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A WEB WITHOUT A WEAVER

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Israeli and German scientists have successfully created artificial silk using genetically engineered spider proteins. The new research may lead the way to the development of ultra light bulletproof vests, new surgical threads and micro-conductors, optical fibers and even new types of clothing.

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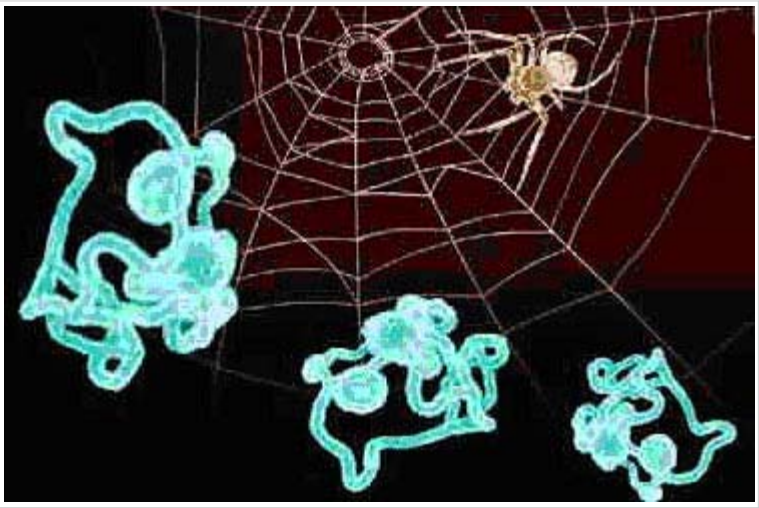

On the bottom the artificial silk made by Dr Uri Gat and his team, on the top spider web illustration

After two years of intensive research a team of Israeli scientists, alongside colleagues from Germany and England, have successfully created the first artificially made spider silk fiber. Pound for pound spider silk is one of the strongest and most flexible materials known to man. During its lifetime a spider creates different kinds of silk fibers; the strongest and most flexible is known as dragline silk and is used by the spider as a lifeline whenever it falls from high altitudes. The properties of the dragline silk are amazing and producing them has long been considered the "Holy Grail" of material engineering. Comparing dragline silk to Kevlar, the material used to create bulletproof vests and bicycle helmets, can give us a sense of these unique properties: when weights are dropped on dragline silk, it can absorb up to ten times more energy that Kevlar can, and on impact most of the kinetic energy dissipates as heat. Dragline silk is also six times stronger than steel and can stretch to twice its own length before being torn apart.

Despite its qualities, producing dragline silk artificially proved to

be an extremely challenging task. Spiders cannot be domesticated therefore extracting large quantities of spider silk directly from them is not an option. In order to try and solve these problems scientists turned to genetic engineering. They tried many different approaches to manufacture the proteins that make the silk using bacteria, yeast, and even plants and mammalian cells in tissue culture. But all of these efforts were unsuccessful in producing fibers with properties similar to the dragline silk. Here comes the groundbreaking work of developmental biologist Dr. Uri Gat from Hebrew University and his colleagues. Gat and his team, alongside scientists from Germany and England, introduced genes which encode two of the dragline silk proteins (ADF-3 and ADF-4) into an insect-infecting virus known as baculovirus. These genetically engineered viruses were then grown in cultures of cells derived from a type of caterpillar called the fall armyworm. Gat believes that the use of caterpillars was more successful than any previous attempt since spiders and insects are both arthropods and so their genomes are more closely related to each other than to those creatures with which prior experiments were conducted.


Dr. Uri Gat

After the engineered viruses infected the insect cells, the cells began producing the proteins, and the artificial dragline silk spontaneously formed within them. These fibers were identical in their diameter to that of real spider fiber and were found to be equal to, and in certain aspects even exceeded, the chemical resistance quality of the spider-created fiber.The potential application of this new research is almost limitless. Everything from ultra-thin light body armor to surgical thread optical fibers and even a completely new line of clothing might be a reality in less than a decade. In order to make this a reality Gat's team is already taking steps to commercialize the research through Yissum Research Development Company of the Hebrew University of Jerusalem in collaboration with the German team.

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