



# Computational Systems Biology: Chapter 19. Applications in Cancer Research: Mathematical Models of Apoptosis

*Stefan M. Kallenberger, Stefan Legewie, Roland Eils*

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Apoptosis is a form of cellular suicide central to various aspects in biology including tissue homeostasis and embryonic development. It is typically dysregulated in cancer. Understanding the apoptotic signal transduction network is thus a central goal of cancer research. Quantitative modeling approaches provided valuable insights into determinants of cell fate decisions, and promise to become a valuable tool to optimize therapeutic strategies. In this chapter, we summarize modeling approaches used in systems biology of apoptosis. In addition, we give an overview of apoptosis-related research questions that can be addressed by modeling. Moreover, we review top-down and bottom-up modeling approaches applied to apoptosis, and particularly focus on ordinary differential equation (ODE) modeling. We describe bistability, temporal switching, crosstalk between death and survival, and discuss approaches to model cell-to-cell variability.

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