

Immune Thermometer: Algorithm to Quantify Tumour Immune Activity



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Diagnostics

Problem

Immunotherapies such as PD-1/PD-L1 checkpoint inhibitors have revolutionised cancer treatment, but they only work effectively in subset of patients – those with immune-hot tumours. Identifying these patients in advance is critical to improve outcomes and avoid unnecessary treatment for those unlikely to respond.

Furthermore, the push toward personalised immunotherapy has created a robust demand for better diagnostics. Tests that determine a tumour's immune status represents one of the fastest growing segments in precision oncology. The Immuno-Oncology Assays market is projected to reach approximately \$10 billion by 2034 driven largely by the expanding use of predictive tests for immunotherapy eligibility.

Solution

This invention, Immune Thermometer is a computational algorithm that measures the “immune warmth” of tumours by analyzing their gene expression profiles. It processes standard RNA sequencing (RNA-seq) data from a patient's tumour sample to evaluate specific immune gene signatures, yielding a composite Immune Activity Score. A higher score indicates a stronger immune activation in the tumour microenvironment, allowing the algorithm to automatically classify each case as immune-hot or immune-cold. This pan-cancer approach is applicable to all human solid tumours – a notable novelty compared to many existing tests that are often limited to certain cancer types.

In clinical settings, the algorithm can be used as a companion diagnostic: given an RNA-seq profile from a routine tumour biopsy, it automatically generates a digital immune score indicating

whether the tumour is immunologically hot or cold. An immune-hot tumour (high score) suggests active T-cell infiltration and a higher likelihood of positive response to immunotherapies. In contrast, immune-cold tumours (low score) may benefit from alternative strategies (e.g. combination therapies to stimulate immune activity).

Intellectual Property Status

This technology is the subject of an Australian provisional patent application filed in March 2026.

Potential Commercial Applications

- Patient selection and stratification for immunotherapies
- Companion diagnostics development
- Clinical trial enrichment
- Translational cancer research
- Retrospective analysis of existing RNA-seq datasets

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Publication

A pan-cancer computational model for predicting immunotherapy response by quantifying tumor immune activity, Cancer Letters, Volume 648, 2026

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