

Logical models of T-helper cells activation and differentiation



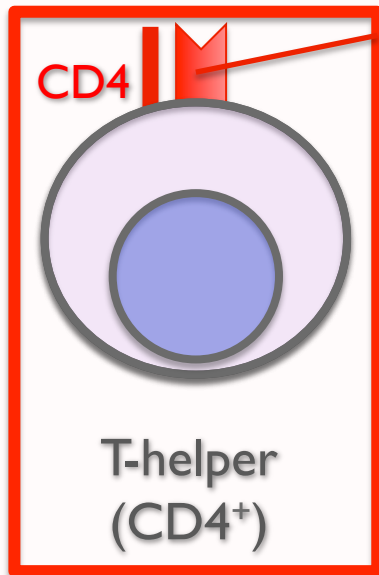
Swiss Institute of
Bioinformatics

Introduction to T-helper cells

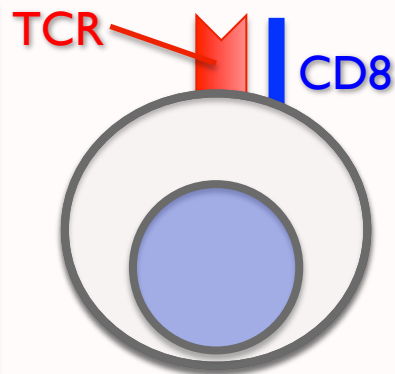
Lymphocytes

T lymphocyte

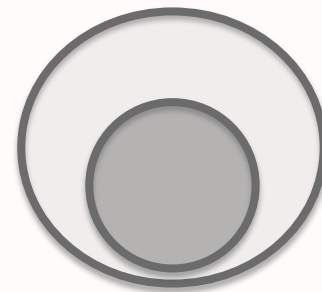
B lymphocyte



T-helper
(CD4⁺)

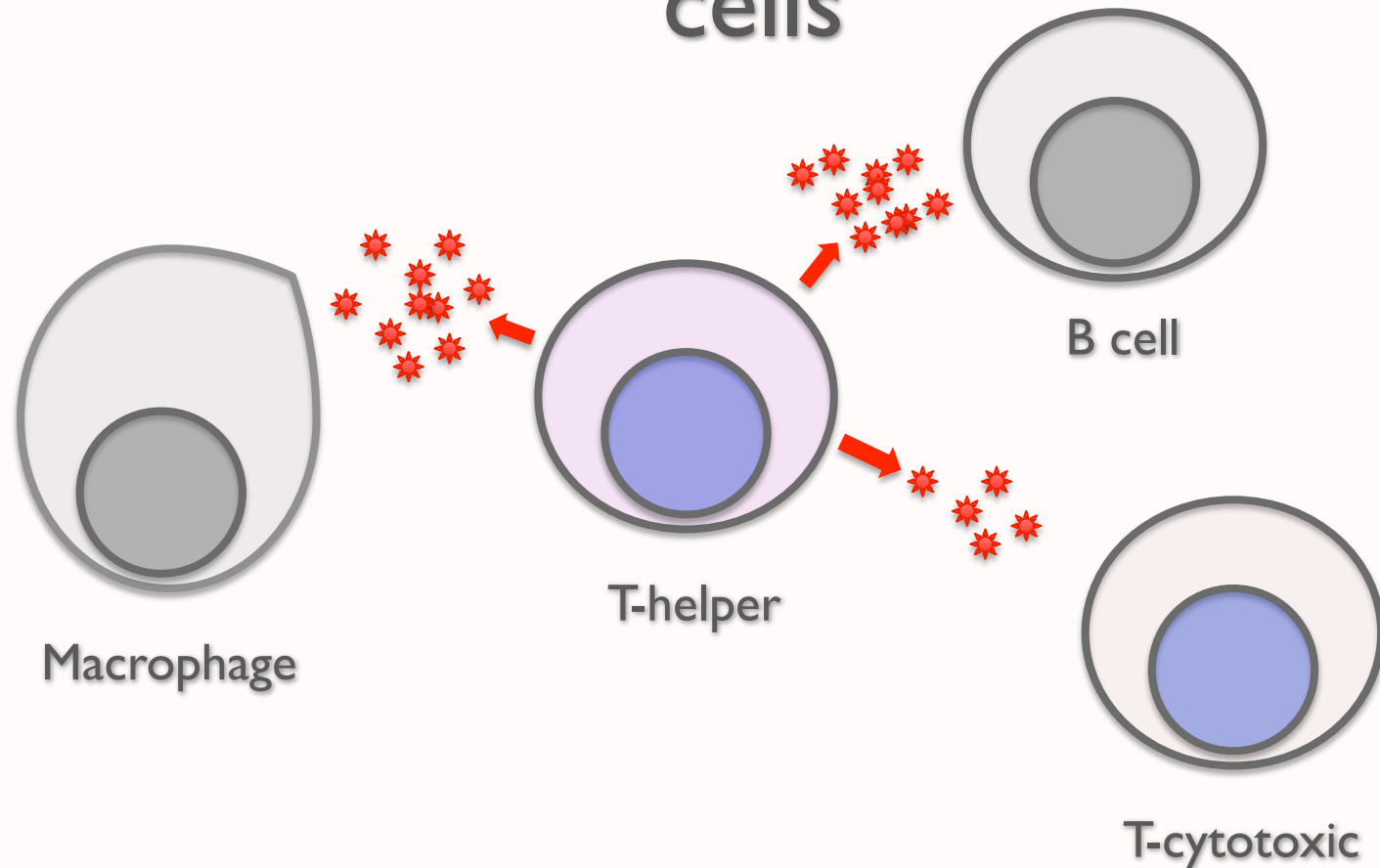


T-cytotoxic
(CD8⁺)

