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PROJECTS FUNDED AT THE UNIVERSITY OF PADUA

CLIN-TCR - Translating TCR–Antigen Pairing to Clinical Relevance: A Platform for Cancer and Autoimmune Applications

Our immune system protects us by recognizing harmful threats such as infections and abnormal cells, including cancer cells. At the same time, it normally learns to distinguish what belongs to our body from what does not, so that our own tissues are not attacked. When this self-tolerance fails, autoimmune diseases can arise. A key role in immune recognition is played by T cells, which use specialized “sensors,” called T cell receptors, to detect small molecular targets displayed on cells. Understanding which receptors recognize which targets is essential for developing better diagnostic tools, personalized therapies, and new vaccines. However, current technologies can identify only a limited number of these interactions and are often biased toward targets that are already known. In previous research, we developed an innovative technology that can systematically and unbiasedly match T cell receptors with their corresponding targets. This approach has been validated in proof-of-concept experiments and is protected by a patent application filed by our institution. The aim of this project is to demonstrate the clinical value of this technology by applying it to cancer and autoimmune diseases. In cancer, the platform will help identify immune receptors that recognize tumor-associated targets, including those specific to individual patients. In autoimmune diseases, it will reveal which receptors are involved when the immune system mistakenly reacts to the body’s own components. By generating and validating large datasets of clinically relevant receptor–target pairs, the project will provide new biomarkers for disease monitoring and new opportunities for immune-based therapies. In parallel, it will strengthen the intellectual property position and define a clear strategy for future commercial development. Overall, this work has the potential to open new avenues for precision medicine and accelerate the development of next-generation immunotherapies and therapeutic vaccines.

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