

## Research group

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## Excerpt of current projects

### 1. **Fat grafting and nerve regeneration:**

#### **Summary:**

In this project the effect of fat and adipose-derived stem cells (ADSCs) on peripheral nerve regeneration will be studied in different settings in an in vivo situation. Based on this, novel therapeutic strategies to improve nerve regeneration and thus function of an extremity after injury could be developed. Next to this we are interested in studying process of fat graft taking itself and the influence of heat preconditioning in this context.

We aim to establish a new in vivo animal model to assess short-term outcome of fat (with and w/o concentrated ADSCs) grafting and improve its survival through the application of preconditioning methods prior to transplantation. Our model shows the revascularization of the fat as the main criteria for tissue survival. Further we will adapt the same model to visualize in vivo peripheral nerve regeneration. Lastly we will approach to visualize and investigate the use of fat grafting in order to treat painful neuromas in light of its mechanical properties and the possibility to create a gliding layer allowing free excursion of the nerve and to potentially prevent the formation of new adhesions of the nerve to the surrounding tissues.

### 2. **Hylomorph Project - Can the healing performance of wound dressings be enhanced by means of micro-structured surfaces?**

#### **Summary:**

The project aims to demonstrate the efficiency of micro-structured wound dressings. Surface micro-structures have been shown in-vitro to improve i) time to wound healing, ii) wound coverage and iii) quality of scar tissue, when compared to identical but flat wound dressings. Therefore apical guidance represents an adhesion-free, material-independent strategy that can be applied to any wound shape and type (from simple mechanical abrasions to burns and chronic wounds). It is an opportunity to better manage simple everyday's wounds and burns (with standard plasters), as well as larger burns and chronic wounds (advanced wound dressing) requiring hospitalization. In this latter case, the treatment with apical guidance promise to significantly reduce the rehabilitation time

### 3. **Cell hibernation strategies in skin substitute engineering**

#### **Summary:**

The goal of this project is to assess the feasibility for artificial induction of a temporary hibernation-like state of cells in a composite skin substitute. Therefore already known strategies for hibernation induction will be used. In addition we aim to identify factors that are responsible for previously observed long-term hypoxia tolerance in stored human skin.

### 4. **Revascularisation Strategies For Skin Tissue Engineering Based on Autologous Graft Taking**

#### **Summary:**

A major challenge for both plastic surgeons and skin tissue engineers today is the limited survival of full thickness skin grafts (FTSG). The grafts often become necrotic as they undergo hypoxia due to failing to acquire a sufficient blood supply. To overcome this, we are taking a deeper look at the vascular endothelial growth factor (VEGF), known for its active role in angiogenesis. By creating a full thickness skin substitute (FTSS) with the addition of myoblasts that stably overexpress VEGF, we aim to significantly increase the speed of revascularisation and therefore decrease the hypoxic

environment. Methods: Through both *in vitro* and *in vivo* studies, we aim to characterise the skin substitute and the concentration of myoblasts needed to quickly reestablish blood supply. The modified dorsal skinfold chamber (MDSC) model will be employed in order to perform intravital microscopy (IVM), which allows continuous monitoring of the vascularisation process.

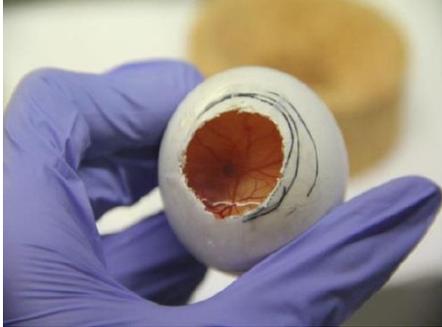


Fig. 1: Common initial selection process consists of testing out a potential scaffold by placing it on the chorioallantoic membrane (CAM) of a chicken egg. A way to test if the scaffold has good biocompatibility is if the CAM vasculature has grown around or towards it. If the vasculature particularly avoids the material and the vessels grow away from it, it is clearly not a good option, as the reaction will be the same *in vivo*.

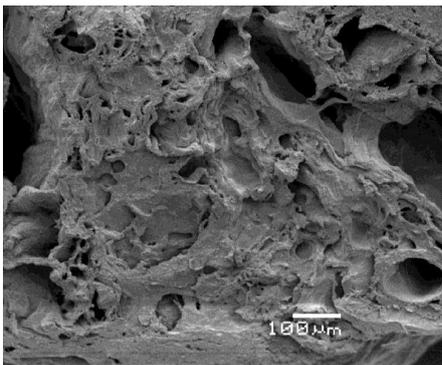


Fig. 2: Scanning electron microscopy (SEM) is used to verify and measure structures, such as pores, which are an essential component for optimal cell growth and adhesion. To the right: SEM of fibrin containing pores as large as 300 μm.