

MADE BY MOTHER NATURE

In 1941, Swiss engineer George de Mestral was hunting in the Jura Mountains with his dog. Back home, he found that burrs had fastened themselves to his pants and in his dog's fur. Like me, he was a curious man by nature. Trying to figure out how the burrs managed to grab on so tightly, he looked at them under a microscope. He saw how the hooks engaged the fabric of his pants and immediately dreamed of creating a way to temporarily bind two pieces of cloth together. But first, he had to figure out a way to duplicate what nature had invented before him.

At first, he was not taken seriously. The first prototypes were made of cotton by a weaver in Lyon. But the cotton wore off quickly, so the inventor moved on to synthetic. Eventually, nylon was found to be the ideal, as a way was found to make it to form hooks. But it took him ten years to mechanize the process. Eventually, he received a patent in 1955 and opened factories in Germany, Switzerland, the United Kingdom, Sweden, Italy, the Netherlands, Belgium, and Canada. He named his new product Velcro, an acronym from the french VELours (velvet) and CROchets (hooks). For his invention, De Mestral was inducted in the National Inventors Hall of Fame in 1999.

When Neil Armstrong walked on the moon, his space suit was closed with Velcro, and his iconic Omega Speedmaster watch had a Velcro wristband. On the Velcro[®] site, we can read that "Velcro covered approximately 3,300 square inches of the interior and exterior of the Apollo 11 command and lunar modules. These uses, some of which were suggested by the mission astronauts themselves, included:

Heat shields

Instruments secured to space suits

Anchoring astronauts' feet in boots

Watch straps

Feeding tubes

Breathing apparatus storage

Inside spacecraft to keep instruments and tools organized and secured

Securing camera equipment

Nose scratching sticks inside helmets"...

Some of these Velcro items are now displayed in several museums, including the National Air and Space Museum in Washington, D.C. Another wristband, worn in 1972 by Commander David Scott while on the moon during the Apollo 15 mission, was sold at auction to a private collector for more than \$1.3 million US. A bit more than what I'm willing to pay for a watch band...

As I write these lines, there are bands of Velcro that hold the pockets of my pants closed. There is Velcro on one of my lunch box lid. Velcro keeps many of my cables tidy and in order. A long band closes a flap over my raincoat zipper. I have placed bands of Velcro on all my electronic flashes; they can receive various reflectors, diffusers and other light modifiers. Velcro is part of our life. And as microscopist, I found that the original Velcro made by Mother Nature is still worth a closer look.

Before the burr becomes the sticky nuisance we all know, they are rather attractive flowers, visited by bees, bumblebees, and many other pollinating insects. At first, the burrs are soft and pliable, but once pollinated, the flower becomes seed. That's when the husks harden, become brittle and easily break off from the stem when the hooks attach themselves to fur or cloth alike.



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Burdock (*Arctium* sp.)

Animals or humans that find burrs attached to various parts of their anatomy will obviously want to get rid of them. And that's the whole reason for the burrs: seed dispersal. So if you get rid of burrs attached to your trousers, you should do it properly, otherwise you may plant some unwanted seeds in your neighborhood...

A somewhat similar species, at least in the general appearance of their flowers, is the bull thistle. But they do not form burrs; instead, their heads "explode" in wind-borne seeds that look a lot like those of dandelion. Their annoying part is their leaves, which are full of sharp thorns.



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Bull Thistle (*Cirsium vulgare*)



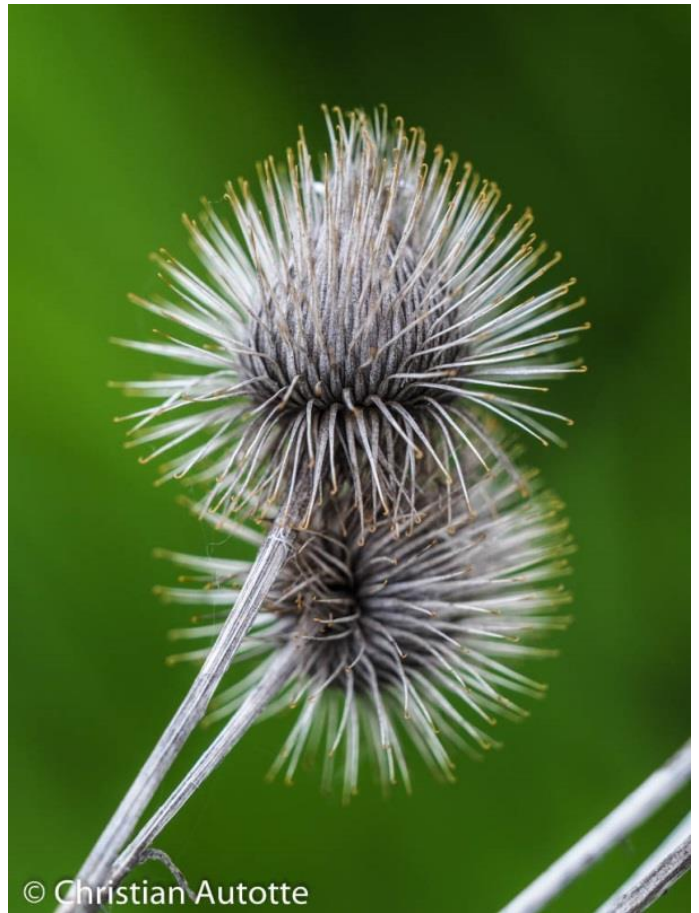
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Bull Thistle thorn, 40x, stack of 4 images

