

STIMULATED RAMAN HISTOLOGY: ONE TO ONE COMPARISON WITH STANDARD HEMATOXYLIN AND EOSIN STAINING

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Despite its invasiveness – the technique necessitates to remove, section and stain small regions of suspect tissues so called biopsies- conventional histopathology remains the gold-standard technique for pathological diagnosis of cancers: it provides the pathologist with microscopic view of the tissue architecture, at the cellular level. Recently, a need for real time technology delivering fast histological-like images has emerged since intra-operative diagnoses can often be required during surgery. Combining Stimulated Raman Scattering (SRS) that addresses vibrational bonds and provides real chemical sensitivity; with second harmonic generation (SHG), we performed label-free cancer detection of unprocessed human surgical specimens in the gastro-intestinal (GI) tract. Investigating the two CH₂ and CH₃ vibrational bands simultaneously [1] both nuclei cells and cytoplasm/extra cellular matrix could be exhibited together with the collagen distribution- another important feature whose morphology is greatly modified during cancer formation; probed in parallel with SHG. Mimicking hematoxylin and eosin (H&E) staining, virtual histology-like images, referred to as Stimulated Raman Histology (SRH) are label-free generated [2]. Here, we demonstrate for the first time SRH and H&E stain comparison on the same cryogenic sections of human tissues (fig.1) from different organs and various pathologies of the GI.

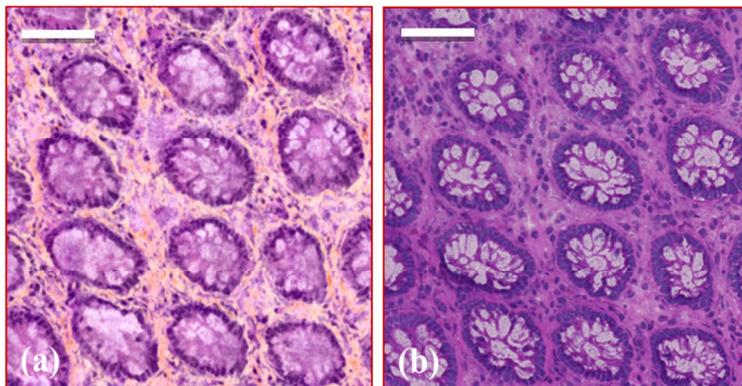


Figure 1: (a) Stimulated Raman histology (SRH) before staining and (b) Eosin and Haematoxylin staining of the same cryogenic slide of human colon. Scale bar 100 μ m.

Quasi-perfect matching in morphological changes, tissue architecture alterations due to cancer growth, as well as fibrosis development in the GI tract could be evidenced confronting SRH and H&E on exactly identical regions of the cryogenic slides probed. Diagnosis on stage disease could also be accurately made in each case hence delivering the ultimate proof of the relevance of SRH as a very promising technique for intra-operative diagnoses.

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[2] DA. Orringer, B. Pandian, YS Niknafs et al. “Rapid intraoperative histology of unprocessed surgical specimens via fibre-laser-based SRS microscopy”. *Nature Biomedical Engineering* **1**:0027 (2017)