Systems Biology For Cell Proliferation Quantification And Modeling Of Lymphocyte Dynamics:
T-Cell Heterogeneity Dynamics Across Aging And Genetic Origins.

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Abstract:

Cell proliferation is the common characteristic of all biological systems, but the quantification, modeling and control of cell proliferation remains a challenge of systems biology. Understanding cell proliferation dynamics requires specific experimental methods and mathematical modelling. This concerns the heterogeneity of T cell populations that continuously differentiate in the immune system, and modify their renewal and fluxes across tissues in response to perturbations and aging. Then, lymphocyte sensitivity to depletion of dividing cell and their recovery post-depletion have allowed us to quantify and model lymphocyte dynamics and renewal. Moreover, following the in vivo staining of cells to reveal their progression across the cell cycle phases, we revealed the heterogeneity of cell populations according to their states and phenotypes, and quantified the percentage of dividing cells and dead cells. Our investigation is based upon single-cell multi-parameter flow cytometry analysis thereby revealing the active incorporation in DNA of a thymidine analogue during S phase after pulse-chase experiments, versus cell DNA content. A generic mathematical model that simulates through ODEs and state-transition diagrams the evolution of single cell behavior during the experiment allows us to fit our data, to estimate proliferation rates and mean cell cycle phase durations in sub-populations. Our model is flexible and can be used with various pulse/chase experiments and even for other cell types.

We revealed the heterogeneity of lymphocyte proliferation, and signatures of T-cell population dynamics through their differentiation from the thymus to the spleen, across aging of the organism and dependent on the genetic origins.

Bio:

PhD in Immunology, researcher at CNRS she founded the “Integrative Immunology: Differentiation, Diversity, Dynamics” team and the ImmunoComplexiT network to better understand “Complex Systems”.

From experimental investigation in murine models, she developed systems immunology to model T cell dynamics by mathematical and computational approaches.

https://immunocomplexit.wordpress.com/an-overwiew-on-modelling-t-lymphocyte-dynamics-from-physiology-to-perturbations-of-immune-system/