# Looking into the skin: Towards better understanding of skin layer mechanics

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## Background & Motivation

Human skin is our protective "living envelope" and largest organ, covering a surface area of 1.6 to 2 $m^2$ in adults. Skin can be considered a multilayer composite (Fig. 1) and demonstrates highly non-linear elastic, anisotropic, viscoelastic material properties similar to those of soft elastomers [1, 2].

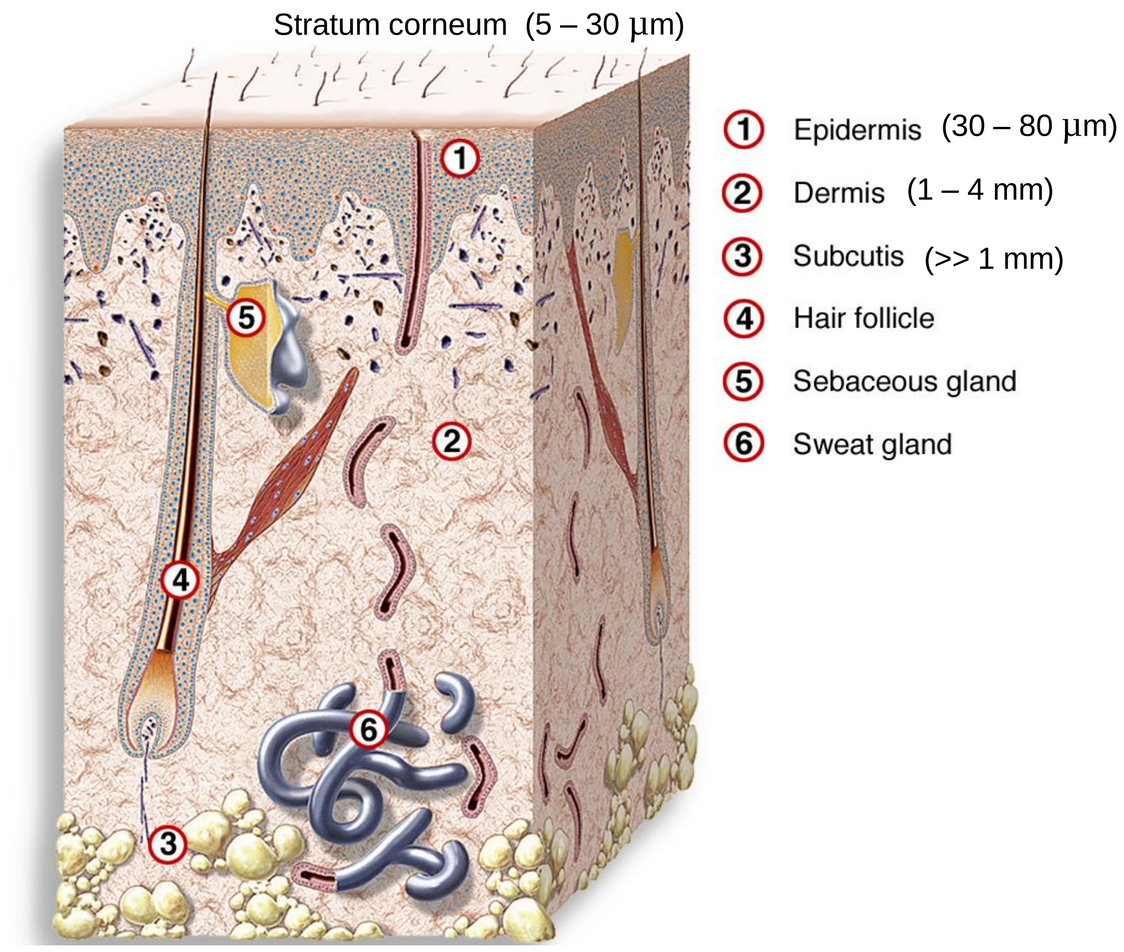


Fig. 1. Structure of human skin

Until now, there is limited understanding on how the different skin layers and appendages (e.g. hairs) contribute to the global mechanical response of human skin.

Knowledge on skin layer mechanics is a prerequisite to improve and optimise surfaces and materials in contact with skin (tools, sport equipment, clothing, consumer products), and to develop realistic mechanical skin models.

## Experimental strategy

A systematic parameter study on the bio-mechanical and bio-rheological properties of *ex vivo* human skin and skin layers will be carried out using recently developed histological preservation methods [1], mechanical testing, as well as imaging techniques. In particular, rheometer measurements are used to determine linear and non-linear viscoelastic regimes of skin under various experimental conditions (Fig. 2). Laser scanning microscopy will be performed to image the micro-architecture of deformed skin tissue (Fig. 3).

