



Innovative Strategies in Malaria Prevention

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Why in News?

Recent advancements in [malaria prevention](#) have shifted focus from genetically modified mosquitoes to **genetically modified malaria-causing parasites**. This innovative approach aims to enhance immune system priming during the liver stage of the parasite's life cycle, potentially leading to more effective [malaria](#) vaccines.

How do Genetically Modified Parasites Help Prevent Malaria?

- **Genetically Modified Parasites:** Malaria causing parasites were genetically altered to study their behavior, prevent diseases, or deliver treatments. They are designed to **prime the immune system** in the liver, preventing disease before entering the bloodstream.
 - Malaria-causing parasites cause infection and symptoms begin to show only when they move into the bloodstream from the liver stage.
 - This method allows for better protection against malaria when exposed to unaltered parasites later, improving overall vaccine efficacy.
 - Additionally, genetically modified mosquitoes can spread resistance to malaria by mating with wild mosquitoes.
 - **Immune priming** is a process by which a host improves its immune defences following an initial pathogenic exposure, leading to better protection after a subsequent infection with the same – or different – pathogens.
- **Trial Efficacy:** In the trial conducted, 89% of participants exposed to late-arresting genetically modified parasites (*p falciparum*, in this case) were protected from malaria compared to only 13% for early-arresting parasites.
 - Early-arresting refers to killing the parasite on day 1 of entering the liver whereas late-arresting refers to killing it on day 6.
- **Comparison with Traditional Methods:** Traditional methods, such as radiation-sterilized mosquitoes and radiation-attenuated **sporozoites** (the infective stage of malaria parasites), require significantly higher exposures (up to 1,000 mosquito bites) for similar protection levels.

What is Malaria?

- **About:**
 - Malaria, a life-threatening disease caused by [Plasmodium parasites](#), is transmitted by **female Anopheles mosquitoes**. Of the five species infecting humans, [P. falciparum](#) and [P. vivax](#) are the most dangerous.
 - After biting an infected person, a **mosquito transmits malaria parasites to the next person** it bites. The parasites travel to the **liver**, mature, and then **infect red blood cells**.
- **Highlights of Malaria in India:**
 - According to the [National Vector Borne Disease Control Programme \(NVBDCP\)](#), malaria remains a significant public health challenge in India, with approximately **1 million cases reported annually**.
 - Approximately 95% of the population lives in malaria-endemic regions, with 80% of cases

occurring in tribal, hilly, and inaccessible areas that house 20% of the population.

- **In 2022, India** represented **66% of malaria cases** in the [WHO South-East Asia Region](#), with *Plasmodium vivax* responsible for nearly **46%** of these cases.

▪ **Treatment:**

- **WHO**-recommended malaria vaccine like [RTS,S/AS01](#) and [R21/Matrix-M](#)

▪ **Global Initiatives:**

- [World Malaria Day](#) - **25th April** (launched in **2007**)
- [WHO Global Malaria Programme \(GMP\)](#) (launched in **2015**)

▪ **Government Initiatives Related to Malaria:**

- **National Malaria Control Programme (NMCP)** - **1953**
- [National Vector-Borne Disease Control Programme](#) - **2003**
- [Malaria Elimination Research Alliance-India \(MERA-India\)](#) - Launched on the eve of 'World Malaria Day' in **2019**.
- **National Strategic Plan: Malaria Elimination 2023-27**

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. Widespread resistance of malarial parasites to drugs like chloroquine has prompted attempts to develop a malarial vaccine to combat malaria. Why is it difficult to develop an effective malaria vaccine? (2010)

- (a) Malaria is caused by several species of Plasmodium
- (b) Man does not develop immunity to malaria during natural infection
- (c) Vaccines can be developed only against bacteria
- (d) Man is only an intermediate host and not the definitive host

Ans: (b)