Functional oscillators interacting with environment

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Interacting oscillators, with or without external driving, have long been studied as a paradigm for emergent collective order. Much less understood, however, is the case in which the oscillators and their environment interact *mutually*—where the units not only sense the environment but also actively reshape it while performing a physiological function. In this talk, I introduce such a system realized in the pancreas. Pancreatic α, β, and δ cells behave as intrinsic oscillators that secrete hormones in response to glucose levels, and they interact with one another by modulating each other's secretion. These hormones, in turn, feed back on the glucose level, so that the coupled cellular oscillators close a loop of mutual regulation that maintains glucose homeostasis. I will discuss how this bidirectional coupling between oscillators and environment underlies robust regulation and controllable synchronization, and what it suggests for nonequilibrium collective dynamics.

[1] T. Song and J. Jo, *Phys. Biol.* **16**, 051001 (2019).
[2] D.-H. Park, T. Song, D.-T. Hoang, J. Xu, and J. Jo, *Sci. Rep.* **7**, 1602 (2017).
[3] D.-T. Hoang, M. Hara, and J. Jo, *PLoS ONE* **11**, e0152446 (2016).