A*STAR Skin Research Labs
A*SRL

Inventions Geneva

Simultaneous Dual-wavelength Excitation Fibre-coupled Handheld Raman Probe for Human Skin Inspection in an Ultrawide Wavenumber Region

Auretek

GUI for data acquisition and analysis

Compact handheld confocal probe

Portable backend with dedicated electrical and optical modules

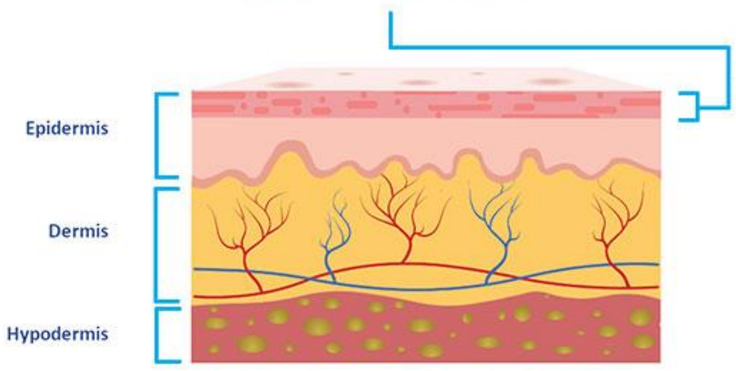
Next-Generation Smart Skin Analyser

- Fast and accurate skin depth profiling
- Wideband spectrum, rich information
- Comprehensive skin biochemical database

Background

Confocal Raman spectroscopy (CRS) is powerful in skin disease diagnosis thanks to its noninvasiveness, superior specificity and depth profiling capability. However, existing CRS systems have various limitations including narrow detection band, large size, non-flexibility and slowness which hinder their clinical applications. To overcome those limitations, we developed a novel handheld CRS system (**Auretek**) with the following advantages:

- Dual-wavelength excitation covering both **fingerprint region** (FP, 450-1750cm^{-1}) and **high wavenumber region** (HW, 2700-3800cm^{-1}) for more comprehensive bio-molecular information.
- Fast switching between two excitation wavelengths achieves simultaneous FP and HW regions Raman spectra acquisition to minimize depth misalignment.
- Fiber-based handheld probe makes it easy to access various parts of human body.



Applications

Skin disease diagnosis

Non-invasive, high-resolution molecular analysis of skin, helping detect biochemical changes associated with conditions like eczema, psoriasis, and skin cancer. It provides real-time, label-free diagnostics, improving early disease detection and treatment monitoring

Cosmeceutic evaluation

Analyzing skin hydration, lipid content, and active ingredient penetration, the device assesses the efficacy of skincare and cosmetic products. It helps cosmetic researchers and dermatologists develop and validate new formulations, ensuring optimal performance and safety

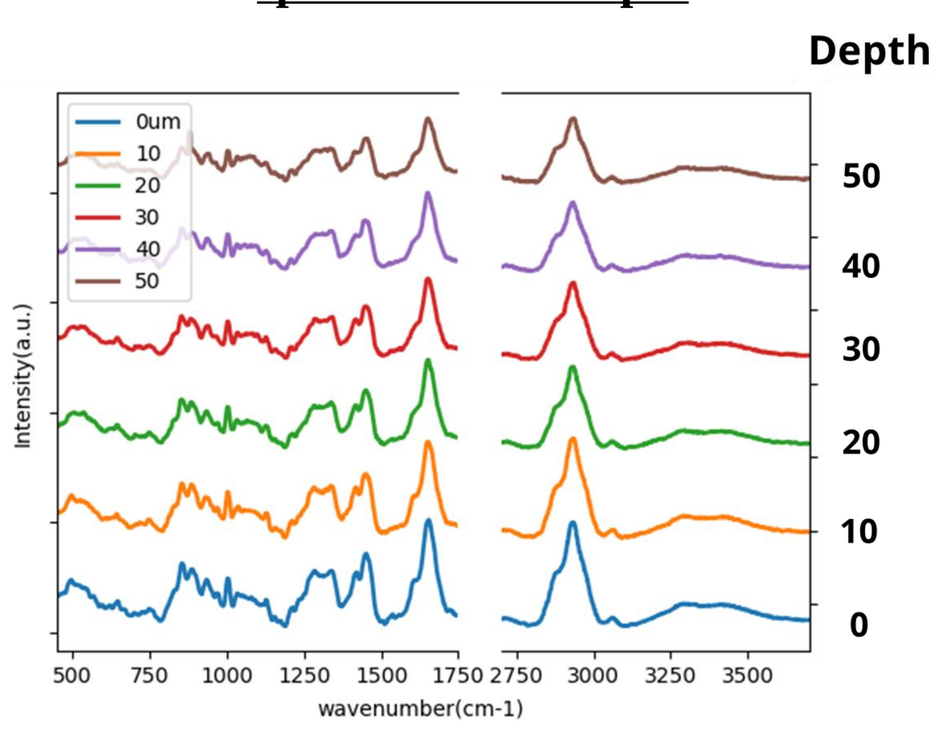
Ageing skin assessment

Measures collagen levels, oxidative stress markers, and hydration balance, providing insights into skin aging processes. It aids in personalized skincare recommendations and evaluates anti-aging treatments, supporting both clinical research and consumer product development.

