UC SANTA BARBARA

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Studies of Spider's Silk Reveal Unusual Strength

University of California, Santa Barbara scientists and U.S. Army researchers are making progress in the study of spider dragline silk, according to recently published proceedings of the National Academy of Sciences.

The protein that lets spiders drop and helps the web to catch prey is what interests the researchers. The molecules are designed to be pulled; they are elastic and very strong. The silk can be extended 30 to 50 percent of its length before it breaks. It is stronger than steel and comparable in strength to Kevlar.

"The last decade has seen a significant increase in the scientific literature on spider dragline silk," according to the proceedings. "This interest is due to the impressive mechanical properties of spider dragline silk, at a time when biomaterials and biomimetics are both exciting interest in the rapidly growing field of materials research."

And why is the U.S. Army interested in this material? "The major interest is to use it as material for bulletproof vests, armor and tethers; there are many possibilities," said first author Emin Oroudjev, a researcher at UC Santa Barbara.

At UC Santa Barbara, the focus is on the basic research of learning how the protein folds and how it is organized in the silk fiber. Using atomic force microscopy and a molecular puller, the researchers are getting clues from imaging and pulling the

protein. These observations help the researchers to model what is happening in the silk gland when silk proteins are assembling into spider dragline silk fibers.

They found that when the protein unfolds it is modular. It has sacrificial bonds that open, and then reform when the load lifts. This follows a pattern that has been found in other load-bearing proteins.

Spider silk is a composite material. It has crystalline parts and more rubber-like stretchy parts. The researchers found that single molecules have both, explained Helen Hansma, co-author and adjunct associate professor of physics.

Spider silk is a composite material that is novel compared to the other load-bearing proteins that havebeen studied.

About UC Santa Barbara

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