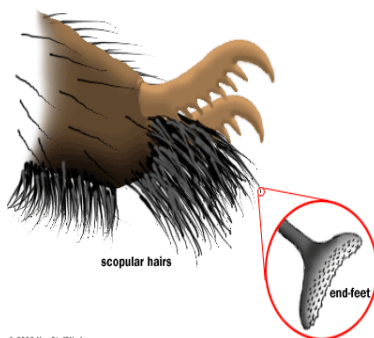


How Do Spiders Move? A guide by Chris Roh

Spiders are unusual in using the body fluid pressure or hydrostatic pressure from their blood (or hemolymph) to move. Spiders use hydrostatic pressure to extend their legs, but muscles to flex the legs. Spiders are able to control their heart rate to control hydrostatic pressure. The faster the heartbeat, the more force is produced due to higher hydrostatic pressure. With this simple mechanism, spiders have adapted to develop various means of locomotion. Many spiders also utilize silk and natural wind in a special locomotion called ballooning.

Walking



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Figure 1 Spider's Feet

Image Source: howstuffworks: spider

Spiders walk by alternating two pairs of legs. While two pairs of legs are in the air, other two stay on the ground and support the body. The amazing part of spider walking is that spiders are able to walk on both horizontal and vertical surfaces. How do they do this? The solution to this mystery is on their feet. At the tip of spider's feet, they have special hairs that end with microscopic feet (enlarged in Fig. 1) that provide additional adhesion to surfaces. This allows enough traction for spiders to hold themselves up vertically, even on the relatively smooth surfaces.

Source: <http://science.howstuffworks.com/environmental/life/zoology/insects-arachnids/spider.htm>

Video: <http://www.youtube.com/watch?v=dE2QPYPKju04>
<http://www.youtube.com/watch?v=EPXDti57C1k&NR=1>

Running/Jumping

Running and jumping requires much higher hydrostatic pressure than walking. Spiders generally maintain relatively low hydrostatic pressure. But when jumping they can generate up to 8 times their resting pressure. This means they can run very fast and jump really high. The fastest spider (Giant House Spider – Agelenidae: *Tegenaria duellicia*) can run 1.73 ft/s. This is very fast considering that the size of the spider is only 0.59 inches. They can move 34 times their body length every second! The highest jumper in the spider world is the Jumping Spider. They can jump up to 25 times their body length using their 3rd and 4th leg pairs.



Figure 2 Jumping Spider Jumping

Image Source: everythingabout: jumping spider

Source: <http://jeb.biologists.org/content/36/2/423.full.pdf>
http://www.everythingabout.net/articles/biology/animals/arthropods/arachnids/spiders/jumping_spider/

Video: <http://www.youtube.com/watch?v=RwarIFPs-eM>

Swimming

Fishing spiders can float on water and swim with their legs. What allows them to float on the water is their light weight and special feet. Fishing spiders weigh only 1.7 g (0.06 ounces). Their feet are even more hairy than typical spider's feet. With these special features, they are able to spread their weight on water and float. When they successfully float on water, they use their 2nd and 3rd leg to row (Fig. 3)

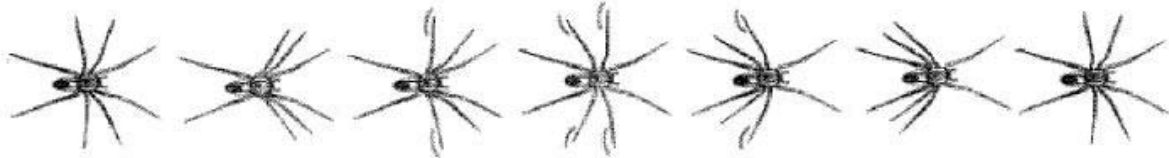


Figure 3 Fishing Spider Swimming Mechanism

Image Source: Locomotion on the water surface: Propulsive mechanisms of the fisher spider *Dolomedes triton*.

Source: Locomotion on the water surface: Propulsive mechanisms of the fisher spider *Dolomedes triton*.

Video: <http://www.youtube.com/watch?v=ueGZ5s88r8Y>

Ballooning



Figure 4 Ballooning spider, ready to take off

Image Source: MS State

Very light weight spiders (usually young spiders) can use their silk to fly or “balloon” on jet stream of air. Spiders have been observed by pilots flying 10,000 feet off the ground. Spider first crawl up to a high place and then let out their silk in an updraft of warm air until the drag force is enough to lift them! The lighter the spider, more chance they have to become airborne. Once they are in the air, they are able to control the duration of the ballooning by spreading their legs to increase the drag of the air (contributing to a slower fall) or bringing their legs in (contributing to a faster fall). They can also reel up their ballooning silk to help control drag that they experience. The reason that they balloon, is so that the spiders can disperse to new areas. This ballooning strategy makes spider one of the highest altitude flyers in the animal world – even without wings!

Source: <http://www.youtube.com/watch?v=kYPABcMzbEg>

Video: <http://www.youtube.com/watch?v=kYPABcMzbEg>

Handsprings

Imagine yourself running in a sandy desert. I am sure you thought, 'it would be so hard!' Spiders living in desert also have hard time running on sand. So they use an interesting way of locomotion: handspringing. The Hand-springing Spider was discovered in Saharan Desert in 2009. They can handspring like a tumbleweed at an amazing 6.5 feet/second! This is ridiculously fast considering that the fastest runner in the spider world can run only at 1.73 feet/second. The exact mechanism of this amazing behavior is not yet known; however, this is one of the most amazing adaptations in the spider world!



Figure 5 Hand-springing Spider Handspringing

Image Source: www.spiegel.de

Source: <http://www.spiegel.de/international/germany/0,1518,602160,00.html>

Video: https://www.youtube.com/watch?v=5XwIXFFVOSA&feature=player_embedded