IN VIVO SKIN STUDIES BY RAMAN SPECTROSCOPY

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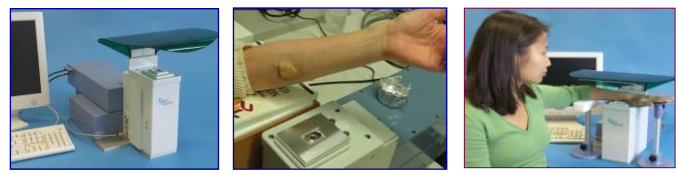
River Diagnostics - *in vivo* skin analysis

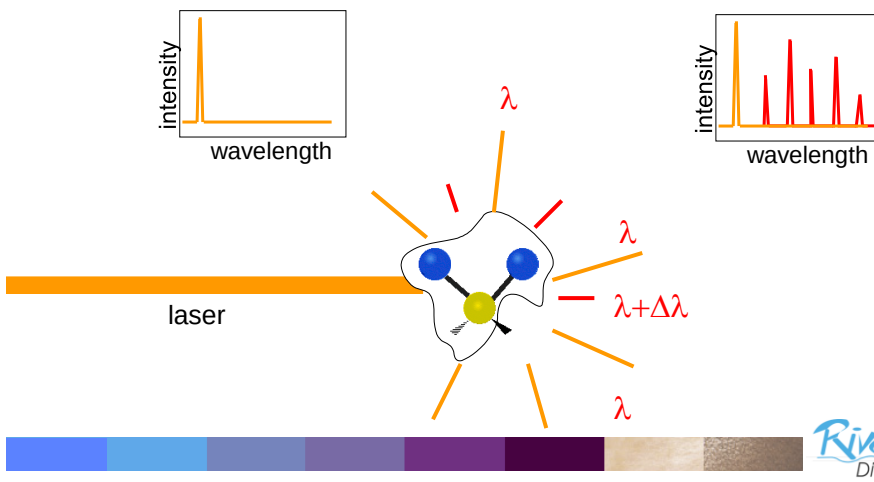
- River Diagnostics founded in 2002 as a spin off from the Erasmus University Medical Centre Rotterdam
- Model 3510 Skin Composition Analyzer in the commercial market since 2004



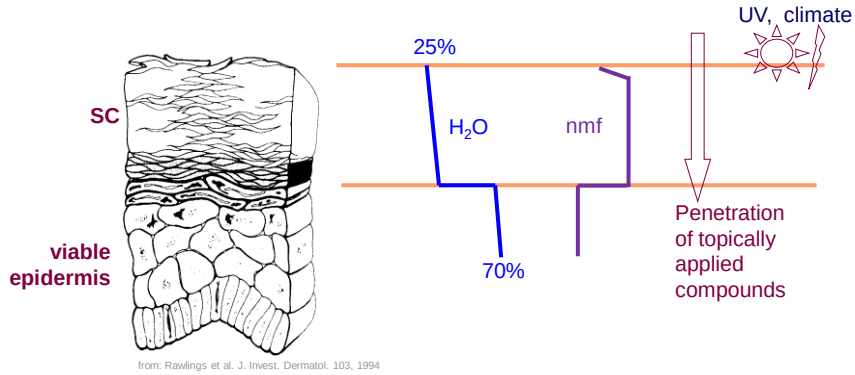
Principles of measurement - Raman skin analysis

- optical, non-invasive and non-disturbing
- no biopsies
- objective
- high spatial resolution
- no dyes or labels involved
- detailed information about chemical composition

Raman spectroscopy - principle



Information in Raman spectra of skin



from: Rawlings et al. J. Invest. Dermatol. 103, 1994

It is all about:

