TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

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ODE Models of Human T-cells in Aging and Immune Disease

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Abstract.

The human body hosts a vast pool of T-cells, a crucial component of the adaptive immune system. The thymus provides a constant supply of new T-cells to the peripheral blood, but its productive capacity is compromised by both chronic and acute forms of atrophy; the former is a normal part of healthy aging, while the latter occurs during times of physiological stress. Partitioning the T-cell pool into "compartments" based on clone size, we formulate a high-dimensional system of ODEs that describes the dynamics of the full human T-cell pool. Capturing the process of age-induced atrophy with a non-autonomous model form, we explore the heretofore unknown causal relationships between the chronic thymic atrophy, T-cell diversity loss, and immune dysfunction all observed in aging individuals. Describing the acute atrophy/recovery cycle with an autonomous model form, we predict equilibrium values to which the T-cell pool converges after a change in thymic productivity levels, as well as the rates at which this process occurs, and consider the broad immunological implications of our findings.