Advantages

Noninvasive **Flexible** **Fast** **Ultra-wideband** UWB

Depth profiling – Stratum Corneum Raman spectra at each depth



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CONFOCAL RAMAN HANDHELD SMART SKIN ANALYZER

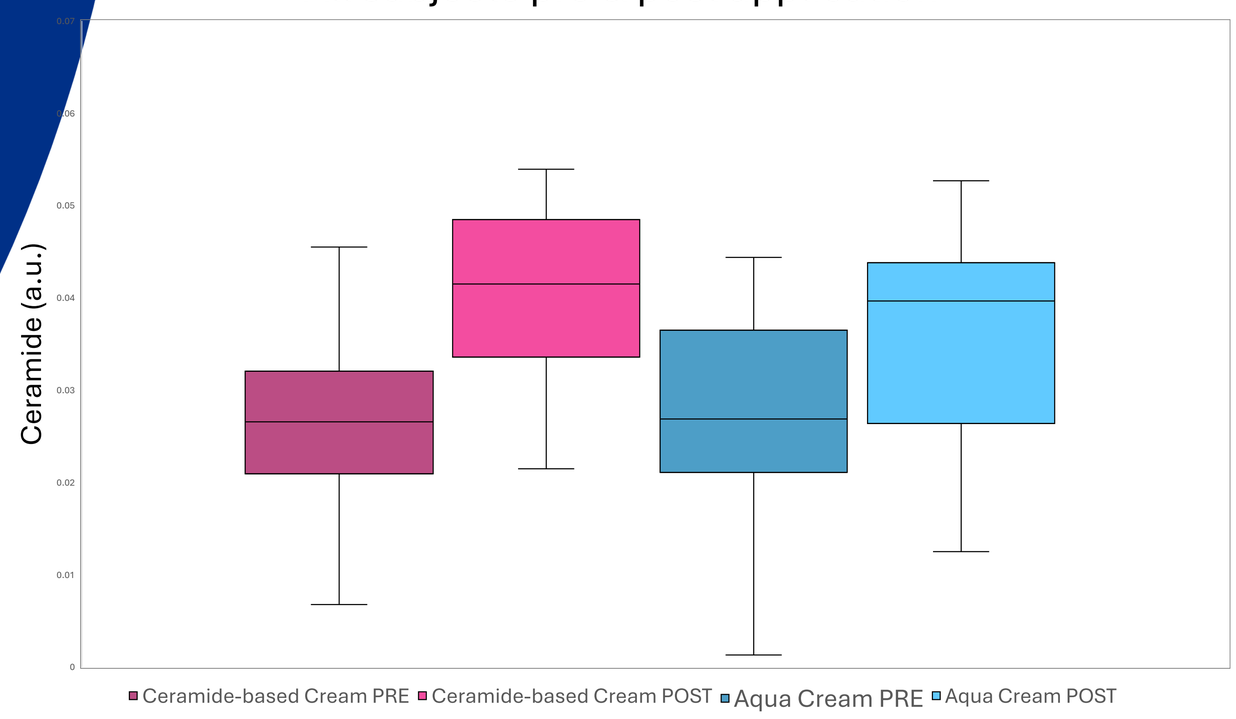
Depth selective barrier function assessment
(0~100μm)

Components:
- Ceramide
- Urocanic Acid
- Lactic Acid
- Cholesterol
- Keratin
- Urea
- Water
- NMF

