

Development of an olfactory prosthesis for people suffering from anosmia

Master/Semester project or lab immersion

(Section: Microengineering – Physics – Electric Engineering – Life Science)

Sensory deficits are a major source of handicap in people's lives. Scientists have already developed prostheses and implants for hearing impairments and are developing those for vision. Partial and total loss of smell (hyposmia / anosmia) impacts 20% of the world-wide population with deleterious effects on quality of life. However, we have yet to develop such devices to restore the sense of smell, primarily because scientific knowledge linking artificial systems to human biological olfaction is still lacking. The ROSE project is composed of a European consortium working together to push the limit of artificial olfactory sensations. The project will be held in close collaboration with the European partners and may include travels to meet with them.

At the LMIS1, we are currently investigating the new possibility of stimulating sensations in the nasal cavity using drugs known for their triggering of acute sensations. Thermal and piezo inkjet printing methods have been identified as promising tools to achieve that goal thanks to their easy actuation mechanism, control in droplet formation mechanism and integrability.

The project thus comprises the definition of the requirements of such a device to be compatible with medical devices regulations to ensure the patient's safety. Also, the possibility of using components existing on the market will be evaluated. The project will redirect to microfabrication technologies in the case where this option was not possible. The topic is highly multidisciplinary, involving aspects of physiology electronics, cleanroom microfabrication and materials science: the focus can be adjusted depending on the student's preferential interests, best knowledge, previous experience and motivation.

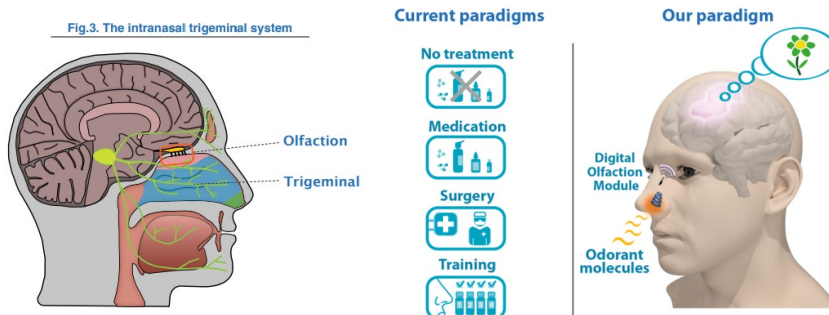


Figure 1 : (a) schematic showing the olfactory system (b) Paradigm of the ROSE project for the restauration of olfaction in anosmic people

Possible tasks:

- Analysis of droplet formation mechanism and assessment of different methods
- Electronics design for the control of droplet formation
- Experiments for the characterization of droplets formation
- Design, optimize and/or execute process flows at EPFL's state-of-the-art CMi cleanroom:
 - Process flow conception,
 - Drawing individual devices and aggregated chip/wafer lithography layouts,
 - Characterization of the resulting components using SEM, AFM, and other metrology tools.

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