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Genetics against Malaria

Genetic engineering may help win the war against malaria, says S.Ananthanarayanan

Mumbaikars of late have become wary of the whining sound of the mosquito and rush to get a blood test at the hint of malaria, for fear that it may be the falciparum kind.

Drug resistance

Malaria was a scourge in much of Asia and Africa and was traditionally treated with Quinine. Eradication, in the third world, at any rate, has been elusive, but drugs like Chloroquine, Primaquine did hold out the promise of control. But a level of self-prescribing in insufficient doses, sometimes as a ‘preventive’, has led to selective breeding of ‘drug resistant’ strains, and these drugs are proving ineffective.

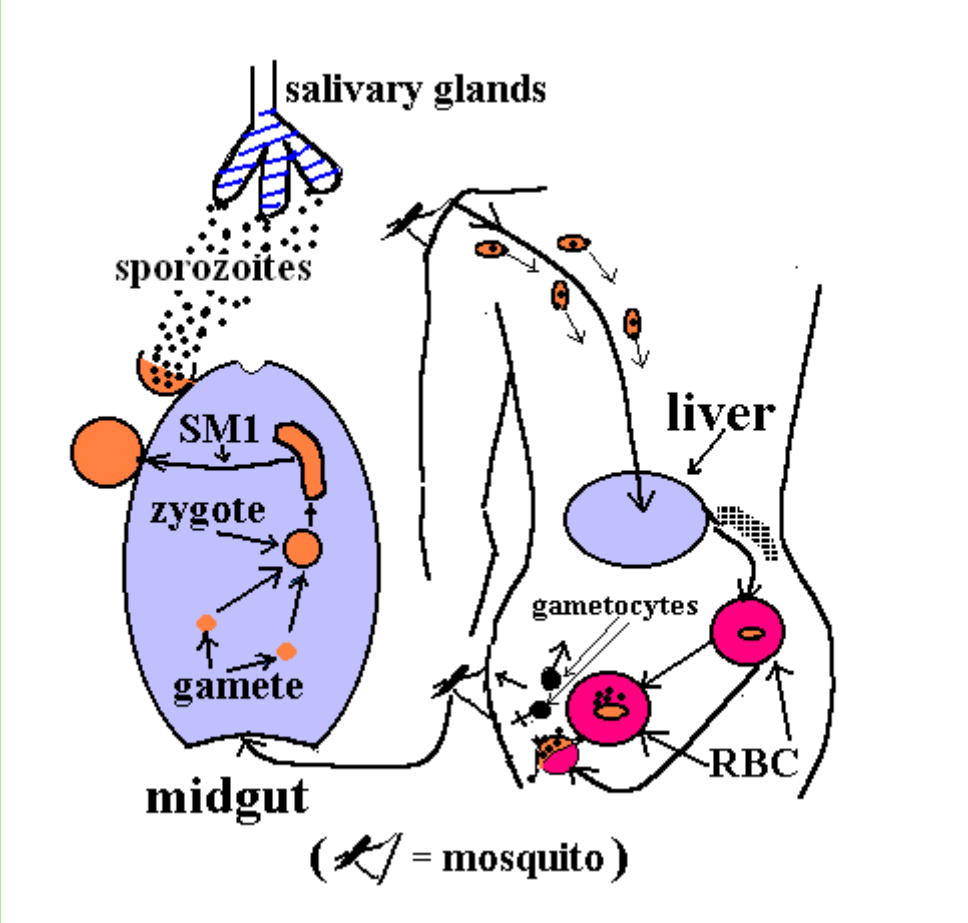
The way resistance builds is that with low doses of drugs, the drug-sensitive elements of the infection get hit, but the small. drug-resistant strains live on and become dominant. As a result, when the infection becomes active again, the same drugs, even if administered in full doses, have larger numbers of resistant strains to combat and may be ineffective. At the same time, the strain carried by mosquitoes is now more of the resistant variety, which multiply, leading to the drugs getting increasingly impotent.

Two kinds of malaria

The chief forms of malaria are ‘vivax’ and falsiparum’. The second form is easily the deadlier, attaching itself to the red blood corpuscles and rapidly leading to damage to the brain, the liver, the lungs if not controlled. Unfortunately, it is this form of malaria that has developed resistance to drugs to a greater degree and the line of treatment is not the same for both kinds. Hence it is important to identify the disease so that the correct treatment is started in time, particularly if it is a case of ‘falsiparum’.

The infection cycle

The parasite enters the bloodstream through a mosquito bite and lodges in the liver, where it multiplies, and 'egg cells' attach to red blood corpuscles. At the next bite of the mosquito, the 'egg cells' (gametocytes) enter the gut of the mosquito, where they become active and pass through the gut wall. Once on the outside, they grow in thousands and spread through the bloodstream to the mosquito's saliva, ready to infect again.



Gene engineered strategy

A viable strategy would then be to come in the way of the parasite traversing the wall of the mosquito's gut. Researchers found that that a certain synthetic substance, called SM1, attached only to the mosquito gut and salivary glands. Did this substance then bind to some projection, perhaps a protein, that was found on the gut wall and in the salivary glands? It was found that injecting this substance into mosquitoes did prevent the malaria parasite from getting out of the gut wall – presumably because the SM1 had gone and blocked the handles that the parasite recognized!

Researchers have now developed a strain of anopheles mosquito that has the DNA, or is genetically programmed to generate SM1, and have that found there is a significant reduction in their capacity to transmit malaria. As the SM1-encoding DNA is inherited by the mosquitoes' offspring, a strategy to generate competing populations of malaria-safe mosquitoes is feasible!