LUIS SERRANO

Biography

CRG Director
ICREA Professor,
EMBO member

Luis Serrano did his PhD at the CBM (Madrid, Spain) on Cell Biology. Then he spent 4 years in the laboratory of Prof. A.R. Fehrs (MRC, UK) working in protein folding. In 1993, he became Group Leader at the EMBL (Heidelberg, Germany) working in Protein Folding and design. Ten years later, he was appointed head of the Structural & Computational Biology programme at the EMBL and he started to work on Systems Biology. By the end of 2006 he moved back to Spain to lead a programme working on Systems Biology, where he was appointed vice-director before finally becoming the CRG director on July 2011. His group is currently focused on Synthetic Biology, engineering and designing of biological systems. He is EMBO and RACEFyN member and received the Marie Curie Excellence Award. He has also been awarded with the prestigious ERC Advanced Grant and participates as Principal Investigators in many research projects financed both by the European Commission (through the 6^{th} and 7^{th} Framework Programmes) and the Spanish Ministry of Science and Innovation. He is Professor of ICREA and has directed 12 PhD thesis. He has published more than 240 papers in international journals. He has always been very mindful about the importance of the successful transfer of scientific discoveries to the society. He was involved in the creation of one of the first Spanish Biotech. Companies (Diverdrugs) in 1999. He is also co-founder of Cellzome, EnVivo and TRISKEL. Some of his work has been commented in Spanish newspapers (El Pais, LaVanguardia, El Mundo...), in the radio and other journals like Newsweek.

Project

European Research Council Advanced Grant
Project acronym: CELLDOCTOR
Project full title: Quantitative understanding of a living system and its engineering as a cellular organelle

Overview
The idea of harnessing living organisms for treating human diseases is not new but, so far, the majority of the living vectors used in human therapy are viruses which have the disadvantage of the limited number of genes and networks that can contain. Bacteria allow the cloning of complex networks and the possibility of making a large plethora of compounds, naturally or through careful redesign. One of the main limitations for the use of bacteria to treat human diseases is their complexity, the existence of a cell wall that difficult the communication with the target cells, the lack of control over its growth and the immune response that will elicit on its target. Ideally one would like to have a very small bacterium (of a mitochondria size), with no cell wall, which could be grown in Vitro, be genetically manipulated, for which we will have enough data to allow a complete understanding of its behavior and which could live as a human cell parasite. Such a microorganism could in principle be used as a living vector in which genes of interests, or networks producing organic molecules of medical relevance, could be introduced under in Vitro conditions and then inoculated on extracted human cells or in the organism, and then become a new organelle in the host. Then, it could produce and secrete into the host proteins which will be needed to correct a genetic disease, or drugs needed by the patient. To do that, we need to understand in excruciating detail the Biology of the target bacterium and how to interface with the host cell cycle (Systems biology aspect). Then we need to have engineering tools (network design, protein design, simulations) to modify the target bacterium to behave like an organelle once inside the cell (Synthetic biology aspect). M.pneumoniae could be such a bacterium. It is one of the smallest free-living bacterium known (680 genes), has no cell wall, can be cultivated in Vitro, can be genetically manipulated and can enter inside human cells.