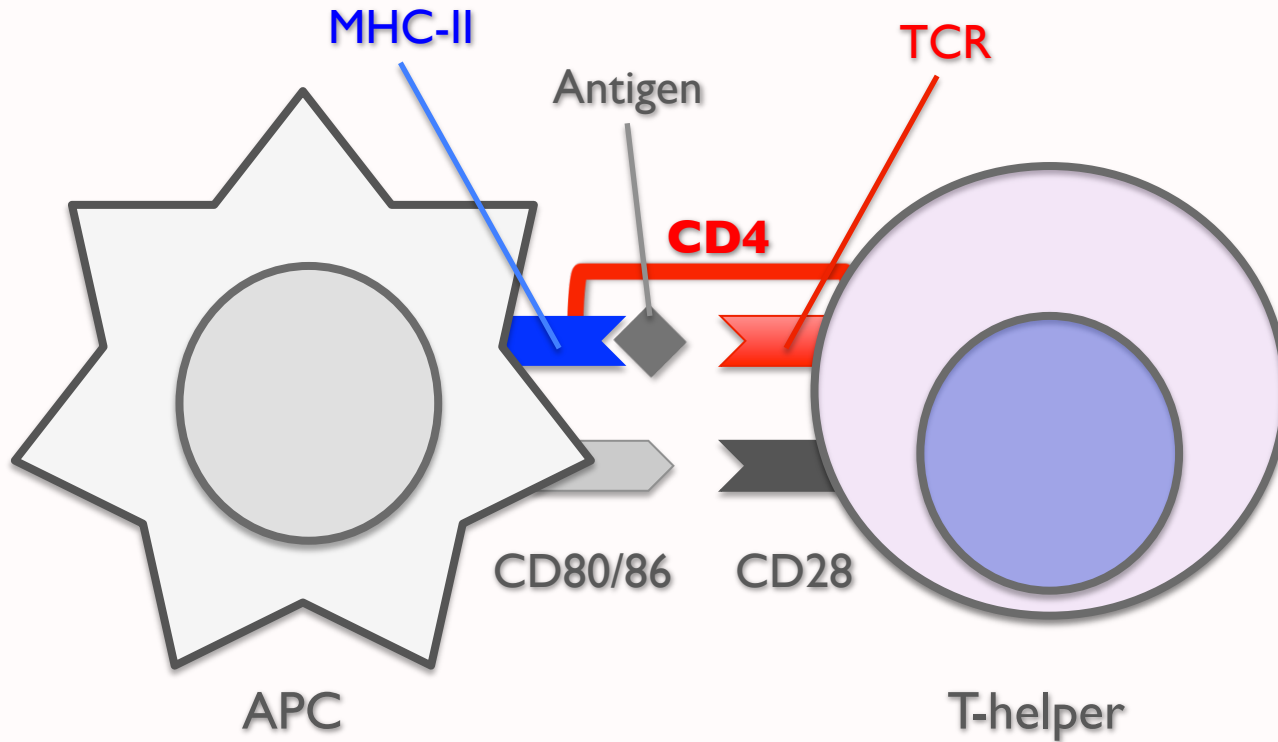


B cell

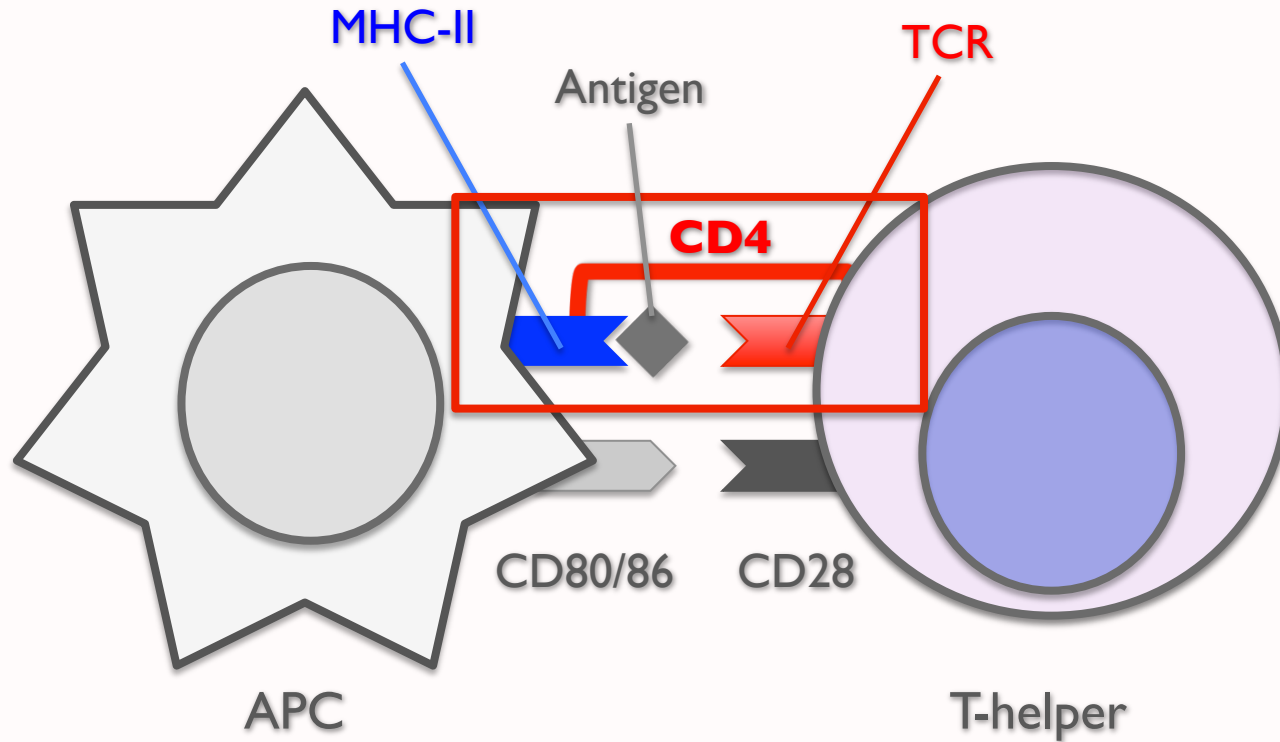
T-helper cells release cytokines to regulate the activity of other immune cells