Once a burdock plant is dry, the burr can stick to any convenient surface. Contrary to what many people might think, one burr is not one seed, but rather a multitude of individual seeds. In fact, each hook is attached to a seed!



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Burdock hook, 100x, polarized light



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Burdock hook, 100x

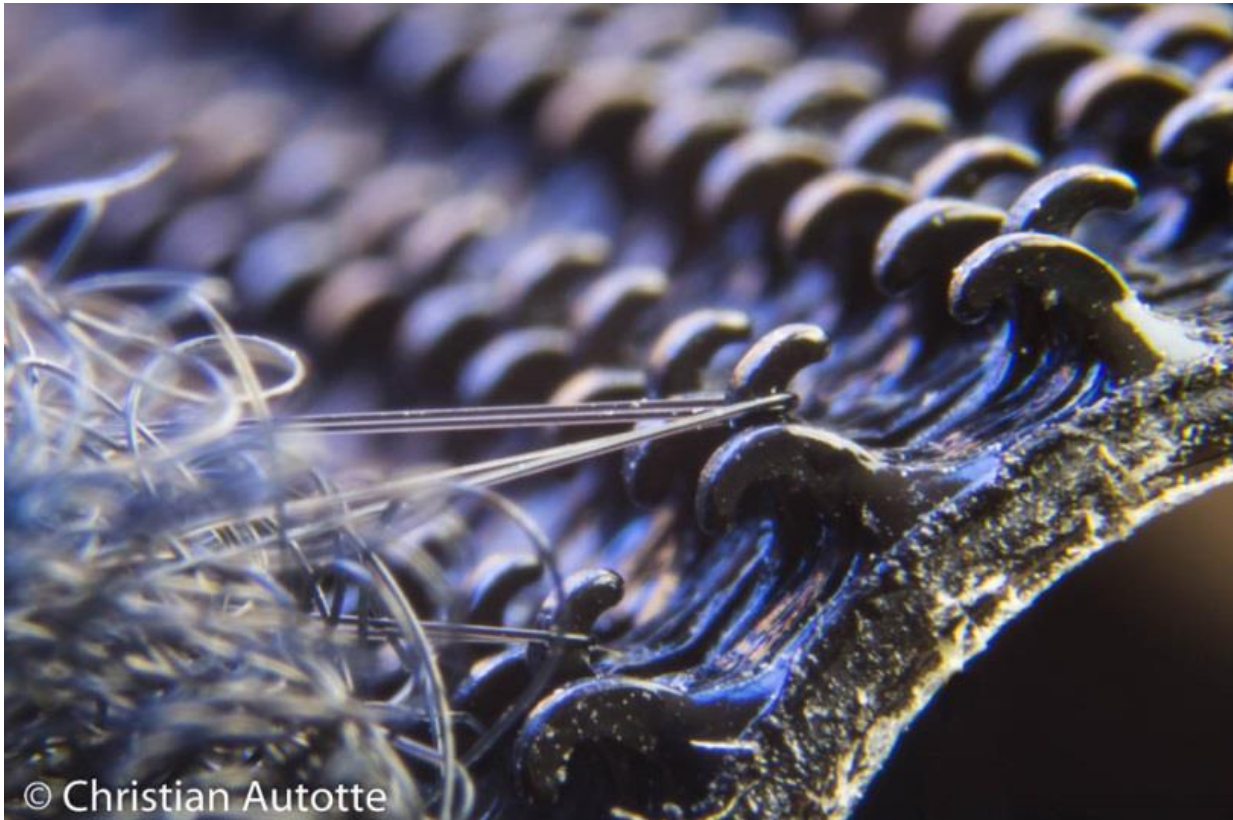
Under the microscope, the hooks reveal how they really are! They look like microscopic fishing hooks. Their points are tough, almost unbreakable. I have made a few permanent mount of the very tip, which can be very interesting to observe in polarized light.



A while back, I found the burr from a different species of plant I could not identify. This one breaks apart easily, revealing the individual seeds attached to their hooks. You can guess how I found that burr...

Eventually, I had to show the artificial version inspired by Nature. Here, we see how the rigid “hook” can grab a piece of cloth, in this case the soft part of the pair from commercial Velcro.

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