USING THE COLD VIRUS TO KILL CANCER CELLS

How an accidental discovery led to one of the largest biotech buyouts in Australian history – and a potential game changer for cancer patients

Professor Darren Shafren's research into the common cold virus led to a major cancer treatment breakthrough and one of the largest biotech acquisitions in Australian history.

In 2018, pharmaceutical company MSD (a subsidiary of US-based Merck & Co., Inc.) acquired the Australian virotherapy firm Viralytics and the rights to its cancer-busting drug CAVATAK® for $502 million (AUD).

Professor Shafren developed CAVATAK®, founded Viralytics with support from the University of Newcastle, and spent nearly 20 years guiding his experimental drug through various clinical trials.

He is now the Chief Scientific Officer in a new private venture that aims to develop more cutting-edge cancer therapies to improve outcomes and quality of life for cancer patients worldwide.

The CAVATAK® history

While traditional cancer treatments such as surgery, radiotherapy or chemotherapy have improved over time, they still come with serious and sometimes debilitating side effects. Their effectiveness also varies depending on the type and stage of the cancer.

Science has more recently focused on the nature of the underlying cancer cells, rather than the affected organs. Principal among the new cohort of oncology treatments are immunotherapies, which essentially introduce viruses to induce an immune response against cancerous tissues.

Immunotherapy represents a new paradigm in cancer treatment and is proving to be particularly useful in late stage and metastatic diseases where conventional therapies fail.

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Professor Shafren recognised the potential for immunotheraphy treatment after an unexpected turn in his research.

He was originally investigating ways to prevent the cold virus from binding to molecules in the lungs, nasal passage and respiratory tract.

In 1999, he was approached by a colleague trying to find new ways to kill melanoma cells in the laboratory setting. On a whim, Shafren suggested using the airborne virus Coxsackievirus A21, one of the causes of the common cold. It obliterated the melanoma cells.

Later that year the University of Newcastle helped Professor Shafren patent the use of CAVATAK® in oncology and form Viralytics.

How CAVATAK® works

CAVATAK® is a genetically unmodified formulation of Coxsackievirus A21 (a form of the common cold). It targets, infects and destroys a wide range of cancer cells, both at the tumour site and throughout the body.

It works by seeking out and attaching itself to a protein that is highly expressed on the surface of many cancer cells (ICAM-1). Once attached to this protein, the virus inserts itself into the cancer cell, replicates and bursts the cell apart.

CAVATAK® can kill both local and metastatic cells, which means it can be used as a single agent, in combination with immunotherapies, or in partnership with traditional chemotherapy.

Other unique attributes of CAVATAK® include:

- potential application across a range of cancers
- potential application by three routes of administration (intralesional, intravenous and intra vesical)
- low toxicity with low levels of Grade 3 or greater adverse events for patients
- its small size (25nm) and non-enveloped nature, which enables it to disseminate more widely in the body than larger oncolytic viruses
- fast replication cycle (6 hours) resulting in a potentially more rapid response

Major milestones

1998: Professor Shafren makes an unexpected discovery about the power of the cold virus in killing cancer cells.

1999: The University of Newcastle helps Shafren secure the first patent for CAVATAK® in oncology treatment. It also helps Shafren establish the virotherapy firm Viralytics.

2004: The first dose of CAVATAK® is administered in a clinical trial in Newcastle, NSW.

2007 – 2009: Shafren and Viralytics partner with several Australian hospitals on Phase 1 clinical trials of the drug.

2010: US Food and Drug Administration (FDA) approves a new drug application for CAVATAK®, which enables trials in melanoma patients.

2011: FDA grants Viralytics an investigational new drug application for a Phase 2 clinical trial in patients with late-stage melanoma.

2015: Merck & Co, Inc., and its Australian subsidiary MSD enter into a formal agreement with Viralytics to evaluate CAVATAK® in combination with Merck's KEYTRUDA™ drug in certain cancers – the first trial of its kind.

2018: MSD acquires Viralytics and the rights to CAVATAK® for $502 million (AUD). Professor Shafren continues to work with MSD to advance clinical trials and develop the experimental drug into a commercial product.

Research impact

Clinical trials involving patients who received CAVATAK® as a stand-alone treatment have consistently shown significant tumour reduction. The drug has also been highly effective in combination with other immunotherapy drugs.

CAVATAK® is currently being investigated in Phase 1b clinical trials in combination with checkpoint inhibitors for patients with advanced melanoma, lung cancer and bladder cancer. These comprise three of the six most prevalent cancer types in the United States, and two of the five most diagnosed cancers in Australia.

To learn more about this research program:
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