MicroRogue: Plasmo (*Plasmodium falciparum*)

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A B

A: Eyes bigger than its belly: a mosquito feeding on human blood. *CDC/James Gathany* https://phil.cdc.gov /Details.aspx?pid=17696. B: A healthy brain, left, and a malaria infected brain, right. Arrows and circles show areas of change and swelling. *Courtesy of Karl B. Seydel.*

Claim to fame: Plasmo causes malaria

Bloodsucking beasties. Malaria is a deadly disease caused by the *Plasmodium* parasite and transmitted by *Anopheles* mosquitoes. These parasites are found in the gut (and saliva) of female mosquitoes living in tropical and sub-tropical regions around the world. In order to make their eggs, female mosquitoes require blood, and lots of it. They can drink up to three times their body weight in blood during a single meal.

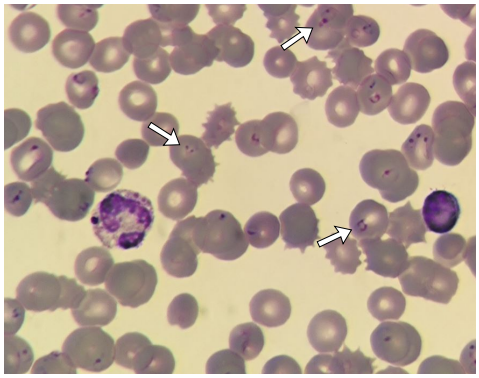
But, and this is the real problem, when an infected mosquito bites us in order to drink our blood, it simultaneously injects the malaria parasite in its saliva into our blood, and hence into our body, where it causes chaos. In 2020, there were almost a quarter of a billion cases of malaria worldwide.

Malicious cerebral malaria. There are five types of malaria parasite that can infect humans. The deadliest is Plasmo – *Plasmodium falciparum*. This parasite is predominately found in Africa and is responsible for 95% of all malaria deaths. It received the title of biggest killer due to its ability to cause malaria coma, also called cerebral malaria.

Cerebral malaria is characterised by fever, headaches and seizures that get worse with swelling of the brain. It can eventually lead to an unrousable coma (a state of unconsciousness in which the victim cannot be woken), disability or worse, death. Approximately 430,000 people die from cerebral malaria each year. It mainly affects small children under the age of five, with one in five dying from the disease.

So: how does the parasite survive in our body long enough to kill us?

Plasmodium's invisibility cloak. Plasmodium parasites possess a special talent: they invade and multiply in red blood cells, a component of blood, which allows them to hide from the immune cells that patrol our body and gobble up foreign invaders.



Plasmodium plays hide and seek: *Plasmodium falciparum* parasites seeking refuge within red blood cells. Arrows show the parasites at different stages of development. *Courtesy of Charalampos Attipa.*

Plasmodium's clearance avoidance. Another trick up Plasmo's sleeve is its ability to avoid clearance by the spleen, an organ which filters and removes old, damaged and abnormal (= *Plasmodium*-infected) red blood cells from our body as blood passes through it. In order to do this, the parasite induces the surface of the red blood cell they have invaded to produce protrusions. These protrusions act like hooks that stick Plasmo-infected red blood cells to the surface of blood vessels like Velcro.

Sticking can occur in any small blood vessel but especially those found in vital organs including the brain. This not only enables *Plasmodium*-carrying red blood cells to avoid being removed by the spleen, but can lead to the blood vessels becoming blocked, causing a reduction in blood flow. This cruel characteristic, called sequestration, is what sets *Plasmodium falciparum* apart from other types of malaria parasite.

Plasmo is a beastly MicroRogue!

Evading the invader

Medicines that effectively clear the parasite from our blood, and a malaria vaccine, offer protection against *Plasmodium falciparum.* Nonetheless, in situations where there is a delay in diagnosis and cerebral malaria has progressed, there is often little current medications can do to reverse the effects. Therefore, it is imperative that we continue to increase our understanding of cerebral malaria in the hope of finding new treatments. But until then…

avoid getting into a sticky situation!