

ICFO COLLOQUIUM SERIES: Listening to cells and seeing handedness

ROMAIN QUIDANT

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10:00 to 11:00
ICFO Auditorium

PROFILE:
Romain Quidant received a PhD in Physics (2002) from the University of Dijon, France. He then joined the newly created ICFO in Barcelona as a postdoctoral researcher. In 2006, he was appointed junior Professor (tenure-track) and group leader of the Plasmon NanoOptics group at ICFO. In 2009, he became tenure Professor both at ICFO and ICREA. After nearly 18 years at ICFO, in June 2020, hejoined the Mechanical and Process Engineering department (D-MAVT) at ETH Zurich. He is recipient of 3 ERC grants and several international and national prizes. Since January 2022, he serves as the Editor-in-chief of ACSPhotonics (American Chemical Society).

ABSTRACT:
Light is uniquely suited to probe biological systems and nanoscale matter. With modern

interferometric and nanophotonic techniques, it can now detect single nanoscale objects without labels. In this talk I will present recent work from our laboratory that uses these capabilities in biology and in chiral nanophotonics. I will also discuss an often-overlooked side of light-based measurements: the light can affect the very components that make the measurement possible.

First, I will show how interferometric scattering (iSCAT) microscopy can be interfaced with microfluidic chips to monitor proteins secreted by living cells in real time and without labels. Because secreted proteins mediate intercellular communication and reflect physiological state, this gives continuous, direct access to how the cell state changes over time. I will discuss several experiments in which cells from organoids or from complete organ-on-chip models respond to external stimuli such as drug treatment or temperature stress. These experiments point to new ways of studying cell behaviour under physiologically relevant conditions.

Second, I will ask a question that most light-based bioassays overlook: what does the sensing light do to the antibodies used to selectively capture the target molecules? I will present evidence that illumination under conditions typical of optical bioassays can damage these capture antibodies and degrade their binding capability. I will then discuss what this means for the reliability of light-based measurements and for how such assays should be designed.

Finally, I will turn to optical chirality, which governs many molecular interactions across chemistry, biology and pharmacology. Chiroptical signals are intrinsically weak and are usually averaged over large ensembles. I will introduce a new chiral microscopy technique that maps the chiroptical response of matter at the nanoscale. A key feature of this approach is its ability to efficiently eliminate artifacts, such as those arising from linear anisotropies and polarization imperfections, that can otherwise mimic a genuine chiral signal.

Hosted by: Prof. Dr. Oriol Romero-Isart