

*Instituto de Biología Funcional y Genómica*

# *Programa de Seminarios Externos*

## *"Dionisio Martín Zanca"*

2023 - 2024

***Rodrigo Ledesma-Amaro***

*Imperial College London  
London, UK.*

***Synergies between synthetic biology  
and metabolic engineering for a  
sustainable bioproduction***

Martes **16**  
Julio **2024**

***Hora:*** 12:00 pm

***Lugar:*** Salón de actos del IBFG

***Web:*** <https://ibfg.usal-csic.es/semext.php>

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CAMPUS DE EXCELENCIA INTERNACIONAL

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### **Abstract**

*Synthetic biology has massively helped the development of metabolic engineering tools in the past decade. Now it is easier than ever to design and generate microbial strains with enhanced bioproduction capabilities. In addition, some of these novel tools still offer a white canvas for envisioning the next generation of metabolic engineering tools, more efficient, robust, and easier.*

*Here, some of our recent contributions to the synthetic biology toolset that paves the way to future technologies will be discussed.*

*In particular, we have explored the capacity to manipulate gene expression in a large multiplexed manner using CRISPRai, which allows both activation and repression of target genes [1]. This is enabled by the simultaneous, inducible expression of up to 24 gRNAs in a single transformation, which accelerates the strain engineering cycle [2].*

*In addition, we have developed novel methods and genetic circuits to induce gene and pathway expression using electricity, which paves the way towards the generation of hybrid wearables devices (bioelectronics) [3]. Electricity has the potential to be an affordable inducer of pathways of interest which is cheap, available and scalable.*

*Finally, synthetic microbial communities have been suggested to be the major players in the bioprocesses of the future, where population behaviours can be designed to maximize production yields from complex substrates. We have combined lab automation, control theory and biochemical characterization to create novel tools to establish stable synthetic communities with enhanced bioproduction capacities [4][5].*

*In addition, I will introduce you to the new Bezos Centre for Sustainable Protein and the Microbial Food Hub, which I have just launched at Imperial.*

*[1] McCarty, N.S., Graham, A.E., Studená, L. et al. Multiplexed CRISPR technologies for gene editing and transcriptional regulation. Nat Commun 11, 1281 (2020).*

*[2] Shaw, W.M., Studená, L., Roy, K. et al. Inducible expression of large gRNA arrays for multiplexed CRISPRai applications. Nat Commun 13, 4984 (2022).*

*[3] Lawrence, J.M. et al. Synthetic biology and bioelectrochemical tools for electrogenetic system engineering. Science Advanced 8, 18 (2022)*

*[4] Aulakh et al. Spontaneously established syntrophic yeast communities improve bioproduction. Nature Chemical Biology (2023)*

*[5] Peng et al. A molecular toolkit of cross-feeding strains for engineering synthetic yeast communities. Nature Microbiology (2024)*