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Research finding points towards developing effective malaria vaccine

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In a recent breakthrough to combat malaria, a collaboration of Indian and American scientists have identified a malarial parasite protein that can be used to develop antibodies when displayed on novel nanoparticles. This approach has the potential to prevent the parasite from multiplying in the human host and also inhibits transmission through mosquitoes. The finding points towards developing a powerful malaria vaccine in the hope of eradicating this debilitating and often fatal disease.

Malaria takes a heavy toll on human lives. About half a million people die every year and several hundred million suffer from this disease across the globe. To add to the disease burden, the malaria parasite is increasingly becoming resistant to commonly used anti-malarial drugs. Development of an anti-malarial vaccine is an integral part of an effort to counter the socio-economic burden of malaria.

Researchers in the malaria labs at Tata Institute of Fundamental Research (TIFR), Mumbai, India, have now identified a five amino acid segment of a *Plasmodium* parasite protein that is normally involved in producing energy from glucose. Work from Prof. Gotam Jarori's lab has earlier shown that this protein, enolase, is a protective antigen and has several other functions that are essential for parasite growth and multiplication.

Taking this a step further, in a recently published paper in the *Malaria Journal*, they have shown that a small part of this protein, that is unique to parasite enolase and is absent in human enolases, has protective antigenic properties. "As enolase was implicated in invasion of red blood cells of the host as well as the midgut of mosquitoes, antibodies against this small fragment can potentially have a dual benefit by blocking the multiplication cycle of the parasite in humans, as well as inhibiting transmission through mosquitoes", says Prof. Jarori.

The work was carried out in collaboration with Prof. Shiladitya DasSarma's laboratory at the University of Maryland School of Medicine, Baltimore, USA, who has developed Archaeal gas vesicle nanoparticles (GVNPs). The small unique segment of enolase was genetically fused to a nanoparticle protein and this conjugated system was used to vaccinate mice. Interestingly, a subsequent challenge with a lethal strain of mouse malaria parasite in these vaccinated animals showed considerable protection against malaria. Says Prof. DasSarma, PhD, a professor of microbiology and immunology at the school, "GVNPs offer a designer platform for vaccines and this work is a significant step forward towards a new malaria vaccine."

This study is a significant advance in the field, since most other vaccine candidate molecules tested so far confer protection against only a single species of parasite, due to the species and strain specific nature of these molecules. "The small segment of five amino acids that forms a protective epitope is present in all human malaria causing species of *Plasmodium* and hence, antibodies directed against it are likely to protect against all species of the parasite", says Sneha Dutta, a graduate student at TIFR who conducted these experiments. Efforts are now focused at developing this into an effective vaccine against malaria.

Source:

Tata Institute of Fundamental Research
