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SCIENCE
Notebook

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Spider Silk Mystery Solved

A team of scientists from a Canadian biotech company and the U.S. Army has finally solved the mystery of how to make spider silk, a 400-million-year-old product stronger than steel and tougher than a bulletproof vest.

The team extracted silk-making genes from two orb-weaving spiders and implanted them in cells from a cow's udder and a hamster's kidney. The cultured cells secreted a water-soluble protein "soup" that was squeezed through a syringe-like aperture, creating a crystalline silk filament like the fiber a spider uses to rappel from the ceiling or to make the spokes of its web.

Details of the research, developed by Montreal-based Nexia Biotechnologies Inc. and the U.S. Army Soldier and Biological Chemical Command, were published in last week's issue of the journal Science.

"The principle of biomimicry works," said geneticist Jeffrey Turner, president and chief executive of Nexia, referring to the development of new technology using models and designs drawn from nature.

Turner explained that spider silk -- developed through 400 million years of evolution -- is at least five times stronger by weight than steel, with remarkable toughness and elasticity, a combination of properties unmatched by any known synthetic fiber. The ability to make spider's silk has been what Turner called a "Holy Grail" of material science for years.

Turner said Nexia's goal is to strengthen the man-made silk enough so it can be used to make soft body armor. It is already strong enough to be made into soluble sutures for delicate surgery or as biodegradable fishing line.

To produce the protein in large enough batches, the team has implanted the gene in the eggs of nanny goats so female offspring will secrete the protein in their udders. "All we'll have to do is milk the goats," Turner said.

Smoking and Criminal Behavior

Women who smoke while they are pregnant appear to be more likely to have sons who get into trouble with the law.

Researchers analyzed demographic data on 8,000 people born in Denmark between 1959 and 1961, and followed up in 1994 to see who had been arrested. They found a correlation between mothers' smoking and children's criminal behavior, with more cigarettes per day among mothers indicating a greater likelihood of an arrest record for the children.

The researchers established that the results were not connected with the families' socioeconomic backgrounds, pregnancy complications or the mothers' history of psychiatric or substance abuse problems.

Of the group in which the mothers had not smoked, 25 percent of the sons were arrested. Of the group in which the mothers smoked more than 10 cigarettes a day in the last trimester, 38 percent of the sons were arrested. Even smoking as few as one or two cigarettes a day appeared to increase the likelihood that a son would get arrested.

While daughters also showed a greater likelihood of arrests, the risk appeared linked to drug abuse. They were more likely to have addictions, leading to criminal behavior and arrests.

The research was conducted by Patricia Brennan, an assistant professor of psychology at Emory University in Atlanta, and colleagues.

"Maternal cigarette smoking may set off a chain of . . . factors that act together to increase risk for deleterious child outcomes," the researchers wrote in the January issue of the American Journal of Psychiatry.

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Placebo Effect and Depression

Brain researchers have found a clue to why people who are depressed often seem to improve just by taking a placebo.

Andrew F. Leuchter of the University of California at Los Angeles and colleagues performed brain scans on 51 patients suffering from major depression. About equal numbers were taking antidepressants or a dummy drug.

The same number of people in both groups reported improvement. But the patients who responded to the placebo had increased activity in the brain's prefrontal cortex, a part of the brain involved in regulating mood, among other things. Those who responded to the antidepressants had decreased activity in that part of the brain.

"What this study shows for the first time is that people who get better on placebo have a change in brain function, just as surely as people who get better on medication. We now know that placebo is, very definitely, an active treatment condition," said Leuchter, whose findings are reported in the January issue of the American Journal of Psychiatry.

Shared Trait of Mice, Humans

Although human beings and mice long ago diverged in their evolutionary development, they still share certain characteristics. New research indicates that the fundamentals of language are among them.

Gunter Ehret of the University of Ulm and Sabine Riecke of the University of Konstanz in Germany played tapes of natural and artificial mouse calls to 60 mother mice while they nursed pups. Three low-frequency sounds prompted the most response. Low-frequency sounds are also important for human understanding of vowels.

In the Jan. 8 Proceedings of the National Academy of Sciences, the researchers said babies' ability to perceive the elementary sounds comes from human beings' evolutionary heritage.

"Call perception in mice is comparable with unconditioned vowel discrimination and perception in prelinguistic human infants and points to evolutionary old rules of handling speech sounds in the human auditory system up to the perceptual level," the researchers wrote.

-- Compiled from reports by Guy Gugliotta,

Rob Stein and Shankar Vedantam

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