**GENOMICS CORE UNIT**

**Core Unit Head**
Orlando Domínguez

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**OVERVIEW**

The Genomics Unit provides on-demand services in the genetics/genomics fields to CNIO researchers and the wider research community. Technologies are put in place with the capacity to interrogate genomes and their activities in a single assay. These methodologies contribute to dissecting molecular hierarchies and pathways. Processes such as functional activation states, as delineated by transcriptomic profiles (mRNA, miRNA) or protein factor interplays at the gene level, and structural features, such as mutation landscapes or variations in chromatin structure, can all be examined to study the quick-paced lives of cancer tumours. We cover a broad range of applications, including solutions such as exome study the quick-paced lives of cancer tumours. We cover a broad range of applications, including solutions such as exome technology, transcriptomic analyses and location of chromatin interacting protein factors or RNA binding. This year we acquired and installed 2 pieces of equipment that enrich our capacity in this field: a Chromium Controller from 10x Genomics, suitable to perform single-cell genomics studies; and a sequencer (NextSeq, Illumina), a necessary element for the readout of NGS applications.

Some of our contributions led to the following research reports being published in 2019, with the co-authorship of some of the Unit’s members: Fernández- Barral et al. report the presence of the vitamin D nuclear receptor (VDR) and stem cell markers (LGR5) in the human intestinal mucosa. Transcriptomics and ChIP-seq data support a direct effect of calcitriol, the active metabolite of vitamin D, in colon mucosa crypt stem cells. Vitamin D was found to display both pro-stemness and antiproliferative effects on the intestinal mucosa and is therefore proposed to contribute to the homeostasis of healthy intestine. The other report by Santos et al. describes organoids that recapitulate urothelial features in vitro. 90% of bladder cancer cases originate in the urothelium, and its growth and differentiation characteristics are poorly understood. The single-cell transcriptomics platform of 10x Genomics revealed cellular heterogeneity in different organoid culture conditions, and common and distinct cellular programmes under differentiation or proliferative responses. In addition, the study uncovered the involvement of Notch signalling in urothelial differentiation, which is consistent with the reported findings of mutated Notch pathway components in bladder cancer. We also manage a rather active transgenic mouse genotyping service.

**With its portfolio of services that survey different levels of biological complexity, the Genomics Unit contributes to the research projects of multiple CNIO groups. A wide genomic level is addressed by deep-sequencing technologies (NGS) and their applications. NGS permits a variety of different explorations, such as whole genome and whole exome tumour characterisation, transcriptomic analyses and location of chromatin interacting protein factors or RNA binding. This year we acquired and installed 2 pieces of equipment that enrich our capacity in this field: a Chromium Controller from 10x Genomics, suitable to perform single-cell genomics studies; and a sequencer (NextSeq, Illumina), a necessary element for the readout of NGS applications.**

**The services in the genetics-genomics fields provided by the Genomics Unit contribute towards the understanding of molecular processes in homeostasis and disease at different levels of biological complexity.”**

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**RESEARCH HIGHLIGHTS**

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**PUBLICATIONS**

- Santos CP, Lapi E, Martínez de Villarreal AM, Megías D, Muñoz A, Real FX (2019). Vitamin D differentially regulates cell populations. On the other hand, the analysis of thousands of single-cell transcriptomes provides an insight into the biology of the single cell populations. In the case of the single-cell transcriptomes, this analysis reveals the heterogeneity of complex populations.


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**TECHNIQUES**

- Purificación Arribas, Guadalupe Luengo, Jorge Hernanz, Ángeles Rubín, Maro de Mesa, Laura Conde

**Tecnico**
José Luis Espadas (since December) (PEJ)*

*Plan de Empleo Joven (Youth Employment Plan)