

Unlocking the manipulation of mosquitoes by malaria parasites

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Scientists will attempt to find out how malaria parasites manipulate their mosquito hosts after discovering that smell could be a major factor.

In a study published in *PLOS ONE* today, a team of researchers led by the London School of Hygiene & Tropical Medicine show for the first time that female [mosquitoes](#) infected with malaria parasites are significantly more attracted to human odour than uninfected mosquitoes.

This was demonstrated in a laboratory setting in which infected female *Anopheles gambiae sensu stricto* mosquitoes were attracted to human odours three times more than mosquitoes that were not infected with the malaria-causing *Plasmodium falciparum* parasite. The rate of landing and biting attempts for infected mosquitoes was around three times greater than uninfected mosquitoes.

The pilot study was conducted in collaboration with Wageningen University and Radboud University Nijmegen Medical Centre in the Netherlands.

Dr James Logan's team has been awarded a three-year grant by the Biotechnology and Biological Sciences Research Council (BBSRC) to investigate how being infected with malaria could cause the mosquitoes to behave differently. If the parasites are manipulating the mosquitoes' sense of smell, increasing the chance they will bite when the parasite is transmissible, then the malaria is more likely to spread.

The scientists, who will work collaboratively with Rothamsted Research, Wageningen University and Radboud University, hope their research will enable the identification of the chemical compounds in human odour to which mosquitoes are attracted and to determine whether infected mosquitoes respond differently to those compounds.

This will provide information that could be used to illuminate how malaria – a disease which causes more than half a million deaths a year – is spread from human to human by parasite-infected female mosquitoes which bite people to feed on blood they need in order to reproduce.

Significantly, the results could help identify new compounds which could be used to develop improved mosquito traps that could specifically target malaria-infected mosquitoes before they have the chance to pass on the parasite to the people they bite.

Building on the newly-published pilot study, the team will conduct experiments using a windtunnel which measures the behaviour of mosquitoes towards odours and electrodes which track the response of individual odour-detecting cells from within the antenna of the mosquito in specially-designed secure laboratories at the School to measure the responses of malaria-infected *Anopheles gambiae* s.s. females to human odours. The scientists also aim to determine whether the response depends on what stage in the lifecycle the parasites are in within insect hosts.

Dr Logan, Senior Lecturer in Medical Entomology and Chief Scientific Officer for arctec, at the London School of Hygiene & Tropical Medicine, said: "It has previously been shown that parasites are able to manipulate the behaviour of insects involved in their transmission and reproductive survival. For example, malaria-infected mosquitoes take larger blood meals than uninfected ones, and will take multiple blood meals.

"We have now shown for the first time that the sense of smell could hold the key to understanding how the parasite successfully manipulates the mosquito to ensure its spread."

"Exploring this further opens up the possibility that we could use this knowledge against the parasite by developing tools with crucial chemicals found in human odour."

Dr Renate Smallegange, a visiting researcher at the School who worked on the pilot study, said: "It is exciting that we are the first ones to prove this phenomenon in a biological relevant system of mosquito, parasite and blood host, and, moreover, in a system affecting millions of people in sub-Saharan Africa."

More information: R.C. Smallegange et al, Malaria infected mosquitoes express enhanced attraction to human odour, PLOS ONE. [Doi: 10.1371/journal.pone.0063602](https://doi.org/10.1371/journal.pone.0063602)

Provided by London School of Hygiene & Tropical Medicine

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