B·DEBATE International Center for Scientific Debate BARCELONA

Universitat Pompeu Fabra Barcelona

ALFONSO JARAMILLO

CV

PARTICIPANT AT:

SYNTHETIC BIOLOGY. FROM STANDARD BIOLOGICAL PARTS TO ARTIFICIAL LIFE

September, 17th-18th, 2015, Barcelona

Alfonso Jaramillo, Professor of Synthetic Biology, University of Warwick, Coventry, UK

Professor Alfonso Jaramillo holds a PhD in Particle Physics (1999) and a Habilitation in Biology (2007). After postdoctoral appointments with Prof. Wodak (ULB, Brussels) and Prof. Karplus (ULP, France and Harvard, USA), he started in 2003 as Assistant Professor at the Ecole Polytechnique (France), becoming tenured in 2005. There, he further developed computational synthetic biology. In 2009, after moving to Genopole (France) as CNRS-senior researcher, he started engineering novel RNA-based circuits in bacteria, allowing the reprogramming of living cells with a synthetic signal transduction system. In 2013, he opened a second lab at the University of Warwick (UK), where he holds the Chair of Synthetic Biology. He has been coordinating several Synthetic Biology international consortia and he is member of the editorial boards of ACS Synthetic Biology and the J. of Biol. Engineering. His lab is currently engineering RNA circuits and synthetic bacteriophages by combining computational design, genome engineering and directed evolution.

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ABSTRACT

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Synthetic RNA Wires in E. coli

The engineering of RNA devices able to detect nucleic acids would enable the detection of bacteria propagating high levels of antibiotic resistance or virulence, or bacteria involved in nosocomial or pandemic infections, major health problems. They could also be used to produce scalable synthetic regulatory circuits able to detect complex RNA levels of endogenous genes, which would have important applications in medicine. The development of RNA-based devices in living cells able to sense small-molecules could allow the post-transcriptional control of cellular phenotypes during fermentation, which would open the way to use synthetic strains in industrial biotechnology. The advance of our knowledge of RNA structure is allowing the engineering of multifunctional RNA molecules by using computational design techniques. These are limited by the lack of feedback from experimentation to modelling, particularly considering the time response at the single-cell level. More accurate biological modelling will not only facilitate the engineering of biology, but it will eventually lead to the quantitative prediction of phenotype from genotype. We developed a computational and experimental methodology facilitating the engineering of RNA-based signal transduction systems in living cells, which is used to generate genetically-encoded devices for the detection of specific small-molecules and nucleic acids. Our work provides a new strategy to engineer synthetic regulatory networks using RNA.