Master2/PhD Project:
Impact of physical constraints on wound healing

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Project description :

Epithelia are tissues that serve as a protective barrier from the external environment and also to separate body compartments in multicellular organisms. In the case of wound healing, cells are migrating, proliferating and differentiating collectively toward the damaged area to restore a protective barrier and maintain tissue integrity. This collective behaviour depends on the interactions with the external environment and with neighbouring cells. These mechanosensitive cellular responses depend on the physical properties of the environment including geometry, confinement and rigidity. The engineering over the past 20 years of microfabricated tools and the accompanying development *in vitro* cellular models allowed to confront mechanics to molecular pathways and helped to propose adequate platforms to study wound healing mechanisms. The design of substrates based on these technologies thus offers new possibilities to probe the cellular responses to changes in their physical environment.

This project focuses on the influence of the mechanical properties of the micro-environment on the mechanisms involved during wound healing of skin cells. Our goal is to develop a cellular platform that integrates physical constraints to understand how epithelial cell migration is impacted by such constraints and thus optimize wound healing processes.

It combines cell biology, engineering and biophysics. It is based on the hypothesis, emerging from our previous data, that geometrical constraints can trigger various responses of epithelial tissues to close gaps. First step, will be to test different types of materials to understand their impact on cells migration and wound healing. Once completion of the first step, we will develop various conditions to optimize the relevant parameters of surface coating, geometry and confinement in model wound assays.

We will use molecular and cell biology approaches together with live cell imaging and micro-fabrication techniques to quantify cellular organization as well as the dynamics of adhesions and cytoskeleton. We anticipate that it will provide methodologies based on both experiments and models that will define optimal conditions for restoring tissue integrity during wound healing. The project will be done in collaboration with the company COLOPLAST.

After Master 2, a possible fully funded CIFRE PhD fellowship:

We are looking for highly motivated graduate students with an interest in multidisciplinary science. Positions will be related to experimental approaches including microscopy, cell culture and microfabrication. A background in cellular engineering will be appreciated.

References:

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