EAU DE SAPIENS

CAN SCENT MIXTURES FROM HUMAN SKIN HELP COMBAT MALARIA?

Today's research to find novel ways of preventing mosquito bites and identifying malaria carriers – by studying the bouquet of compounds emitted from human skin – will go a long way towards eliminating malaria tomorrow.

Researchers:
Professor Egmont Rohwer, Dr Yvette Naudé and Dr Madelien Wooding, Department of Chemistry

Imagine the day when we can lure and trap mosquitoes with baits that are more attractive to the female mosquito than any human being. Imagine if we could drastically improve the control of malaria – which affects 10% of the South African population each year – and even eliminate it in the country.

This dream of the University of Pretoria Institute for Sustainable Malaria Control (UP ISMC) has also motivated analytical chemists to develop something more attractive than humans on which mosquitoes can feed. For more than a decade, UP ISMC's analytical chemistry team has been researching human skin emanations with the goal of recreating chemical mixtures that mimic the scent of the most mosquito-attractive human being.

Professor Egmont Rohwer, who initiated the project and works with team members Dr Yvette Naudé and Dr Madelien Wooding of the Department of Chemistry in the Faculty of Natural and Agricultural Sciences, elaborates: "A novel silicone rubber skin-sampler, worn as a patch on the forearm for 30 minutes, was successfully developed to capture thousands of compounds accurately for later release and analysis by sophisticated, state-of-the-art separation and identification techniques."

This provides reliable skin-emission profiles that can be processed by computerised pattern recognition techniques, allowing for chemical fingerprinting of metabolites originating from the infective agent and clues for designing a better lure for mosquitoes.

"The best available mixtures thus far use up to 12 different compounds," Prof Rohwer says. "We believe we require a lot more and that their relative concentrations – an aspect that has not received a lot of attention – would be crucial to provide the irresistible lure. This is a massive challenge and test for our team's international reputation in the research fields of chromatography and mass spectrometry. Our scientists have successfully diagnosed tuberculosis by this means and have obtained promising results for the screening of malaria."

Early results indicate that identifying latent cases might also be possible, which is important for malaria elimination as trans-border movement of asymptomatic carriers could be a significant reservoir of the *Plasmodium* parasite. Latent cases are carriers of malaria that show no symptoms but carry the parasite in the liver, spleen or bone marrow. Such cases are generally not found with the existing blood microscope test, the rapid diagnostic test, and the more sensitive and selective DNA-based tests.

Adding to the arsenal

The most successful tools available to keep malaria at bay are insecticide-treated bed nets (ITNs) and indoor residual spraying (IRS). The latter refers to the annual spraying of long-lasting insecticides on indoor walls to target female mosquitoes that often rest here before biting humans for their blood meal. This is where transmission occurs. Consistent implementation of IRS requires enormous manpower and funding.

Another challenge to eliminating malaria in South Africa is the influx of citizens who come from neighbouring countries where there is a higher malaria risk and who may be asymptomatic carriers of the *Plasmodium* parasites. A cheap and successful chemical lure-based trap, together with efficient screening of trans-border visitors for malaria, would go a long way to eliminate the disease in South Africa.

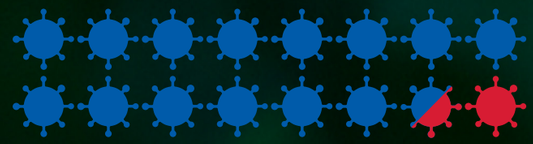
The UP ISMC team considers their "magic scent mixture" to be a missing third partner of IRS and ITNs as they work towards ending malaria.

"Another heart-warming result of our published skin-analysis research is an invitation by a top US-based research group to participate in a unique programme in Zambia where mosquito-biting preference is studied in response to volatile scent profiles of a large group of people," Prof Rohwer says. "The next challenge will be to extend our skin metabolic profiles technique to other species of mosquito (besides *Anopheles arabiensis*) and infective agents (beyond *Plasmodium falciparum*) to tackle other diseases spread by mosquitoes, such as Zika, chikungunya, West Nile and dengue fever."

Why this research matters

Malaria is a major health issue and killer in sub-Saharan Africa, and current elimination methods place a heavy burden on resources. The development of an alternative diagnostic method will reveal latent cases of malaria, which constitute a hidden reservoir of the disease, and help diagnose it more effectively. This groundbreaking method also holds the promise of prevention by luring and trapping mosquitoes with scents that are more attractive to the female mosquito than any human being.

SDG 3: Good health and well-being



700 million

Number of people worldwide who contract **mosquito-borne diseases** each year, of which malaria is the main contributor

1 million+

Number of people who die from mosquito-borne diseases each year

** Where each icon represents 50 000 000 people.*