Nonlinear endoscopy using specialty optical fibers

I will start with the basics of nonlinear contrasts to perform label free imaging in biological samples and I will move on showing novel endoscopes developments based on specialty optical fibres that can activate these nonlinear contrasts at the end of flexible imaging probes. I will focus first on a multimodal nonlinear micro-endoscope for real-time, label-free imaging of biological tissues using a specialty hollow core fibre. The endoscope has a diameter of 2mm and can perform 2photon and 3 photon fluorescence, harmonic generation and coherent Raman imaging at 10 frames/s. I will then move to the development of a lensless endoscope that represents the ultimate limit in miniaturization of imaging tools: an image can be transmitted through an optical fibre by numerical or physical inversion of the fibre's pre- measured transmission matrix. The lensless endoscope has a diameter of 200µm and uses a "tapered multi-core fibre (MCF)", designed for integration into ultra-miniaturized endoscopes for minimally invasive two-photon point-scanning imaging.

Lecturer : Hervé Rigneault is research director at CNRS. He graduated with an engineer degree in optics in 1991 from Ecole Centrale Marseille and got his PhD from Aix-Marseille University in 1994 in the field of nonlinear optics. He obtained his habilitation from Aix Marseille Univ in 2000. Since then, he is developing optical techniques for life science applications and created the Mosaic group at the Fresnel Institute in 2000. He is the author of more than 230 publications in the field of optics, optical spectroscopy and molecular imaging. He was awarded with the CNRS Bronze medal in 2000, the IXcore foundation award in 2022 and the CNRS excellence award in 2021 and 2014. He became an Optica Fellow in 2020 and obtained and ERC advanced grant in 2021 in the field coherent Raman imaging for biomedical applications.