Valencian researchers lead the development of a revolutionary integrated device for the early detection and study of cancer and infectious diseases.

- The DISRUPT project brings together researchers from the NTC (Nanophotonics Technology Center) and CVBLab (Computational Vision and Bioinformatics Lab) at the UPV (Universitat Politècnica de València) under the coordination of DAS Photonics.
- The project aims to revolutionize the field of biomedical imaging by developing a photonic chip technology to carry out tomography of cancerous and infected cells. The project falls under the prestigious EIC-Pathfinder programme, aiming to upscale the field of biomedical imaging and diagnosis for different diseases.

The projected outcomes of DISRUPT point to the development of a "radically" new technology, integrated tomographic microscopy, to aid in early cancer detection quickly and cheaply. The project aims to perform cellular tomography on a photonic chip, creating a miniaturised version of current systems and improving and universalising these techniques to study and treat cancer and infected cells.

"Tomography, is a biomedical imaging technique commonly used in conventional CT scans which involves the creation of detailed images on internal organs, tissues, bones, etc. In our case, the technique shall be enabled within a photonic chip to obtain images of cells, specifically 2D refractive index maps. It hence helps to both diagnose and monitor the possible progress of the patient." according to Amadeu Griol, a researcher and group leader at the Nanophotonic Technology Centre of UPV. “It is in a way, similar to having a CT scan on a chip and using it to obtain images of cells for subsequent analysis.” he adds.

The researchers at both the UPV and DAS Photonics, are convinced that obtaining this cellular information in both real-time and on a miniaturised device opens endless possibilities for the study, diagnosis and treatment of cancer or infectious diseases.

"This project is highly multidisciplinary, involving professionals from various scientific fields and combining techniques such as the integrated photonic design of nano-antennas, microfluidics and artificial intelligence for reconstructing these cellular images,' adds Sergio Lechago, senior research engineer at DAS Photonics and technical coordinator of the project.

Among other biomedical techniques, the resulting technology will lead to new avenues in stem cell research, immunocyte phenotyping and pathological tissue classification.

"All this through this device integrated into a photonic chip, based on Tomographic Phase Microscopy (TPM). DISRUPT represents a paradigm shift, by guaranteeing the creation of tomographic microscopes that are much cheaper, lighter, smaller and with better resolution and performance than the few currently existing systems," asserts Carlos García Meca, Research Director at DAS Photonics and coordinator of the project. "In this way, these devices can be installed in any health centre or outpatient clinic, thus facilitating medical diagnosis and opening up new possibilities in telemedicine," adds Maribel Gómez, a postdoctoral researcher at the UPV's Nanophotonics Technology Centre.

Prostate and gynaecological cancers and infections

The DISRUPT project aims to develop and validate a novel device for analysing prostate and gynaecological cancer tumour cells, as well as infected cells. "With our technology, we will be able to reconstruct an image of the cell to know whether it is tumoral or benign in the case of cancer or to distinguish and predict different types of diseases or infectious processes. For cell identification, we will use Artificial Intelligence and Machine Learning techniques to compare our results with different medical image databases of the diverse types of cells of interest." explains Adrián Colomer, a researcher at the CVBLab of the Universitat Politècnica de València.

The DISRUPT project began last December and will run up to the end of 2025. With a budget of three million euros. It also involves key participants such as the Valencian Institute of Oncology (IVO), the National Tumour Institute of Milan, the Max Planck Institute for the Science of Light (Germany) and the company Microfluidic ChipShop, also from Germany.