Activation of T-helper

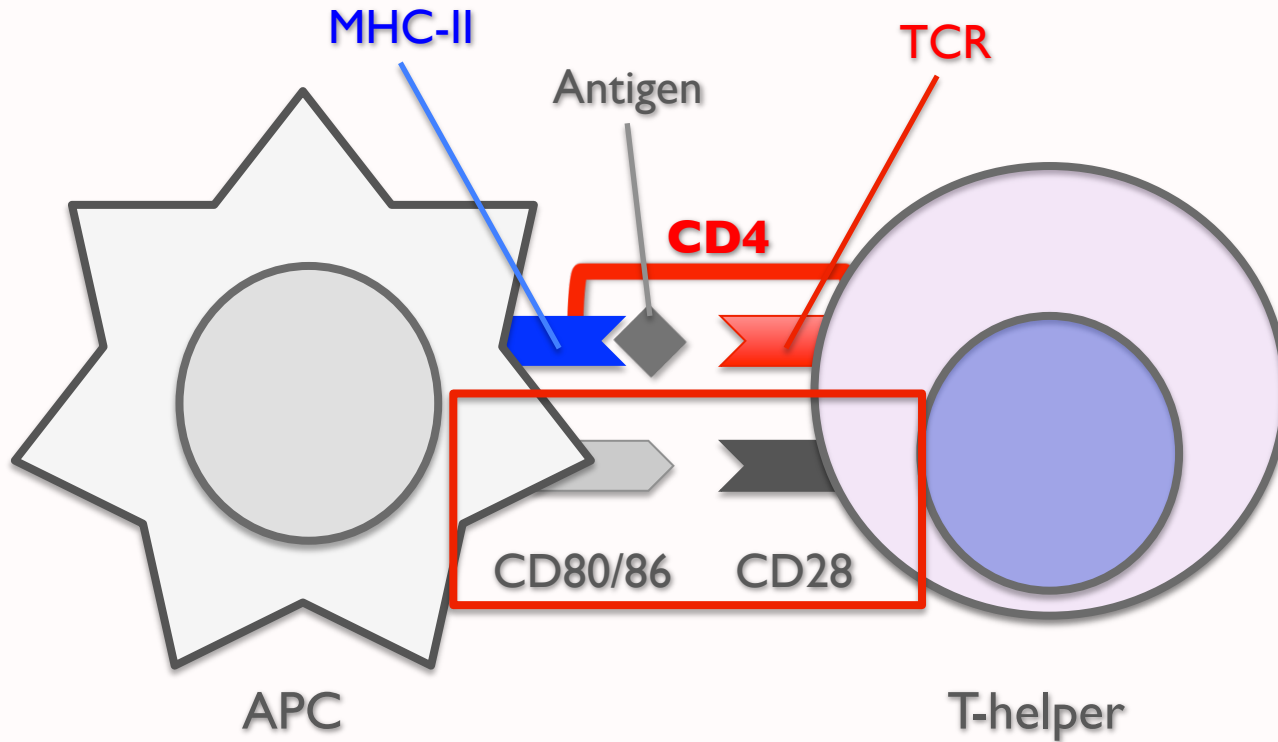


Activation of T-helper



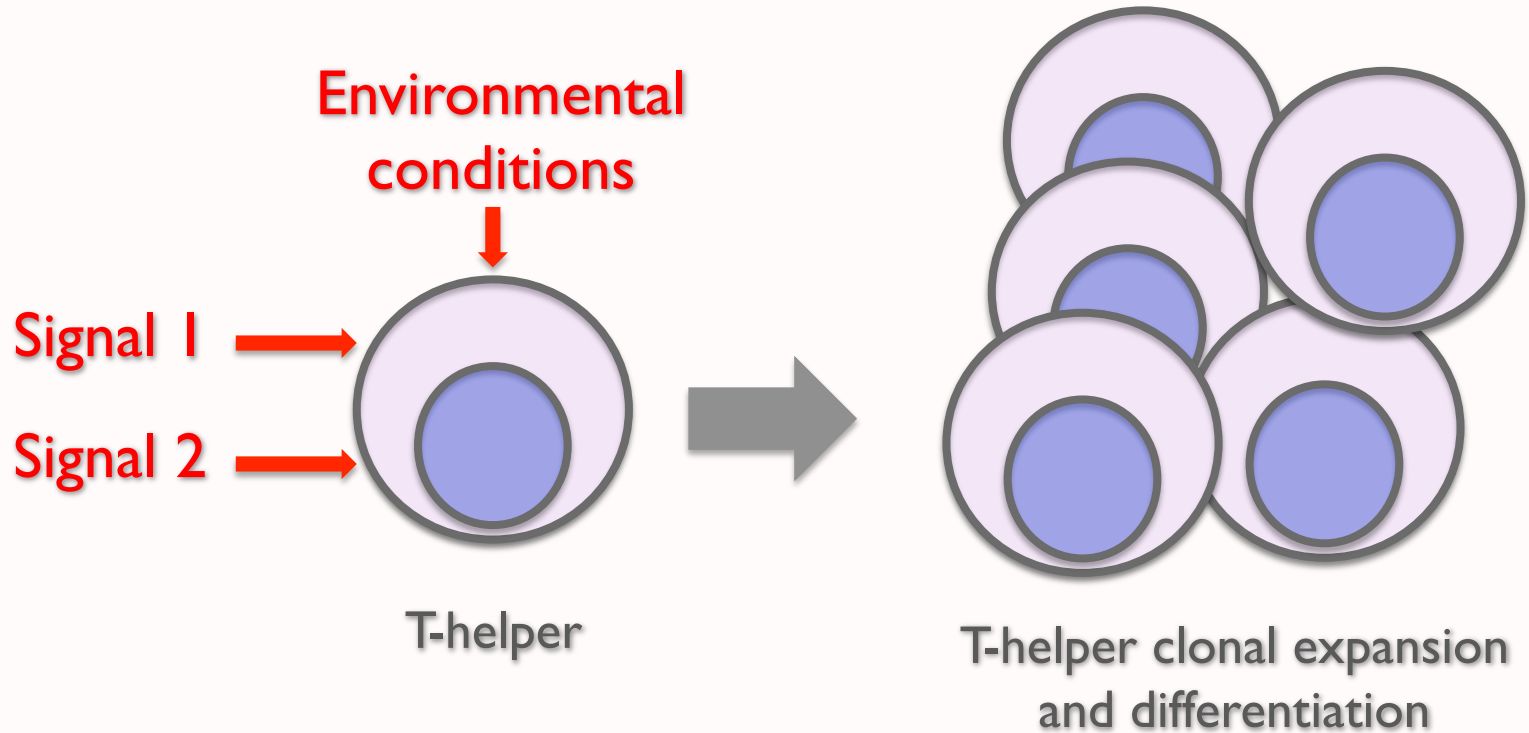
Signal I: recognition

Activation of T-helper

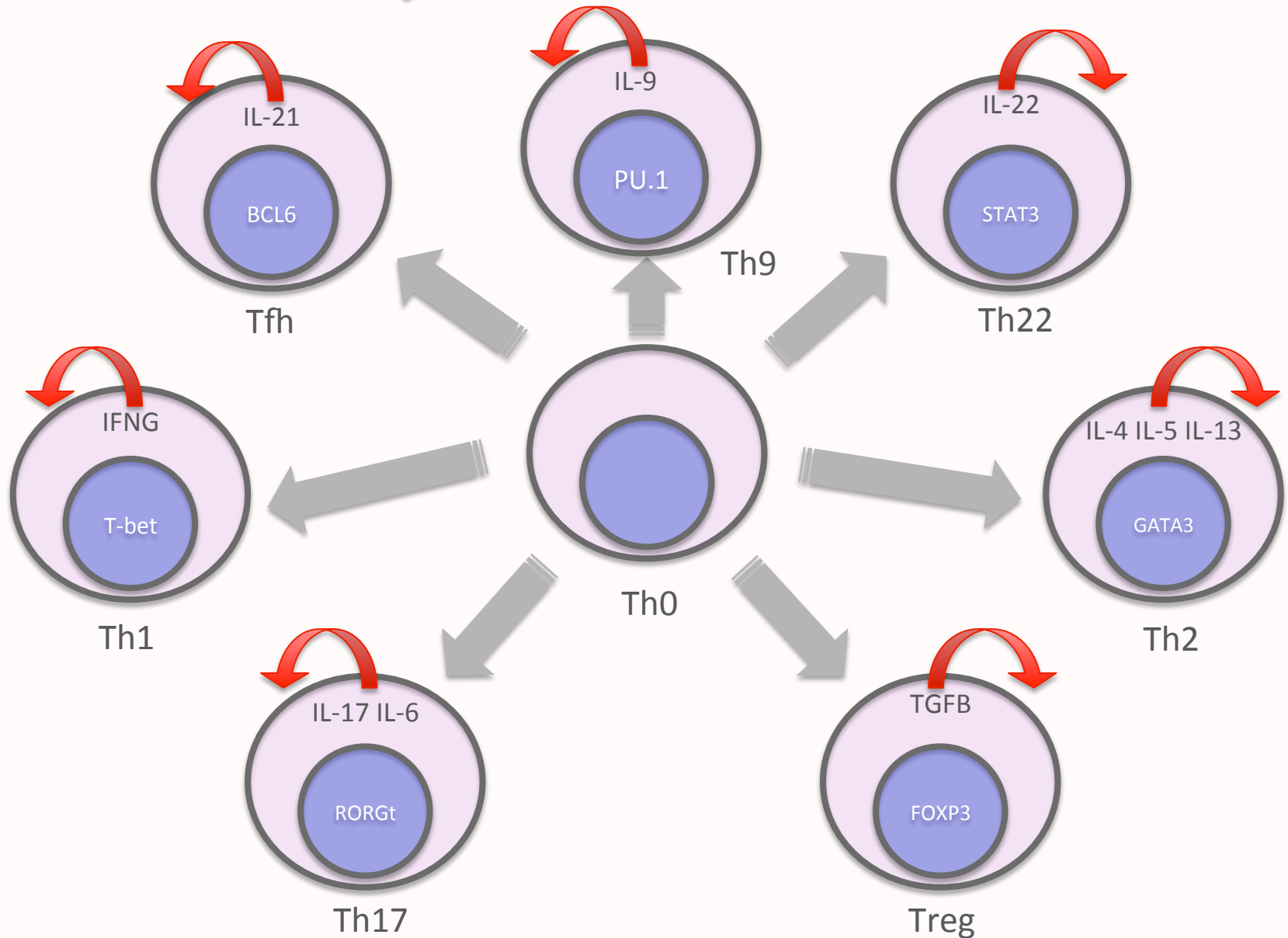


