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Epigenetics and Why Biological Networks are More Controllable than Expected

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A fundamental property of networks is that perturbations to one node can affect other nodes, potentially causing the entire system to change behavior or fail. In this talk, I will show that it is possible to exploit this same principle to control network behavior. This approach takes advantage of the nonlinear dynamics inherent to real networks, and allows bringing the system to a desired target state even when this state is not directly accessible or the linear counterpart is not controllable. Applications show that this framework permits both reprogramming a network to a desired task as well as rescuing networks from the brink of failure, which I will illustrate through various biological problems. I will also briefly review the progress our group has made over the past 5 years on related control of complex networks in non-biological domains.