

# Rhythms and Evolution:

## Effects of Timing on Survival

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### Abstract

The evolution of metabolism regulation is an intertwined process, where different strategies are constantly being developed towards a cognitive ability to perceive and respond to an environment. Organisms depend on an orchestration of a complex set of chemical reactions: maintaining homeostasis with a changing environment, while simultaneously sending material and energetic resources to where they are needed. The success of an organism requires efficient metabolic regulation, highlighting the connection between evolution, population dynamics and the underlying biochemistry.

In this work, I represent organisms as coupled information-processing networks, that is, gene-regulatory networks receiving signals from the environment and acting on chemical reactions, eventually affecting material flows. I discuss the mechanisms through which metabolism control is improved during evolution and how the nonlinearities of competition influence this solution-searching process.

The propagation of the populations through the resulting landscapes generally point to the role of the rhythm of cell division as an essential phenotypic feature driving evolution. Subsequently, as it naturally follows, different representations of organisms as oscillators are constructed to indicate more precisely how the interplay between competition, maturation timing and cell-division synchronisation affects the expected evolutionary outcomes, not always leading to the “survival of the fastest”.