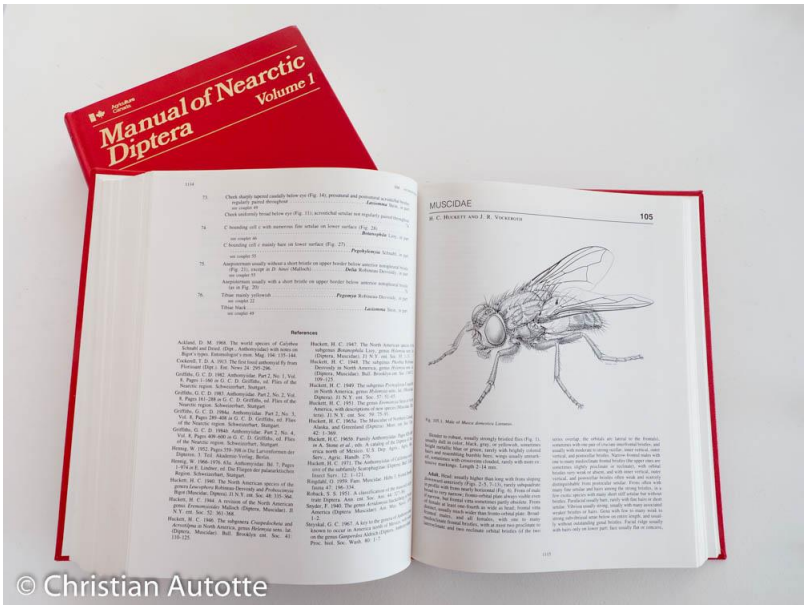
THE FLY

Back when I was a teen, the very first pay check I got was spent on a camera. Simple and sturdy, it came with the standard 50mm lens. On the very first roll of film that went through the camera I made my first macro photograph through the simple expedient of holding a magnifying glass in front of the lens. The subject was a common house fly… The picture was not very good, but I was hooked on macro photography…

Fast forward quite a few years and I found myself as a specialized cameraman on a National Film Board of Canada documentary. Among the subjects that I filmed were quite a few species of flies. One of the consultants was entomologist Dr. Monty Wood. Sometime later, I was to find a pair of books on eBay: Manual of Nearctic Diptera; one of the authors was Dr. Wood. Recently, I also found an eBook copy of the third and last book in the series. Together, these three books number nearly 1600 pages of rather dry and technical text describing families and genera of the flies found in America, north of Mexico.



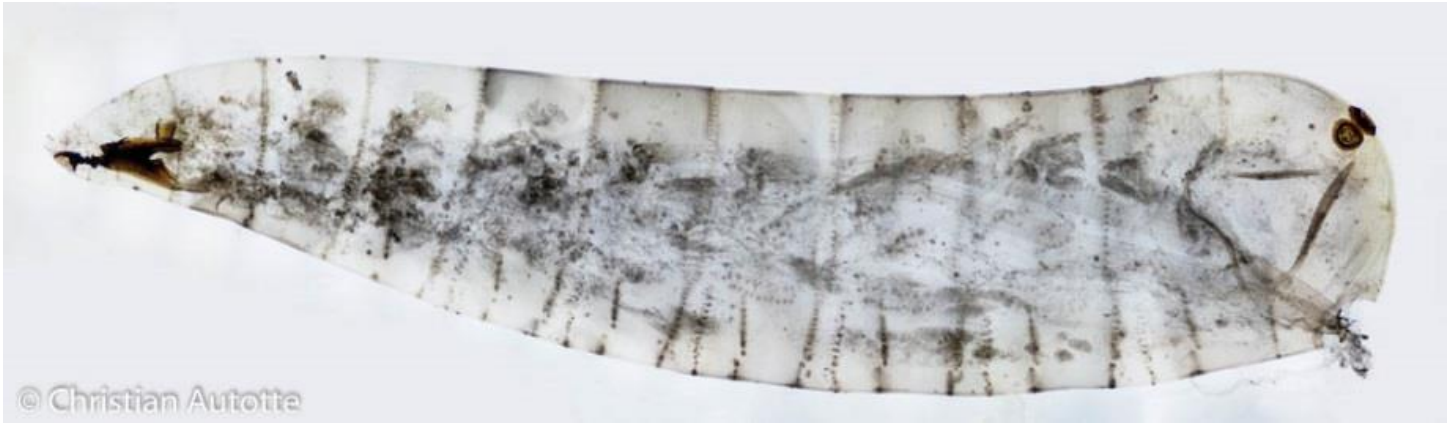
Regular readers of Micscape will be familiar with Walter Dioni, who wrote numerous articles in Micscape about slide preparation and mounting. One of his favorite subjects to use in his experiments was the common housefly. And that makes a lot of sense; while many species of insects are on the brink of extinction either through habitat destruction or over-enthusiasm by collectors, the flies are not among them. Ironically, the species we try to eradicate through pesticides tend to develop resistance and continue pestering us. The houseflies are plentiful and are at no risk of disappearing, no matter how many may be sacrificed for amateur experiments.

