



NANO
DERM

**Quality of Skin as a barrier
to ultra-fine particles**

A research project funded by the European Commission



Research and Technology
Development Programme



Quality of Life and Management
of Living Resources Programme
Key Action 4 - Environment & Health

Project ID:
QLK4-CT-2002-02678

Ultra-fine Particles are ...

.. Nanoparticles

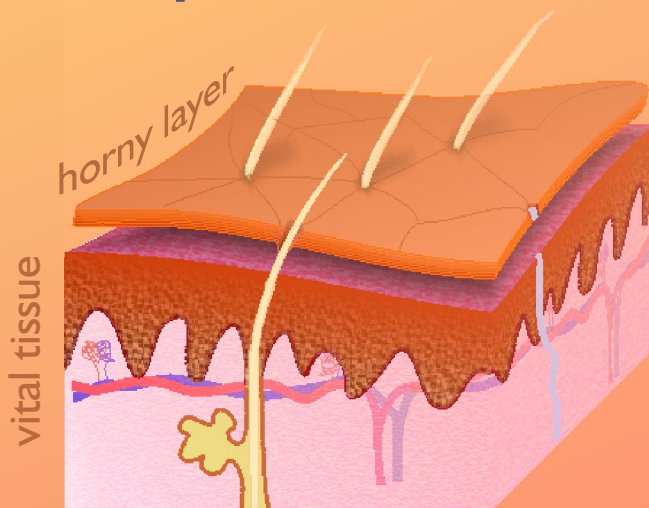
These are made of Titanium-, Zinc- or Silicon-oxide. They can be smaller than 20 nanometers, i.e. 500 times smaller than a human hair.

20 nm

.. in our daily Life

Today's population is increasingly exposed to nanoparticles. Household and bodycare products, e.g. sunscreens with physical UV-filters, contain such particles.

.. a possible Risk Factor



.. to Skin after Penetration

Tape stripping studies and recent ion microscopy pilot studies revealed that such particles in liposomal formulations penetrate the horny layer with large concentrations at the stratum granulosum, thus, developing a possible risk of further penetration into vital tissue, especially for skin with an impaired barrier function.



The Project

Methodologies

- Ion microscopy for quantitative elemental maps with detection limits of about $1 \mu\text{g/g}$ and lateral resolutions well below $1 \mu\text{m}$ as well as density maps for morphological imaging
- Electron microscopy for the identification of individual particles and agglomerates and accumulation sites
- Autoradiography with radiolabelled nanoparticles for high detection sensitivity
- Molecular and cell-biological methods to assess the skin response and activation of dermal cells

Objectives

New methodologies (high-resolution ion microscopy, radiotracer) on skin cross sections will be established to study the quality of skin as a barrier against formulations containing nanoparticles. Whereas the cellular response to such particles is well documented, it is not yet clear whether such particles effect the horny layer only or indeed penetrate into vital tissue. Tape stripping experiments are not conclusive because they have no lateral and limited depth resolution and stop at the dermis. Electron microscopy identifies individual particles but is less suited for large scan elemental maps. However, ion microscopy yields elemental maps with $\mu\text{g/g}$ detection limits. If such particles penetrate into vital tissue, in-situ and in-vitro studies of tissue and cells will follow.

Expected Achievements

- Quantitative information on the penetration for all strata of skin and on penetration pathways
- Information on impacts on human health
- Preventive strategies depending on the result of the assessment which could be:
 - a) there is no risk at all for products containing nanoparticles
 - b) some products are not recommended for high-risk groups, e.g. not in combinations
 - c) some products should not be used over extended periods.
- Enforcement of a better product information and consumer protection.
- Transfer of knowledge to the scientific community, industry, and health organizations.

Partners within the **NANO DERM** Project

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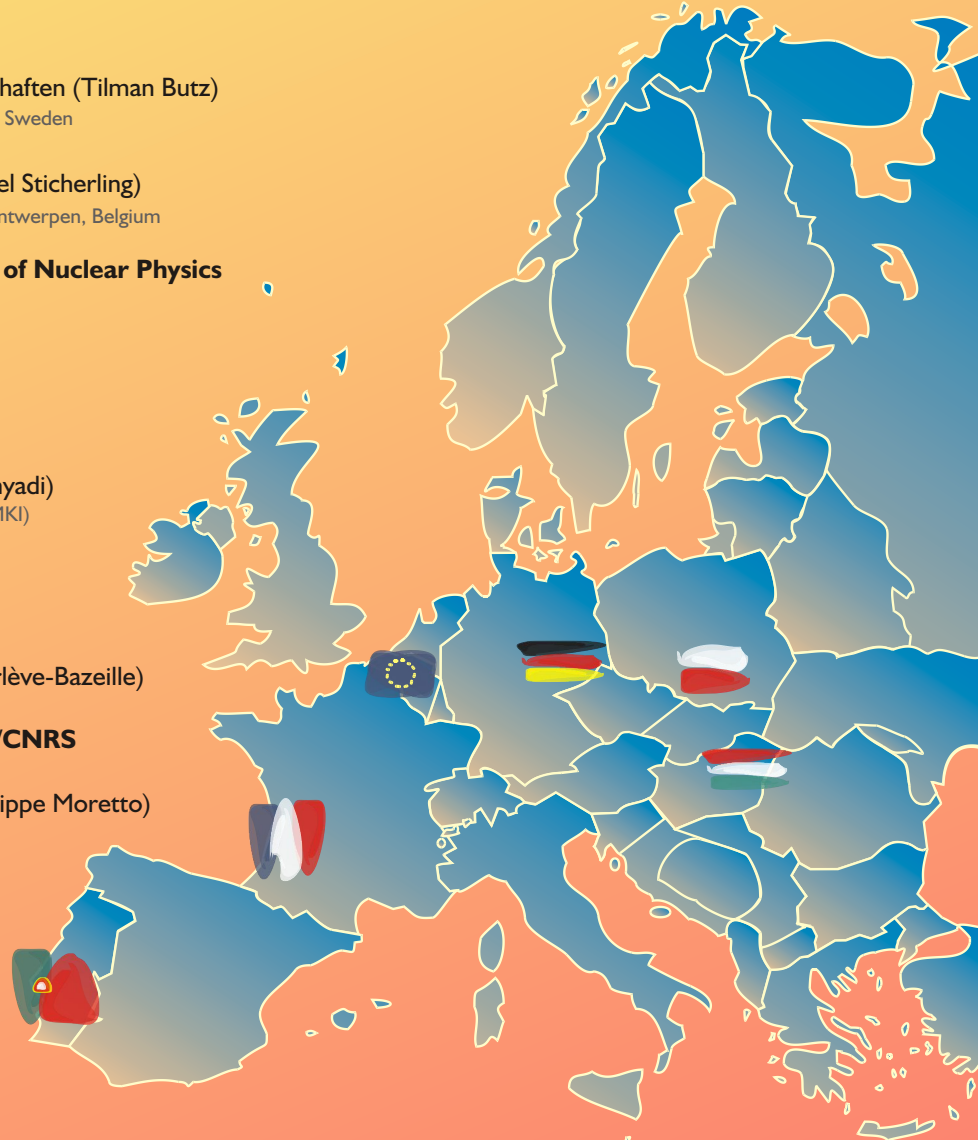


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