Human skin organ culture for analyzing wound healing mechanisms in vitro

**GENERAL FIELDS OF RESEARCH**
- Pharma Industry
- Plastic Surgery
- Cosmetics
- Toxicology
- Cell Biology
- Microbiology

**OUR EXPERTS FOR THE HUMAN ORGAN CULTURE MODEL**

**For the biotechnological side of the project**
Prof. Charli Kruse, Fraunhofer EMB

**For the wound healing, skin biology, and dermatological side of the project**
Prof. Ralf Paus, University of Manchester
Dr. Jennifer Klöpper, University of Lübeck

**For the clinical side of the project**
Dr. med. Felix Stang, UK-SH

**CONTACT**

Fraunhofer Research Institution for Marine Biotechnology EMB
Prof. Dr. Charli Kruse
Mönkhofer Weg 239a, 23562 Lübeck
Phone +49 451 384448-11
charli.kruse@emb.fraunhofer.de

Institute of Inflammation and Repair,
University of Manchester
Prof. Dr. Ralf Paus
Oxford Rd, Manchester M13 9PL, UK
ralf.paus@manchester.ac.uk

Dept. of Dermatology, University of Lübeck
Dr. Jennifer Klöpper
Ratzeburger Allee 160, 23538 Lübeck
Phone + 49 451 500 2516
jennifer.kloepper@uksh.de

Section for Plastic Surgery,
University Medical Center Schleswig-Holstein (UK-SH)
Dr. med. Felix Stang
Ratzeberger Allee 160, 23538 Lübeck
Phone +49 451 500 2061
felix.stang@uksh.de
Bioengineered human skin “equivalents” have been advocated as suitable wound healing models. However, the generation of such skin “equivalents” is costly, time-consuming and labour-intensive and requires substantial cell culture expertise. Moreover, these reconstitution assays cannot claim to fully reflect native human skin, and employ cultured cells whose properties likely have been altered during isolation, culture, and reconstitution. Furthermore, these assays typically lack several skin cell populations appreciated as important wound healing protagonists (e.g. endothelial cells, macrophages, and mast cells) as well as skin appendages. We here present a quantifiable and reproducible assay system for several preclinical research issues of human skin wound healing that allows the long-term culture of normal adult human skin under precisely defined (i.e. serum-free) organ culture conditions with a “punch-in-a-punch” technique.

This human skin organ culture model, first established by the team of Prof. Paus at the Dept. of Dermatology, University of Lübeck, on the basis of preparatory work by Lu et al. (Exp Dermatol 2007), will be further developed jointly by the EMB and the collaborating partners.

**INTRODUCTION**

The human skin punch model provides a unique, easily reproducible tool to re-examine long-standing questions concerning wound re-epithelialisation and the molecular mechanism underlying wound healing. It presents the following advantages:

1) Operates under precisely defined, serum-free conditions, and uses a metabolically optimized medium to sustain the long-term organ culture of human skin.

2) Uses human adult, full-thickness skin that even includes the subcutis, with its wound healing promoting pluripotent stem cells, adipokines, and skin appendages.

3) The current assay system encompasses a number of sensitive, quantitative morphometric and molecular read-out parameters that have not been used in previous in vitro wound healing assays. These read-out parameters facilitate highly standardized, biologically instructive, and easily reproducible in vitro wound healing research in the human system.

4) Allows the observation of epidermal wound healing in an environment that is negligibly affected by systemic growth factors, cytokines and inflammatory cells.

5) The model can be easily adapted to specific wound healing research questions including analysis of soluble factors, stem/progenitor cells and toxicology.

**TOPICS**

- Wound healing capacity
- Cell migration, proliferation & apoptosis
- Angiogenesis
- Immune parameters
- Cell differentiation
- Skin remodeling
- Cell signaling

**SERVICE**

- Skin organ cultures
- Tissue sectioning & histology
- Automated immunohistochemistry
- Histomorphometry
- Multiplex cytokine analysis
- Gene expression profiling
- Cell culture, labeling & tracking
- Microscopy & photo-documentation