Nuria Montserrat, PhD

Research Professor and Senior Group Leader
ICREA (Catalan Institution for Research and Advanced Studies)
Barcelona, Spain

I became interested in organ regeneration and stem cells during my master and PhD training that finished in 2006. The same year I got a Postdoctoral fellowship from the Fundaçao para a Ciência e Tecnología (Portugal). In 2007 I moved as a post-doctoral researcher at the Hospital of Santa Creu i Sant Pau in Barcelona. In 2008 I joined the Center of Regenerative Medicine of Barcelona (CMRB) thanks to the support of a Juan de la Cierva fellowship under the direction of Dr. Izpisúa Belmonte. In 2010 I first co-authored how to reprogram cord blood stem cells for the first time (Nature Protocols, 2010). Then I first-coauthor the first work deriving iPSCs with new factors (Cell Stem Cell, 2013). I also collaborated in projects aimed to characterize the genomic integrity of human iPSCs as well as in the differentiation of iPSCs towards different lineages for disease modeling (Stem Cells 2011; Nature 2012; Nature Methods 2012, Nature 2012, Nature Communications 2014). I have first co-authored how the reactivation of endogenous pathways can be artificially reactivated and promote heart regeneration in mammals (Cell Stem Cell, 2014). My expertise in the fields of somatic reprogramming and organ regeneration helped me to be awarded an **ERC Starting Grant** by 2014 that allowed me to become Junior group leader at the Institute of Bioengineering of Catalonia (IBEC). In January 2015 I got a Ramon y Cajal fellowship and from 2019 I am ICREA Research Professor and Senior Group Leader. During these years our findings in the field of Regenerative Medicine led to the derivation, for the first time, of cardiac grafts from human pluripotent stem cells and decellularized cardiac myocardium (Biomaterials 2016), and the derivation of renal analogues with 3D bioprinting (Materials Today 2017). I have recently led the derivation of vascularized kidney organoids (Nature Materials, 2019) and co-led on the application of kidney organoid technology to model SARS-CoV-2 infections (Cell, 2020) identifying a therapeutic compound that nowadays is under clinical trial in COVID19 patients (The Lancet Respiratory Medicine, 2020; EMBO Molecular Medicine 2020). I have recently led the first work on the identification of metabolic regulators protecting the renal tubule from acute injury exploiting kidney organoid technology (Cell Metabolism, 2020), among others. In December 2020 the ERC has recognized all these efforts and I have been awarded with the prestigious **ERC-Consolidator Grant** to study the interplay between mechanobiology and metabolism during kidney development and disease.

Abstract

How to engineer human pluripotent stem cells to understand human development and disease.

[1] Pluripotency for Organ Regeneration, Institute for Bioengineering of Catalonia (IBEC), The Barcelona Institute of Science and Technology (BIST), Barcelona, Spain
[2] Catalan Institution for Research and Advanced Studies (ICREA), Barcelona, Spain
[3] Centro de Investigación Biomédica en Red en Bioingeniería, Biomateriales y Nanomedicina, Madrid, Spain

In recent years considerable progress has been made in the development of faithful procedures for the differentiation of human pluripotent stem cells (hPSCs). An important step in this direction has also been the derivation of three-dimensional cell cultures that represent micrometer to centimeter size versions of human organs, the so-called organoids. The convergence of stem cell biology and bioengineering now offers the possibility to provide physiologically relevant stimuli in a controlled fashion, resulting in the development of naturally inspired approaches to overcome major limitations of the organoid field.
Here we will discuss current developments in the kidney organoid field and emphasize the achievements and ongoing challenges of bringing together hPSC organoid differentiation, bioengineering and disease modelling with a particular focus on genetic and systemic disorders as well as COVID19 research.