

Spider silk is one of the strongest natural fibres in the world.

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Kraig spins a widening web with spider silk



For many people spiders are one of the most terrifying creatures on the planet. Nevertheless, they certainly seem to have their uses. They kill irritating flies and in some countries are considered a delicacy at the dinner table. Venom from certain types of spider can even be used as less harmful alternatives to pesticides. However, arguably their best attribute is their ability to spin ultra strong webs, which have many functions including catching prey, protecting their offspring and suspending themselves in mid air. This technology is now being translated for, and used in, the growing technical textiles sector.

Biotechnology specialist Kraig Biocraft Laboratories, Inc is heavily involved in developing spider silk technology and believes it will be more and more widely used as time goes on. It claims spider silk is a "super fibre" and its main focus is on the development of spider silk-based high-performance fibres for the technical textiles sector. (According to the company, the global technical textiles industry is a $92 billion a year market and it reports that this figure is expected to rise to $127 billion by 2010.)

Spider silk measures up well against the world's toughest substances according to Kraig's founder and chief executive officer, Kim Thompson. "Spider silks, which are our focus, are among the strongest natural fibres known to man; stronger than steel, by many measurements tougher than [DuPont's] Kevlar," he says, adding that they are also "extremely lightweight and flexible". The tensile strength of spider silk is similar to nylon and materials such as cellulose and collagen. However, its elasticity allows it to stretch far further than these materials without breaking or even losing its shape.

Having obtained a B.A. in Applied Economics from Michigan State University and a Juris Doctorate from the University of Michigan Law

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School, Mr Thompson decided to set up Kraig in April 2006 having seen "the potential to harness genetic engineering technology for industrial-scale production". The problem was that commercial production of spider silk was far from straight forward. Spider silk is made when spiders spin liquid protein into solid fibres. However, because of their cannibalistic tendencies, it is not practical to keep them in concentrated colonies. So it was up to Kraig to find a way around this problem through the use of genetic engineering.

Important partners

The Michigan-based firm has been working alongside experts from the University of Wyoming and from the University of Notre Dame (Indiana). "The company has been very fortunate in that it's been able to recruit the brightest minds in our field," says Mr Thompson. "Our chief scientific consultant is Dr Malcolm Fraser who has the Fraser Laboratory at the University of Notre Dame," he explains, adding, "his work in genetic engineering has been absolutely groundbreaking."

Dr Randy Lewis, from the University of Wyoming, has become another very important figure for the firm. According to Mr Thompson, Dr Lewis is "probably the world's foremost expert on spider silk and spider silk technologies". "With this team we have been able to make great strides," he says. Both Dr Fraser and Dr Lewis currently serve on Kraig's board of scientific advisors.



Kraig has worked closely with the University of Notre Dame (pictured) and the University of Wyoming since the company was established in 2006.
Tysto/Wikipedia

The company has signed an intellectual property agreement with the University of Wyoming, which holds the patent on various important DNA and genetic sequences and related technologies. The agreement, signed back in 2006, gives Kraig exclusive rights in its field of use to use these gene sequences and

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technologies. Meanwhile, the company has signed a collaborative research and intellectual property agreement with the University of Notre Dame, which Mr Thompson claims "holds another big piece of the puzzle" in terms of revolutionary genetic engineering technology. "That relationship has been very positive for the company and it has borne fruit for us here in 2008," he says emphatically.

Three new patents

Several new patent agreements have come about as a result of the company's research alliance with the University of Notre Dame. The first was filed by Kraig earlier this year. According to Mr Thompson, this patent: "describes the invention of a new molecule which the company has invented for use in creating high-performance fibres for the technical fibres marketplace."

The other two patents were filed by the University of Notre Dame. The first of these is a gene-splicing technology that uses DNA's natural repair process to help in genetic manipulation. "This has a direct application in the company's work for creating our industrial production model," Mr Thompson states. The other is an important invention relating to human diagnostics technology. "The application describes genetically fused polymers for use in diagnostic test kits," he continues. "These are fibres that have been fused with antigens and reactive agents for testing blood, urine or saliva. This is a human aspect of our fibres technology."



Capturing the market

The company has revealed some ambitious targets, with the main aim of making a big impact within its field. "Our goal is to develop recombinant spider silk fibres that can capture between two and four per cent of the technical textiles market in that timeframe," says Mr Thompson, explaining his plans for the next five to 10 years. This would reportedly equate to between $2.5 billion and $5 billion in annual sales.

He also believes the company could become part of something much bigger. "Given the dynamics of the market, in our view it is not unlikely that the big players in the industry will view Kraig as an acquisition target," Mr Thompson concludes. His expectation is that the company will eventually merge with one of the existing "industry giants" that currently dominate in the technical textiles arena. In the meantime, its main focus will be on developing high-strength fibres for use in composites, ballistic protection, armour and ultra-strong cables.

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