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Life Science in Live by Nonlinear Microscope and Endoscope

Nonlinear imaging techniques, such as 2-photon/3-photon autofluorescence, second/third harmonic generation (SHG/THG), coherent anti-Stokes Raman (CARS) scattering and stimulated Raman scattering (SRS), stand out for life science applications by their label-free property. These techniques can be used to observe morphology of biological systems or targeting specific molecules in the system. Together with a fast-scanning system, nonlinear techniques can be also used to follow real-time dynamic biological process, such as animal metabolic process, molecular delivery in skin and neural activities in brain.

We developed a fast, sensitive and compact nonlinear microscope system, which includes 2-photon fluorescence, SHG and SRS imaging. Our microscope has been used for medical applications (tumor diagnose [1], organoid observation), chemical and pharmaceutical applications (cosmetic spreading, pharmaceutical tablet quality control [2]) and biological applications (metabolic process [3], molecular penetration in skin[4]).

To go one step further, we also integrate nonlinear techniques (2-photon/3-photon, SHG/THG, CARS) in a flexible endoscope (see Figure 1) [5], to access samples that cannot be placed in a microscope, and to observe biological process in a living model such as mice [6].

In conclusion, our nonlinear microscope and endoscope can provide label-free live imaging for various biological and biomedical applications and can be adapted for different samples *in vitro* and *in vivo*.

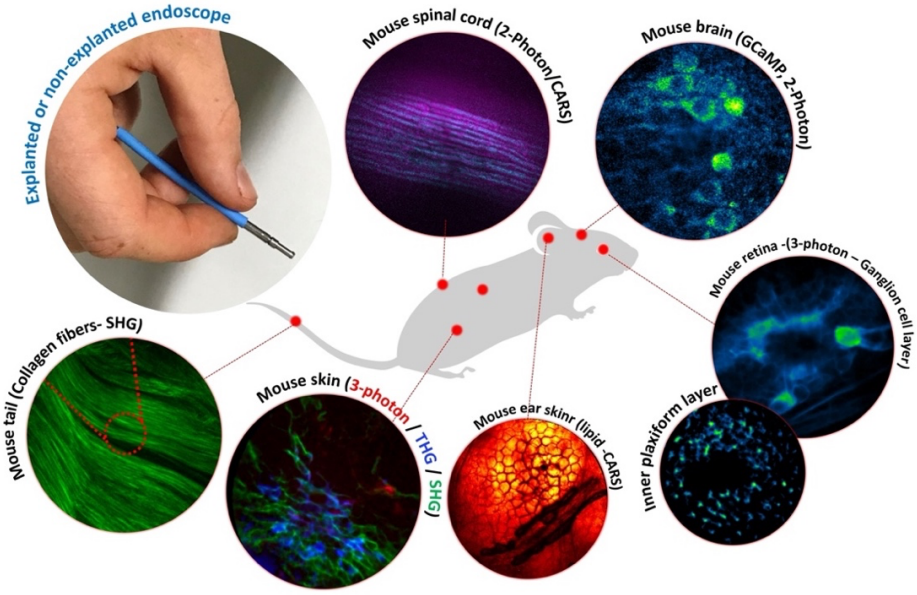

Figure 1: Imaging different locations on/in mice using nonlinear endoscope M-FIP.

References

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