Visit the Museum’s Butterfly Garden some Saturday morning and you might learn that there are as many as 20,000 species of butterflies around the world… and there’s only one Elena Strekalova.

The Butterfly Effect

Elena Strekalova is a postdoctoral associate in the Department of Civil and Environmental Engineering at Massachusetts Institute of Technology. Her research focuses on understanding the physical properties of disordered mesoporous materials, such as cement, using density functional theory calculations.

Every Saturday she works at the Museum as a science interpreter in the Butterfly Garden, alongside curator Bob Greene, his staff, and volunteers. Strekalova has been a Museum educator since 2002, and she was instrumental in researching and developing many of the popular presentations delivered in the Butterfly Garden since its grand opening in 2006. She now trains new science interpreters to present these programs.

Visiting the Butterfly Garden

The Butterfly Garden, which was created with lead support from trustee Wendy Kistler, offers one of most amazing multi-sensory experiences at the Museum of Science. Overlooking the Charles River, the warm conservatory is filled with exotic plants and about 250 loose butterflies, approximately 25-30 different species from New England and around the world. Even the most rambunctious young visitors are calmed as the Butterfly Garden’s hundreds of free-flying residents flutter about.

Visitors to the Butterfly Garden participate in guided observations led by Museum educators, like Strekalova, covering the defining details—size, color pattern, wing shape—that make each species unique. Printed guides with photographs help visitors identify the butterflies, and some moths,
“I want to bring the butterflies in there, talk about science we see in our everyday lives. I want them to learn about the physicists who study networks and see that networks happen everywhere.”

– Elena Strekalova
while small signs describe butterfly behaviors like feeding, courting, and basking. The “emergence box” offers a window into the butterfly’s metamorphosis from caterpillar to chrysalis to winged adult.

“We started as a sun lab,” says Strekalova. “When we began creating the Butterfly Garden, we were thinking, ‘What are we going to teach the public? ’ Butterflies are nice, but this is the Museum of Science. We need to bring something else. So I looked into different research papers on how butterflies have memory and can learn certain things like colors and how this particular flower has nectar and this one doesn’t. I was researching plant and butterfly interactions.”

Then she started looking at the comparative biology research of Ioannis Miaoulis, president and director of the Museum of Science. His work examined how the butterfly’s iridescence also enables it to control how much heat energy is absorbed by its wings and how much is reflected.

“In our interpretations we show the relationship between butterflies and solar panels, the biological optical effects of thin-films, and how they are related to studies on photonic crystals and radiative properties of computer chips.”

**A Researcher and an Educator**

Born in Russia, Strekalova moved to France upon completing high school and lived there for three years. “The first year I studied the culture, the language, and then, I went to medical school.” She emigrated to the United States in 2000 and enrolled at the University of Massachusetts, Boston a year later. “At the time,” she says, “I was a biology major. I love biology. I just don’t like how we learn about biology. And then I discovered that I liked chemistry, and by the time I got to the fun classes, I realized, oh, I’m interested in physics more than chemistry. As a result, in five years I graduated with a double major, a minor, and an MS in chemistry.”

When Strekalova was a member of the Center for Polymer Studies at Boston University, where she earned her MA and PhD in physics, she focused on the behavior of liquid water in bulk, nanoconfined, and biological environments. Water is the most common substance on Earth, and it is a complex liquid, displaying more than 60 anomalies.

“My PhD topic was on phase transitions and critical phenomena,” says Strekalova. “It’s hard to observe liquid phase transition experientially because water freezes. So we need to make models and observe it in those models. I was working on how you can recognize a phase transition and its critical point.”

In her post-doc at MIT, Strekalova is studying absorption and desorption of water in cement. “I am applying tools that are long-known to biologists in measuring bone structures to study the porosity of cement,” she says. “Understanding cement will lead us to the development of better materials for our homes, roads, and will help oil companies have safer and cleaner production practices by preventing the release of harmful gases into our atmosphere.”

This fall Strekalova is teaching a 200-level honors course at the UMass Boston called, Science: in the Universe, Nature, Art and Daily Life. “I try to demonstrate to my students—no matter their concentration—that they can take an active participation in the development of science and technology, that they are all scientists at heart.”

She wants her students to experience original science papers, like Gregor Mendel on genetics and Barbara McClintock on jumping genes. “I want to give my students historical background,” she says. “I want to bring the butterflies in there, talk about science we see in our everyday lives. I want them to learn about the physicists who study networks and see that networks happen everywhere. The other topic I want to bring in is chaos—like an example of the butterfly effect, how things become synchronized or chaotic.”

Somehow, Strekalova balances these disparate interests—water, cement, butterflies—just as she balances her life in higher education with her passion for teaching at the Museum, in an informal setting.

“The Museum might appear completely different from my PhD program or my work at MIT, but sometimes you don’t know where you get the inspiration or how the concepts can be related. I’m still thinking I might go into industry or finance or consulting because they do the same models and computations, they look at the same trends. It’s so funny how things come together.”