



Spider Web Engineering

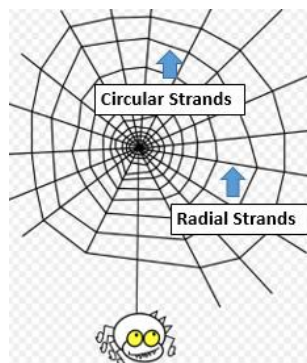


One of the coolest adaptations of spiders is their ability to use traps to capture prey. This ability has evolved over time in spiders and it is advantageous because it allows spiders to catch prey without having to burn the energy to run them down. As a result, webs provide an energy efficient way of gathering food.

Spider webs are made of silk that is stronger than the same weight of steel and yet much more flexible. Spiders produce this silk from spinneret glands and several different types of silk are produced. Sticky silk designed to trap prey is used in web construction. Fine thin silk is used for both web construction and to wrap up and immobilize captured prey. Fine silk safety lines are also used frequently as spiders are often blown from their webs.

Spiders construct their webs in an organized and calculated manner. Since most webs span gaps that are too large for spiders to crawl across, spiders start by producing a sticky thread to drift on the breeze that is blowing. When the thread sticks to an object on the other end, the spider feels the change in vibration and then tightens and strengthens this foundational strand.

After fortifying this first strand, the spider starts to make V-shaped strands that extend outwardly from the center. These outward (radial) strands are added while making sure that distance between them is small enough for the spider to easily cross. After the outward strands are finished, the spider strengthens the center of the web with circular strands as it works its way from the inside out. Finally, the spider replaces these circular strands with sticky ones that are designed to capture prey.



These amazing web creations have been studied by naturalists and scientists for centuries and we have recently been able to create a new material that mimics the spider silk's strength and stretchiness. These lab-made fibers are created from substances called hydrogels that are 98 percent water and 2 percent silica and cellulose. This material offers the possibility of improving the strength and performance of lots of products including helmets, body armor, and airplane wings.

In this STEM Challenge, your job is to create and test a model of a spider web that spans the gap needed for the best hunting possible. In designing your web, you should engineer like a spider who starts with the foundational strand to bridge the gap, adds the outward ones and then ties things together with the circular strands. Happy hunting.