LEGS!

Calm down young men, I'm not talking about *those* legs… And with endless apologies to the ladies, the legs I'm talking about are far more interesting… Actually, I'm even more interested by what is found at the end of those legs: feet (and no, I don't have a foot fetish either…). Starting out with one basic design, Nature and Evolution came up with a multitude of specialized tools in insects' legs and feet.

The first thing to notice about insect legs is the hairs… Let's face it, insects have hairy legs, but those hairs are not meant to keep them warm, like those in mammals. Mostly, the rigid hairs are sensory organs. Some are sensitive to touch; others feel the air move and thus can tell its speed and direction.

Fly Leg, 80x, Polarized light with wave plate

And at the end of those six legs are the feet…

Cranefly leg, 80x, Polarized light with wave plate

Fly leg, 80x

A classic foot for microscopist is that of the common house fly, if only to figure out how they manage to walk on the ceiling without falling in our soup more often than they do! That's accomplished with a soft pad made up of very fine hairs. It used to be thought that those hairs could grasp on tiny defects on any surface, in part by capillary adhesion, but the Max Planck Institute in Germany has discovered in 2006 that a kind of glue is also produced by the pad, allowing the fly to maintain its footing even on a perfectly smooth glass pane. Looking at windows where flies have walked you may be able to see their footprints.

Housefly foot, 200x, stack of 7 images

Of course, house flies are not the only insects thus equipped, and my collection of slides produced nicer examples from a deerfly and a horsefly foot.

Flies can also *taste* with their feet, so by walking around on any surface they know if it's worth extending the mouth parts to suck in some sustenance… Glad I'm not a fly…

Deerfly foot, 100x, stack of 6 images

Horsefly foot, 100x, stack of 38 pictures

Robberfly foot, 60x, stack of 18 pictures

Culex Mosquito foot, 400x, stack of 42 shots

Mosquito foot, 400x

Going over my slide collection I noticed something peculiar about mosquitos' feet: some had a straight claw while others possessed a second hook. So I went to one of the books in my library, a mammoth undertaking in four volumes entitled "Manual of Nearctic Diptera" ; volume #1 (674 pages long…) included a key to the species of Culicidae which included the mention that the claws of female are "toothed on foreleg and midleg" of some species, while in other the claws are said to be "simple". That is one other element in the identification key that distinguish those species from others. I guess I'll have to sacrifice a few more mosquitoes to fulfill my curiosity… Poor things…

Mosquito foot, 400x, stack of 55 shots

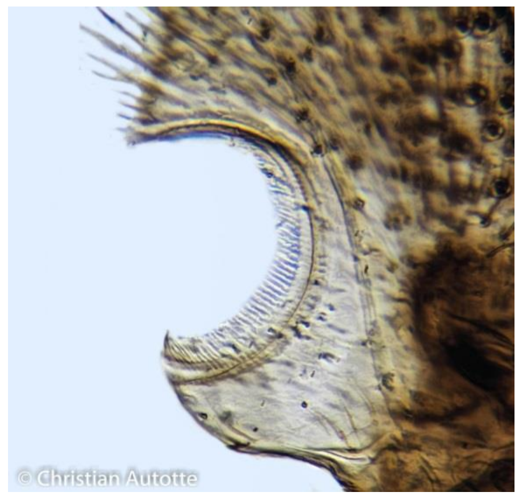
Incidentally, some years ago I had the pleasure and honor of working with one of the books' many authors, Dr. Monty Wood of the University of Toronto. He was a consultant on a documentary by the National Film Board of Canada on which I worked as a cameraman for macro subjects.

Mosquito foo, 800x, stack of 10 shots

Bumble bee feeding on thistle

Honey bee hind leg, 80x

Next on my list was the honey bee. I was first attracted by their hind legs. Long hairs form what is known as the "basket" which is used to gather pollen grains.



Honey bee "brush", 200x, stack of 11 shots

Searching a bit further, I spotted something intriguing on their front legs. It looks as if a piece of the leg was neatly cut off by a cookie cutter. Playing with the fine focus control I noticed that the hole was fringed with a dense brush of fine hairs. A bit of research confirmed my suspicion: it's a specialized tool to brush dust off the bee's antenna! If you watch living insects, you must have noticed them cleaning their face, rubbing their legs together to get rid of dust particles, and possibly going carefully over their antennas. So it would make sense that other insects be equipped with similar cleaning tools on their front legs. The first one I looked at was a small fly, and sure enough, I found a two pronged brush roughly where I found the bee's brush. And I found something similar on an ant's leg.

Small fly leg, 400x, stack of 20 shots

Ant leg, 200x, phase contrast

Water strider foot, 400x, stack of 18 shots

Water Boatman hind leg, 40x

Other insects live *under* water and need to move through this denser medium. Water boatman hind legs are fringed with two rows of hairs. When the legs move forward the hairs fold out of the way, offering no resistance; but as the legs move backward the hairs open up and form a paddle that pushes against the water.

Water Boatman

Water striders

Water striders always impress with their ability to walk and "skate" on water. The tip of their middle and hind legs are covered with a dense coat of curly water-repelling hairs. Two long setae on top and a curly one at the tip may very well be part of their "wave detection" system; striders feed on drowning insects, finding them by the waves they make while struggling in the water.

Water Boatman hind leg, 100x, stack of 6 shots

Beetle foot, 40x, stack of 15 shots

Other legs and feet modifications are crude and simple by comparison. Beetles that spend their life on the ground don't need to climb up glass surfaces. They either have a very small pad or no pad at all. A ground beetle leg looks like a digging tool, with strong claws and tough spines along its edge. When I saw this, I had to take a close look at the ultimate leg with spines: a small tropical praying mantis. A friend gave me a mounted one from his insect collection. Because it has not been cleared and mounted on a microscope slide I had to photograph it with incident lighting; it's still quite impressive.

Praying Mantis front leg, 40x, stack of 8 shots

Ground beetle leg, 40x, stack of 10 shots

Wasp leg joint, 200x, stack of 43 shots

Chitin is rigid, so insects developed some interesting solutions to gain flexibility between individual elements of their exoskeleton. While examining the detail of a wasp leg, I noticed this arrangement, which looks like something an engineer might come up with. I suspect that the coarse spines are "detectors" indicating where the joint has flexed, its exact spatial position.

My slide collection includes many insect parts to which I return time and again, often discovering some new fascinating details. That, if anything else, is a good enough reason to make permanent slides of specimen collected in nature.

One last note about the ethics involved in making microscopic studies of insects. I am always leery of killing something just to study it, especially when it is done only for amateur purpose. Many insects are abundant, but if we all get involved we could threaten some species survival with our enthusiasm. Several species are already rare due to the interest of insect collectors. Some insects I have no problem killing, many are even dispatched with a certain amount of glee: mosquitoes, blackflies, deerflies, and other biting insects are so numerous and so prolific I doubt that we could ever get rid of them permanently… and if we do… good riddance! Other insects are useful, like dragonflies (who eat those nasty biting bugs), or honey bees. For those insects, I rely on Nature to provide me with free samples. I have picked up more than a few specimens as drowning victims in lakes, ponds, and swimming pools. Others are collected at the end of the warm season; dragonflies, wasps, many beetles and spiders, will perish with the first heavy frost anyway, so I collect a few to be mounted and studied during the cold season.

Take a look at the following on the comb found on ants:

Ant comb: https://www.cam.ac.uk/research/news/close-up-film-shows-for-the-first-time-how-ants-use-combs-and-brushes-to-keep-their-antennae-clean

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