

## **Pulsatile regulation of cellular behavior**

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Increasing evidence shows that many cell regulatory processes rely on stochastic pulsing of factors that direct gene expression and protein activity. Controlling the activity of these processes involves adjusting the intrinsic dynamics of the genetic circuits that generate the pulsing behavior. In this lecture I will review different molecular circuits that lead to pulsatile behavior, contrasting this dynamical regime with the more common regime of biochemical oscillations. As a model situation, I will discuss ways to systematically characterize how different biochemical perturbations control the dynamics of competence pulses in *Bacillus subtilis* bacteria under nutritional stress. I will also discuss examples in which pulsing does not arise from excitable dynamics, such as the response of alternative sigma factors in *B. subtilis* under energy stress.

### Reading list:

1. Levine, J. H., Lin, Y. & Elowitz, M. B. Functional Roles of Pulsing in Genetic Circuits. *Science* **342**, 1193–1200 (2013).
2. Rué, P. & Garcia-Ojalvo, J. Gene circuit designs for noisy excitable dynamics. *Math. Biosci.* **231**, 90–97 (2011).
3. Garcia-Ojalvo, J. Physical approaches to the dynamics of genetic circuits: a tutorial. *Contemp. Phys.* **52**, 439–464 (2011).