Main chemical composition of the skin at different depths

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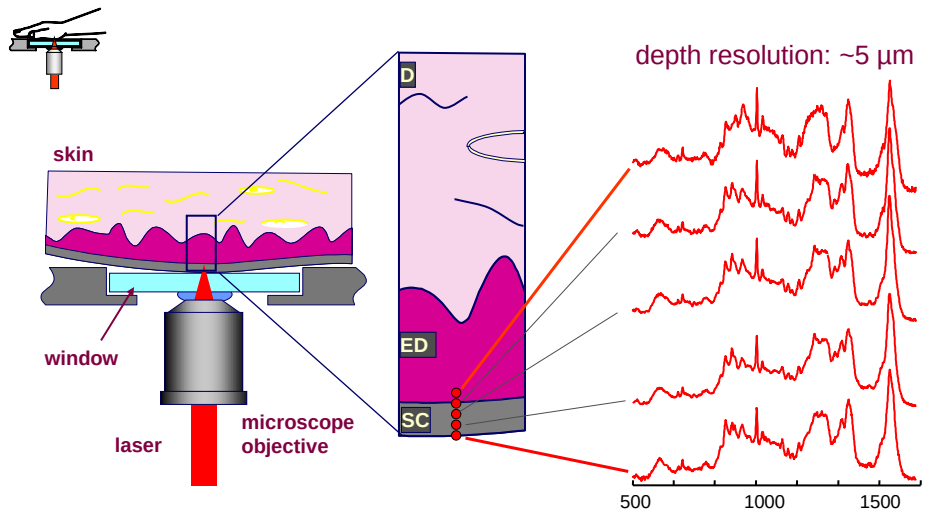
confocal Raman microspectroscopy



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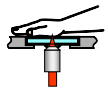
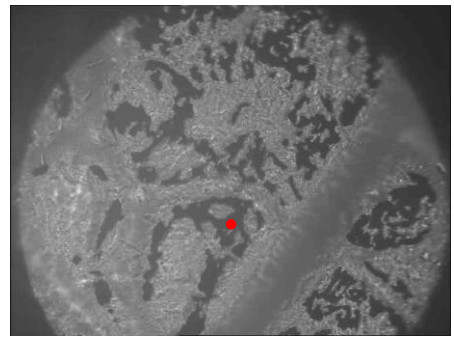
confocal Raman microspectroscopy



Visual micrograph of skin



400 µm

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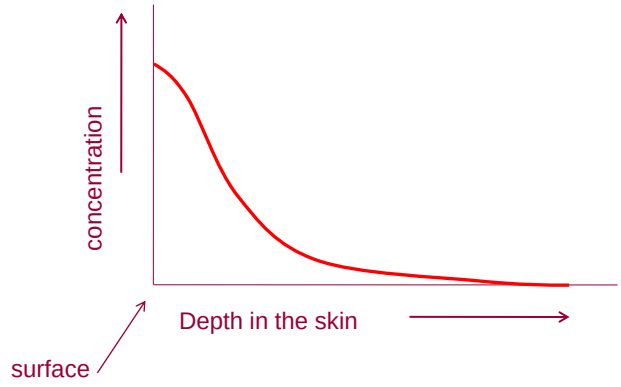
Information in Raman spectra of skin

- A Raman measurement usually results in concentrations versus depth



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Information in Raman spectra of skin, examples

- skin characterisation
  - water, nmf, lipids, carotenoids, urea
  - typing, aging effects, ethnic effect, cultural effects
  - neutraceutical
- Penetration and penetration kinetics
  - glycerol, dmso, lactate, ethanol, caffeine, menthol, nicotinamide, uv absorbers, oils, retinol, carotenes
  - formulation optimization
  - transdermal drug delivery, various pain relief agents
  - Toxicological: pyrene, toluene, butoxyethanol
- metabolic processes
  - hydrolysis of esters
- effects of products
  - moisturization
  - pH modulation
- effects of environment / skin treatment
  - humidity, season, climate, solar exposure
  - bathing, washing
- medical (diseased/disfunctional skin)
  - Atopic dermatitis

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Applications

- Water concentration measurement
- Skin characterization
- Penetration of active

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applications – effects of moisturizers

In 2006, a large study was published by PG researchers:

Sieg A, Crowther J, Blenkiron P, Marcott C, Matts PJ. Confocal Raman Microspectroscopy – Measuring the effects of topical moisturizers on stratum corneum water gradient in vivo.Proc. of SPIE Vol.6093 60930N, 2006.

