Micro-spectroscopy opens new routes for diagnostics

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Just as mechanical properties and chemical compositions of materials are of fundamental importance in buildings, the cells that comprise every living organism have different properties and shapes depending on their function and state. Uncontrolled modifications in cell elasticity, or in the elasticity of any biological tissue in general, are symptoms and effects of pathologies—hardened coronary arteries causing heart problems, weakened bones inducing orthopedic complications, elastic changes in corneal tissue provoking ocular pathologies, etc. A non-invasive experimental technique that can probe in-situ the elastic and the biochemical properties of cells and tissues would be a strategic diagnostic tool.

In recent years, optics and photonics, and in particular, microspectroscopic techniques, are effective for materials analysis. A study titled "Non-contact mechanical and chemical analysis of single living cells by micro-spectroscopic techniques," which will appear in the journal *Nature-Light: Science & Applications*, introduces the use of a new spectrometer capable of non-invasively analysing living cells in situ with sub-micrometric spatial resolution. The optical system acquires the Brillouin and Raman spectra simultaneously, and by exploiting the interaction between light and matter, is able to provide contactless mechanical and chemical maps of the system under investigation. The collaboration of physicists and biotechnologists extends this approach to the analysis of single living cells, proving in particular the ability of the technique to monitor the mechanical modulation due to subcellular protein structures.

Furthermore, it has been found that upon oncogene expression, cells show a significant softening. This property can explain the invasive potential observed in tumor cells—their increased deformability helps them spreading through the narrow spaces of the extracellular matrix, favoring the future development of metastasis.

This study highlights how mechanical properties of cells can be a new bio-marker for pathologies and how the proposed technique can become a potential diagnostic tool, even in tumors.

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