MULTI-TASKING AN INACTIVATED INFLUENZA VACCINE TO PROVIDE RAPID INNATE IMMUNE SYSTEM-MEDIATED AND SUBSEQUENT LONG-TERM ADAPTIVE IMMUNITY AGAINST INFLUENZA AND SECONDARY PNEUMOCOCCAL INFECTIONS

Brendon Y Chua, The University Of Melbourne
bychua@unimelb.edu.au
Chinn Yi Wong, The University Of Melbourne
Edin J Mifsud, The University Of Melbourne
Kathryn M Edenborough, The University Of Melbourne
Toshiki Sekiya, The University Of Melbourne
Amabel CL Tan, The University Of Melbourne
Francesca Mercuri, The University Of Melbourne
Steve Rockman, bioCSL Limited
Weisan Chen, Latrobe University
Stephen J Turner, The University Of Melbourne
Peter C. Doherty, The University Of Melbourne
Anne Kelso, WHO Collaborating Centre for Reference and Research on Influenza at The Peter Doherty Institute
Lorena E Brown, The University Of Melbourne
David C. Jackson, The University Of Melbourne

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The threat to global health posed by influenza warrants continued efforts to improve the protective capability of influenza vaccines particularly against outbreaks of novel strains. Both innate and adaptive immune systems differ in mechanism, specificity and times at which they take effect. The innate immune system responds within hours of exposure to infectious agents while adaptive immunity takes several days to become effective. Here we show, by using a simple lipopeptide-based TLR2 agonist, a low dose of an inactivated detergent-split influenza vaccine can be made to simultaneously stimulate and amplify both systems in animals to provide immediate antigen-independent anti-viral protection mediated by innate immune responses while giving the adaptive immune system time to effect long-term antigen-dependent immunity (Chua et al. 2015). This immediate effect protects against both homologous and serologically distinct heterologous viral strains within a day of administration for up to a week. The enhancement of the adaptive immune response is characterized by the induction of high levels of hemagglutinin and neuraminidase-inhibiting antibodies against homologous virus as well as viral nucleoprotein-specific primary CD8+ T cell responses, which act to reduce disease severity associated with heterologous viral infection and significantly mitigate the severity of infection caused by contact-dependent transmission. Results from the use of antibody deficient and CD8+ T cell depleted animals also indicate that the heterologous immunity bestowed by this vaccine co-formulation is attributed to robust recall T cell-mediated responses. Additionally, we also demonstrate that vaccination can significantly lessen the impact of secondary infections with Streptococcus pneumonia by reducing (i) viral-associated pulmonary bacterial burdens, (ii) levels of pro-inflammatory cytokines that normally accompany co-infection and (iii) the vascular permeability of the pulmonary tract thereby preventing systemic bacterial infection (Mifsud et al. 2015). These protective effects are achieved using a considerably smaller dose of vaccine than is usually required to induce biologically active antibody responses in animals. The value of this cost-effective method coupled with its ease of implementation and conferring of dual functionality on influenza vaccines could be especially beneficial for improving community protection particularly during periods between an outbreak and when a vaccine becomes available or in scenarios when there is imperative for mass vaccination against a strain to which the population is immunologically naïve.

References: