

# Spider Webs May Unlock Fiber Production Secrets

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Spider webs may hold the secrets that modern fiber makers are seeking.

It is a possibility that is being explored by Professor Robert W. Work in NCSU School of Textiles in a research project entitled "The Alpha-Beta Transformation of Spider Silk Polypeptides as Related to the Formation and Properties of Fibers so Produced." As chief investigator for the project, Dr. Work will direct his team of associates in studies and experimentation for examining the basic phenomena which control fiber formation and determine the excellent physical properties possessed by spider silks.

"Among scientists there is very little understanding of how the spider, by 'doing what comes naturally,' easily makes a solid fiber from a liquid polymer," says Work. "In comparison," he explains, "nylon must be melted at 525 degrees Fahrenheit, extruded under thousands of pounds of pressure, and stretched to several times its original length in order to secure an equally strong fiber."

An initial \$5,000 research grant from Research Corporation of New York City will provide a stipend for one year's study by a graduate student working under Dr. Work's direction in an effort to determine the structure and properties of the extremely strong silk strands used by the spider to support its orb web.

A more recent \$52,000 grant from The National Science Foundation will be used in research aimed at securing the liquid polymer from the spider and determining whether it can be converted to a fiber by the experimenters under controlled conditions of flow, temperature and shear rate.

## Mobile Silk Factories

Spiders, nature's master spinners, are mobile silk factories. Producing their own raw materials, transforming them into a variety of fiber strands, and then using them for the artful weaving of intricately designed and delicately beautiful webs, these primitive creatures have unique and specialized tools which have enabled them to weather eons of environmental changes. Their inherent expertise and economy of function present tantalizing goals for fiber makers using man-made materials and machines.

Spider silks, a variety of complex liquid proteins produced by five or six special abdominal glands, are extruded as solid fibers from the spider's body by clusters of tiny nozzled spigots, or spinnerets, as they are called by entomologists. These fibers, possessed of special and different physical properties, their precise form determined by the spinnerets, are drawn from the minute nozzles by the spider's hindmost legs.

Serving as both home and hunting preserve for the spider, the orb web contains several kinds of silk for use as attachment points, cables, anchor





lines, orb radials and spirals and egg cocoons. The silk also becomes the swathing bands which detain a captured prey until dinner time. All these end products are the result of a complex but unified system of production planned and carried out by the spider alone. From the intricate "factory" in the spider, man may gain knowledge which will be basic for use in the laboratory and in industry.

Working with Professor Work and his associates in the University will be Dr. Peter N. Witt, research director of the North Carolina Department of Mental Health, whose work on the internal chemistry of spiders is well known. Dr. Witt's dramatic photographs of spider webs spun by "drugged" spiders are an exciting and important contribution to the study of the effect of certain drugs on human biochemistry and behavioral patterns.

### Opportunities Open

Commenting further on the current research on spider polypeptides and the fibers produced from them Dr. Work says, "Although broad objectives of the spider research relate to the basic phenomena associated with fiber formation, it may be hoped that when a better understanding is developed, the results will find advantageous application in the man-made fiber industry."

The spiders which will occupy the labs under a variety of controlled environmental conditions are known to zoologists as *Argiope aurantia*. To the average householder, they are just ordinary, garden variety, golden spiders.

It's exciting to contemplate what those glistening, dew-drenched webs may contribute to North Carolina's number one industry.

*Dr. Peter N. Witt and Dr. Robert N. Work Study Spider Webs*

