Stochastic modeling of innate immune responses

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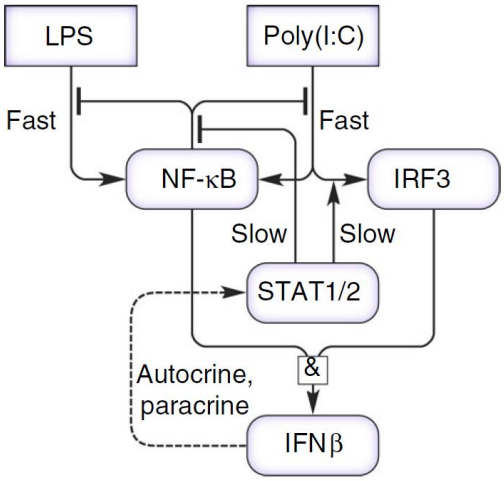
I will start from deterministic and stochastic modeling of NF-κB pathway and proceed to our recent study in which we analyze cell fate decisions in intertwined NF-κB/IRF3 and STAT signaling pathways.

In first part I will show how noise and feedbacks lead to nearly all-or-nothing responses to small TNF doses that activate single or few receptors TNF receptors. Responses to such weak signals are enabled by the kinase cascade that works as nonlinear signal amplifier.

In the second part I will discuss cell fate decisions that arise in the crosstalk of three transcription factors and are coordinated by paracrine IFNβ signaling at the cell population level. In this example initial heterogeneities in expression of virus sensing proteins lead to formation of distinct subpopulations of cells.

Tay et al. **Single-cell NF-κB dynamics reveal digital activation and analogue information processing**, *Nature* 466:267-271 (2010)

Czerkies et al. **Cell fate in antiviral response arises in the crosstalk of IRF, NF-κB and JAK/STAT pathways**, *Nature Communications* 9:493 (2018)



Czerkies et al. 2018