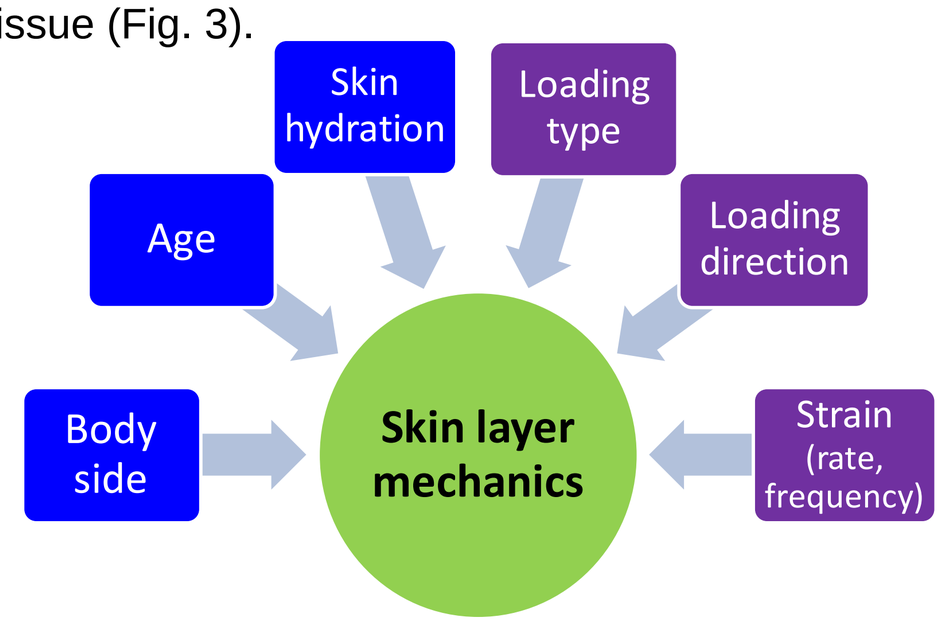


Fig. 2. Factors influencing the mechanical properties of skin

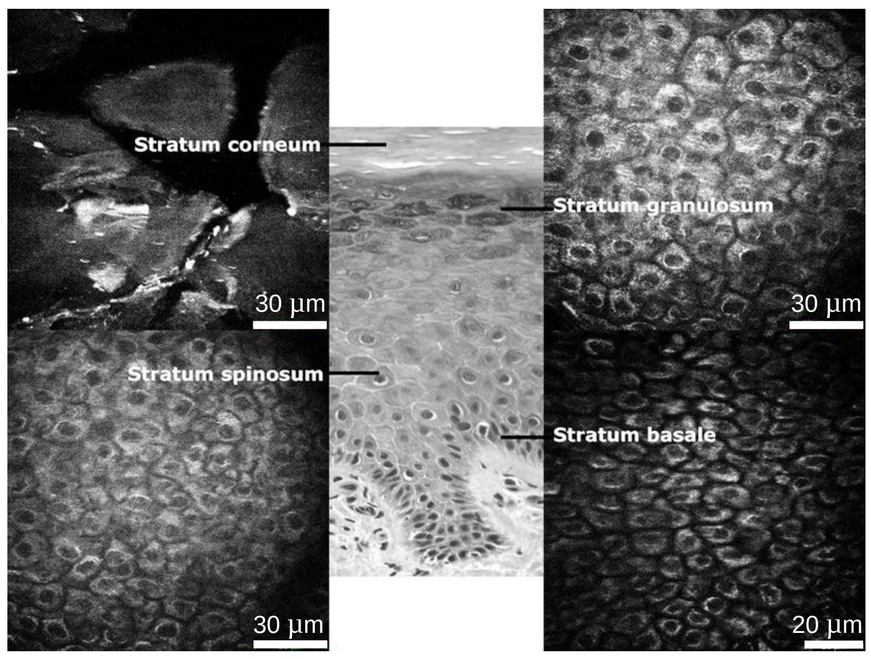


Fig. 3. Structure of epidermal skin layers: Multi-photon tomography images in comparison to histological staining. Reprinted from ref. [3]

## Specific research objectives

The overall goal is to gain new insights in the relationship between mechanical loading and structural/morphological changes of human skin.

- Mechanical and rheological characterisation of human skin under oscillating shear loading.
- Visualisation and quantification of skin deformation behaviour at macro- and micro-scale.
- Application of experimental results in theoretical models.

## References

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