VNIVERSITAT DE VALÈNCIA

Institut Cavanilles de Biodiversitat i Biologia Evolutiva

SEMINARIS D'EVOLUCIÓ I COMPLEXITAT

Dimecres 18 de juliol de 2012, 12.30h
Sala de seminaris (semisoterrani)

Automated RNA synthetic biology in living cells

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A grand challenge in biology is to use our current knowledge of RNA science to perform the automatic engineering of completely synthetic sequences encoding functional RNAs in living cells. Such computational approach once combined with high-throughput characterization experiments could provide a new forward-engineering testing of molecular mechanisms that circumvents our limited comprehension of biological systems. We have developed fully automated methodologies able to design RNA devices implementing smart sensing within the cellular environment. The computational algorithm, based on a physicochemical model, produces novel RNA sequences by exploring a space of 10^{40} possible sequences compatible with predefined structures. We tested our methodology by trying various design specifications for diverse structures and interaction models allowing the engineering of riboswitches, riboregulators and regazymes working in *E. coli*. Our results not only provide a library of new regulators for synthetic biology, but they also suggest that only the energy of formation and the activation energy could be sufficient criteria to engineer RNA interaction and regulation in bacteria. The designed sequences exhibit no significant similarity to any known non-coding RNA sequence. Our riboregulatory devices work independently and in combination with transcription regulation to create complex logic circuits in bacteria. We also characterize the RNA dynamics by using time-lapse microscopy with custom microfluidic growth chambers to track single-cells. Our results demonstrate that a computational methodology based on first principles can be used to engineer interacting RNAs with allosteric behavior in living cells..