2. SYNTHETIC BIOLOGY AND BIOSYSTEMS CONTROL LAB (SB2CLAB-UPV)

The group **Synthetic Biology and Biosystems Control Lab** at the Institute of Automation and Industrial Informatics, U. Politècnica de València (**SB2CLab-UPV,** http://sb2cl.ai2.upv.es) is the Spanish pioneer group of systems and control engineering applied to systems and synthetic biology. The **SB2CLab-UPV** integrates researchers with background in the areas of systems and control engineering, bioinformatics and machine learning, systems biology and synthetic biology, with over 20 years of experience in their application to biosystems and bioprocesses. Its members have expertise both in theoretical, computational work (dry-lab), and experimental molecular biology lab work (wet-lab).

The main active research lines are:

- Synthetic feedback regulation of gene expression in microbial cell biofactories.
- Automated design-build-tert-learn cycle for metabolic engineering and synthetic biology.
- Machine learning and multi-objective optimization bioinformatics tools for pathway engineering and standard calibration and selection of DNA parts in synthetic genetic circuits.
- Context-aware methods and models for model-based design of synthetic genetic circuits.
- Application of possibility and network theory to the robust estimation of metabolic fluxes.

Recent representative publications include:

- *Automated engineering of synthetic metabolic pathways for efficient biomanufacturing*, Metabolic Engineering, Volume 63, pp. 61-80, 2021.
- *Extended Metabolic Biosensor Design for Dynamic Pathway Regulation of Cell Factories*, iScience, Volume 23, Issue 7, 2020.
- *Robust estimation of bacterial cell count from optical density.* Nature Communications Biology. *Volume 3-1, pp.1-29, 2020.*
- *Multiobjective Identification of a Feedback Synthetic Gene Circuit*, IEEE Transactions on Control Systems Technology, vol. 28, no. 1, pp. 208-223, 2020.
- *Pathways to cellular supremacy in biocomputing. Nature Communications, 10(1), 5250, 2019.*
- *Characterization of Gene Circuit Parts Based on Multiobjective Optimization by Using Standard Calibrated Measurements,* ChemBioChem, pp.2653-2665,2019.
- *Opportunities at the intersection of synthetic biology, machine learning, and automation.* ACS Synthetic Biology, 8, 1474–1477, 2019.
- *Machine Learning of designed translational control allows predictive pathway optimization in Escherichia coli,* ACS Synthetic Biology, 8:1, pp.127–136, 2019.

Representative active projects where the members of the SB2CLab-UPV are IPs:

- *Shikifactory100: Modular cell factories for the production of 100 compounds from the shikimate pathway,* Horizon2020 BIOTEC-03-2018. EU. Grant ID: 814408, 01/01/19-01/01/23. IP: P. Carbonell
- *Design, characterization and optimal tuning of synthetic biocircuits for bioproduction with control of the metabolic load.* MINECO FEDER DPI2017-82896-C2-1-R. 01/01/18-30/09/21. IP: J. Picó

International projection:

The **SB2CLab-UPV** members are very active at international organizations and committees. J. Picó is Vice-Chair of the International Federation of Automatic Control (IFAC) Technical Committee on Biosystems and Bioprocesses (TC8.4) since 2018. A. Vignoni is member of the IGEM Engineering Committee, where he serves as Sub-committee Leader, since 2020. P. Carbonell is member of BMC Bioinformatics and Frontiers in Biotechnology Editorial Boards and Consulting Editor for Engineering and Systems Biology for Learning Materials in Biosciences (Springer Nature). The group has a wide network of relevant international contacts and keeps regular international collaborations.

Available Infrastructures:

The **SB2CLab-UPV** facilities are fully equipped to perform molecular biology experimental work (PCR, incubators...) and singular equipment, such as a multi-mode plate reader with fluorescence and luminiscence measurement, NIR spectroscopy, digital microscopy and a low-cost mini-turbidostats. The group also has access to singular equipment and services located on the same campus (eg. genomic sequencing) and the high-performance computing facilities of the UPV, in addition to having its own server with 18 parallel computing cores.

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