Signal 2: verification

Activation of T-helper

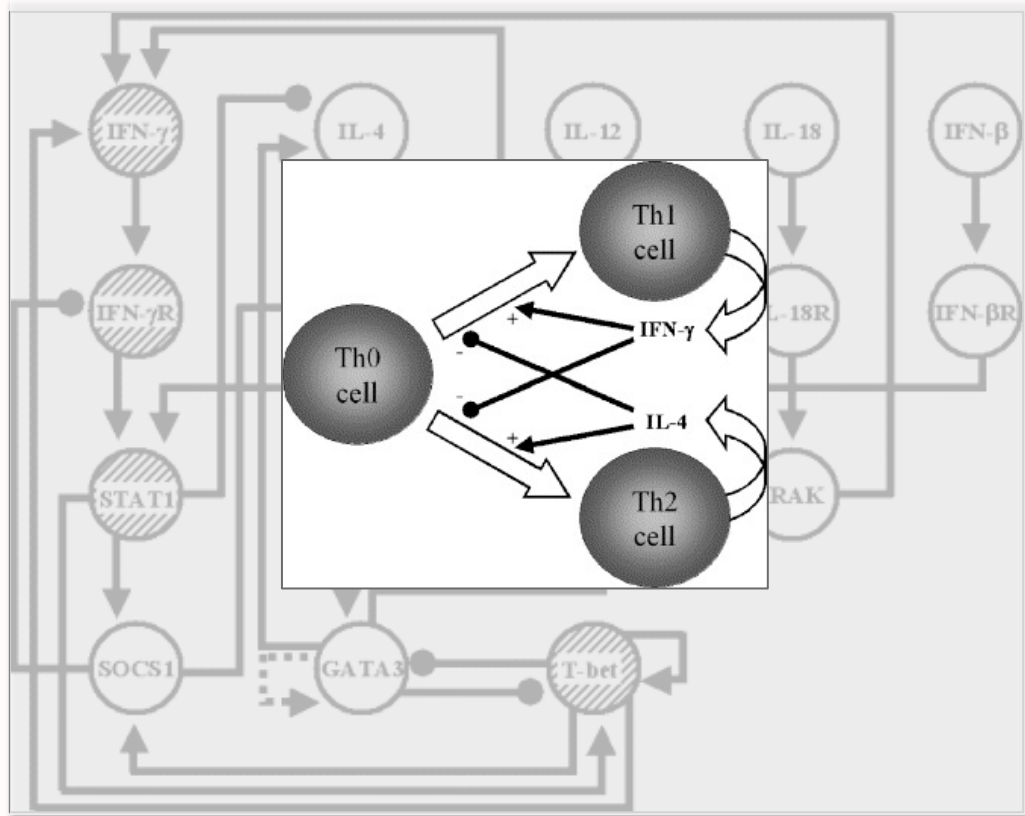


T-helper differentiation



T-helper models

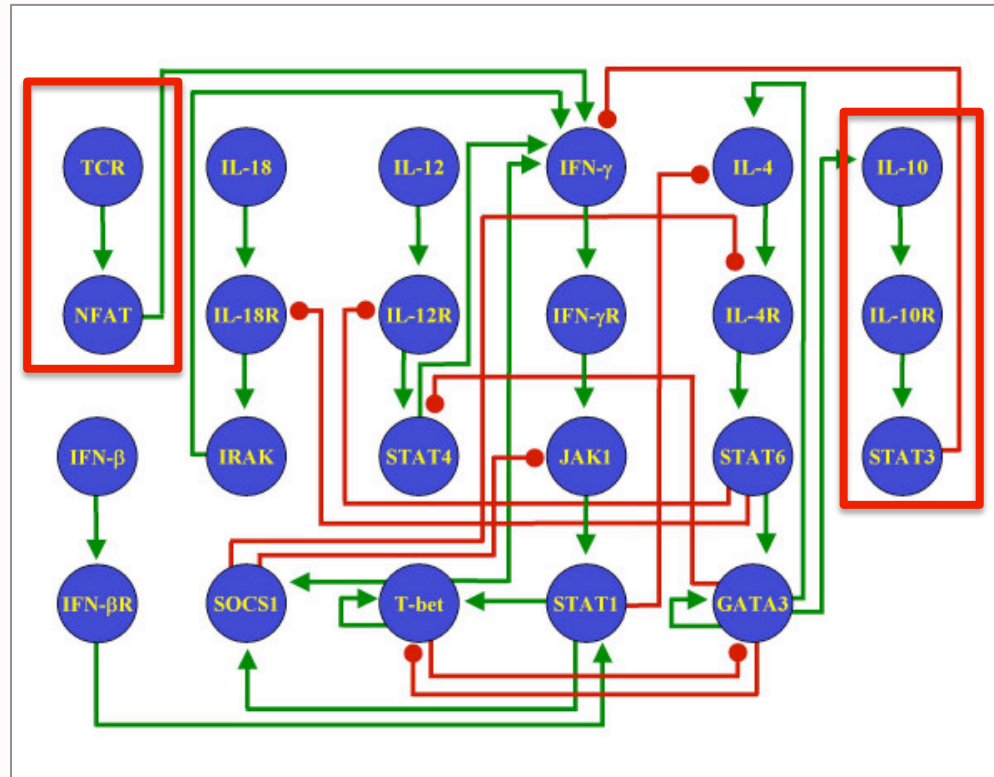
Mendoza L (2005)



