

Understanding the immune system to help advance precision oncology

Our knowledge of the immune system has grown significantly over the centuries. We can now help our own defense system to combat disease with the latest immunotherapies. Here are a few achievements illustrating how the study of immunology has advanced through the years:

1796

Edward Jenner is recognized as the “father of immunology” with his work in vaccination—using cowpox to inoculate patients and protect against smallpox.



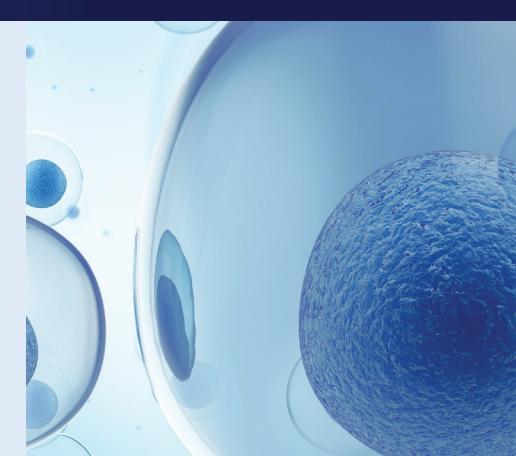
1890

Emil von Behring and **Shibasaburo Kitasato** report an antitoxin serum for diphtheria, which we now know consists of antibody proteins. Von Behring received the Nobel Prize in 1901 for this work, but Kitasato did not.



1957

Frank Macfarlane Burnet postulates clonal selection theory to explain how lymphocytes respond to antigens. We now know that each lymphocyte has a single type of receptor with unique specificity to an antigen.



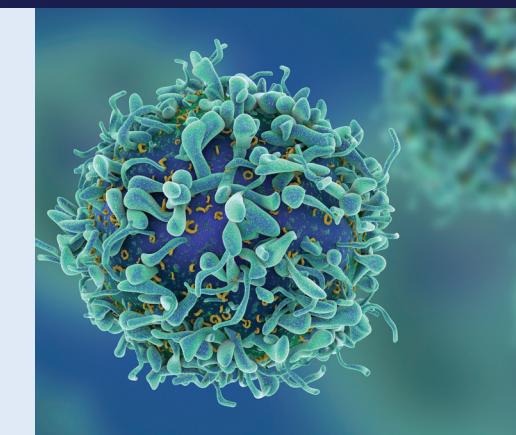
1976

Susumu Tonegawa determines the genetic mechanism that produces antibody diversity. He was awarded the Nobel Prize in 1987 for his efforts. This finding forms the basis of understanding how a finite genetic region can encode an infinite range of antigen-specific receptors.



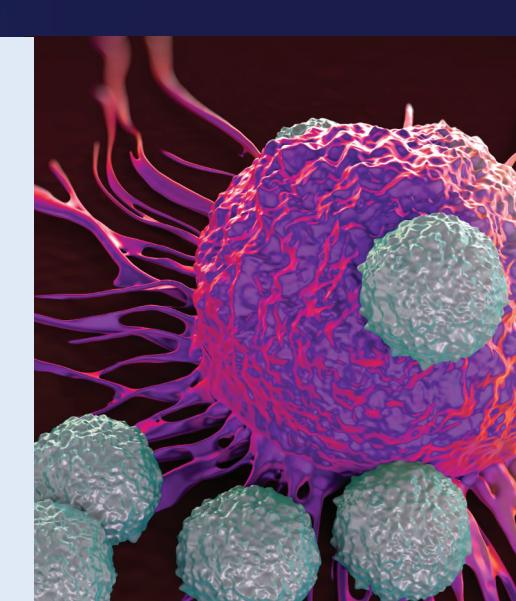
1983

Tak Wah Mak and **Mark Davis** discover a T cell receptor (TCR) gene in human and mouse, respectively. This was crucial for understanding how the TCR complex recognizes specific antigens to elicit a response.



1992–1995

Tasuku Honjo and **James Allison** discover how PD-1 and CTLA-4 act as checkpoint proteins in T cells to suppress the ability of the immune system to fight cancer. Their independent work has led to the development of immunotherapy drugs, and they were jointly awarded the Nobel Prize in 2018.



Present

Targeted next-generation sequencing is enabling researchers to understand the immune system at an unprecedented level. Analysis of clonal expansion, diversity, and convergence is now possible with the **Ion Torrent™ Oncomine™ immune repertoire assays**. These assays enable biomarker discovery and may improve predictive outcomes for immunotherapies.



Find out more at thermofisher.com/immune-repertoire