How we explore the future of tissue engineering

Alexander König | June 27, 2019, Düsseldorf
What is tissue engineering?

- Cells
- Scaffold
- Medium
- Tissue

Cells

Cells

Cells

Liver

Heart

Muscle
Why tissue engineering?

1 in 55,000 people experience severe burns

Patient’s own skin graft

250,000 cases of diabetic foot syndrome.
50,000 foot amputations

Better wound healing

In vitro test models

Approx. 2,100,000 tests on vertebrate animals

300 in 100,000 people suffer from Crohn’s disease

Stem cell therapy

per year in Germany
Ingredients for cell cultures

**Today**Primarily formulations of animal origin

**Future**Formulations of nature-inspired components based on e.g. cQrex®

Scaffold material

**Today**Materials of animal origin

**Future**Nature-inspired materials based on e.g. Resomer®

Process know-how

**Today**Complex, manual processes

**Future**Automated, scaled processes

Technical challenges for tissue engineering

Advanced solutions for tissue engineering
Connecting competencies—a global approach

USA
Competence center for Medical Devices
Biomaterial production, processing & analytics…

Germany
Health Care, Care Solutions, Creavis
Components for cell culture media, cosmetics expertise…

Singapore
Tissue Engineering Project House
Cell cultures, 3D printing, application technologies…
The skin: a complex organ

The skin, measuring 1.5 to 2 m², is one of the largest human organs.

The skin is the interface of humans and their environment.

It provides heat regulation and immune protection.

It is exposed to sunlight and substances in the air and is affected by ingredients in household cleaners or cosmetics.

It has unique microbiotic properties.
The skin: layers and functions

**Human skin**

- **Stratum corneum**: Protective function
- **Epidermis**: Barrier function and skin renewal
- **Dermis**: Elasticity and resistance, blood vessels and nerves

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*Image of human skin layers and functions.*
Skin models: realistic, reconstructed skin

Conventional skin model

Stratum corneum
Reduced barrier function

Epidermis
Simplified structure

Dermis
No blood vessels, nerves or immune system

Ideal skin model

Stratum corneum
Improved dehydration protection

Epidermis
Penetration of cosmetics and active ingredients

Dermis
Mechanical and dermatological properties, penetration into blood circulation
Our technical approach

- **Scaffold**: Comprised of biodegradable, non-animal material
- **Medium**: Enables skin cells to grow in quasi-natural conditions
- **Technology**: Makes engineered skin scalable and reproducible
Example:

*in vitro* test
Skin model applications

Cosmetics development

Safety and efficacy of cosmetic products:
- Protection factor of sunscreens
- Irritation potential of shower gels

Research & development:
- Understanding the effect of pollution
- Modeling of skin aging

Pharmaceutical development

Safety and efficacy of new drugs:
- Efficacy in diseases like psoriasis, eczema
- Evaluation of potential side-effects

Research & development:
- Understanding blood circulation
- Modeling immune response

Safety and effectiveness

Alternative to animal testing for:
- Irritation
- Corrosion
- Sensitization

Effectiveness:
- Biological activity of new ingredients
- Impact of environmental influences
- Effect on microorganisms
In vitro skin model applications

Optimized human skin models can

- enhance the relevance of in vitro tests.
- further reduce the need for animal studies.
Example:

Clinical skin application
Clinical skin application

Grafts
Patient’s own skin from cell culture

Standard treatment
Skin from cell culture

Chronic wounds
- Active wound dressings
- Cell patch

3 months
Our vision: Solutions for reliable, scalable and effective tissue engineering

**Solutions for reliable, scalable and effective tissue engineering**

**RELIABLE**
Ultrapure scaffold material without animal substances for cell cultures

**SCALABLE**
Scalable process along the value chain with consistently high quality

**EFFECTIVE**
Materials and media of the proven highest quality and effectiveness
Our goals

We want to ...

...simplify and accelerate the production of human cells and tissue in the laboratory for better reproducibility.

...pave the way for innovative healing and testing methods.

...develop new solutions for medical and cosmetic applications, using our existing competencies.