Modern experiments monitor biological systems with high resolution that may reach the molecular level. Excessive noise caused by the measuring hardware and the experimental procedures or unaccounted processes demand the formulation of specialized methods for the analysis and interpretation of the acquired datasets. Nevertheless, physical limitations and the inherent uncertainties in the underlying systems, such as unknown parameters, states, or dynamics pose unique conceptual and computational challenges that lead to intractable model selection problems. In this talk, I will present an overview on the difficulties that are commonly encountered and highlight recent advances including novel Bayesian non-parametric approaches which provide elegant alternatives to model selection.

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