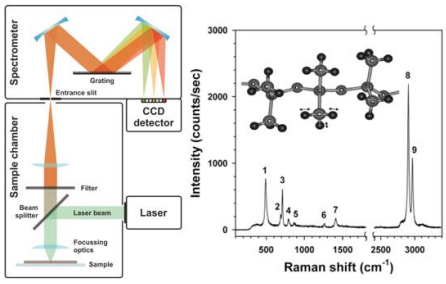
Confocal Raman microscopy to study breast implant's early rupture in mastectomy patient

Laboratoire ICube, Strasbourg, France

Internship proposal

The IPP team of the ICube laboratory at Strasbourg's civil hospital is offering a 6-month internship on the theme of "Biomedical Optics".

The goal of this internship is to understand the mechanism of early rupture of breast implants used for mastectomy patients, using confocal Raman microscopy and hyperspectral data analysis.



Raman spectroscopy setup, Raman spectrum of PDMS [1,2]

The polydimethylsiloxanes (PDMS) are the basis of both the gel and shell of most of the breast implants. [polydimethylsiloxane (PDMS)] Today, *in vivo* aging of implants remains largely unknown and the here is no quantitative criterion for predicting the need to change them, and this is left to the surgeon's discretion. A recent study carried out by ICube's MMB and RDH teams by ultrasound elastography and mass spectrometry has showed that prostheses became stiffer and organic compounds appeared in the implant as the duration of implantation increased. Confocal Raman microscopy shows the ability to complete the missing information for chemical modification of implant due to complicated environment in mastectomy patient body.

Rotational and vibrational transitions in molecules provide the Raman scattering which is suitable to detect chemical bonds and modifications in materials such as polymers. Confocal Raman microscopy as label free method, with improved instrumentation such lasers (532nm and 633nm) and EMCCD (Electron Multiplying Charge Coupled Device) detector provide a complete chemical map of sample with an enhanced signal collection. Advanced data analysis in next step, help collection of particular information to comprehend the modification of polymer leaded to the micro-rupture and implant removal.

Required skills: fundamental knowledge of optics, data analysis, R programming.

Expertise acquired during the internship: the student will have acquired solid expertise in Raman spectroscopy, design of portable Raman setup, hyperspectral data analysis, fundamental knowledge on biopolymers

Possibility of continuing with a thesis: Yes

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References:

(1) Langmuir 2005 DOI :10.1021/la050233
(2) Heritage 2019 DOI :10.3390/heritage2020102
(3) Polymers2023 DOI :10.3390/polym15183835
(4) Gland Surg2017 DOI :10.21037/gs.2016.09.12
(5) Appl. Phys. Lett.2013 DOI :10.1063/1.4794871
(6) Commun. Chem.2022 DOI :10.1038/s42004-022-00702-7
(7) L. Ruffenach, F. Bodin, C. Cosentino, D. Funfschilling, N. Bahlouli, and S. Chatelin, Ultrasound elastography to prevent rupture in the breast implants, 48th Congrès de la Société de Biomécanique, 25-27 octobre 2023, Grenoble, France