Project:

Optical needle sensors for therapy monitoring of inflammatory skin diseases to prevent recidives (PhotoSkin)

Technological keywords:

Raman spectroscopy, Laser development, Fiber optics

Industrial sectors addressed:

medical technology, skin diagnostics

Total project costs: **2.670.786 €**

Partners' descriptions:

- Institute of Photonic Technology (IPHT), research on biophotonics and chemometrics, Germany, Research Organization, IPHT will be responsible for the coordination of the consortium, system and software integration, Raman measurements, chemometrical modelling
- TOPTICA Photonics AG (TOPTICA), laser development, Germany, SME, development of a tailored laser source
- Z-Light Ltd., leading manufacturers of medical fiber probes, Latvia, SME,
- Department of Skin Physiology at the Charité - Universitätsmedizin Berlin, hospital and medical research facility, Germany, Medical End-user (Hospital), investigating the principles of spectroscopic distinction between healthy and psoriatic skin and for the evaluation of the optical measuring system in clinical routine
- World of Medicine : W.O.M. WORLD OF MEDICINE GmbH, international system suppliers in the field of medical technology, Associative partner,
- Elfi-Tech Ltd., innovative sensing technology solutions for non-invasive measurements of physiological and blood parameters, Israel, Associative partner, contribute to the system development by simulation and optimization

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Project abstract:

- The PhotoSkin sensor will provide an entirely new access to clinically relevant information based on the three-dimensional lipid structure within psoriatic skin. Coordinated by German Institute of Photonic Technology, the project combines a range of transnational complementary competences and experiences in innovative high-tech companies (Z-light Ltd/Latvia, Elfi-Tech Ltd/Israel and TOPTICA Photonics AG/Germany), and a research-intensive hospital (Charité, Germany). PhotoSkin will develop a minimally invasive Raman-based sensor to monitor (i) the lipid distribution and composition as well as (ii) the hydration state of human skin as a future routine tool for diagnosing and monitoring the treatment outcome in psoriasis patients. Psoriasis is a chronic, immuno-inflammatory disorder, which causes significant costs to the public health care systems in Europe. In the skin of psoriasis patients the stratum corneum is thickened, histopathologically composed of parakeratotic cells and characterized by a poor hydration status and barrier function. Furthermore, psoriasis lesions show a changed lipid pattern compared to healthy subjects, even when the skin appears clinically benign. Thus the spectroscopic characterization of the dermal lipid structure is of utmost importance both for diagnosis and monitoring therapy, as no cure for psioriasis exists and treatment is solely focused on soothing the symptoms and controlling the underlying dermal inflammation. The spectroscopic sensor to be developed will provide currently not accessible information about the chemical composition of deeper tissue layers. This will significantly impact diagnosis and treatment of psoriatic patients as currently treatment is – due to side effects of the applied drugs – discontinued as soon as the surface of the skin appears healthy in a visual inspection. Raman spectroscopy is a potent approach to match the clinical and diagnostic needs associated with psoriasis. It is non-invasive, applicable in vivo, upon use of near-infrared excitation light significant and sufficient tissue penetration can be achieved and the chemical sensitivity of the method allows for spatially resolved monitoring of the chemical composition of tissue – and in particular – monitoring the lipid constituents in tissue. PhotoSkin will build on the strength of this spectroscopic approach and the outstanding technological competences of the project partners to develop and test an innovative fiber-optic probe for bedside online diagnosis and treatment monitoring of psoriasis.

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Expected results and exploitation plan:

The potential impact of progress beyond the current stat of the art is reflected by the main results expected by the end of the project. These can be divided into:

Physical results:

- Design and demonstrator fabrication of a Raman based system for the characterization of skin
- Developed algorithm for the processing of recorded Raman data to extract clinical /medical relevant information

Increased knowledge:

- Deeper understanding of the changed structure of psoriatic skin
- Dissemination of information through publications and conferences

Commercial exploitation of results:

- SMEs will commercialize developed hardware, i.e., laser system for shifted excitation Raman spectroscopy, spectrometer and fiber probes
- SMEs will increase their share in the market of vibrational spectroscopy
- Acquisition of new projects to continue the research on dermatological questions using vibrational spectroscopy

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