A network model for the control of the differentiation process in Th cells.
Biosystems 84: 101-114

T-helper models

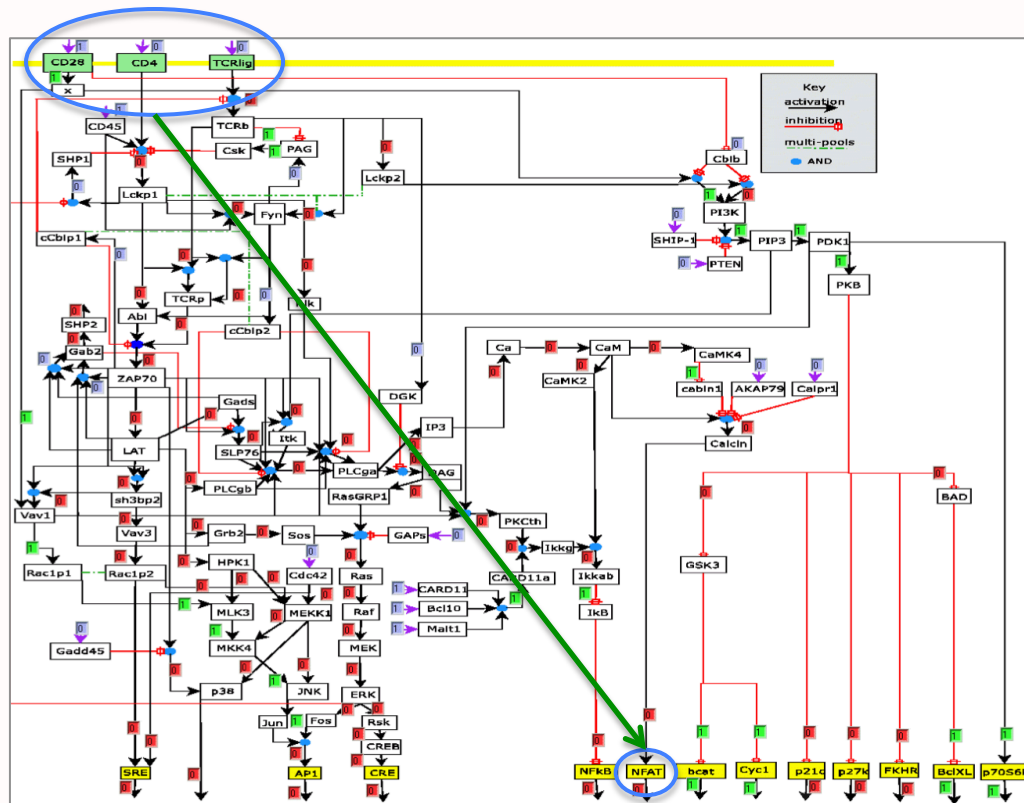
Mendoza L and Xenarios I (2006)



A method for the generation of standardized qualitative dynamical systems of regulatory networks. Theoretical Biology and Medical Modelling 3: 13

T-helper models

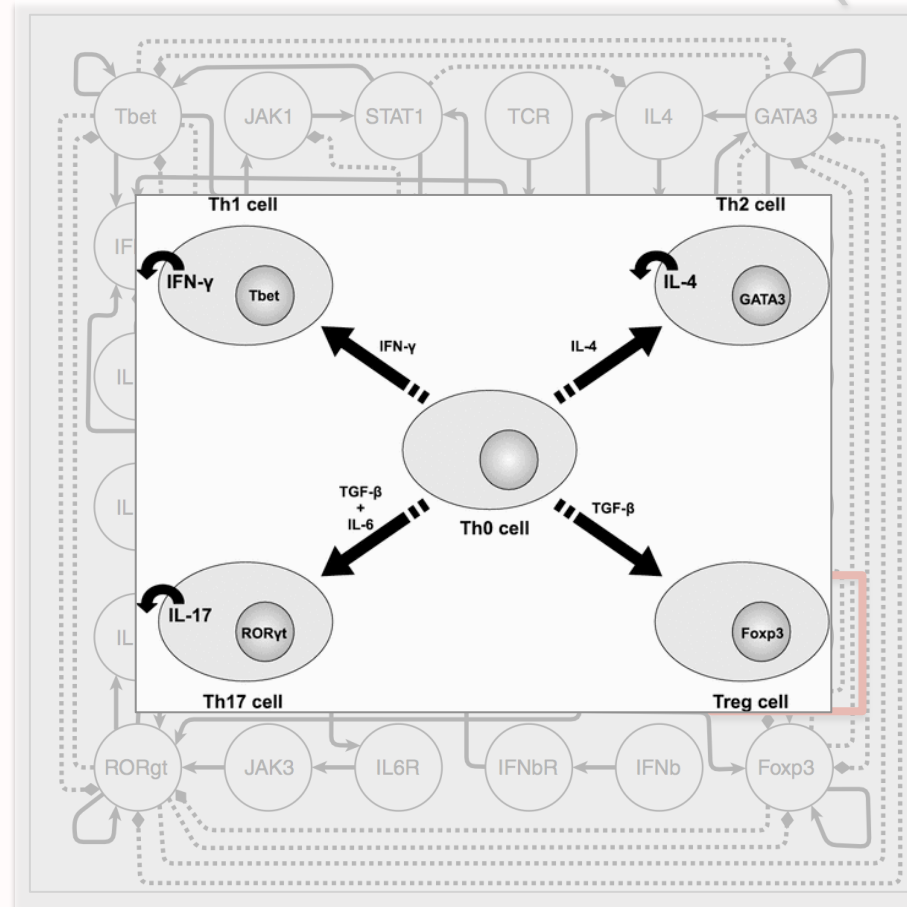
Saez-Rodriguez J et al (2007)



A logical model provides insights into T cell receptor signaling. PLoS Computational Biology 3: e163