Flies are Diptera, which literally translates as “two wings”. Hymenoptera, such as bees and wasps, may appear to have two wings, but they actually have four, which are linked together with a Velcro-like attachment called the hamuli. In flies, the hind pair of wings has been reduced to halters but it should not be thought of as “degeneration”; as we will see later, halters are just as important as regular wings and place the two-winged among the most advanced flying machines that Nature has invented.

Male horsefly hovering in mid-air

Musca egg, 100x

Like most insects, flies lay eggs out of which comes a larva, the maggot off common houseflies and many other species. Maggots often live inside their own food, be it manure, mud, or decaying flesh. These living spaces are for the most part devoid of oxygen, so the larva breathes through a pair of spiracles found at the rear end of its body. Some species that live in mud have a long “snorkel” that can stretch to reach the surface.

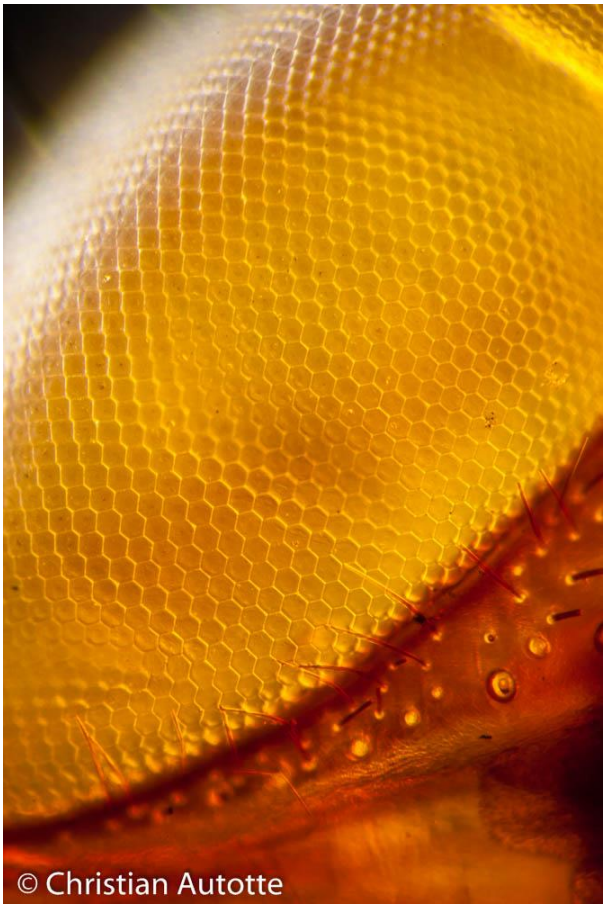


Maggot, panoramic shot from 40x pictures

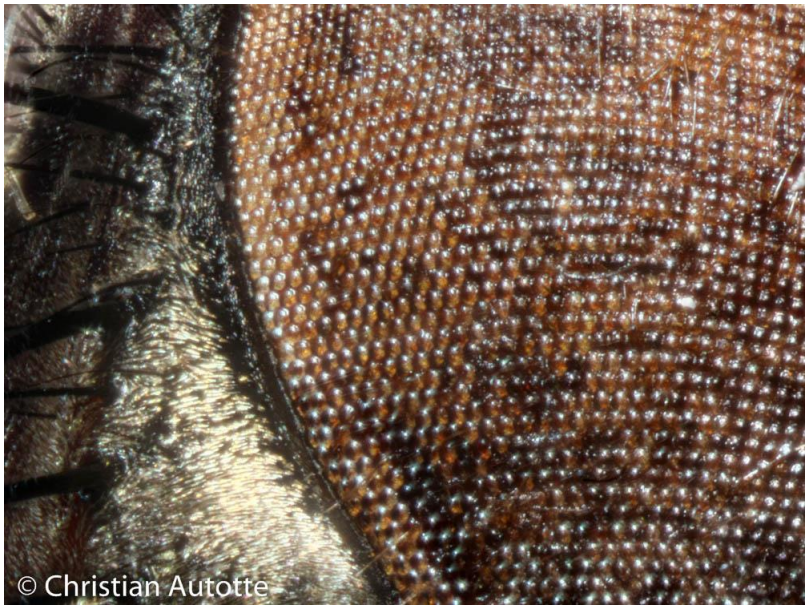
Front of maggot, 100x

Spiracles, 100x

The front and back end of a maggot. On the front end we can see the mandible. Right below are the oral ridges, reminiscent of ridges found in the adult fly labellum. In both larva and adult, these ridges facilitate the flow of liquid food toward the mouth opening. At the rear end is found a pair of spiracles used for breathing; they are visible as black dots on a living maggot and may be mistaken for eyes.



Housefly eye, 40x



Housefly eye, about 40x

The most obvious thing on a fly's head must be its eyes. The shot above was made with a microscope lens on a bellows. At left, a fly head was left in caustic potash to make it sufficiently translucent for microscope observation. Below, a tiny portion of a horsefly eye was prepared to see the individual elements that look like bee's honeycomb.

