Title	Dynamic modelling of cytokines in health and disease
Group	Systems and Synthetic Biology
Project type	Thesis
Credits	36
Supervisor(s)	Dr. Edoardo Saccenti (SSB)
Examiner(s)	Dr. Edoardo Saccenti, TBD
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Begin date	Open

Used skills: Dynamic modelling, parameter estimation, data analysis and statistics, linking and interpreting new information with respect to existing biological knowledge

Requirements: Ability to program in R and\or Python and\or Matlab, familiarity with dynamic models (Ordinary differential equations), parameter fitting and a good mathematical background are desired skills.

Description: Cytokines are released by cells to coordinate an immune response to help protect against foreign and/or dangerous matter. They are produced in response to infection and inflammation, and exaggerated cytokine responses are responsible for a broad array of very challenging and often fatal clinical conditions such as influenza, severe acute respiratory syndrome (SARS), bacteria-induced toxic shock syndrome and sepsis.

In this project we are interested in reviewing and exploring different cytokine dynamic models in the context of bacterial infection: these models are sets of interlaced Ordinary differential equations describing the behaviour and the interplay of pro- and anti-inflammatory cytokines. Scope of the project is to understand whether these models are of utility when only limited amount of data is available and if the estimated model parameters can be used to define groups of subjects with definite characteristics for better diagnosis and treatment.

References

Baker, M., S. Denman-Johnson, B. S. Brook, I. Gaywood and M. R. Owen (2013). "Mathematical modelling of cytokine-mediated inflammation in rheumatoid arthritis." Mathematical medicine and biology: a journal of the IMA **30**(4): 311-337.

Dranoff, G. (2004). "Cytokines in cancer pathogenesis and cancer therapy." Nature Reviews Cancer **4**(1): 11-22.

Zhang, W., S. Jang, C. B. Jonsson and L. J. Allen (2019). "Models of cytokine dynamics in the inflammatory response of viral zoonotic infectious diseases." <u>Mathematical medicine and biology: a journal of the IMA</u> **36**(3): 269-295.