# Interactions of Nanoparticles with Lung Fluid and Cells

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## Describe the team that the student will join for the project.

The intern will join a group of 7 researchers, composed of 2 PhD (Fanny Mousseau, Gwennhaël Brackx), 2 postdocs (Leticia Vitorazi, one position to be hired) and 3 permanent positions. The permanent positions are an ANR awarded "Chaire d'excellence" (Emek Seyrek), an assistant professor (Gaelle Charron) and a CNRS scientist (Jean-François Berret).

Our research group develops novel functional nanostructures with stimuli-responsive features and biocompatibility. The particles, proteins and other biomacromolecules are elementary bricks of colloidal scaffolds designed for applications. Based on techniques of assembly using non-covalent interactions, this approach offers versatility and simplicity for the fabrication of novel nanomaterials with enhanced functionalities. A second objective of our research deals with the applications of these nanomaterials in medicine, biology and in environment. It includes their use as tools for imaging and therapy in living cells and tissues, as well as the study of their cyto- and genotoxicity. In this research, emphasis is put on key features such as interactions, localization and titration of nanomaterials in biological and natural environments.

## Project description :

Nanoparticles (NPs) have emerged as fundamental constituents in the development of nanotechnology. Concerns have been raised however regarding their potential risks for human health and for the environment. It has been realized that interactions of NPs with living cells depend dramatically on their behavior in biological fluids [1]. The effective unit of interest is not the NP itself, but the particle and its "corona", which implies the layer that forms around the particles, with associated proteins or biomolecules coming from the surrounding biological fluid [2] Because of the importance of this "surrounding matrix", it is necessary to study biological fluids that are close to real life biofluids and determine the corresponding nanotoxicity [3]. One fluid among all biological fluids is significantly relevant for human safety, the lung fluid. It represents the first barrier against inhaled particles (Figure 1).

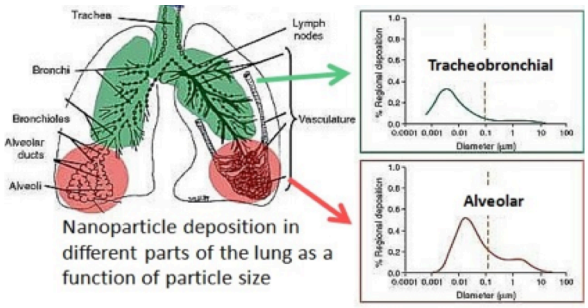


***Figure 1** : Representation of the different levels of the lung, showing tracheobronchial and alveolar compartments (left). Percentage of deposition as a function of the particle size (right).*

In this project, we will study the interactions of different types of nanoparticles in lung fluids. The aims of the project are:

1) To construct a biomimetic lung fluid to act as the model biological medium for studying interactions of NPs and cells. The lung fluid is composed of mainly phospholipids and surfactant proteins, which will form the nanoparticle corona constituents. A lung fluid will be constructed using the real constituents, including the surfactant proteins. A model LF will also be employed as a comparison.
2) To study different types of nanoparticles with different size and charge properties for their interaction with the lung fluid, how the nanoparticle corona forms, and how does the final nanoparticle corona interacts with the lung epithelial cells.

**Recent References on this work**

*1. N. Lewinski, V. Colvin and R. Drezek, Small, 2008, 4, 26-49.*
*2. M. P. Monopoli, C. Aberg, A. Salvati and K. A. Dawson, Nat. Nanotechnol., 2012, 7, 779-786.*
*3. R. Landsiedel, L. Ma-Hock, A. Kroll, D. Hahn, J. Schnekenburger, K. Wiench and W. Wohlleben, Adv. Mater., 2010, 22, 2601-2627.*