Biology

The long and short of 'web legs'

For those not intimidated by a spider web, its airy complexity can be a thing of beauty — and a marvel of engineering. Among the different silken traps built by spiders is the commonplace, mostly circular web of the garden spider, which weaves spiral strands on supports slung between plants or buildings. Included in that process is construction of the initial auxiliary spiral used for support and later removed, and of the final main, or capture, spiral. From camera-carrying scientists intent on web research came the suggestion years ago that some of the eight legs on a spider are used as measuring sticks to control the distance between strands as they are spun into place. But what happens if the web-gauging appendages aren't their usual long, leggy selves?

Whether lost in battle or through the natural process of molting, missing legs of garden spiders usually are replaced, but the new legs are shorter than the originals. Using computers to analyze photographs of different webs, Fritz Vollrath from Oxford University in England studied what happens to webs made by spiders with regenerated legs. As he reports in the July 16 NATURE, Vollrath collected spiders that had regenerated one or more of their legs on one side of the body. He then studied the geometry of the webs they made, finding that shorter first legs (or second, if the first was missing) resulted in narrower spacing between strands in the capture spiral. However, even if all four legs on a side were shorter, the strand spacing in the auxiliary spiral was unaffected. Among other experiments by Vollrath are those showing that rotating a web-building spider in the vertical plane results in "dramatically deranged" capture spirals but normal auxiliary spirals. These observations, says Vollrath, show that different "behavioral rules" determine the pattern of the different spirals built by garden spiders.

Cell-skeleton changes linked to cancer?

Mutations in a gene coding for the most abundant structural protein in cells may lead to cancer, say researchers at Stanford University and the Linus Pauling Institute of Science and Medicine in Palo Alto, Calif. The discovery of the gene, which directs production of beta-actin protein, adds a new twist to the expanding list of genes thought responsible for cancer. Prior to the current studies, these so-called oncogenes were thought to change the protein growth factors of a cell, not its interior framework. But, as reported in the July MOLECULAR AND CELLULAR BIOLOGY, the researchers were able to change normal cells to cancerous cells by injecting mutant beta-actin genes.

Gene product induced by seizures

Treating mice with a convulsion-causing drug triggers a temporary buildup in nerve cells of a protein coded for the c-*fos* gene, say researchers at the Roche Research Center in Nutley, N.J. Although the protein's exact role in the body's response to convulsions is not understood, the scientists say it may affect how the brain adapts to repeated seizures. Related to genes found in mouse-cancer viruses, c-*fos* normally expresses itself in low amounts. However, about 90 minutes after the researchers injected mice with the seizure-inducing drug pentylenetetrazole (Metrazole), levels of c-*fos* protein were detected in parts of the brain. By four hours after the injection, "essentially all" neurons in the cortex and limbic-system areas of the brain contained the protein. The scientists report in the July 10 SCIENCE that the distribution of these c-*fos*-containing neurons is similar to that of binding sites for at least one known anticonvulsant drug. As might be expected from these similar distribution patterns, the scientists also found that prior treatment of mice with anticonvulsant drugs blocks the Metrazole-induced production of the c-*fos* protein.

Botany

What's tall, tough and read all over?

Despite its treeless terrain, southern Texas may someday be the site of paper-pulp mills. The mills would make the pulp from an unfamiliar source: not wood chips or recycled paper, but a lanky relative of okra and cotton called kenaf. Even after 25 years of government research on the plant as a pulp supply, kenaf is far from a common sight on U.S. farmlands. But kenaf-pulping technology is reaching a private sector that has hopes the plant can capture a chunk of the U.S. paper market, while serving as a model in the search for new crop alternatives appealing to farmers. And with the first full-scale printing of a newspaper this month on kenaf-derived newsprint, those hopes moved closer to the marketplace and to the fields.

Otherwise known by the scientific name *Cannabinus hibiscus*, kenaf resembles a giant hollyhock, says Daniel E. Kugler, manager of the Kenaf Demonstration Project for the U.S. Department of Agriculture (USDA) in Washington, D.C. An annual plant, kenaf can grow from seedlings to its mature height of about 12 to 15 feet within a five-month growing season. Its fibrous trunk first attracted attention in the 1940s as a possible source of material for making string and twine. More recent USDA research programs have focused on kenaf as a fast-growing pulp source to help supply paper, an industry currently worth $58 billion per year in the United States.

The $1.4-million project headed by Kugler, begun in March 1986, is the last in a series of joint efforts by federal and commercial groups to prove that paper made from kenaf could compete with that from traditional sources in both production costs and quality. A press run of 83,000 copies by the Bakersfield Californian on July 13 showed kenaf paper to be high-quality newsprint, says Kugler. The kenaf was grown in Texas, pulped in Ohio and made into newsprint in Quebec by processes that overcome its tendency to snarl and clog machinery.

Convinced that kenaf products can be competitively priced, a group headed by Charles S. Taylor of Kenaf International in McAllen, Tex., is planning a commercial-scale kenaf mill in Texas to be operational by mid-1990. Besides kenaf's speedy growth, another advantage is that processing it into pulp apparently requires less energy than that needed to prepare wood for paper production, says Taylor.

According to figures collected by the American Pulpwood Association in Washington, D.C., the total U.S. pulpwood consumption in 1986 exceeded 91 million cord units from domestic and Canadian sawmills. (A cord is a stack of wood approximately 128 cubic feet in size.) Association spokesman Neil Ward says the equivalent of half of every piece of wood becomes pulp, which is then converted to various paper products, rayon and particle board.

Although kenaf is used for paper in the Far East, it is too early to tell whether it could significantly replace wood for making paper in the United States and Canada, according to Ronald J. Slinn, vice-president of the New York-based American Paper Institute.

With lower quality standards than other types of paper, newsprint is the logical first step to prove the plant's worth. About 12 million metric tons of newsprint are used in the United States each year, says Ward. (Two-thirds of the U.S. newsprint supply currently is imported from Canada.)

"As far as kenaf is concerned, we don't see ourselves necessarily competing with wood [producers]," Taylor told SCIENCE NEWS. What he and others do expect is that farmers who now grow cotton will consider switching to kenaf, thereby providing economically depressed rural areas with an alternative cash crop. Research groups are designing farm equipment that might be adapted from that already used to harvest sugar cane, says Kugler. But it remains to be seen whether kenaf truly is a worthy paper component.