T-helper models

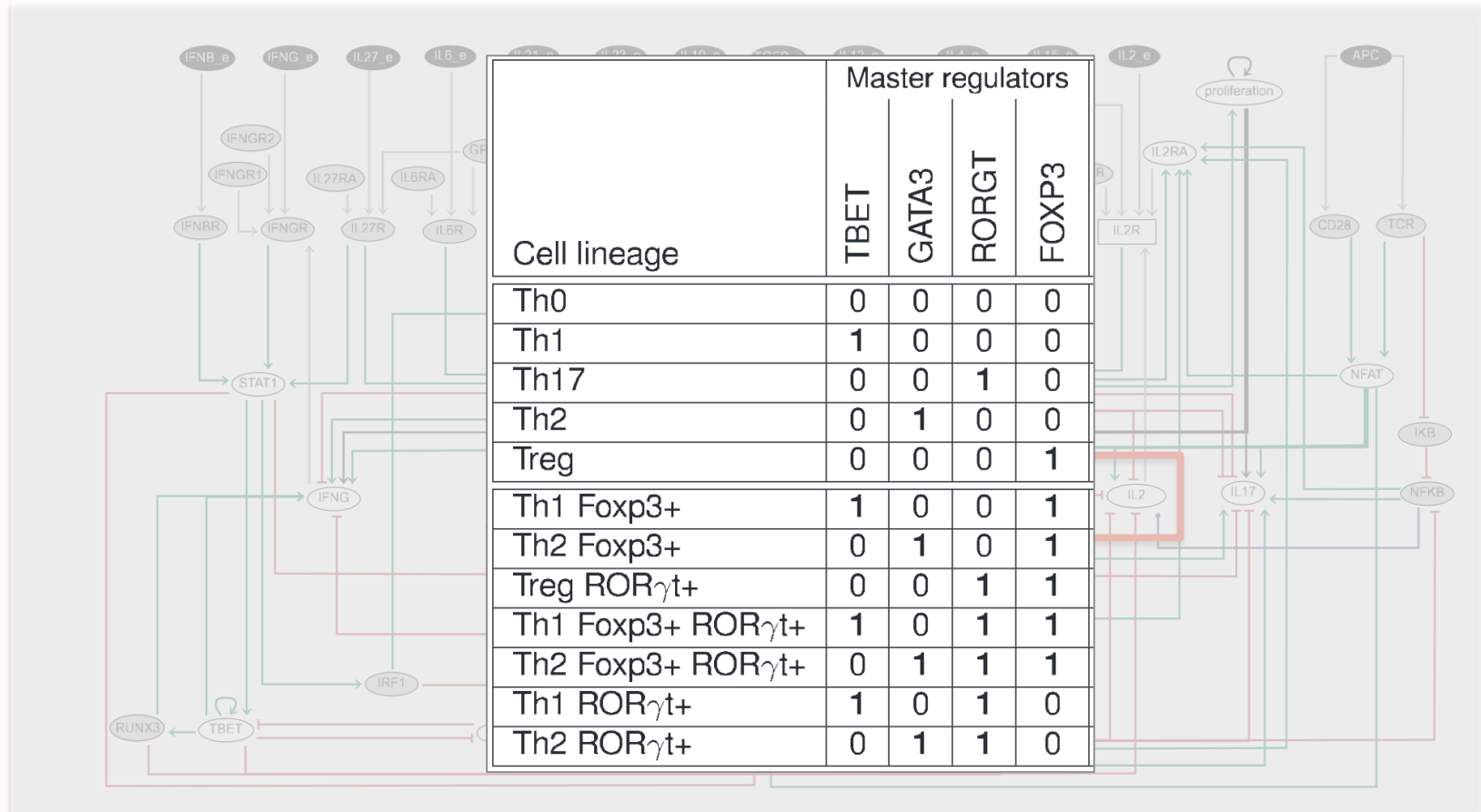
Mendoza L and Pardo F (2010)



A robust model to describe the differentiation of T-helper cells. Theory in biosciences 129: 283-293

T-helper models

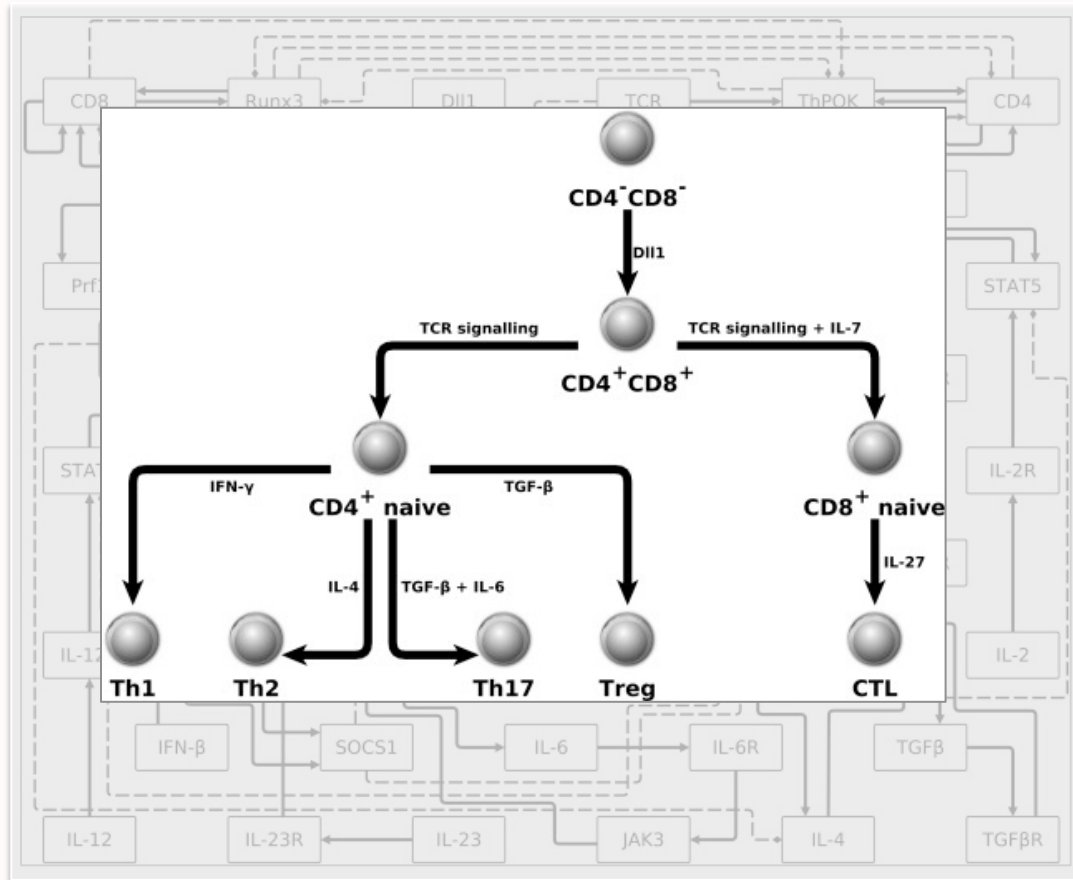
Naldi A et al (2010)



