

Master Internship Advanced Laser Patterning for Engineering Standardized Bio-chips

(Duration: 6 months, starting 2025)

Laboratoire Hubert Curien, CNRS UMR 5516; Université Jean Monnet, France

Background: Ultrafast laser surface micro-/nano-patterning and surface functionalization have been proven to be a powerful tool for biological and bio-medical applications^{1, 2}. In many occurrences, the initial phase of surface design of the functional micro-/nano-structures is rather time consuming. One of the major reasons is that this design is an iterative process consisting of a series of steps. In each step only one sample is fabricated and there is a long wait time before the aimed bio-assessment³. The objective of ALPES (Advanced Laser Patterning for Engineering Standardized Bio-chips) project is to reduce the iteration steps by adopting bio-chips, on which many different samples are fabricated. A standardized bio-chips with a vast variety of nanostructures on the chip for fast screenings would be of common interest for many related research activities (screening human cells, bacteria and smaller sub-cell units, etc)⁴. The standard bio-chips would accelerate the design process, and the fast screening would give inspirations for advanced designs / optimization process⁵.

Objectives: The design and realization of the patterns/test areas on a bio-chip are of multidisciplinary nature, based on an excellent understanding upon what is needed for bio-assessment and what is feasible by femtosecond laser irradiation. To this extent, the Master 2 intern is expected to ensure good communications between experts in biology and in laser physics, to propose and to fabricate the selection of the patterns (with the support of the experts). Multiple identical bio-chips are to be prepared to this end. These bio-chips will be made available for other ongoing and upcoming projects where fast screening is necessary. The host institute is Hubert Curien laboratory, and the intern shall be working closely with colleagues from Sainbiose lab of medicine faculty, as well as technology transfer center Manutech-USD.

Practical information: The successful candidate must be a team player, results-driven, and self-initiator. He/she should be enthusiastic about physics, optics, engineering and biology. The hosting laboratory and associated laboratories are all located in Saint Etienne, France. The internship at Master 2 level is funded by Manutech-SLEIGHT (with intern stipend regulated according to Jean Monnet University remuneration scheme). For application of this opening, customary documents such as motivation letter, CV and recommendation letters/contacts should be made available to the contact person indicated below.

Note: The Hubert Curien Laboratory is a restricted access area. The fellowship is conditioned by a security clearance, to be applied for during the application (two months process time). To apply for a security clearance, we need the following documents: exhaustive CV, and passport copy.

Contacts:

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References

- [1] M. Maalouf, *et al.*, Polarization of Femtosecond Laser for Titanium Alloy Nanopatterning Influences Osteoblastic Differentiation, *Nanomaterials*. 12 (2022).
- [2] S. Papa, *et al.*, Dual-functionalized titanium by ultrafast laser texturing to enhance human gingival fibroblasts adhesion and minimize Porphyromonas gingivalis colonization, *Appl. Surf. Sci.* 606 (2022).
- [3] A. O. Ijaola, *et al.*, Wettability Transition for Laser Textured Surfaces: A Comprehensive Review, *Surfaces and Interfaces*, 21 (2020),
- [4] Fonctionnalisation de la surface des implants avec des vésicules extracellulaires sur des nanostructures générées par laser femtoseconde, thèse Manutech-SLEIGHT (Nanotrap), 2024.
- [5] Hemant V. et al., An algorithm-based topographical biomaterials library to instruct cell fate, *Proceedings of the National Academy of Sciences*, 108 (2011).