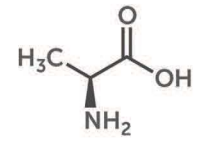
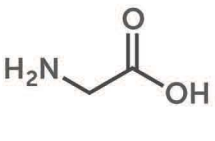
THE CHEMISTRY OF SPIDERWEBS

October is mating season for some spiders. Like them or loathe them, these arachnids use some fascinating biochemistry to spin webs with unique material properties that scientists want to emulate.

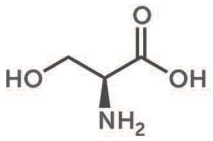
SPIDER SILK'S ELASTICITY AND STRENGTH



ALANINE



GLYCINE



SERINE

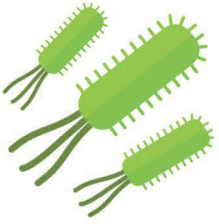
Spider silk is a protein fiber. Major amino acids in the silk proteins are alanine and glycine. Serine and proline are also present in significant quantities in some types of silk. Glycine-rich regions give spider silk its elasticity, forming amorphous areas in its structure. Alanine-rich regions link together through hydrogen bonds to form crystalline areas that give spider silk its strength.

EUROPEAN GARDEN SPIDER SILK VS. KEVLAR

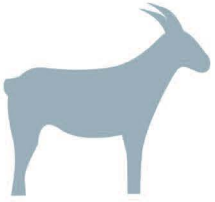
DRAGLINE SILK	FLAG SILK	KEVLAR
		
27%	**270%**	**2.7%**
ELASTICITY (% increase in length when stretched)	ELASTICITY (% increase in length when stretched)	ELASTICITY (% increase in length when stretched)
1.1	**0.5**	**3.6**
STRENGTH (GPa)	STRENGTH (GPa)	STRENGTH (GPa)
180	**150**	**50**
TOUGHNESS ($MJ \cdot m^{-3}$)	TOUGHNESS ($MJ \cdot m^{-3}$)	TOUGHNESS ($MJ \cdot m^{-3}$)

SYNTHETIC SPIDER SILK

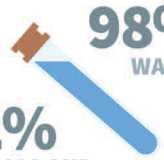
Materials scientists want to find a way to reproduce spider silk's strength and stretchiness. So far their attempts have been met with mixed success; they've yet to produce synthetic spider silk on a large scale.



Some research has used bacteria to produce spider-silk-like proteins.



In the U.S., goats were genetically modified to produce spider silk proteins in their milk.



U.K. researchers made artificial spider silk with silica- and cellulose-based fibers.