Directions

Read this article. Then answer questions ~~29 through 35.~~

Move Over, Spider-Man—Here's Spider-Goat!

by Joli Allen

Making silk threads isn't just for spiders anymore. A special type of goat is doing it, too. Nubian goats look and act like any other playful, floppy-eared goats. But when they aren't playing, these goats are busy making spider silk.

Spider silk is absolutely amazing. It's five times stronger than steel, but it's also very light and flexible. Because of this, scientists plan to use it to make some totally cool things! Imagine clothing that's as light as a cobweb, yet won't tear, or fishing line and tennis racket strings that won't break. Doctors might be able to use spider silk for making tiny stitches in delicate eye surgery, but it could also be strong and flexible enough to replace some worn-out parts of the human body. The silk also could be used to build airplanes, buildings, and bridges, as well as create a tough coating for space stations. Because of all these possibilities, scientists have been searching for ways to make spider silk in huge quantities, and they have finally found the answer: Nubian goats!

Scientists have studied spider silk for years. They tried to raise spiders on spider farms to collect silk from them, but the spiders didn't enjoy living so close to one another. Spiders like their own space, and when they don't get it . . . well . . . they make space by eating their neighbors!

Goats, the scientists discovered, are much friendlier than spiders and are also easier to work with. Because they're bigger, a few goats can produce more silk than a roomful of spiders. The scientists chose Nubian goats for this job because they make milk at a younger age than many other goats. So, the Nubian goats will make spider silk sooner and for longer periods of time.

But how do the goats actually make the spider silk? That's what scientist Jeffrey Turner wanted to figure out when he taught animal science at McGill University in Montreal. He noticed that the body parts of spiders that make silk and the parts of goats that make milk are very much alike. Because of this, he figured that goats might be able to make spider silk. The idea excited him, and he started his own company in 1993 to do more research on how goats could do what spiders have been doing for years.

Eventually, Turner and his fellow scientists found a way to place spider genes in goats so that the genes fit nicely, like a guest in a comfortable hotel. Every living animal, including humans, has a set of genes inside of it that tells its body what to do. These genes are very, very tiny, but they hold lots of information on how to build parts of the body. A spider's genes contain instructions for making spider silk, and a goat's genes contain instructions for making milk. So by putting spider genes into goats, the goats then have the genes that tell their bodies how to make spider silk proteins.

Proteins are the body's basic building blocks. Just as people have proteins in their bodies that make their hair, skin, and muscles, the goats now have special proteins for making spider silk. When the goats produce milk, the spider silk proteins are in it, but it looks just like regular milk. Scientists separate the proteins out of the milk by skimming off the fat and then sprinkling salt on it. The salt makes the spider silk proteins curdle into small clumps. These clumps are scooped out, and water is added until the mixture has the thickness of maple syrup. This is spider silk, and it's ready to be spun!

Next, the silk is taken to a spinning machine that copies the way spiders spin their silk. The secret to extra strong silk is in how the spiders spin it: they stretch the silk over and over again. The stretching makes all the protein building blocks line up, lock together, and form a strong but flexible band. When the giant spinning machine is finished, the silk threads are stronger than steel and as flexible as rubber . . . but they're also thinner than a human hair.

Producing milk with spider proteins in it doesn't hurt the goats. Scientists did years of research to make sure the goats would be safe and healthy. The milk that's left after the spider proteins are removed can still be used—as fertilizer on fields that grow feed for the goats.

In 1998, Dr. Turner bought a farm in Canada for raising his spider-silk goats, and they still live there today. The one thousand goats that make spider silk are raised in a normal environment and are healthy, curious, and energetic—just like any other Nubian goats. Their owner gives them lots of space to roam and play. The goats particularly enjoy rolling down the farm's grassy hills, and they love listening to country music. Other music, such as rock music, has strange rhythms that make the goats jittery, but the steady beat of country music keeps them calm and happy. H'm . . . I wonder if they'd like the "Itsy Bitsy Spider" song.