Skin product evaluation

Emollients cosmetic study

All subjects pre & post application

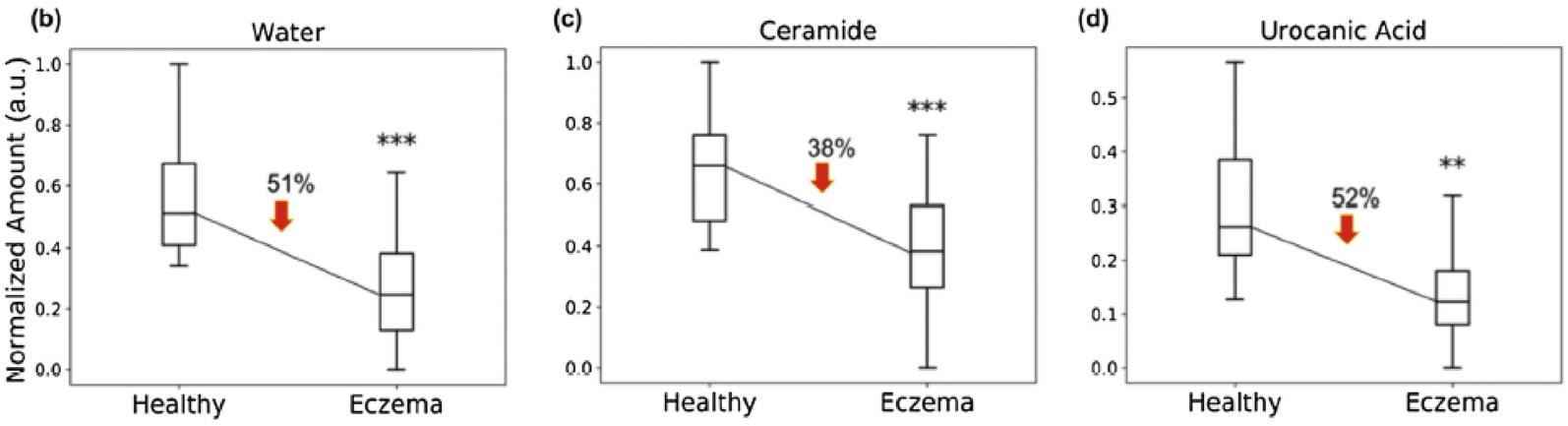


Ceramide in **superficial skin layers (0~50um)** of subjects (n = 20) pre-and post-application of ceramide-based or aqueous (Aqua) cream.

Skin health monitoring

Detect and monitor treatment response of skin biochemicals

Assessment of skin barrier function in Eczema

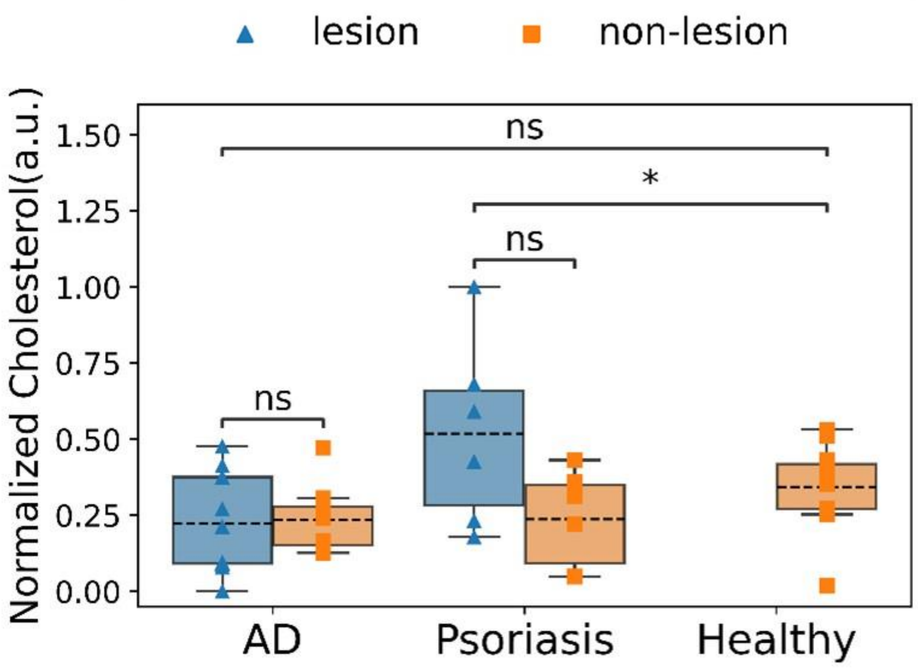


Box plots of water, ceramide, and urocanic acid content for healthy subjects and eczema patients.

Clinical Methodology:
Subjective assessment , questionnaires (SCORAD and PASI score) and TEWL

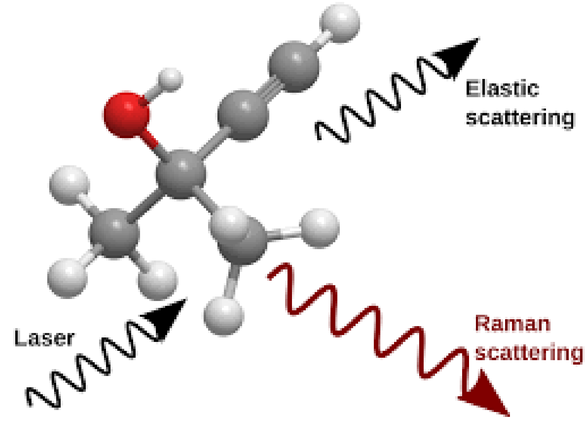
J Dermatolo Sci. 2019,2020

Atopic dermatitis & Psoriasis – a comparison



Compared to healthy subjects, cholesterol in AD skin is lower and psoriasis lesional skin is significantly higher.

J Biophotonics. 2023



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