Imaging of cellular immune response in human skin

Tech ID: 33445 / UC Case 2022-724-0

BRIEF DESCRIPTION

This patent application describes methods for non-invasive, label-free imaging of the cellular immune response in human skin using a nonlinear optical imaging system.

SUGGESTED USES

·Non-invasive Imaging of Immune Cell Populations in Human Skin: The primary use of the invention is to non-invasively image immune cell populations in human skin. This can aid in understanding autoimmune disease initiation and designing therapeutic strategies.

·Monitoring Therapy Effectiveness: The invention can be used to evaluate and monitor the effectiveness of therapies in stimulating or suppressing immune responses in skin lesions. By comparing images of skin lesions before and after therapy administration, clinicians can assess the therapy's impact on the immune response.

·Identification and Characterization of Immune Cell Populations: The invention enables the identification, differentiation, and quantification of various immune cell populations in human skin. By detecting and analyzing morphological, metabolic, and behavioral signatures of cells, it provides insights into the immune response at a cellular level.

·Detection of Activated T-Cells: The invention can detect activated T-cells in the skin, which is crucial for understanding immune responses and evaluating therapeutic interventions targeting T-cell activation.

·Applications in Various Skin Disorders and Diseases: The invention's uses extend to a wide range of skin disorders and diseases, including skin cancer, autoimmune skin disorders, skin infections, and various other conditions such as cold sores, eczema, psoriasis, and more.

·Imaging Modality Combinations: The invention suggests combining nonlinear optical imaging with other modalities such as reflectance confocal microscopy (RCM), optical coherence tomography (OCT), and photoacoustic imaging for enhanced imaging capabilities and comprehensive analysis.

·Overall, the suggested uses of the invention span from basic research in understanding immune responses to clinical applications in diagnosing and treating various skin disorders and diseases.

FEATURES/BENEFITS

·Non-invasive Imaging: The invention enables non-invasive imaging of immune cell populations in human skin. This avoids the need for invasive procedures, reducing patient discomfort and risk of complications.

·Label-Free Imaging: The imaging process is label-free, meaning it does not require the use of exogenous labels or dyes to visualize immune cells. This simplifies the imaging process and eliminates potential artifacts or side effects associated with labeling agents.

·High Resolution and Depth: The nonlinear optical imaging system used in the invention provides high resolution and depth-resolved images of human skin, allowing for detailed visualization of immune cells beneath the skin surface.

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OTHER INFORMATION

KEYWORDS

Non-invasive imaging, Cellular immune response, Human skin imaging, Nonlinear optical imaging, Label-free imaging, Immune cell characterization, Therapy monitoring, Skin disorder diagnosis, Metabolic analysis, Morphological analysis

CATEGORIZED AS

» **Optics and Photonics**

» All Optics and Photonics

·Detection of Endogenous Biomolecules: The imaging system detects fluorescence signals generated from endogenous biomolecules found in human skin, such as the reduced form of nicotinamide adenine dinucleotide (NADH). This leverages natural properties of skin tissue for imaging, enhancing specificity and reducing potential adverse effects.

·Metabolic Analysis: The invention includes methods for analyzing the metabolic signatures of detected immune cells. This provides insights into the metabolic state of immune cells, which can be indicative of their functional status and involvement in disease processes.

·Morphological and Behavioral Analysis: Computational analysis techniques are employed to distinguish immune cell populations based on their morphological, metabolic, and behavioral signatures. This allows for comprehensive characterization of immune cell populations in human skin.

·Dynamic Imaging of Immune Response: The nonlinear optical imaging system can be used for dynamic imaging of the immune response in human skin based on endogenous molecular contrast. This enables real-time visualization of immune cell dynamics and interactions in response to stimuli or therapies.

·Therapy Monitoring: The invention can be used to evaluate and monitor the effectiveness of therapies in stimulating or suppressing immune responses in skin lesions. This enables clinicians to assess treatment efficacy and make informed decisions regarding patient care.

·Overall, the features and benefits of the disclosed invention offer significant advantages in studying immune responses, diagnosing skin disorders, monitoring therapy effectiveness, and advancing personalized medicine approaches for skin-related conditions.

» **Imaging**
» Medical
» Other
» **Medical**
» Devices
» Diagnostics
» Disease: Cancer
» Disease: Dermatology
» Imaging
» Other
» Research Tools
» Screening
» **Research Tools**
» Other

TECHNOLOGY DESCRIPTION

The technology described in the patent application presents an innovative approach to non-invasive imaging of the cellular immune response in human skin. Leveraging advanced nonlinear optical imaging systems, the method enables high-resolution, depth-resolved imaging without the need for exogenous labels or dyes. By detecting fluorescence signals from endogenous biomolecules like NADH, the system analyzes metabolic signatures of immune cells, providing insights into their functional status and involvement in disease processes. Computational analysis techniques are employed to distinguish immune cell populations based on their morphological, metabolic, and behavioral signatures, offering a comprehensive characterization of the immune response. Additionally, the technology facilitates dynamic imaging of immune cell dynamics and interactions in real-time, allowing for the monitoring of therapy effectiveness in stimulating or suppressing immune responses in skin lesions. Overall, this technology represents a significant advancement in understanding and diagnosing various skin disorders and diseases, with potential applications in both research and clinical settings.

STATE OF DEVELOPMENT

Prototype developed

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	12458276	11/04/2025	2022-724

RELATED CASES

2022-724-0

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