## P18: Bioprinting of 3D immunogenic skin model

3D bioprinting is a transformative technology leading to a paradigm shift in individualized therapy. Among other things, it allows to develop 3D tissue models based on human biology and reduce the need for animal experiments. As a PhD student, you will join a highly interdisciplinary and multinational research group "3D Printing and Biofabrication" working on cutting edge technologies ranging from multiphoton lithography, for high resolution bioprinting, to organ-on-a-chip and advanced tissue engineering.
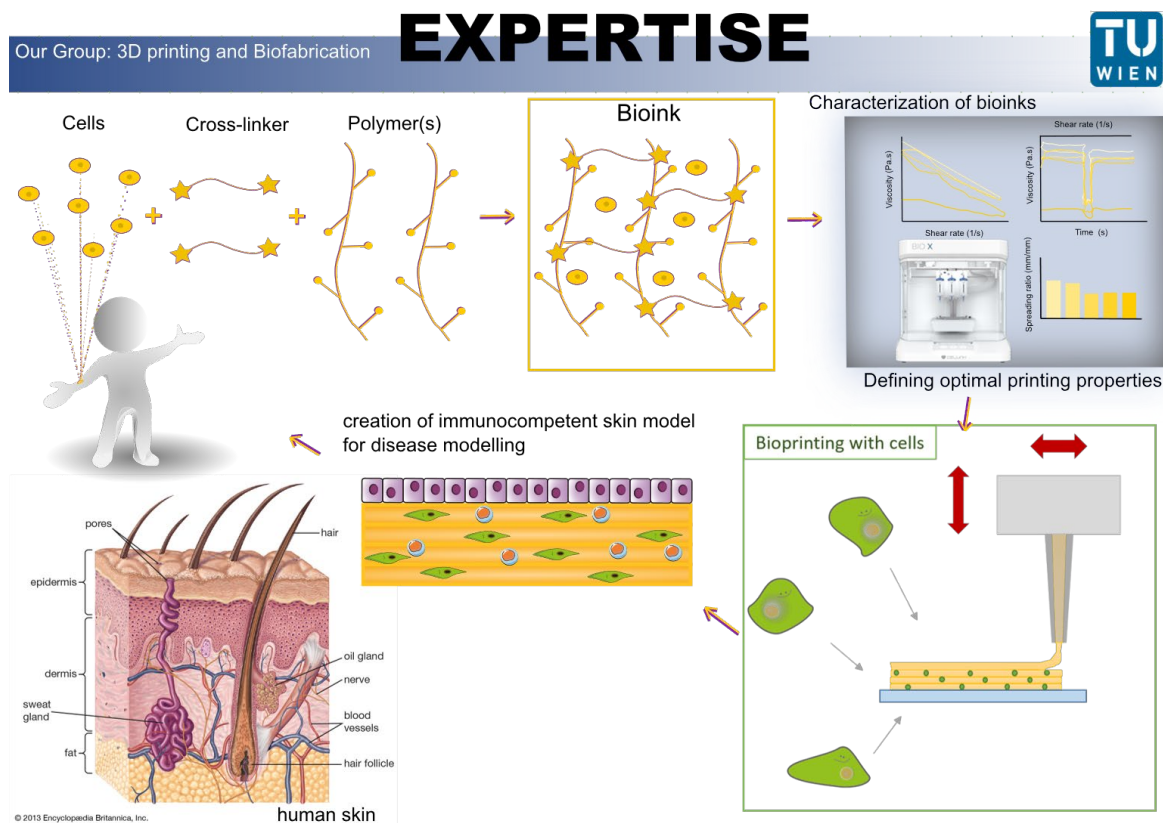
Are you getting intrigued, some literature and recent group results can be found here:

https://amt.tuwien.ac.at/or watch the video showing how to build a Castle on tip of a pencil an image winning our group the Wikipedia Science Competition

Supervisory Team[1]

Primary Supervisor: *Dr. GUILLAUME Olivier, TU Wien – 3D printing and biofabrication – IMST*

TU Wien project partners: *Prof. OVSIANIKOV Aleksandr, IMST, Prof. THURNER Philipp, ILSB and Dr BAUDIS Stefan, IAS.*

External academic partners: *Prof STARY Georg, Med Uni Wien (Vienna, Austria)*

External industry partners: *Mr BRISSON Bruno, Poietis (Bordeaux, France).*

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[1] The Early Stage Researchers (ESRs) will be accompanied during their thesis by an individual "Thesis Advisory Committee" (TAC), which will guide the ESR through the graduate studies. The TAC will consist of the thesis primary supervisor, and two additional members of the Supervisory Team selected by the ESR.

Project Description

The immune system plays a fundamental role in the physiology of tissues, both in a healthy and diseased state. In order to decipher the role of cells individually and on community, there is a need to deconstruct complex *in vivo* tissues to reproducible 3D *in vitro* models. Bioprinting offers a unique possibility to produce such tissue equivalents in accordance to a computer aided design (CAD) and study them in a systematic manner. The aim of this PhD thesis will be to unravel some key roles played by immune cells in a diseased skin. This will be achieved by developing an immunocompetent skin model, which can mimic inflammatory skin diseases, with perspectives to help in the R&D of novel therapeutic modalities. To reach this goal, the candidate will be hosted in our group with full access to bioprinting, cell culture, molecular biology and to a variety of cutting-edge characterization techniques such as AFM, confocal microscopy.... The candidate will be co-supervised by several PIs with multidisciplinary expertise covering the different facets of this project, from biomaterial scientist, biophysicist, chemist to biologist and dermatologist. His/Her activities will not only be supported by academics, but also by an industrial partner (Poietis France), renowned pioneers in the field of bioprinting and tissue models.

Key Goals and Tasks

The primary aim of this PhD thesis is to develop *in vitro* a skin equivalent tissue, integrating not only skin cells, but also a viable immune compartment.

Such 3D immunogenic skin model will permit to mimic immune-disease states (like granuloma for instance), and subsequently to screen for optimal therapeutic modalities in a high throughput manner.

Your task will be to:

1- Develop specialized bioinks, in terms of natural extra-cellular matrix (ECM) based biopolymers, skin cells and immune cells
2- Characterize the final bioinks in terms of viscosity, printability and cellular behavior.
3- Define the optimal printing properties
4- Fabricate and characterize the 3D bioprinted skin equivalent integrating skin cells and immune cells
5- Mimic in vitro diseased states and study the influence of therapeutics on its evolution

This project is highly multidisciplinary, involving physico-chemistry, cell culture, immune biology and pharmacology.

Project-specific Requirements

- Completed master studies in biomedical engineering, biomaterials science, biology or similar
- Within our highly interdisciplinary group it is not expected that a candidate possesses expertise in every area, but previous work in the field of cell culture, immune cells, biomaterials, microscopy, tissue engineering or molecular biology, along with relevant analytical methods will be considered a strong asset.

- Enthusiasm for acquiring new skills in various fields such as biology, but also in CAD design and 3D bioprinting
- Affinity for working in a multidisciplinary environment
- Willingness to travel to project meetings and scientific conferences
- Excellent English language skills in scientific field
- Personal skills: having a problem-solving mind with an excellent motivation