Hagfish slime as a model for tomorrow's natural fabrics

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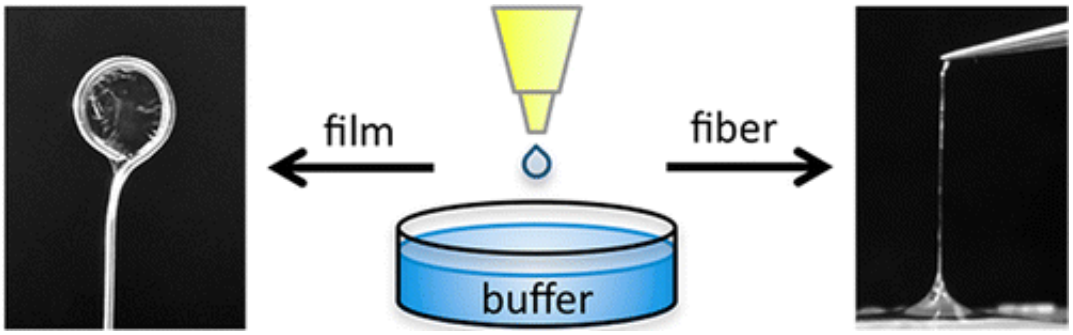

Nylon, Kevlar and other synthetic fabrics: Step aside. If new scientific research pans out, people may be sporting shirts, blouses and other garments made from fibers modeled after those in the icky, super-strong slime from a creature called the hagfish. The study appears in ACS' journal *Biomacromolecules*.

Lead author Atsuko Negishi, her supervisor Douglas S. Fudge and colleagues explain that petroleum is the raw material for making modern synthetics. Rising prices and the quest for more sustainable alternatives have led scientists to consider the possibilities of using protein-based raw materials, such as spider silk. Another candidate comes from the hagfish, an eel-like fish that produces a thick slime to protect itself against predators. A single Atlantic Hagfish can produce quarts of slime

in seconds. It clogs the gills and may suffocate other fish. The slime consists of tens of thousands of remarkably strong threads, each 100 times thinner than a human hair. The scientists set out to investigate spinning spider-silk-like fibers from the proteins of these slime threads.

They developed a method for drawing hagfish slime thread proteins into fibers comparable to lab-made spider silk. It involved casting a thin self-supporting film of thread proteins on the surface of a salt solution, then grabbing it with forceps and lifting it upwards so it collapses into a single strand. The threads in hagfish slime, they indicate, might be models for synthetic fibers made from renewable, naturally occurring proteins.

More information: "The Production of Fibers and Films from Solubilized Hagfish Slime Thread Proteins" *Biomacromolecules*, 2012, 13 (11), pp 3475–3482. DOI: 10.1021/bm3011837

Abstract
Hagfish slime threads, which make up the fibrous component of the defensive slime of hagfishes, consist primarily of proteins from the intermediate filament family of proteins and possess impressive mechanical properties that make them attractive biomimetic models. To investigate whether solubilized intermediate filament proteins can be used to make high-performance, environmentally sustainable materials, we cast thin films on the surface of electrolyte buffers using solubilized hagfish slime thread proteins. The films were drawn into fibers, and the tensile properties were measured. Fiber mechanics depended on casting conditions and postspinning processing. Postsecondary drawing resulted in fibers with improved material properties similar to those of regenerated silk fibers. Structural analyses of the fibers revealed increased molecular alignment resulting from the second draw, but no increase in crystallinity. Our findings show promise for intermediate filament proteins as an alternative source for the design and production of high performance protein-based fibers.