Malaria Vaccine: Malaria Vaccine Institute and GlaxoSmithKline Biologicals

Malaria remains one of the world's deadliest killers. Every year, the disease takes the lives of more than one million people, mostly sub-Saharan African children under age five. Hundreds of millions more people fall ill from the mosquito-borne disease. Major hurdles to traditional prevention and treatment strategies include drug resistance by the malaria parasite and heightened resistance to insecticides by the mosquito that transmits it. Scientists have been working for decades to develop a preventive malaria vaccine. While they have successfully demonstrated that such a vaccine is possible, many challenges continue to impede progress on the road to an effective product. The complex life cycle of the malaria parasite (the most deadly being the *Plasmodium falciparum* species) represents a major hurdle. While each stage of the parasite's development offers an opportunity to attack it, the parasite's ability to evade people's immune responses has made the development of a malaria vaccine technically difficult.

PATH[1] is an international, nonprofit organization that creates sustainable, culturally relevant solutions, enabling communities worldwide to break longstanding cycles of poor health. The PATH Malaria Vaccine Initiative (MVI)[2] is a global program established in 1999 through an initial grant of US$50 million from the Bill and Melinda Gates Foundation, which has since awarded MVI an additional US$207.6 million, including US$107.6 million to complete development of the most promising malaria vaccine candidate. MVI's mission is to accelerate the development of promising malaria vaccines and to ensure that they are available and accessible in the developing world.

Among the candidates in MVI's portfolio, the RTS,S vaccine of GlaxoSmithKline (GSK) Biologicals[3] is the most advanced. Created in 1987, the pre-erythrocytic vaccine candidate's early development was undertaken by GSK Biologicals, in close collaboration with the Walter Reed Army Institute of Research. In January 2001, GSK Biologicals, MVI, and other partners—with support from the Bill and Melinda Gates Foundation—entered into an agreement to develop the vaccine for children in sub-Saharan Africa. Clinical evaluation of RTS,S began in 1992 and the results since then represent a breakthrough for malaria vaccine development. RTS,S has proved to be effective for at least 18 months in reducing clinical malaria by 35 percent and severe malaria by 49 percent. *Time* magazine highlighted this project as one of the most important health accomplishments of 2005.

PARTNERS

Partners in the malaria vaccine project are

- from academia, New York University
- from government, Walter Reed Army Institute of Research
- a nonprofit organization, PATH Malaria Vaccine Initiative
- a pharmaceutical company, GSK Biologicals
- two health-research centers, the Center for International Health (CIH), Hospital Clínic

MIHR/PIPRA. 2007. Malaria Vaccine: Malaria Vaccine Institute and GlaxoSmithKline Biologicals. In *Executive Guide to Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices* (eds. A Krattiger, RT Mahoney, L Nelsen, et al.). MIHR: Oxford, U.K., and PIPRA: Davis, U.S.A. Available online at www.ipHandbook.org.

Editors' Note: This case study was prepared by MIHR members of the Technology Managers for Global Health (TMGH), a special interest group of the Association of University Technology Managers (AUTM) (see www.tmgh.org) and adapted for this *Executive Guide*. The original version was published as part of a collection of case studies: MIHR/TMGH. 2007. *Academic Licensing to Global Health Product Development Partnerships* (ed. U Balakrishnan). MIHR: Oxford, U.K.

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of the University of Barcelona and Centro de Investigação em Saude da Manhiça (CISM)

The Bill and Melinda Gates Foundation provided funding for the project.

TECHNOLOGY

This vaccine candidate is a recombinant protein that fuses a part of the *P. falciparum* circumsporozoite protein with the hepatitis B surface antigen molecule. Combined with a proprietary GSK adjuvant system, RTS,S induces the production of antibodies and white blood cells that are believed to diminish the capacity of the malaria parasite to infect, survive in, and develop in the human liver. In addition to inducing partial protection against malaria, the RTS,S vaccine candidate stimulates a protective immune response to hepatitis B, which commonly infects people in developing countries.

PROGRESS, CURRENT STATUS, AND GOALS

GSK Biologicals and MVI are currently conducting several small-scale trials in infants and young children, the groups most vulnerable to malaria and that would benefit most from an effective malaria vaccine. Working with in-country research institutions, clinical trials are ongoing in partner African countries, including Mozambique, Tanzania, Gabon, and Ghana. A variety of immunization schedules will be assessed, and the efficacy of the vaccine will be evaluated when administered with the Expanded Programme on Immunization. If these trials are successful, the partners will proceed to a large-scale Phase III clinical trial to determine the efficacy of the vaccine in the same age group. If all goes well, the RTS,S vaccine could be licensed as early as 2010.

ABOUT THE CLINICAL PARTNERS

The Center for International Health (CIH), Hospital Clínic of the University of Barcelona

The Center for International Health (CIH) is a pioneering structure within the University of Barcelona's Hospital Clínic, the leading Spanish biomedical research center.[4] The CIH is involved in health care, training, and research in global health issues. The collaborative programs in Africa, particularly the development of the Manhiça Health Research Center, which is in close partnership with Mozambican institutions, are a central component of the activities of the CIH.

THE CENTRO DE INVESTIGAÇÃO EM SAUDE DA MANHIÇA

Centro de Investigação em Saude da Manhiça (CISM) is the first peripheral health research center in Mozambique to undertake medical research into key health problems in that country. Founded in 1996, CISM was developed under a collaborative program between the Mozambique Ministry of Health, the Maputo School of Medicine (Universidade Eduardo Mondlane), and the Hospital Clínic of the University of Barcelona with core funding from the Spanish Agency for International Cooperation.[5]

MOZAMBIQUE'S MINISTRY OF HEALTH

The mission of Mozambique's Ministry of Health is to promote and preserve the health of the Mozambican population, to promote and provide quality and sustainable healthcare services, and to, with equity and efficiency, gradually increase access to sustainable healthcare for all Mozambicans. ■

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1 PATH: www.path.org.

2 Malaria Vaccine Initiative: www.malariavaccine.org.

3 GlaxoSmithKline Biologicals: www.gsk-bio.com.

4 University of Barcelona Hospital Clínic: www.hospitalclinic.org.

5 CISM: www.manhica.org.