Modelling cell response and molecular mechanisms of extracellular self-DNA inhibition

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Project Summary

The occurrence of environmental DNA has been widely studied in the context of ecological monitoring and species inventorying in both aquatic and terrestrial ecosystems. The recent discovery of the inhibitory effect of extracellular self-DNA opened new perspectives on the role of environmental DNA in species-environment interactions.

The presented project proposes to study the functional mechanisms of self-DNA inhibition in different model organisms, including animals, plants, unicellular eukaryotes and prokaryotes, to address common aspects and peculiarities. The program will be based on advanced cellular and molecular technologies and bioinformatics. First, the project will focus on the study of the effects of exposure to both self- and heterologous-DNA on cell cycle and metabolism. Second, the molecular mechanisms elicited by the sensing and signalling during the above-mentioned conditions will be investigated by both conventional molecular methods and high-throughput omics technologies, such as transcriptomics, epigenomics, and bioinformatics.

The results will be used to define a molecular network model of the involved cellular processes and will support the implementation and calibration of a mathematical model of cell cycle and metabolism according to the System Dynamics and Fluxomic approaches.

The findings of this project will contribute to shed light on the differential responses of organisms to either self or heterologous environmental DNA. This will be relevant to clarify still open questions about the dynamics of ecosystems' structuring and patterns of species coexistence and biodiversity.