

The PvRII Malaria Vaccine Candidate

The International Centre for Genetic Engineering and Biotechnology (ICGEB) in New Delhi, India and Bharat Biotech International Limited (BBIL) are developing a *Plasmodium (P.) vivax* vaccine candidate, PvRII (*P. vivax* Region II). The PvRII vaccine candidate is based on the Duffy binding protein, the sole invasion pathway for this parasite. This protein enables *P. vivax* to bind to receptors on red blood cells, in essence, opening doors to invade the cells. Because the vaccine is designed to thwart invasion of red blood cells, it may be able to prevent disease caused by *P. vivax*.

Although less deadly than *P. falciparum*, *P. vivax* is the most widespread malaria species occurring throughout Asia, South America and, to a lesser extent, Africa. Globally, *P. vivax* causes 70 million to 80 million cases of malaria each year and at least half the cases of malaria in India. Furthermore, *P. vivax* malaria has been on the rise due to the parasite's increased resistance to anti-malarial drugs. Although *P. vivax* is rarely fatal, it can cause serious disease and affect the overall health and productivity of infected people, thereby affecting social and economic development as well. As a general rule, every individual in a moderately *P. vivax*-endemic area can expect to experience from 10 to 30 or more episodes of malaria in his or her lifetime.

The Partnership

ICGEB and BBIL are developing the PvRII vaccine candidate with funding from numerous national and international partners, including the Government of India's Department of Biotechnology, the World Health Organization's Tropical Disease Research Division, the Indo-US Vaccine Action Program, an alliance between the Department of Biotechnology and the US National Institutes of Health and the PATH Malaria Vaccine Initiative based in Bethesda MD, USA. In addition, the project involves technical collaboration with GlaxoSmithKline Biologicals, which is based in Rixensart, Belgium.

Steps in Malaria Vaccine Candidate Development

Research and Pre-clinical Development: Identify relevant antigens and create vaccine concept; pre-clinical evaluation; develop initial vaccine manufacturing process.

Phase 1 Clinical Trials: Establish the safety and measure immune response in malaria-naïve and malaria-exposed populations.

Phase 2 Clinical Trials: Monitor safety and potential side effects; measure immune response; measure preliminary efficacy against infection; and determine optimum dosage and schedule.

Phase 3 Clinical Trials: Continue to monitor safety, potential side effects, and evaluate efficacy on a large-scale.

Submission for licensure: Submit vaccine file to regulatory authorities for approval to market.

Introduction: Make vaccine available for use.

Phase 4 Clinical Trials: Follow-up safety monitoring; measure duration of protection and assess vaccine compliance.

Current Development Plans

The current status of the vaccine development plan includes the initiation of the pre-clinical immunogenicity and toxicology studies. These studies are expected to be initiated by the end of 2007, following which a Phase 1 safety and immunogenicity study is anticipated.

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The PATH Malaria Vaccine Initiative (MVI) is a global program established at PATH through an initial grant of \$50 million from the Bill & Melinda Gates Foundation. MVI's mission is to accelerate the development of promising malaria vaccines and ensure their availability and accessibility in the developing world. For more information, visit www.malariavaccine.org. **PATH** is an international, nonprofit organization that creates sustainable, culturally relevant solutions, enabling communities worldwide to break longstanding cycles of poor health. By collaborating with diverse public- and private-sector partners, PATH helps provide appropriate health technologies and vital strategies that change the way people think and act. PATH's work improves global health and well-being. For more information, visit www.path.org.

The International Centre for Genetic Engineering and Biotechnology (ICGEB), with laboratories in New Delhi, India, and Trieste, Italy, is dedicated to developing and promoting application of biotechnology for solving problems in health and agriculture, particularly in developing countries. For more information, visit www.icgeb.trieste.it.

Bharat Biotech India Limited (BBIL), a leading technology-driven venture in India, is focused on providing path-breaking solutions through biotechnology for diseases that are challenging the entire human race. BBIL focuses on infectious diseases and brings to bear core competencies in developing novel health care solutions for the developing world. Bharat Biotech is one of the first bio-pharma facilities in India to be audited and approved by the Korean Food & Drugs Administration. For more information, visit www.bharatbiotech.com.