MicroCubes are protein-based vaccines that can accommodate various antigens and elicit strong T-cell responses. They distinguish themselves by unique crystalline organisation, resulting in slow-release of the antigen and self-adjuvanted stimulation of both arms of the immune system.

- HIV, Hep B, influenza, TB, oncology and many more disease antigens or combinations of antigens can be applied to MicroCube technology
- Heat and protease-resistance allows for conservation at room temperature
- Outstanding stability gives slow dissolution, releasing the antigen and generating sustained stimulation of the immune system
- Crystalline nature results in activation of both arms of the immune system with strong humoral and T-cell responses

THE CHALLENGE
Traditionally antiviral vaccines have been developed from attenuated or killed viruses because they induce superior T-cell responses. Unfortunately, this method of vaccination can only be extended to a few of the pathogens and may be associated with significant side effects. DNA vaccines or recombinant viruses have been investigated over the past decade and but have fallen short of their initial promise.

Many alternative antigen delivery systems have been actively investigated for greater efficacy, safety and ease of production. One successful system uses virus-like particles to self-assemble the viral structural proteins and this is the basis of recent successes such as anti-HBV, anti-HPV and malaria vaccine candidates.

Because many pathogens do not produce self-assembly particles, there are limitations to the size of the antigens that can be incorporated onto heterologous virus-like particle (VLP) scaffolds. Consequently, there remains a need for a versatile vaccine platform able to deliver antigens of various natures and size, inducing robust humoral and cellular responses.

THE TECHNOLOGY
Researchers from the Faculty of Medicine, Nursing and Health Sciences have developed the MicroCube vaccine platform. The ease of design and versatility of MicroCubes supports their use as a potential generic platform for vaccines against cancer and infectious diseases such as HIV, Hep B, influenza and TB.

The superior stability of MicroCubes indicates that they will be particularly suitable in cases where the cold chain is too costly or is impractical to maintain.

MicroCubes have been developed from protein crystals produced by common insect viruses. In nature, these crystals function to protect the virus particles and are thus robust and able to package large protein cargoes.

We have engineered MicroCubes to incorporate antigens of interest in place of the virus particles, thereby exploiting their remarkable robustness and multivalent presentation of antigens. Importantly, their capacity to accommodate cargoes of different sizes and structures is unique, and vastly superior to that of traditional virus-like particles.

Recent murine immunisation studies showed no toxic effect of MicroCubes and demonstrated that HIV Gag MicroCubes induce robust Gag-specific humoral and cellular responses. The technology has also demonstrated promising results when applied to the HA hemagglutinin antigen in a murine challenge model of influenza.


THE OPPORTUNITY
Monash seeks a partner to optimise and adapt the system for application to cancer and infectious diseases such as HIV, influenza, TB and Hep B.

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