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Inflammation and Metabolism in Tissue Repair and Regeneration

The skin is the primary barrier to the outside world and depends on the ability to repair and regenerate itself throughout life. Aging and aging-associated diseases are the primary risk factors for a decline in skin regenerative capacity and function in the elderly. In a review paper published in Science, Sabine Eming (Dept. of Dermatology, University Hospital of Cologne, CMMC and CECAD) together with her colleagues Thomas Wynn (National Institutes of Health, USA) and Paul Martin (University of Bristol, UK) summarize the state of the research and emerging concepts that may expand therapeutic perspectives by addressing the role of key inflammatory and metabolic processes in tissue-regenerative responses.

Effective tissue repair is essential for survival. Tissue repair after injury induces a complex, dynamic metabolic and cellular process aiming to restore normal tissue architecture and function. Repair mechanisms often require an intricate interplay between activation of tissue resident cells, recruitment of inflammatory cells and the extracellular environment. Repair processes are believed to recapitulate fundamental aspects of embryonic development and organ regeneration by activating similar molecular and cellular pathways. Dysregulation of this well-orchestrated response would lead to chronic wounds or progressive fibrosis, with both outcomes impairing tissue function, possibly leading to organ failure and death.

Sabine Eming (Dept. of Dermatology, University Hospital of Cologne, CMMC and CECAD) recently reviewed together with her colleagues Thomas Wynn (National Institutes of Health, USA) and Paul Martin (University of Bristol, UK) the intrinsic role of inflammation and cell metabolism in tissue-regenerative responses, by presenting emerging concepts that may expand therapeutic perspectives and discussing future research perspectives.

Clearly, understanding the fundamental mechanisms by which these developmental programs are reactivated and maintained in adult tissues is of particular interest for the treatment of chronic injury. For example organ fibrosis - a combination of inadequate numbers of functioning cells and aberrant extracellular matrix - is a leading cause of morbidity and mortality due to diseases such as idiopathic pulmonary fibrosis, liver cirrhosis, renal fibrosis, scleroderma and myelofibrosis. The demographic changes of an aging population and the obesity epidemic are further increasing the number of patients affected by fibrosis, accordingly raising the public awareness for this disorder.

“Further developments in this research area will undoubtedly augment therapeutic strategies and improve patient prognosis for regenerative disorders,” states Sabine Eming. She continues: “Understanding precisely the cross-talk between key inflammatory cells and the wound environment, as well as the mechanisms of matrix remodeling and de-novo synthesis in the repairing tissue, will assure the development of precise therapeutic strategies for managing and improving healing in the clinic.”

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