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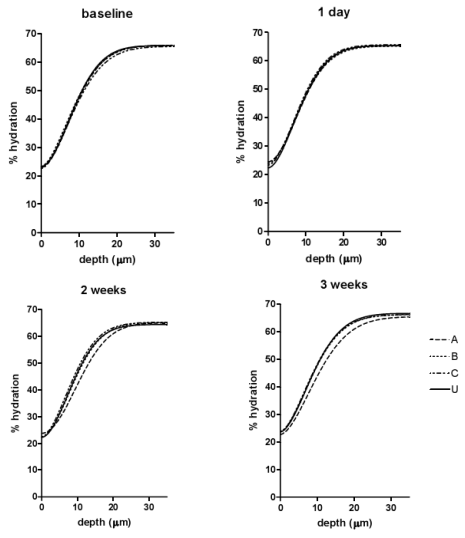
applications – effects of moisturizers



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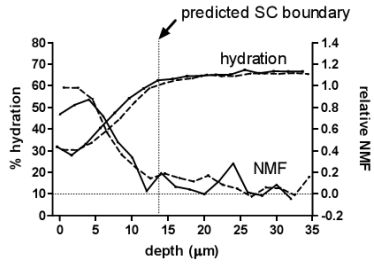
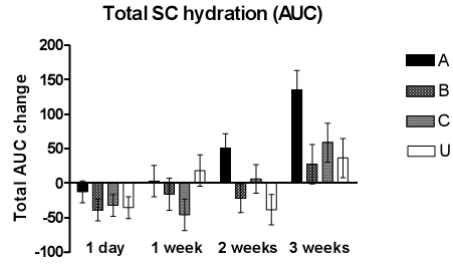
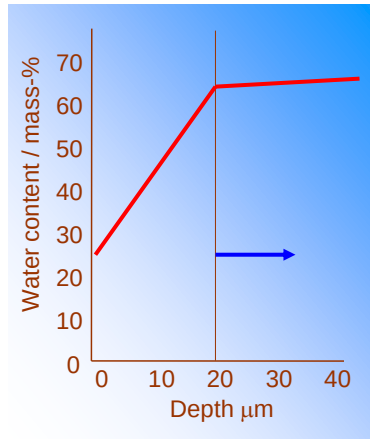
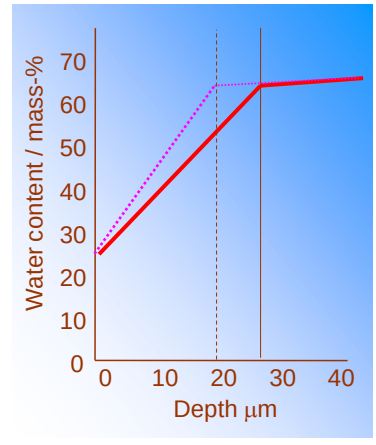
applications – effects of moisturizers





skin hydration: swelling



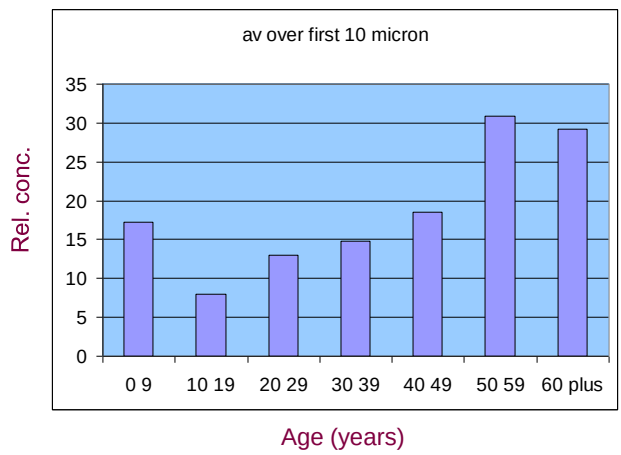


Applications

- Water concentration measurement
- Skin characterization
- Penetration of active

