

# FIRST WORKSHOP

"DYNAMICAL SYSTEMS APPLIED TO  
BIOLOGY AND NATURAL SCIENCES "

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## ABSTRACT | Bruno Oliveira

### Title

An Immune Response Model with Regulatory T cells

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### Abstract

The primary function of the immune system is the protection of the host from pathogen invasion. During such an invasion, T cells under exposure to their specific antigen are activated leading to secretion of growth cytokines (predominantly interleukin 2, denoted IL-2), and expression of the IL-2 receptor which triggers cytokine driven proliferation. Under most circumstances, the immune system is able to successfully remove the pathogen. However, the immune system may also target self antigens (autoimmunity) and cause tissue damage and death. Regulatory T cells (Tregs) limit such autoimmune responses by growth inhibition of T cells. Therefore, the immune system has to achieve a delicate balance between appropriate immune activation and immune response suppression. How such a balance is established and controlled is studied in this presentation. Our motivation is the observation that T cell proliferation through cytokines already has such a control structure; cytokine driven growth exhibits a quorum population size threshold. We propose that Tregs locally adjust these thresholds by inhibiting IL2 secretion. The immune response-suppression axis is then a balance between the local numbers of activated T cells and activated Tregs. We study the effects in the quorum T cell population thresholds by the parameters of the model and we describe the equilibria manifold in a neighborhood of the default values for the parameters and variables.