

CONFOCAL MICROSCOPY CORE UNIT

Diego Megías (until December)
Core Unit Head

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OVERVIEW

Optical microscopy has traditionally been an indispensable tool in cell biology studies. In fact, one of the main challenges in oncology research is the study of specific markers, expression patterns or individual cells in the tumour environment.

The Confocal Microscopy Unit provides the CNIO Research Groups with all the standard methodologies as well as the latest advances in microscopy, offering access to state-of-the-art equipment and software packages related to confocal microscopy, including technical and scientific advice and support to the CNIO scientists. The Unit is also actively involved in developing, testing, and implementing new microscopy technologies, tools and imaging applications that could be of interest to the Research Groups at the CNIO. Training activities are also an essential component of our mission.

“The Confocal Microscopy Unit is fully committed to disseminating advanced microscopy methodologies that are useful for cancer research and society at large; we organised courses, talks and visits, always with the aim of increasing our understanding of cell biology and the disorders of cells that lead to cancer.”

Students in Practice
Ramón Carballas (January-June),
Jorge Padilla (until March), and
Álvaro Román (January-June)
(Universidad Carlos III de Madrid,
Spain)

RESEARCH HIGHLIGHTS

The Confocal Microscopy Unit continues to dedicate significant effort towards developing and implementing High Content Screening (HCS) technology at the CNIO. In 2021, the Unit renewed its equipment in this field, thanks to the funding obtained with a grant awarded through an infrastructures call of the Ministry of Science and Innovation. The Unit already had 1 Opera (Perkin Elmer) HCS system, which enables experiments to be run on fixed and live cells in multiwell plates, and the monitoring of cell dynamics (translocation, cell division, etc.) through the use of fluorescence. The acquisition of a new Opera Phoenix HCS microscope with a robotic plate handler will boost screening capacity, making 24/7 operation time possible. This new system will significantly reduce acquisition time and improve sensitivity and excitation flexibility. The platform is equipped with the latest analysis software, getting better results from 3D organoid campaigns and live-cell imaging assays.

In addition to this new system, the Unit is equipped with: 1 super resolution confocal microscope (sp8 STED super-resolution microscope with a white light laser and 3 depletion laser lines); 3 laser scanning confocal systems (Leica SP5) that incorporate UV and multiphoton excitation, as well as a white light laser and hybrid detection; and 2 wide field systems (a THUNDER system with computational clearing algorithms and 8-channel led excitation, and a Leica DMRI6000 system, equipped with microinjection and microfluidics control). All the microscopes are automated and equipped with incubators for live cell imaging.

The Unit implemented the use of high-throughput technologies applied to confocal microscopy using not only the Opera system, but also through a sample navigation application integrated into the SP8 and SP5 confocal systems. This enables high-throughput feeding of the instrument, both in multiwell plates and in tissue sections. These advances allow us to increase the level of information obtained from a sample, as well as carry out the automated screening of cell behaviour under different treatments.

The Unit is involved in promoting and helping its users with novel protocol development for sample preparation, bringing knowledge in tissue clearing as well as in expansion microscopy. Moreover, microfluidics, used for live cell assays in perfusion chambers, has also experienced a great increase in performance and demand. Experiments of intra-vital microscopy are available, and we are now running several projects for studies of metastasis, skin alterations and immune system response. ■

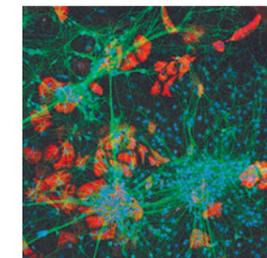


FIGURE Confocal image of cells in culture labelled for neurons (green) and astrocytes (red).

► PUBLICATIONS

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- Leivas A *et al.* (incl. Pérez M, Megías D, Martínez-López J) (2021). NK-G2D-CAR-transduced natural killer cells efficiently target multiple myeloma. *Blood Cancer J* 11, 146.
- Martínez-Pastor B *et al.* (incl. Mata G, Megías D, Efeyan A) (2021). Assessing kinetics and recruitment of DNA repair factors using high content screens. *Cell Rep* 37, 110176.
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- González-Martínez J *et al.* (incl. Gómez J, Pérez-Martínez M, Megías D, Boskovic J, Ortega S, Malumbres M) (2021). Deficient adaptation to centrosome duplication defects in neural progenitors causes microcephaly and subcortical heterotopias. *JCI Insight* 6, e146364.