The eyes of a common housefly give it nearly 360° vision. But this alone does not explain why it's so difficult to catch a fly. In experiments where tiny electrodes were inserted in the visual cortex of flies it was determined that they could perceive a light turning on an off at a rate of 400 flashes per second, which is 6 times faster than humans. When we look at a movie, the projection of 24 individual images per second gives us the impression of continuous motion. But to a fly the same movie would look more like a slide show… That processing power is the main explanation behind their elusiveness: even when we are moving fast to swap them with the sport page, the fly would have the time to read the headlines before taking off…

Horsefly eye, 200x

Mouthparts of unidentified fly, 40x

Housefly mouthparts, 100x

The flies are so annoying because they must feed, and that is usually the way we get in contact with them. Either the fly lands on something we are eating ourselves, or they try to feed directly on us one way or another. They might be attracted by our perspiration or, in the worst case scenario, they want our blood…

Deerfly mouthparts, 30x

The common housefly is equipped with a sponge that sucks liquid. Basically, they spit saliva on what they want to eat and suck the resulting mush back in. It's been said that our houses are full of fly vomit… Lovely…

For their part the blood suckers, like deerflies and horseflies, cut through the skin with stiletto-like mandibles, inject saliva that prevents the blood from clotting, and suck the blood as flies do with any other liquid. So, contrary to some popular beliefs, biting flies do not cut off a piece of meat and fly off to eat it at their leisure…

Unidentified fly leg, 40x, polarized light

Horsefly foot, 100x, stack of 38 pictures

Deerfly foot, 100x, stack of 6 images

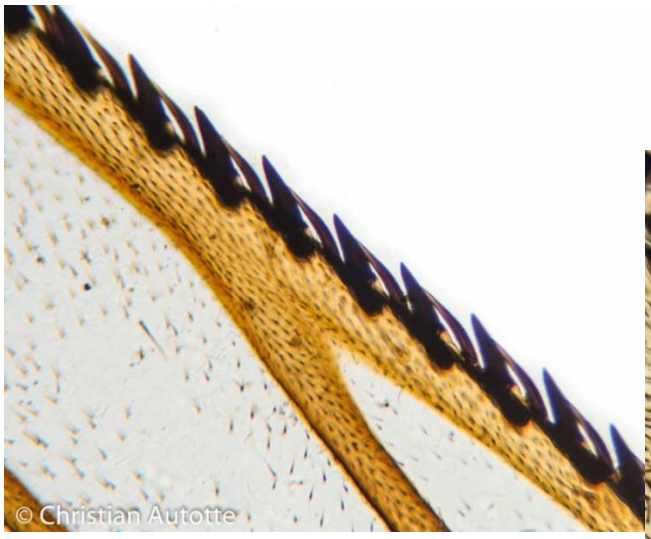
We all know it, flies are hairy beasts. They have hairy legs, torso, and abdomen. These hairs are not usually to keep them warm, although some species of early fliers do have a kind of fluffy fur that will serve that purpose. Most hairs are “setae”, sensitive organs that can detect air movements, especially when the fly is airborne.

