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Use of system biology to identify genes associated with enhanced immunogenicity to a skin patch (nanopatch) delivered vaccine

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Vaccinations greatly reduce the burden of infectious diseases. The current vaccination methods using the needle and syringe, have a number of drawbacks. Firstly, they require liquid vaccine for delivery, as such, there is a need for cold chain during transportation. Secondly, intradermal (ID) and intramascular (IM) vaccination rely on trained personnel to perform these techniques. Finally, using needle and syringe introduce risks of needle-stick injury as well as the spread of blood-borne diseases. The Nanopatch mitigates these issues. Vaccine dry-coated onto the Nanopatch retains its activity even after six months at 25°C. The Nanopatch is designed to be easily administrable using a hand held applicator with the potential for self-administration. The Nanopatch delivers vaccine to the skin's viable epidermis and dermis layers. This reduces the possibility of damaging the blood vessels due to the array microprojections measuring only 0.11mm. We have previously shown that the Nanopatch is able to induce similar immune response with ID injection with 1/10th [1] and IM injection with a 1/100th of the vaccine dose in mice [2]. The Nanopatch has demonstrated to be a more advantageous route of vaccination than the conventional ID and IM, in both immunogenicity and administration. However there is still a need for a broader understanding of the mechanisms that lead to the enhanced immune response induced by the Nanopatch. To approach this question, we used systems biology methods to investigate which genes are up/down regulated at the site of vaccination. Here, I will discuss the Nanopatch molecular profile compared to ID. This study will contribute towards the knowledge for new potent vaccine development and better understanding of the molecular mechanisms of the Nanopatch action. We envisage the outcome will allow Nanopatch technology to translate from murine to larger animal models and ultimately leading into human clinical trials.

Biography

Germain Fernando completed his PhD at the University of Arizona, USA and postdoctoral studies at the Baylor College of Medicine in Texas, USA. He is now working as a Senior Research Fellow at the Australian Institute for Bioengineering and Nanotechnology (AIBN), University of Queensland, Brisbane, Australia, developing needle-free vaccines.

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