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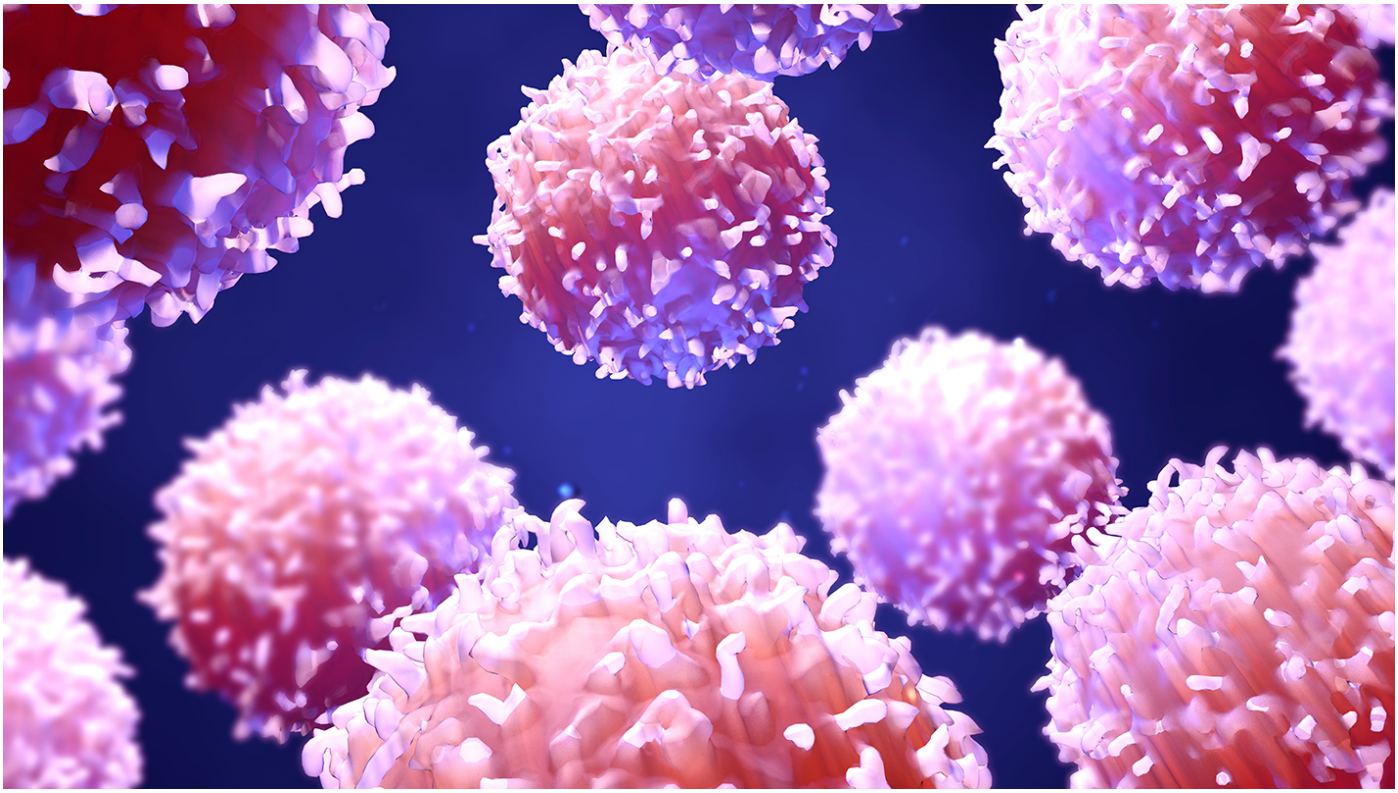

The Immunometer Project

Institute for Immunity, Transplantation and Infection

The immune system is one of the most important systems in the body in determining health. When it works well, it defends us daily against a vast array of bacteria, viruses, and other pathogens, often without us even knowing that we were infected. When we get ill with a cold or flu virus, for example, it works diligently to fight the virus, generally eliminating it in days or at most a few weeks. But it can also make mistakes, which can be seen in the dozens of autoimmune disorders in which the immune system attacks a particular tissue or organ, mistaking it as an invading pathogen. Multiple sclerosis, juvenile (or Type I) diabetes, Lupus and rheumatoid arthritis are all examples of this class of disease. It also can direct immune reactivity against essentially innocuous components of food, pollen or contact agents, resulting in allergic disorders such as anaphylaxis, asthma, and atopic dermatitis. These allergic disorders now affect an increasing proportion of the population of the developed world.

Our immune system is also implicated in many cardiovascular and other diseases involving inflammation, and recent work has highlighted its ability to destroy cancerous cells. But despite the importance of our

immune system, we have no established biomarkers to tell us whether or not it is working well, as it often isn't in very young children and especially in older adults.

At Stanford, we have pioneered the development and use of sophisticated assays to probe the complexities of the human immune system. We have used these systematically to understand human immune variation in long-term studies of aging, genetics, and children. We are completing the largest analysis to date of individuals in our "Thousand Immunomes" study for which we have combined an extensive series of immunological tests carried out by our innovative Human Immune Monitoring Center with health information of individuals gathered from the clinic. These data have already given clear warning signs of disease well before it becomes clinically noticeable. As part of the study, most participants have also received the flu vaccine as a kind of "immunological stress test" that enables us to measure their response to this common vaccine. This groundbreaking research inspired us to launch "The Immunometer Project" to develop a simple test for immune function that would be like a cholesterol test in cardiology; that is, to give an early warning of problems in a person's immune system, so that corrective action might be taken.

We seek funding to broadly survey the immune systems of patients in various Stanford clinics, so we can ask important questions, such as, "What are the immunological characteristics of patients with different cardiovascular syndromes? Different types of cancer? Autoimmune diseases? Allergic disorders?" We strongly suspect that many poorly understood diseases or syndromes have an immunological component that hasn't been discovered yet. These participants will also receive the flu vaccine to generate a more active immune response.

With funding of $5 million over the next five years, we can pursue our goal of providing a clinically actionable draft set of metrics that can identify subjects at risk for specific types of disease and the therapeutic they will respond to most effectively. This knowledge could be truly transformational to the field of medicine, helping inform patients and their physicians as to how they can make smarter, more precise decisions earlier in the course of treatment.

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