Diversity and plasticity of Th cell types predicted from regulatory network modelling. PLoS computational biology 6: e1000912

T-helper models

Martínez-Sosa P and Mendoza L (2013)



The regulatory network that controls the differentiation of T lymphocytes.
Biosystems 113: 96-103

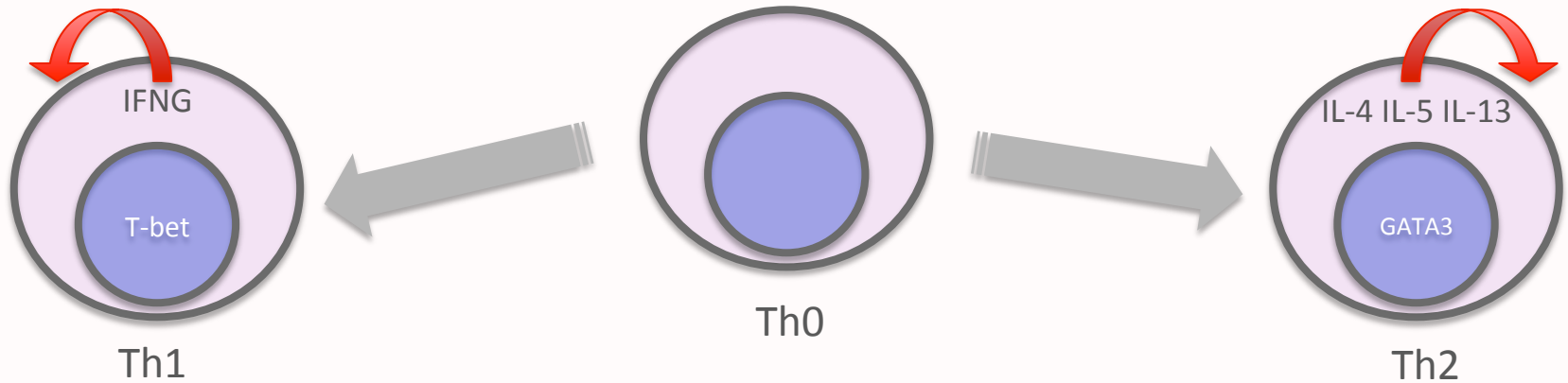
Abou-Jaoudé W, T. Monteiro P et al
(2015)



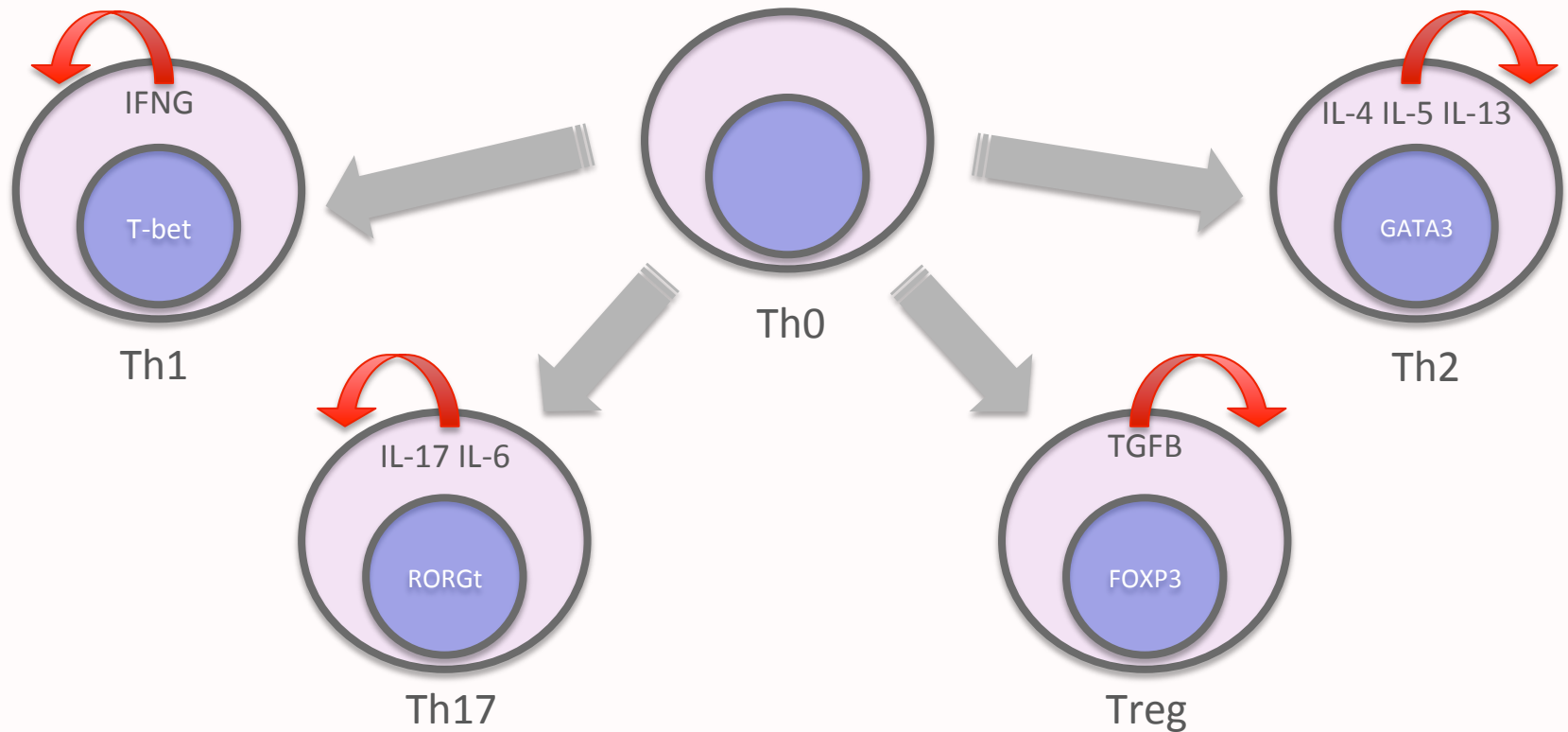
Summary

Integration of new phenotypes,
simulation of environmental conditions
and cell plasticity

