Multi-scale modelling of Inflammation

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Inflammation is the response of the innate immune system to a range of external and internal cues and is regulated by a highly complex and intricate network of cytokines and a host of other molecules. A dynamic balance between the two pro- and anti-inflammatory cytokines, their receptors, regulators and other adaptor molecules defines the nature and extent of inflammation and the outcome of the pathology. It is this delicate interplay among various molecular players that brings in the complexity and the ability to adapt to multiple situations. On one hand, inflammation is essential for triggering a rescue and repair response upon infections and endogenous signals such as tissue damage. On the other hand inflammation itself damages tissues and can be an underlying cause of several diseases. This dualistic nature of inflammation has made a clear definition rather difficult. Simple associations with individual molecules and linear correlations will therefore not suffice. Instead, a systems perspective of inflammation is necessary to obtain a quantitative appreciation of its induction, extent, duration, regulation and resolution. This understanding will be the key to more accurate diagnosis and staging of diseases and more importantly for optimal treatment choice as well as developing new rational strategies for therapy.

This project involves the design and construction of multi-scale models of inflammation in cancers. It is expected to lead to higher order understanding of the initiation, maintenance and resolution of inflammation and facilitate many applications in disease diagnosis and treatment.