More interesting is what is found at the end of those hairy legs: the feet.

Flies feet are fascinating, especially when a good mount is placed on the microscope stage. They have claws to grasp rough surface. When there is nothing to hang on to, they use fat pads called pulvilli which are equipped with a multitude of tiny hairs that end in spatula-like tips. For a long time, it was believed that these hairs alone were enough to allow a fly to walk on glass and ceilings, but we now know that the hairs produce a kind of glue made of sugar and oils.

Another interesting fact about fly’s feet: they are equipped with something like taste buds, so that a fly can tell if they are walking on something they would like to eat… like manure… Bon appétit…

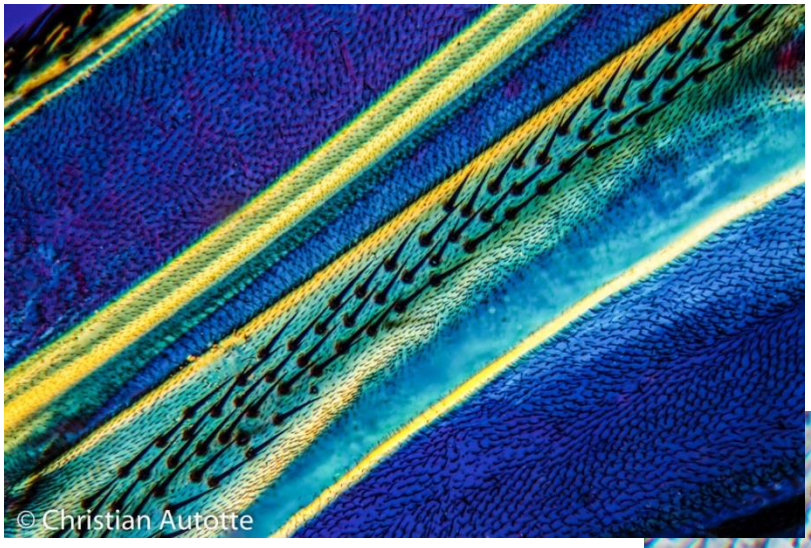
(I did write about insect legs in the past: http://www.microscopy-uk.org.uk/mag/artoct20/ca-Legs.pdf)



Housefly wing front edge, 200x, stack of 4 images

Deerfly wing front edge, 200x, stack of 5 images

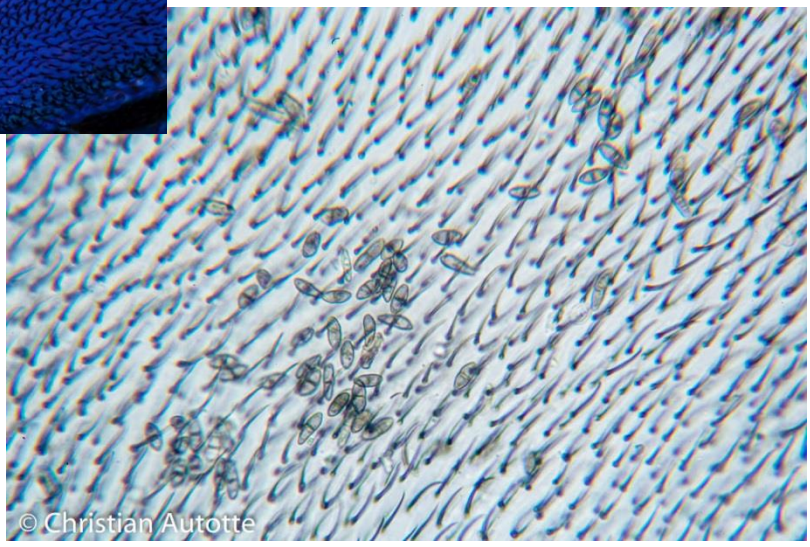
The wings of flies are every bit as fascinating as their feet, and a lot simpler to examine under the microscope. Most are covered with dense hairs that play an important role in flight as they reduce air turbulence. On most Diptera the front edge of the wing also present a few rows of sharp teeth; these may also play a role in their aerodynamic abilities.



