

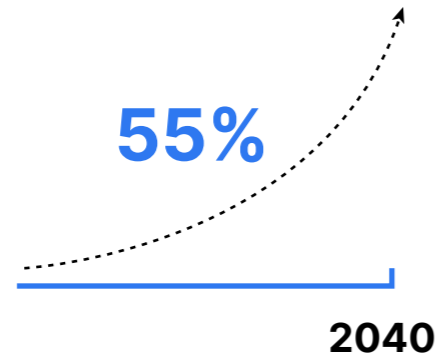


How Cancer Vaccines Work

Introduction¹

In 2020, there was approximately:

With cancer incidence rates projected to rise:



Occurring in more than four in 10 new cases of cancer, common types include:



Lung



Female breast



Bowel

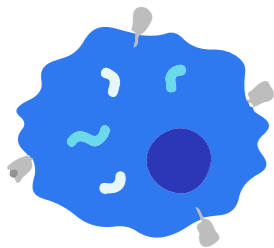


Prostate

Current cancer vaccines are important because they can prevent certain cancers and enhance the immune system's ability to target and treat cancer cells.

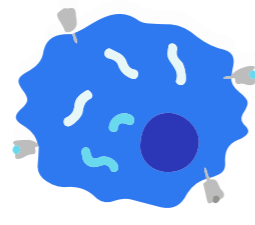
Mechanism and Types^{2,3}

Two main classes of tumour antigens targeted by T cell immunotherapies:



Tumour-associated antigens (TAAs)

and



Tumour-specific antigens (TSAs).

TSAs are expressed only in tumour cells, produced by mutations that create novel peptide sequences. TAAs may be present in normal cells but are expressed at higher levels or are more accessible in cancer cells.

The main types of cancer vaccines are DNA, RNA, peptides, whole cells, dendritic cells, and viral vaccines.

Current and Emerging Cancer Vaccines

Selected Approved Therapeutic Cancer Vaccines⁴

Melanoma Cancer Vaccine

Talimogene laherparepvec is approved to treat advanced melanoma.⁴

Prostate Cancer Vaccine

Sipuleucel-T is approved to treat metastatic prostate cancer⁴

Bladder Cancer Vaccine

Bacillus Calmette-Guérin (BCG) is approved to treat early-stage bladder cancer. It is made of inactivated tuberculosis-like bacteria.⁴

Nadofaragene fireadonevec is approved for early-stage bladder cancer that has progressed despite BCG therapy.⁴

Selected Ongoing and Emerging Clinical Trials⁴⁻⁷

Head and Neck Cancer Vaccine

Phase I/II clinical trial for HPV-associated head and neck cancer vaccine.⁴

LungVax:

Researchers at the University of Oxford, the Francis Crick Institute, and University College London have received funding from Cancer Research UK and the CRIS Cancer Foundation to develop a preventative lung cancer vaccine, 'LungVax'.⁷

Pancreatic Cancer Vaccine

Autogene cevumeran is a personalised mRNA vaccine that is being tested to prevent recurrence of pancreatic cancer after surgery.⁶

Melanoma

A Phase III study has just started for mRNA cancer immunotherapy for melanoma. Including 1,089 patients with melanoma, the study is testing mRNA-4157 and pembrolizumab against the use of pembrolizumab alone, in individuals with high-risk Stage II-IV melanoma.⁵



Future of Cancer Vaccines and Potential Impact

NHS Cancer Vaccine Launch Pad⁸

The NHS Cancer Vaccine Launch Pad (CVLP) is a program aiming to accelerate the access to personalised cancer vaccine clinical trials for people with cancer.

This initiative aims to provide up to 10,000 patients with personalised cancer treatments in the UK by 2030.

Future Outlooks^{9,10}

Many factors can improve the clinical efficacy of cancer vaccines, including finding new cancer antigens, optimising delivery methods, and strategic patient selection for example.

Lipid nanoparticles have shown promise as a carrier for mRNA cancer therapies.

Four potential research hotspots and frontiers for future research could be, 'immune checkpoint inhibitors', 'tumour microenvironment', 'T-cell suppressor', and 'dendritic cells'.

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