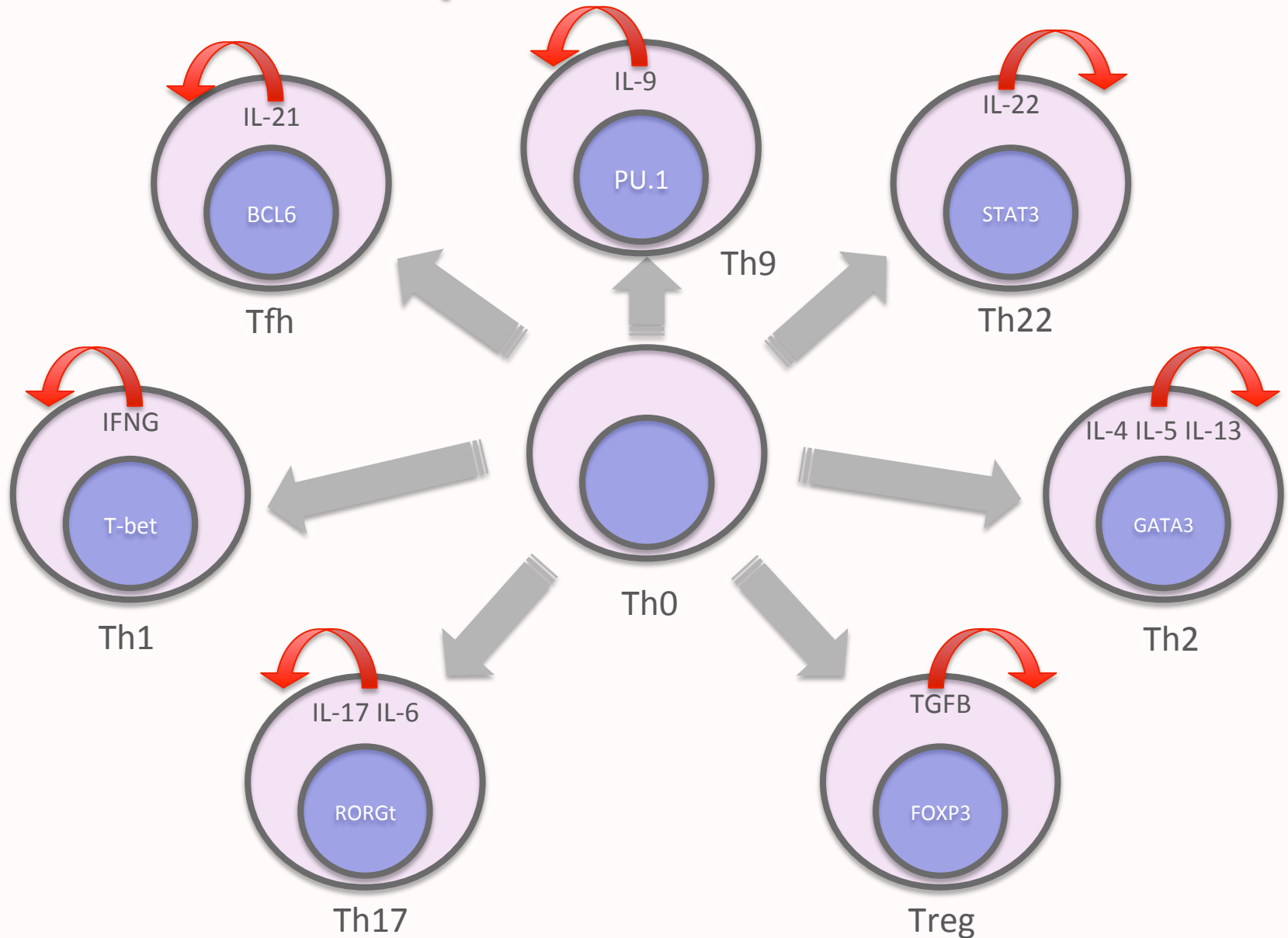
T helper model 2005-2006



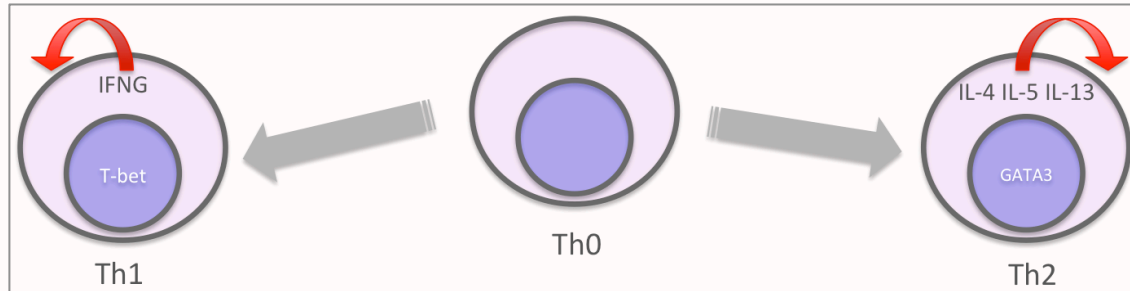
T helper model 2010



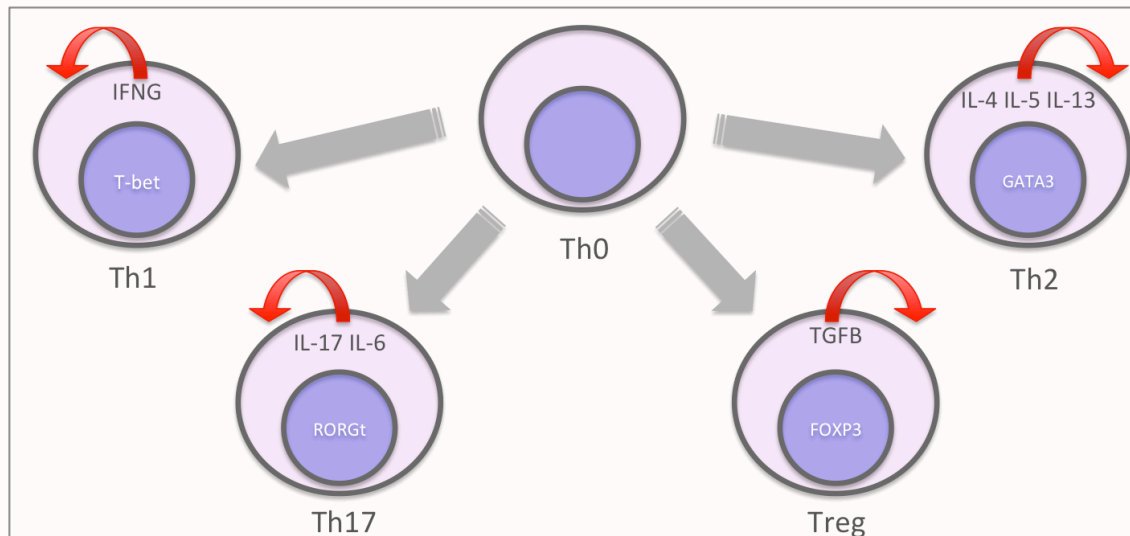
T helper model 2015



Simulations using Squad and BoolSim



Squad, GINsim and
Model checking
23 genes
35 interactions
Mendoza & Xenarios 2006



BoolSim, GINsim and
Model checking
34 genes
93 interactions
Naldi et al 2010

Thanks



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