GROUND BREAKING NEW METHODOLOGY PUBLISHED IN NATURE MEDICINE UNCOVERS THE MISSING NUMBERS TO THE ONLY CLOCK THAT REALLY MATTERS IN THE BODY – YOUR IMMUNE AGE.

There is the age you say you are – which is not always accurate but always medically irrelevant.

There is your chronological age – which is accurate but ignores inter-person variation.

And then there is your immune age - the key determinant of future health and response to disease and treatment - quantified now for the first time, creating a potential paradigm shift in drug and vaccine development and medical practice.

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TEL AVIV, Israel – New data, published in Nature Medicine, from scientists at the Technion, Stanford and CytoReason describes for the first time ever a way to reliably quantify a person's "immune age". This game changing capability provides a much more reliable predictor for the status of your immune system than any other method and could lead to fundamental changes in drug & vaccine development and medical practice.

The immune system is the critical function in the body for managing health. It is a complex system with hundreds of different cell-types. Until now, no metric had existed to quantify an individual's immune status. This ground-breaking new data, while requiring further development, describes a metric (called IMM-AGE) by which we can accurately understand a person's immune status, providing increased information for accurate prediction and management of risks for disease and death.

This new capability will have major drug development implications: Given the importance of immune status in vaccine response, this new data could play a significant role in both the design of future vaccine trials and in re-evaluating past vaccine trials. Moreover, this new metric for immune aging could see chronological age augmented by "immune age" as a way of improving drug development programs - providing for enhanced clinical trial entry/exclusion criteria that can elicit a more homogenous response and greater likelihood of success.

"This paper represents a very important step towards developing useful measures of immunological health, helping to identify disease-related risk", said Prof. Mark M. Davis, Head of the Stanford Institute for Immunity, Transplantation and Infection. "It's been sixty years since the last immunological benchmarks (Complete Blood Counts) were introduced into general medical practice. This much more sophisticated method reflects the tremendous explosion of knowledge generated in the field."

The researchers developed their unique data by following a group of healthy volunteers (135) for nine years, taking annual blood samples which were profiled against a range of 'omics' technologies (cell subset phenotyping, functional responses of cells to cytokine stimulations and whole blood gene expression). This captured population- and individual-level changes to the immune system over time, which when analyzed using a range of novel, immune aligned, machine learning analytical technologies, enabled identification of patterns of cell-subset changes, common to those in the study, despite the large amount of variation in their immune

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system states. The data and metrics generated was then validated against a cohort of more than 2,000 patients from the Framingham Heart Study

"Starting in 2007, this study is really the birthplace of CytoReason – the beginning of the collection of the unique immune-focused data sets and the development of specific technologies to interrogate and transform these highly complex, multi-dimensional data into increased big-picture knowledge and clinically meaningful insights", said Prof. Shen-Orr, Head of Systems Immunology & Precision Medicine lab at the Technion and Co-Founder and Chief Scientist at CytoReason. "The immune age is a biological clock that will help to identify in individuals, the decline and progress in immunity that occurs in old age – with the aim of determining preventive measures and developing new treatment modalities to minimize chronic disease and death."

The research team consisted of Prof. Shai Shen-Orr and Dr. Elina Starosvetsky (CytoReason and Technion), MD/PhD student Ayelet Alpert, Dr. Yishai Pickman (lead equal co-authors) and other members of the Systems Immunology & Precision Medicine Lab at Technion, Prof. Mark M. Davis and colleagues from Stanford, and Dr. Renaud Gaujoux, Lead Data Scientist at CytoReason.

About CytoReason

Based on more than 10 years of research, CytoReason's technology uses a proprietary data and machine learning model to reconstruct cellular information from bulk tissue, to train an immune-specific NLP engine, and to integrate multi-omics data. The company's platform organizes and standardizes collaborators' data (gene, protein, cell, and microbiome) and integrates it into CytoReason's proprietary disease model to generate mechanistic understanding of the immune system, leading to novel insights.

CytoReason's technology has yielded 2 pending patents, 10 commercial and scientific collaborations and 16 peer reviewed publications. Fully applicable to cancer immunotherapy, autoimmune, neurodegenerative and infectious disease research, CytoReason is at the cutting edge of society's boldest attempts to improve health outcomes through better understanding of the immune system.

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