Immunisation without a painful jab: Vaxxas revolutionise vaccine delivery

Zoe Boyer

Abstract: Vaxxas is a University of Queensland (UQ) start-up formed in 2011 by UQ's commercialisation company, UniQuest. Vaxxas is developing the high-density microarray patch (HD-MAP) to administer vaccines, resulting in a pain-free immune response without the need for refrigeration or a needle and syringe.

Keywords: Vaxxas, HD-MAP, vaccines, microarray patch

1. The success story

The recent COVID-19 pandemic has demonstrated how emerging infections can have a serious and lasting impact globally. It is clear that our best line of protection from such diseases is vaccination. However, traditional vaccination technology comes with its own challenges, including the need for costly cold-chain storage. The University of Queensland (UQ) start-up company Vaxxas Pty Ltd is set to revolutionise vaccine delivery through its innovative High-Density Microarray Patch (HD-MAP).

2. Where did we start?

Having previously undertaken research involving vaccine delivery at Oxford, Professor Mark Kendall arrived at UQ in 2006, well-versed in the challenges encountered in this field. Leading the team out of UQ's Australian Institute for Bioengineering and Nanotechnology, Professor Kendall sought an innovative approach to delivering vaccines, with the aim of increasing global vaccine accessibility, particularly in low and middle-income countries . The outcome was the development of the high-density array patch, which addresses the issues encountered in traditional vaccine administration. A comprehensive IP protection and commercialisation strategy was initiated and deployed by UniQuest, the commercialisation company of UQ.

3. Our technology

The HD-MAP is a one-centimetre square patch consisting of thousands of micro-projections, each a quarter of a millimetre in length, dry-coated with a concentrated vaccine suspension that is stable at 40°C over 12 months.

When applied, these micro-projections penetrate and directly deposit the vaccine solution within the dense population of key immune cells located under the skin. The

micro-projections are short enough to avoid the deeper nerve cells in the skin that register pain, thus ensuring the pain-free delivery of the vaccine.

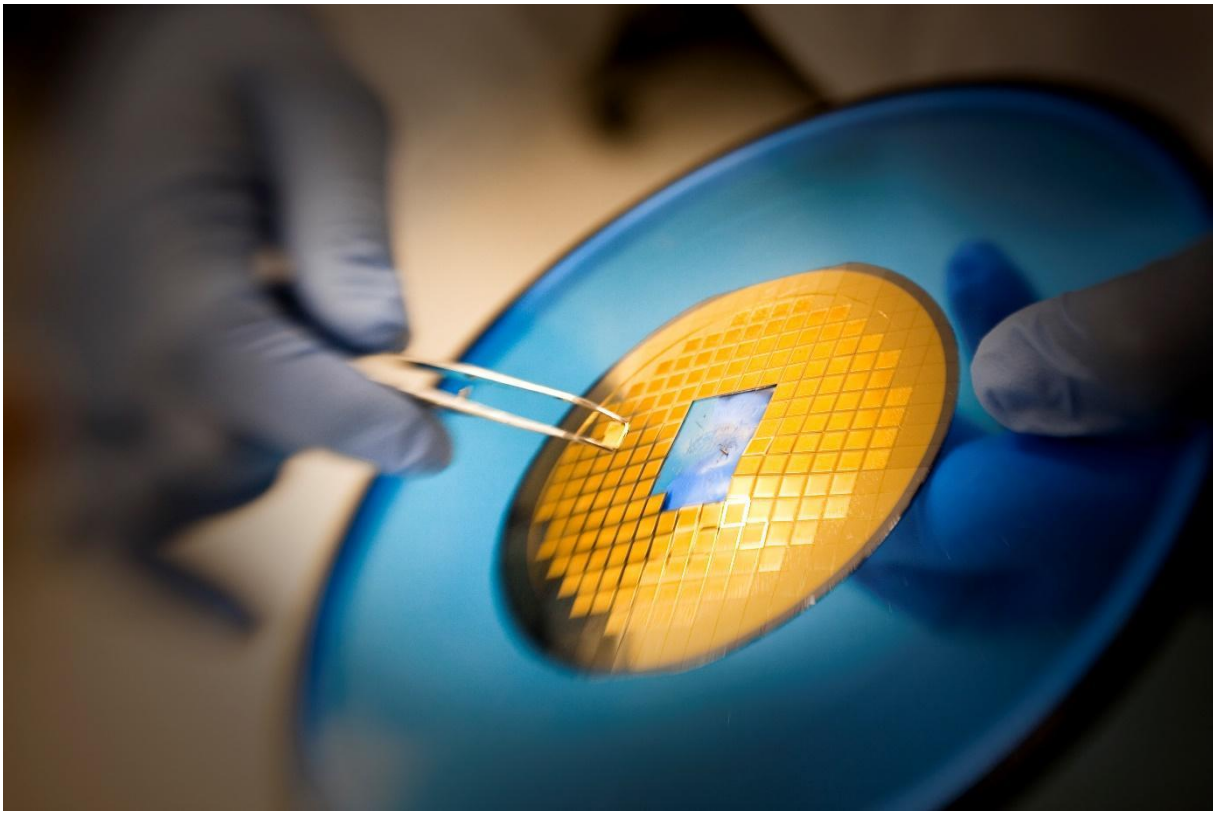

Figure 1. The Vaxxas nanopatch can immunise against disease with a simple 'click' applicator, where thousands of microscopic projections almost imperceptibly deliver vaccines into the skin.

