Master Thesis Project

A model to understand the resistance of cancer cells to chemotherapy.

When tumor cells are exposed to chemotherapeutic agents, a variable fraction of the tumor survives the treatment and even becomes resistant to the therapy. It is now understood that cell-to-cell heterogeneity (differences in the 'internal' state of each cell) are a main reason of this differential response to anti-cancer drugs.
Results of our lab have shown that a main reason for cell-to-cell variability in internal state is the difference in mitochondrial content between cells(Guantes et al., 2016; Guantes et al., 2015). Mitochondria are the energy 'factories' of the cell, and the amount of mitochondria that a cell has largely affects basic processes, such as transcription, translation and alternative splicing.
Using a combination of experiments and mathematical models, we have recently found that mitochondria play also a key role in survival of cancer cells to chemotherapeutic agents inducing apoptosis (programmed cell death).

The proposed project will involve an extension of a computational model of the apoptotic route, including cell division and partition of mitochondria, to compare with experimental results in our lab that use *in vivo* fluorescence microscopy to simultaneously monitor mitochondrial content and death time of cancer cells. The student will participate both in the numerical simulations and in the analysis of the experimental results.

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Guantes, R., Diaz-Colunga, J., and Iborra, F.J. (2016). Mitochondria and the non-genetic origins of cell-to-cell variability: More is different. Bioessays *38*, 64-76.

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