

Network Dynamic and Cell Physiology

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THE PHYSIOLOGICAL capabilities of a living cell (metabolism, reproduction, signaling, motility, etc.) are controlled by complex networks of interacting biochemicals (genes, RNAs, proteins and metabolites). Although intuitive reasoning about these networks may be sufficient to guide the next experiment, detailed computational models are required to codify the results of hundreds of observations, and a sophisticated theoretical framework is necessary to understand the “molecular logic” of the rich dynamical repertoire of cellular control systems. Over the past 40 years, in collaboration with splendid colleagues such as Art Winfree, Albert Goldbeter, Jim Keener, Bela Novak and Kathy Chen, I have been developing methods to predict the dynamical properties of biochemical networks and relate these properties to the life-sustaining behaviors of cells.