



Vaccine and Infectious Disease Organization

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IMPROVING VACCINES FOR NEWBORNS

The Bill & Melinda Gates Foundation's Grand Challenges in Global Health Initiative

OVERVIEW

- In 2003, the Bill & Melinda Gates Foundation, in partnership with the Foundation of the National Institutes of Health, established the Grand Challenges in Global Health initiative.
- \$450 million US was made available for 14 global health challenges identified through consultation with scientists and public health leaders around the world.
- Two additional funding commitments were made by the Wellcome Trust (\$27.1 million), and the Canadian Institutes of Health Research (\$4.5 million).
- In June 2005, out of 1,500 proposals, 44 successful grants were announced.
- One of four Canadian teams, VIDO was offered a grant of \$5.6 million over five years for the project "Linking innate and specific immunity to develop single dose vaccines for neonates."

THE PUBLIC HEALTH PROBLEM

- Vaccination is one of the best ways to reduce sickness and death in infants and young children worldwide. Yet almost 30 million children have no access to immunization, and nearly two million children die each year of vaccine-preventable diseases (World Health Organization).
- Access to immunization varies widely around the world: a child in a developing country is 10 times more likely to die of a vaccine-preventable disease than a child in an industrialized country.
- Due to the unique immune systems of newborns, it is difficult to achieve a strong and balanced immune response with vaccination.
- Most existing vaccines require multiple immunizations (booster shots) - a major challenge in countries where it is difficult for families to travel for medical attention. Thus, vaccines are needed that are effective after a single dose (single dose vaccines).
- The template disease for this project is whooping cough (pertussis). Pertussis is still one of the most important diseases of young children, with an estimated global burden of more than 48.5 million cases and up to 300,000 deaths each year. In the developed world, nearly all mortality occurs in infants too young to have been vaccinated or in non-vaccinated older children.



FINDING THE SOLUTION THROUGH RESEARCH

- Over the course of the first four years of the project the research team has created a platform for single-dose vaccines by developing novel adjuvant formulations that create a broad and long-lasting immune response with a single immunization.
- Most disease-causing organisms enter mammals via mucosal surfaces. By immunizing here, vaccines formulated using the platform adjuvant will be more effective at preventing infection.
- The individual components of adjuvants are relatively inexpensive to produce on a large scale, so they can be readily used in developing countries. Multiple components are required as each component has unique characteristics, allowing the team to approach the problem from a number of directions.
- During these experiments, the research team has learned more about how the immune system of newborns works and how effective immune responses in the newborn can be created with a single immunization.
- Many of the test formulations that were screened for use were tested for which “marker” genes are up-regulated, or turned on, as a result of vaccination. These results were used to improve the formulation to achieve the goals for the project. These studies also supported comparisons of responses in newborn humans versus young animals.
- The team is also investigating the role of antibodies received by the newborn from the mother and possible ways of overcoming the interference of these antibodies with vaccination of the newborn.
- The team is also working to develop a formulation of the vaccine platform that is capable of being given without the need for a needle, yet still is capable of generating effective immune responses both at the mucosal surface and periphery of the body.

The technologies being developed will be “platform technologies;” that is, applicable across species and across diseases.

There will be applications for enhancing the immunity of newborns to many disease-causing organisms, and significance to numerous vaccines for both newborns and adults, with the potential for profound impact on the health and economic activity of developing countries.

RESEARCH TEAM

Lorne Babiuk, Principal Investigator (Chair, Management Committee); Andrew Potter; Volker Gerdts, (Scientific Manager); Sylvia van Drunen Littel-van den Hurk (Management Committee); Jim Holmstrom, (Project Manager) (with Bernadette Mah, University of British Columbia); Arshud Dar; Philip Griebel; Paul Hodgson; George Mutwiri; Scott Napper; Hugh Townsend; Heather Wilson

COLLABORATORS

Scott Halperin, Department of Pediatrics, Faculty of Medicine, Dalhousie University; Robert Hancock, The Centre for Microbial Diseases and Immunity Research, University of British Columbia; Mi-Nah Kweon, Chief of Mucosal Immunology, International Vaccine Institute, Korea; Song Fong Lee, Department of Applied Oral Sciences, Dalhousie University

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