applications – characterization of aging

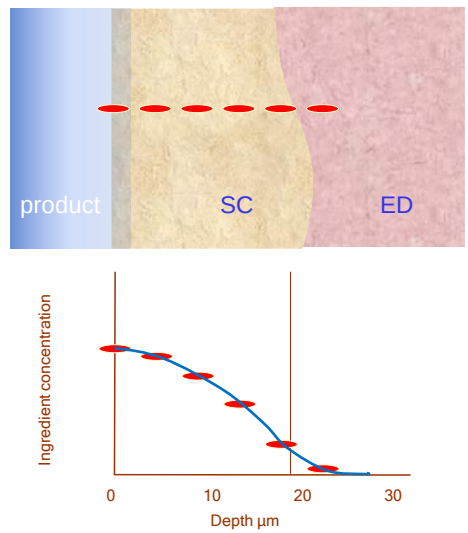
urea



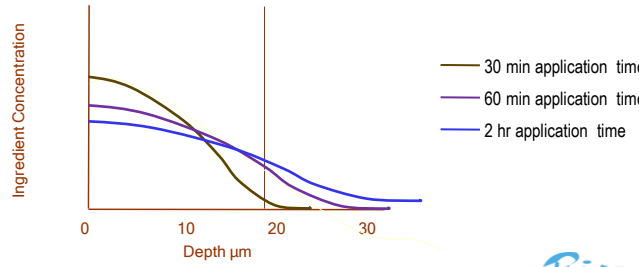
Applications

- Water concentration measurement
- Skin characterization
- Penetration of active

How to extract practical information, concentration profiles

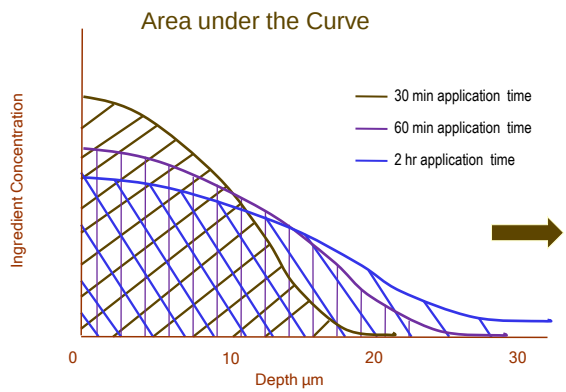


How to extract practical information, kinetics of diffusion

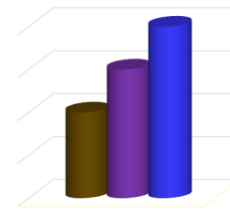


How to extract practical information, Absorbed volume of product

Area under the Curve



Absorbed volume product



Ingredient Concentration in mmol/gr keratin → Absorbed amount in µg/cm^2

applications - retinol delivery

Pudney et al., Applied Spectroscopy 61(8): 2007

An *In Vivo* Confocal Raman Study of the Delivery of *Trans*-Retinol to the Skin

PAUL D. A. PUDNEY,* MICKAËL MÉLOT, PETER J. CASPERS, ANDRE VAN DER POL, and GERWIN J. PUPPELS

Measurement Science Unit, Unilever R&D, Colworth Science Park, Sharnbrook, Bedford, MK44 1LQ (P.D.A.P., M.M.); and River Diagnostics B.V., Rotterdam, The Netherlands (P.J.C., A.v.D.P., G.J.P.)

- **Solution 1:** 70 % ethanol, 30 % PG and 0.3 % *trans*-retinol
- **Solution 2:** 99.7 % MYRITOL®318 and 0.3 % *trans*-retinol
- monitor penetration for 0-6 hrs after application

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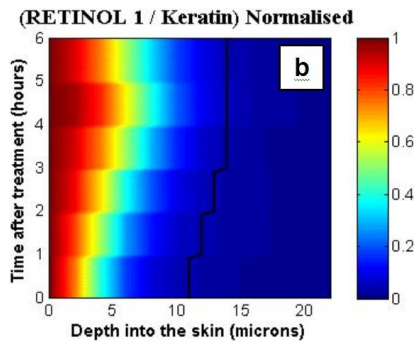
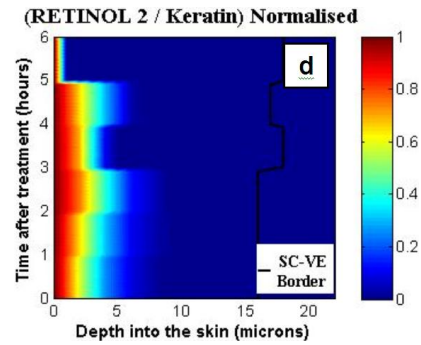
applications - retinol delivery

Pudney et al., Applied Spectroscopy 61(8): 2007

in PG/EtOH



in MYRITOL®318



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Thank you for
your attention
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