

The mosquito's taste for human genes

Somendra Singh Kharola

'It is your small, high, hateful bugle in my ear.'

D. H. Lawrence, *The Mosquito*

The mosquito is picky when it comes to its food. The malaria vector, *Anopheles gambiae*, for example, has a predilection for pregnant women, and also for those people already infected with malaria. Furthermore, certain mosquito species are even choosy about the weight of their targets. Verily, these mosquito species find individuals with a greater body mass more tempting than individuals who have less 'beef' on their bones. The next question is most pertinent: *what factors determine how attractive an individual appears to mosquitoes?*

'This is all to do with the way we smell,'¹ said Dr. James Logan, London School of Hygiene & Tropical Medicine.

Indeed, the single most important factor that stimulates the mosquito's interest is one's smell: human body odour. In addition, several other factors – by affecting the transmission and strength of one's body odour – also play a role in determining how enticing a feast an individual appears to the mosquito. Such factors include – one's body surface area, one's rate of perspiration, and one's body temperature.

A recent study, Fernández-Grandon *et al.*², conducted at the London School of Hygiene and Tropical Medicine, reports the discovery of one other factor that affects one's body odour: one's genes.

'We found that our body odour, and hence our mosquito attractiveness, is also mediated, at least in part, by our genes,' said the lead author of the study: Fernández-Grandon, Natural Resources Institute, University of Greenwich.

This would imply that if a child's mother or father, owing to the expression of certain genes, smell a certain way that mosquitoes find attractive, then even the child, by inheriting the same genes, could also end up smelling similarly, and thus be hounded by mosquitoes.

You are probably shrugging your shoulder and saying: *So what?* Are not all human traits, including body odour, after all, mediated by genes? Are not the results of the study...obvious?

'Although it does seem obvious that our odours are mediated by our genes, this has never really been rigorously proven in the laboratory,' said Dr Fernández-Grandon. In fact, according to the author, many people are of the questionable belief that our odours are influenced by the food we consume. For instance, an urban legend prevails in some countries that the consumption of garlic endows an individual with mosquito repellent properties – something, research studies report, is simply not true.

To test their hypothesis – whether the body odour and the mosquito attractiveness of an individual have an underlying genetic basis – Fernández-Grandon *et al.* conducted an experiment that involved using several pairs of identical and non-identical twins (all women aged between 50 and 90) to 'bait' *Aedes aegypti* mosquitoes.

Each of the volunteers, designated either as Twin A or as Twin B, was instructed to slip their hands into one of the arms of a Y-tube olfactometer – a 'Y' shaped wind-tunnel. The odours exuded from the hands of the twins were thus, like a hunter's tethered goat, presented to the mosquitoes, allowing them a choice of either Twin A or Twin B.

Once the mosquitoes had made their choice, they were counted, and the proportion of mosquitoes – *how many chose Twin A? How many chose Twin B* – was calculated. For each set of twins, the researchers tested around 1000 mosquitoes.

'If the volunteers were equally attractive to mosquitoes we would expect around 50% of the mosquitoes to fly to their odour – half would fly to Twin A, while the other half would fly to Twin B,' said Dr. Fernández-Grandon.

Which is exactly what the team found in the case of identical twins.

Simply put, the study finds that, given any identical twin pair recruited for the study, an individual attracts mosquitoes with the same 'intensity' as her identical sibling. No such sameness in mosquito attraction 'intensity' is observed between non-identical siblings, however.

But how does all this imply a genetic basis to the trait of an individual's mos-

quito attractiveness? In other words, how does one connect the dot of an individual's mosquito attractiveness to the dot of the individual's genes?

Identical twins are genetically alike. Unlike usual siblings and non-identical twins, the genetic relatedness of identical twins is a full 100%. No wonder, several of their physical traits are strikingly similar. They have similar eyes, similar hair, similar ears, similar noses, similar thumbprints, and of course, similar body odour. Therefore, as is observed in this study, given how similar identical siblings are when another physical trait – their mosquito attractiveness – is considered, it is most apposite to infer that even this trait is also rooted in genes.

'Mosquitoes pose an enormous threat to human health due to the diseases they carry,' said Dr. Fernández-Grandon. If we identify the nature of what makes us attractive to mosquitoes, we could also find ways to alter our odours to repel them. In addition, we hope that understanding how different human populations may vary in their attractiveness to mosquitoes could improve statistical modelling of disease spread.'

But mounting these genetic defences against the mosquito's siege would take some time; after all, we still do not know which human genes – *precisely* – make an individual more or less mosquito attractive. Till research studies sniff out these genes, one must continue to persevere against the bugle screams of the mosquito's wings.

1. http://www.lshhtm.ac.uk/newsevents/news/2015/twins_mosquito_study.html; Twins experiment reveals genetic link with mosquito bites; Video; Dr James Logan, Thursday, 23 April 2015.
2. Fernández-Grandon, G. M., Gezan, S. A., Armour, J. A., Pickett, J. A. and Logan, J. G., *PLoS ONE*, 2015, **10**(4), e0122716; doi:10.1371/journal.pone.0122716.

Somendra Singh Kharola (S. Ramaseshan Fellow).
e-mail: somendrakharola@gmail.com