4. The journey so far

Vaxxas was established in 2011, following the investment of AU$15m from a syndicate of investors sought out by UniQuest. Since then, they have achieved a number of significant milestones. In 2012, Vaxxas announced a research collaboration with pharmaceutical company, Merk & Co, with an option to licence the technology for production of their vaccines. As global interest in the HD-MAP technology grew, Vaxxas secured series B investment of AU$25m in 2015.

Vaxxas continued to develop the HD-MAP technology and by March of 2020, they published promising results from a phase I clinical trial. Here they demonstrated a strong protective immune response to influenza accomplished through HD-MAP immunisation, with the vaccine suspension remaining stable when stored at high temperatures. However, 2020 brought additional challenges that no one could predict. *"We initially faced the same challenges as any other business, with restrictions on coming into the workspace ... and supply of materials were lacking ... which slowed us down and created a few barriers"* says Chief Development and Operations Officer, Dr Angus Forster. *"Then all of sudden it wasn't just about vaccine development, but how you get people vaccinated".*

The focus shifted to the translation of pre-clinical models to clinical trials, working towards scaling up the technology from small-scale laboratories to commercial production to facilitate vaccination roll-out, particularly in the context of future pandemics. To accomplish this, the start-up sought out a partnership with German sterile manufacturing company Harro Hölfiger. Further interest was generated, culminating in additional partnerships, including with the US Government, the Bill and Melinda Gates Foundation and, closer to home, the Queensland Government. *"It's a dynamic space to be based in,"* says Dr Forster, *"the profile of vaccination scientists has gone up...public awareness of vaccines has increased ... it's an amazing time to be working in vaccines".*

5. Look to the future

Over the past decade Vaxxas has continued to grow from a small start-up company to one with over 75 employees. Having refined the HD-MAP technology and publishing promising phase I clinical trial results last March, Vaxxas is now preparing to undertake further clinical trials in association with the University of the Sunshine Coast. CEO David Hoey has said the HD-MAP technology was likely to play an important role in future pandemics because it ensured vaccines could be quickly and easily deployed to the global population. *"Vaxxas' HD-MAP will make it possible to post vaccines directly to people in their homes. The patch is easy to use and doesn't require a nurse or doctor to administer the vaccine. So, if you can use one-sixth the vaccine to get the same results faster, you can get it made up and deployed far more quickly and, as we are learning, speed is everything in a pandemic response."*

The HD-MAP technology will undoubtedly shape how we deliver our vaccines in the future on a global scale. The patch eliminates the need for complex cold-chain storage due to the increased stability of the dry-coated formulation. This makes the HD-MAP vaccines cheaper to transport and store, potentially benefiting lower- and middle-income countries.

Further benefits of the HD-MAP technology includes the removal of the risk of needle-stick injuries to healthcare workers and the creation of a simple and pain-free vaccination process, helping children and adults with needle phobias. Hoey concludes that *"this new technology could allow for home-delivered vaccinations, where families could safely and effectively self-administer vaccines in future pandemics during quarantine or isolation".*

The company

vaxxas

Vaxxas Pty Ltd (CAN 152 205 242)

Suite 13.02, Level 13

179 Elizabeth Street

Sydney, NSW, 2000

Australia
https://www.vaxxas.com/

Investment Rounds (collected in 05/08/2021)

| Series A | August 2011 | One Ventures | A$15m |

| Series B | February 2015 | One Ventures | A$25m |

| Grant| March 2017 | Bill & Melinda Gates Foundation| A$5m |

Main facts (collected in 05/08/2021)

The Company started in 2011.

The first product is currently undergoing clinical trials.

The company currently employs over 75 employees.

The next milestone is scaling up the technology from small-scale laboratories to commercial production to facilitate vaccination roll-out, within the context of potential future pandemics.

Zoe Boyer is a third year medical student at Macquarie University's recently established Doctorate of Medicine, where she focuses heavily on global health. She has a practical understanding of the Australian Healthcare system and how it services individuals both in metropolitan centres and regional areas. Zoe is an experienced researcher and has expertise in the field of bioinformatics. She holds a Bachelor of Medical Science (Honours) at University of Sydney where she undertook additional research focusing heavily on HIV genome sequencing for the Centre for Virus Research at The Westmead Institute for Medical Research.

Zoe has also had a long standing professional role within the Prostate Biobanking team at Garvan, where she facilitates the collection and management of biobanking data.