be a scientist just like them," Sen says. By the time he entered Bogazici University as a freshman majoring in chemical engineering, Sen knew just where to look for a flesh-and-blood mentor. "I didn't know why he took for granted that I knew the answer," says Erman. "Out of many possible answers, I only said he should first become a good student!"

> "Being a government research scientist is a great thrill. There may be less freedom in research subjects compared to academia, but knowing that your research is useful to others is very fulfilling."
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> —Taner Z. Sen

Sen, already a student by nature, began working in Erman's lab in the Polymer Research Center at Bogazici University the following summer. He stayed on in the lab to complete his master's degree, working on a number of ongoing projects involving polymer science, rubber elasticity, and local chain dynamics and performing simulations of synthetic polymers. The projects were in collaboration with *Ivet Bahar*, now *John K. Vries* Chair in Computational & Systems Biology at the University of Pittsburgh School of Medicine. "Under the leadership of Ivet Bahar and Burak Erman, the Polymer Research Center was this exciting, intellectually stimulating place for physical and biophysical computational research," Sen says. A serious student and a hard worker in the lab, Sen continued to enrich his scientific training by reading not only academic papers, but poetry, philosophy, and literature. He encouraged his lab mates to do the same. "Taner has that extra dimension where he looks at life also from a philosopher's eyes," says Erman, "a dimension which 99% of the students and colleagues I met during my academic career happen to lack."

In addition to his experience in Erman's lab, a side project during his master's work involving quantum chemical modeling of asparagine deamidation in collaboration with *Viktorya Aviyente* convinced Sen that he indeed loved computational science. He was drawn to "being able to express the biological phenomena with mathematical equations," he says. "You have to always make a myriad of assumptions, and sometimes some of them are incredibly wrong, but mathematizing a problem grants you a predictive power and allows you to generate testable hypotheses." While working on his PhD in Polymer Engineering at the University of Akron in Ohio, he decided to do some experimental work to complement his computational training. He then took a postdoc position at Iowa State University in *Robert Jernigan's* lab, working in collaboration with *Andrzej Kloczkowski* on protein dynamics, interactions, and networks. "Taner was always fully responsible, reliable, and reputable in every way," Jernigan says. "I knew I could always trust anything that he had done."

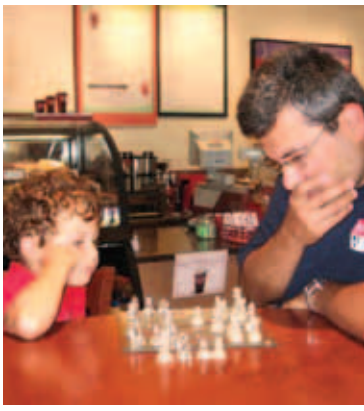
Working on a variety of projects with a variety of people primed Sen for the position he holds today at the USDA-ARS and Iowa State University. "My research is advancing on many different fronts," he says. "I am working on building a metabolic network for maize; understanding the origins of thermostability in endoglucanases, which are crucial enzymes for biofuels; predicting hub proteins as part of biological networks; and tailoring polymer-protein interactions on a molecular level for medical applications." Each project is undertaken with a different collaborator. "Building collaborations and being aware of what is going on at the forefront of biophysics have helped my career tremendously," Sen says. One of Sen's collaborators, *Andrew Rader*, Assistant Professor in the Department of Physics at Indiana University-Purdue University Indianapolis, annually doubles as his roommate during the Biophysical Society (BPS) Annual Meeting. "We would discuss various projects we were working on or thinking about as we walked back to the hotel room," Rader says. These chats led to in-depth calculations in between scientific sessions and left both parties with work to do in the interim. "When we got together the next year we realized we were both looking at protein thermostability from slightly different perspectives, he more bioinformatically and I more structurally," Rader says. Their complementary analysis resulted in at least one paper.

Sen makes a point to foster new collaborations among those he mentors as well. *Ragothaman Yennamalli*, now a postdoc at University of Wisconsin-Madison, was Sen's very first postdoc. Sen exposed Yennamalli to a variety of projects with several collaborators, including Rader, like *Jeffrey Wolt*, *Eve Wurtele*, *Ling Li*, and *Marit Nilsen-Hamilton*. "He introduced me to people in his professional network, thereby expanding my network," says Yennamalli. "If he is excited about a topic or subject, his enthusiasm is contagious to people around him." Now Sen and Yennamalli are collaborators, using molecular dynamics simulation to further study endoglucanase and to understand its relation to thermostability. "Taner is a serious guy but is also always ready with a laugh and to make or appreciate a joke," says Nilsen-Hamilton, one of Sen's more recent collaborators. "This makes our collaboration so much more enjoyable."

Sen's position centers around collaboration, but not only with fellow researchers. "In a government lab, different practices exist depending on the agency and the research groups," he says. "From my experience working in the USDA-ARS, research priorities are directed by the stakeholder groups. These stakeholders can be scientists working with a particular species, or industry groups representing, for example, breeders." Though Sen takes his cue from the stakeholders, there's some wiggle room for actually getting the job done. "The stakeholders do not guide day-to-day activities of scientists, but rather provide broad general guidelines for the agency, which are implemented in 5-year project plans of individual research groups," he says.

When he's not ensconced in his daily activities in the lab, Sen volunteers. He's a member of the BPS Public Affairs Committee, which works to strengthen communication between scientists and the general public. He talks to high school students about their science projects in the State Science & Technology Fair of Iowa each year when he serves as a judge for the organization, helping to generate a positive experience for students considering careers in the sciences. "I am planning to write a career guide for young scientists to share my experiences in science," he says. "I want to help students become better prepared to gauge their career options and expectations." Sen hopes that such a career guide will educate students about available career options in science in academia, government, and industry. Chances are that Sen's six-year-old son Burak will be well prepared himself, should he choose a scientific career: Sen's kitchen serves as a makeshift lab for the science experiments he and Burak conduct together.

"We are computationally more capable today to model biological systems than ever before," he says. Even so, the system isn't perfect—something that Sen intends to change for the better. "Overcoming the hurtles in analyzing and integrating experimental outcomes will enable better modeling of biological interactions and energetics," he says, "which in turn will provide a better understanding of how molecular phenomena give rise to phenotypes that are beneficial to medicine, energy, and the environment." In his position, he is well placed to truly make a difference.



Taner Sen playing chess with his son Burak.

Taner Sen and his son Burak conducting science experiments in Sen's kitchen.