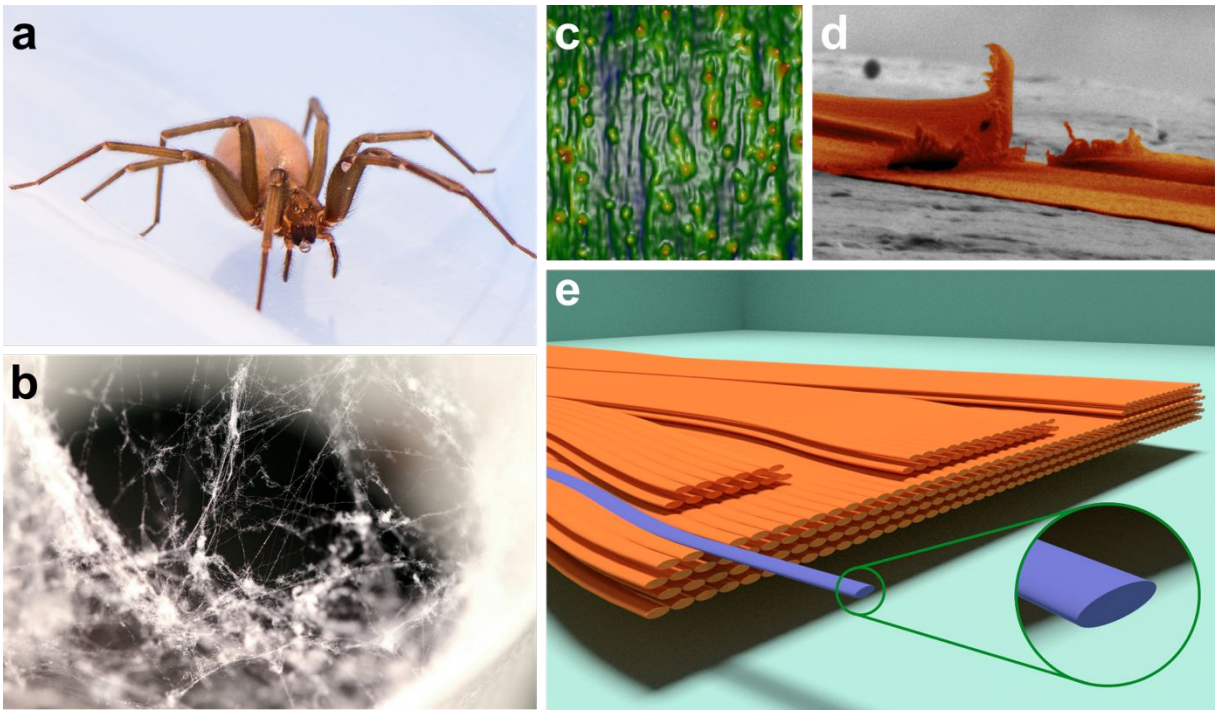
Spider Silk Fibers are Actually Super Strong Cables of Thousands of Nanostrands

Scientists have long been puzzled about what makes spider silk five times stronger than steel. William & Mary professor Hannes Schniepp and graduate student Qijue Wang found that the secret of the material's incredible strength lies in its nanostructure. Studying spider silk fibers that are ten thousand times smaller in cross section than a human hair, they found that every single one of them is actually a tiny cable, made out of thousands of even smaller nanostrands, thin protein-based threads less than one-millionth of an inch in diameter.

The researchers employed a high-powered atomic force microscope capable of detecting molecular-sized structural details to study the thin fibers of the brown recluse spider, the most dangerous spider in North America. Expecting a uniform mass, they discovered the nanostrands forming the super-strong spider silk "cable". However, unlike in a rope or cable, the nanostrands are not twisted together but instead run perfectly parallel, side by side.

The researchers' finding means that a single nanostrand carries all the appealing properties of spider silk. The researchers believe these nanostrands are the key to unlock the mystery of all silks. More importantly, the findings can guide the development of artificial silk-based materials for many exciting engineering applications ranging from aerospace to biomedicine.

The story will appear in a few days in *ACS Macro Letters*, the world's most highly ranked polymer journal, where it was selected to be featured on a cover. The work was funded by the National Science Foundation.



(a) A female recluse spider. (b) Its silk fibers. (c) Microscope image of the silk fiber surface showing the nanostrands. (d) Electron microscope image of a recluse silk fiber. (e) 3D model of the structure.

Prof. Hannes Schniepp is available for Q&A at schniepp@wm.edu or +1-757-577-2274. More images available.