The 'real' Spider-Man: Why Hollywood should look to the jumping spider

This tiny acrobat could change how we think about spider silk

By Jenny Green, ASU News
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Imagine a new Spider-Man movie opening not with a laboratory accident involving a black widow, but with a tiny, fuzzy spider sitting quietly beneath a leaf.

It has enormous eyes, extraordinary jumping ability, and a silk-producing system so sophisticated that scientists are only beginning to understand it.

Meet the regal jumping spider, Phidippus regius — perhaps the most biologically convincing inspiration for Spider-Man that Hollywood has overlooked.

The idea is more than a clever twist on a familiar superhero story. It is an opportunity to tell a better story about science, evolution and the remarkable abilities hidden in the natural world.

“The regal jumping spider is a fuzzy, big-eyed hunter about 2 cm long, native to the southeastern U.S. and the Caribbean, and harmless to people,” says Mary Ellen Lewis, who graduated last semester with a medicinal chemistry degree from ASU.

A superhero with 8 eyes and a spectacular leap

For generations, Spider-Man's origin has revolved around a radioactive or genetically altered spider — often depicted as a black widow — that transforms an ordinary teenager into a superhero.

Black widows are remarkable arachnids, but their most familiar talent is building prey-catching webs. They do not possess Spider-Man's extraordinary combination of agile jumping and movement across smooth surfaces.

Instead, it is the jumping spider that better matches Peter Parker's fictional abilities. A jumping spider’s large, forward-facing eyes give it excellent vision. Rather than waiting passively for insects to become trapped in a web, it actively hunts, carefully tracking its prey before launching itself through the air. It can leap many times its own body length with remarkable precision.

And those tiny legs? They are covered in specialized hairs and structures that help the spider grip surfaces. These microscopic features contribute to its ability to climb and cling to places that would challenge a much larger animal.

But the jumping spider’s most intriguing superpower may be its silk.

“Over the past few years, jumping spiders have unexpectedly captured the public imagination, exploding in popularity as pets and going viral in short TikTok videos thanks to their expressive eyes and charismatic leaps,” Yarger says.

“However, beyond their status as cute, trending social media stars, these remarkable arachnids are now gaining serious attention from the scientific community for something far more extraordinary: their silk.”

While dragline silk from orb-weaving spiders has long been the standard model in biomaterials, silk from jumping spiders possess distinct physical and biological properties that make it uniquely suited for advanced biomedical applications.

However, to translate these natural fiber advantages into engineered, bioinspired synthetic materials for regenerative medicine, one has to first establish a detailed structure-function relationship to understand how its molecular architecture drives this performance.

“This is precisely where Lewis’ research has been so vital,” Yarger says.

The secret life of a spider that doesn't build webs

Unlike the familiar orb-weaving spiders that construct elaborate circular webs, jumping spiders prefer the life of an agile hunter. They stalk insects by sight and pounce when the moment is right.

Yet they use silk constantly.

Before a daring leap, a jumping spider lays down a silk safety line. When it needs to rest, molt or lay eggs, it constructs a sheltered silk retreat, sometimes called a tent. Inside, it can build an egg case to protect its developing young.

One little spider, therefore, produces different silk structures for different purposes.

That raises a fascinating question: If jumping spiders don't use their silk to build giant prey-catching webs, has evolution equipped them with a different kind of silk, tailored to their very different lifestyle?

For scientists, this is not merely a superhero fantasy. It is an important unanswered question about natural materials.

Spider silk is famous for its remarkable combination of strength, flexibility and lightness. But much of what we know about its molecular structure comes from web-building spiders, including orb-weavers and black widows.

Jumping spiders belong to a different branch of the spider family tree. Their silk should not automatically be assumed to work in the same way.

To discover what makes it special, researchers have begun looking much more closely.

Rose and the silk that remembers water

Meet Rose, a regal jumping spider from the Yarger Lab's live colony.

Rose's silk is providing researchers with a surprising scientific story.

In a structural study of jumping spider silk, Lewis examined material from four sources: the spider's tent, the silk attached to a wall, the egg case and the lining of the egg case. Using scanning electron microscopy, she could see the intricate physical architecture of the fibers.

The images revealed an astonishing variety of structures, from delicate networks of fine fibrils to fibers bundled together into cable-like arrangements.

The egg case lining was especially intriguing. It contained two distinct populations of fibers, approximately 11 and 19 micrometers thick. Both were substantially thicker than the roughly 4–8 micrometer fibers typical of egg-case silk in many web-building spiders.

It was a reminder that even within a single animal, silk is not simply one uniform substance. Its architecture varies with its purpose.

But the biggest surprise came when the researchers examined the molecular structure of the tent silk — and what happened when it encountered water.

A fiber that changes after it has been spun

Spider silk contains proteins whose molecular arrangements help determine the material's properties. One important structural feature is the presence of tiny, ordered regions called beta-sheet nanocrystals, embedded in a more disordered, flexible protein matrix.

Think of the silk as a microscopic composite material: Some regions provide organized molecular structure, while others contribute flexibility and extensibility.

Scientists traditionally pay considerable attention to how these structures form as a spider spins its silk. But what if the story doesn't end when the fiber leaves the spider?

The researchers measured the proportion of beta-sheet structure in Rose's tent silk using a technique called attenuated total reflectance Fourier-transform infrared spectroscopy, or ATR-FTIR.

The results were striking.

Results from an early set of measurements showed the increase in beta-sheet content persisted partly after redrying, suggesting that hydration can leave a lasting molecular change.

In other words, exposure to moisture appeared to reorganize the protein structure of the silk. Even after the material was dried again, its molecular arrangement did not return completely to its original state.

The researchers describe this as a kind of molecular memory: The fiber retains evidence of having been wet.

This process could be compared to annealing a material — except that here, ordinary humidity appears to encourage molecular rearrangement without the need for heating or a chemical solvent.

It is a remarkable possibility. The spider may spin a fiber, but the surrounding environment can continue to shape that fiber long afterward.

Further experiments, including X-ray scattering and solid-state nuclear magnetic resonance studies, are underway to help resolve the structure in greater detail.

If scientists can understand how jumping spider silk forms its distinctive structures, and how moisture influences them, the knowledge might inspire new approaches to designing protein-based fibers.

Imagine lightweight materials whose molecular organization can be adjusted after manufacture, or fibers designed for applications where flexibility, strength and environmental responsiveness all matter.

These possibilities remain research questions, not finished technologies. But they offer a start to answering some scientific questions with the jumping spider as a guide.

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Main image



ASU medicinal chemistry graduate Mary Ellen Lewis holds a jumping spider on her arm while in Professor Jeff Yarger's lab on the Tempe campus. Photo by Nathan LeVang/Arizona State University

Text image(s)



A jumping spider on a leaf. Photo courtesy of the Yarger lab



Rose is a regal jumping spider from the Yarger Lab's live colony. Photo courtesy of the Yarger lab



Professor Jeff Yarger handles a jumping spider as Mary Ellen Lewis looks on in Yarger's lab on the ASU Tempe campus. Photo by Deanna Dent/Arizona State University