Horsefly wing, 100x, polarized light, stack of 5 images

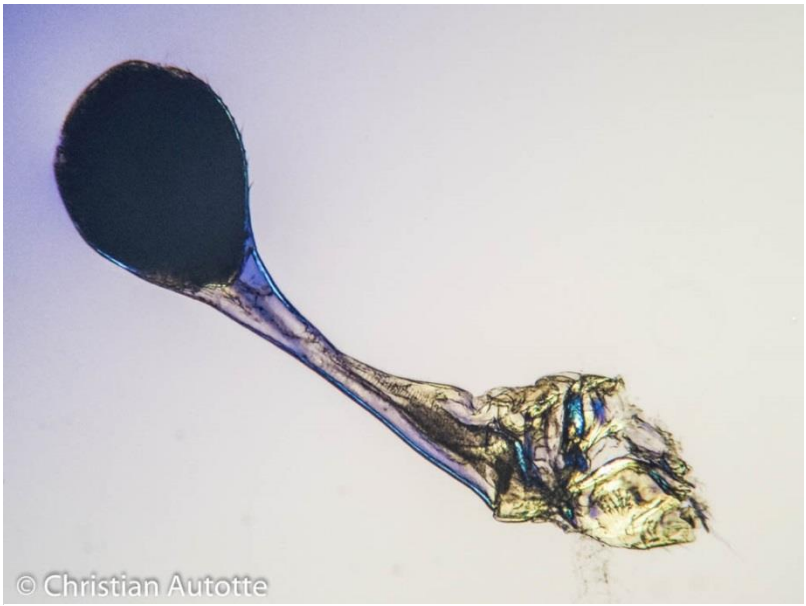
Some insect wings can be very colorful when seen under polarized light, like the horsefly wing seen here.

On one specimen that I mounted were found some mysterious organisms. They may be pollen grains, or algae, or some microorganism that the fly picked up in its environment. I was never able to identify them.



Horsefly wing, 400x

Robber fly halter, 70x, polarized light



Unidentified fly halter, 80x, polarized light

Unidentified fly halter, 80x

As we said earlier, while insects first evolved with four wings, flies have reduced their hind pairs to what is known as halters. These vibrate during flight and act like vibrating structure gyroscopes. A fly without halters will not be able to fly but most will be able to walk on a level surface. In short antenna species, like the housefly, halters move in opposition to the wings, so when the wings go up, the halters go down, and vice-versa. But other species of Diptera, like mosquitoes, may move their halters in synchrony with their wings or they may have no clear pattern in relation to their wing flaps. There is still plenty of research to be done regarding these strange organs.

While not as colorful or loaded with various features as the true wings, the halters can still present some interest to the amateurs.

What follows is a series of various flies that I have photographed over the years. And these were nor shot with a simple magnifying glass…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Incidentally, except for the egg and maggot, all other specimens were mounted by the author. In most cases, the mounting medium was made with Elmer glue, glycerin and water (30 ml of glue, 18 ml of glycerin, and 2 ml of water). I found that it remains clear and is very easy to handle. For dense subjects (like fly legs), the formula can be modified with the addition of lactic acid (30 ml of glue, 15 ml of lactic acid, 1.5 ml of glycerin). The acid will gradually clear the dense tissue and make them more translucent. However, the densest subjects are still cleared with a bath of potassium hydroxide, also known as caustic potash (very corrosive and toxic!). That's a treatment that was used with the fly eyes and feet prior to mounting.

Those who understand french can watch the NFB documentary "Mont Rigaud, une colline chez les hommes" in streaming at http://www.nfb.ca/film/mont_rigaud_une_colline_chez_les_hommes/

As a cameraman, I shot all the insects, frogs, and tadpoles in that film.

While on the subject of understanding french… Those who would like to read more of my ramblings can go to https://www.conseilsphotos.com/ , a site where I provide photographic tips and suggestions.

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