

Taking quantitative approach to immune system study, researchers gain deeper understanding of T cell behaviour

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Credit: AI-generated image ([disclaimer](#))

Although our immune system is largely responsible for fighting disease and regulating our overall health, it can sometimes use a little help. The EU-funded QUANTI (Quantitative T cell Immunology) project intends to provide this help by shifting the immunology research landscape away

from a qualitative approach and towards a quantitative one.

The problem with current synthesising models and immunological data is they cannot be managed by immunologists, mathematicians, computer scientists or physicists alone. Instead, the QUANTI project combines all these disciplines into their research in order to provide a coherent framework for understanding the dynamics of peripheral T [cells](#) during adaptive immune responses. The result is the development of new, quantitative concepts for characterising and therapeutically modifying immune responses.

Breakthroughs on multiple fronts

Through a range of work packages, the project has already produced some important breakthroughs. For example, one QUANTI team, working in conjunction with a team of Australian researchers, is embracing quantitative practices to gain previously unachievable insights into how the size of immune responses are controlled. The team is following the behaviour of hundreds of cells using new imaging and computational biology approaches developed specifically for the project.

From this research, the scientists discovered that when immune T cells face a new infection, they increase in number via cell division – essentially creating an army ready for battle. According to an article published in *Nature*, after an infection is eradicated, these T cell armies stop expanding and die off, leaving behind a few memory cells that provide long lasting immunity. Researchers believe that this insight will prove influential in improving vaccinations and developing new ways to treat autoimmune diseases.

A shift to a system-level strategy

This discovery was only possible thanks to QUANTI's innovative combination of laboratory techniques with mathematical analyses – representing a remarkable improvement in research efficiency. In the past, these scientists would have had to invest considerable time tracking [immune cells](#) using microscopy, a process that limits one to watching individual cells over the course of days to see whether they are dividing or dying. Now, with the QUANTI approach, scientists have the capability to simultaneously follow hundreds of T cell families, thus giving them a broad view of how their behaviour is influenced by which family they belong to.

Clearly, by adopting a multi-disciplinary and inter-sectorial research environment, the QUANTI project is advancing the development of new quantitative concepts to characterise and therapeutically modify immune responses. Ultimately, this innovative, hands-on and inter-disciplinary approach to biomedical sciences will spearhead the shift from a qualitative, molecule-orientated approach to immunology to a quantitative, systems-level research strategy.

More information: Project website:
www1.maths.leeds.ac.uk/applied/QUANTI/

J. M. Marchingo et al. T-cell stimuli independently sum to regulate an inherited clonal division fate, *Nature Communications* (2016). [DOI: 10.1038/ncomms13540](https://doi.org/10.1038/ncomms13540)

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