

# Plenary Lectures



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**Title** Feedback and Control in Biological Circuit Design

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**Abstract :**

Biological systems make use of feedback in an extraordinary number of ways, on scales ranging from molecules to cells to organisms to ecosystems. In this talk I will discuss the use of concepts from control and dynamical systems in the analysis and design of biological feedback circuits at the molecular level. After a brief survey of relevant concepts from synthetic biology, I will present some recent results that combine modeling, identification, design and experimental implementation of biological feedback circuits. These results include the use of intrinsic noise for system identification in transcriptional regulatory networks, analysis of the role of multiple feedback loops in providing robust behavior (ultrasensitivity and bimodality), development of feedback circuits for rate regulation and event detection, and the use of time delay as a means of designing biomolecular feedback dynamics. Using these results as examples, I will discuss some of the open problems and research challenges in the area feedback control using biological circuits.