



Biophysicist in Profile

Kalina Hristova

Kalina Hristova, 2007 recipient of the Biophysical Society's Margaret Oakley Dayhoff award, knew from a very early age that her future was in science. Not only were her parents scientists, but she also felt much more comfortable with science than with literature, art or other academic disciplines – and she excelled in it. “The thing is,” she says, “I’ve never changed my mind. I always encountered the right people. I’ve never had a bad advisor or bad colleague to turn me away from what I wanted to do, so I guess I’m very lucky.”

Now Associate professor in the Department of Materials Science and Engineering at the Whiting School of Engineering of Johns Hopkins University, Hristova says that her entry into the narrow field of membrane biophysics was “sort of by chance.” While working on her undergraduate and Masters Degree work in physics at The University of Sofia in her native Bulgaria, Hristova decided to focus on biophysics. Studying solid-state physics, she was assigned work with membranes – and has worked with membranes since.

Impressed with the work of Duke University's *David Needham*, Hristova came to the US to pursue her PhD in Mechanical Engineering and Materials Science at Duke. She then went to the University of California, Irvine, for postdoctoral work. Postdoc advisor, *Stephen White*, had a marked impact on her and the work she has done since.

“He’s really an amazing scientist,” Hristova notes about White, an award-winning researcher and teacher who still maintains his lab at UC Irvine. “Science drives him.

He loves doing it and pursues his interest with fervor.” She was intrigued by the “very interesting science” he was doing, approaching a very biological problem with physical chemical tools. He would try to disassemble a biological system and do “very elegant physical chemical measurements on it in a very quantitative, meticulous, clean way, so that the data will always be very beautiful.”

Hristova’s own scientific fervor comes alive when she talks about the difference that such care and precision can make. “Predictions!” she asserts. “You really need some very high quality physical chemistry work if you are to go beyond understanding in a qualitative way to making predictions.”

This is particularly true in her lab at Johns Hopkins University, where she and her team are studying mutations that alter membrane proteins and cause disease. The mutations do not change everything, but make incremental changes – causing modest variations in the interactions between proteins. Measurements that are not sufficiently careful and precise will not catch the difference, Hristova says. “But if you are doing careful physical chemistry measurements, then you can see the difference – and obviously that difference is enough to cause disease.” If a change in protein interactions can be detected, and if predictions can be made as to how the cellular outcome will be



(1-r) Kalina Hristova, Mikhail Mezlyakov (a research scientist), and Xue Han (graduate student, winner of a 2006 SRAA Award from the Biophysical Society)

different, then how a mutation causes disease can be understood.

As Hristova and her team move into more and more complex systems, they enter uncharted territory with unexpected challenges. “But I have really fearless students, so they will do it,” she remarks. It is very hard and challenging work; she notes that it is not clear if a simple physical chemical description will actually capture the behavior in cells, “but we are trying to find out.” She quickly acknowledges her students’ dedication and successes. In the last three years, two of her students received student research achievement awards in membrane structure and assembly from the Biophysical Society.

One of the reasons Hristova likes teaching at Hopkins is its tradition of undergraduate involvement in research, particularly in the school of engineering. “They start as freshmen and mature here,” she notes. They co-author papers all along the way, then move on to graduate school or medical school. Hristova finds this rewarding and has no desire to move into an administrative position. “I just want to be close to the lab and close to teaching.”

Edwin Li, Hristova’s first postdoc student, came to Hristova’s lab in 2002 and never regretted the decision. With a degree in chemical engineering, biophysics was a completely new field for him. “Thanks to her, I not only quickly learned the concepts and principles in this field, but also came to appreciate it and be passionate about it. She truly enjoys her work – although it is more her ‘nature’ than her ‘work’ – and is always a source of counsel and motivation to those around her.” Li, who continues to work as an assistant research scientist in Hristova’s lab, considers her “perhaps the best mentor I’ve had,” noting that she takes care to ensure that the working environment is good for each of her students and postdocs.

Hristova’s interactions with students are not limited to science or teaching. She offers them opportunities for social networking and mutual support. They take regular breaks. “We

go out for coffee, we have cake for every birthday, and we like going for hot wings once in a while. When we go out, we don’t talk about work. They’re interesting people.”

She doesn’t try to get away from science much, though. Her husband Tihomir Hristova is a scientist (also at Hopkins), and their son Alex is a physics student at Harvard, so science is very much a part of their interactions. Hristova enjoys experiencing new places when



Kalina Hristova (second from right) with the Membrane Chix group at the Society Annual Meeting.

she travels to conferences, and sometimes her family travels together over the summer. At the same time, she is part of a group of women near her age who all study membranes – and have dubbed themselves “Membrane Chix” – whose support for each other is not only professional, but also personal.

Hristova regularly reviews grant proposals, most of the time for the National Science Foundation. She notes that one of the most common failures in grant proposals is that they do not communicate well exactly what work is being proposed. Asked what tips she might have for Biophysical Society members seeking grants, she replied, “Make sure the reviewers know what you’re talking about – as simple as possible, with short sentences, and to the point.”

