

# Challenge and promise

## Human skin aging

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Dear Colleagues in Dermato-Endocrinology Research,

We are witnessing an unprecedented and rapid expansion in the elderly populations of the developed and developing worlds. The effects of age-related frailty, disability, and disease combine to present an immense and growing cost to society in terms of health and social service expenditure, impaired quality of life, and physical and emotional suffering. Research that can lead to novel interventions that extend life spans and improve quality of life for the elderly has the potential to exert enormous impact on this ever-aging society.

Our skin displays the first signs of aging. Considering the fact that a collection of human internal organ specimens for experimental research purposes faces major practical and ethical obstacles, the skin may be viewed as a promising tool for aging research. With age, skin undergoes major morphological and physiological changes and, consequently, becomes fragile and prone to various diseases. Understanding the mechanisms behind skin aging is the first step toward prevention of these various diseases.

This special issue on skin aging is supported by renowned aging researchers and is aimed at dermatologists and other scientists working in the fields of biology, biogerontology, bioinformatics, and gender-medicine. Another potential audience includes politicians interested in state-of-the-art research on this topic. The issue is divided into three parts. In the first part, the reader receives an overview of current knowledge about the pathomechanisms of aging skin.

Andrea Vierkötter and Jean Krutmann summarize the influence of several environmental factors on the initiation of skin aging. Among them, sun exposure, air pollution and smoking present ethnic-specific manifestations of extrinsic aging.

Nicolai Treiber et al. focus on the oxidative stress theory, presenting the important role of the antioxidant balance in the aging process and showing recent research data about the mitochondrial superoxide dismutase 2.

In the review of Florence Debacq-Chainiaux et al., the terms replicative senescence and stress-induced premature senescence (SIPS) are described in detail, and the reader has the opportunity to learn more about *in vitro* models that have been developed for studying the long-term effects of UV and stress on several skin cell types.

There is no doubt that hormones play a key role in the regulation of skin homeostasis and in the aging process. Jörg Reichrath describes

the protective role of Vitamin D and its compounds against hazardous effects of skin-aging agents, such as UV and ionising radiation, and presents recent data showing the detoxifying effects and regulation of genes involved in cellular aging by vitamin D.

Melatonin, the hormone that has been postulated to be one of the most important endocrine regulators and antioxidants, is the topic of the review by Konrad Kleszczynski and Tobias Fischer. The authors provide the most up-to-date knowledge on the multiple protective actions of melatonin in the skin, which has been documented to counteract production of reactive oxygen species (ROS) and mitochondrial and DNA damage after UV irradiation. Topically applied exogenous melatonin or metabolites are now regarded as promising anti-aging strategies.

The data discussed by Eleni Papakonstantinou et al. suggest that there is a close connection between disturbed hyaluronic acid (HA) homeostasis and skin aging, and they provide current evidence that there is a distinct profile of HA in intrinsic and extrinsic skin aging.

Paraskevi Gkogkoglou and Markus Böhm provide background information on the key role of Advanced Glycation End products (AGEs) during skin aging, how the production and accumulation of AGEs affects skin morphology and physiology, and they discuss the potential of anti-AGE strategies.

Christine Liezmann et al. approach skin aging from a unique view. They present how neurotransmitters and neurotrophins may act as stress mediators modulating the immune response in the spleen, and they introduce us to the term “inflammaging.”

Evgenia Makrantonaki et al. address the influence of genetics on skin aging and, particularly, on the differences observed in diverse ethnic populations and between genders, suggesting that products specialized for each gender and population should be developed in order to satisfy special needs.

In the second part, the reader sees the real picture of aged skin, which is not only characterized by wrinkling and thinning, but is also a basis for the development of several serious diseases that definitely affect quality of life and life expectancy of elderly people. Fragkiski Tsatsou and colleagues present the relationship between skin aging and carcinogenesis in addition to key features of epidemiology, major risk factors, and possible pathogenetic mechanisms associated with the development of UV- and age-related skin cancer. Basic clinical and histopathological features, as well as the course of UV-associated skin lesions and their prognosis, are also presented.

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Finally, in the last part, readers have the opportunity to learn what they can do to prevent premature skin aging and associated diseases. Many are focusing on the central role of nutrition; however, what really has scientifically proven to be effective in the battle with time is being reviewed in the article by Silke Schagen et al.

In addition, Ruta Ganceviciene et al. describe current strategies to cope with the signs of aging and help our skin look healthier, including preventive measurements, topical and systemic therapeutic agents, and invasive procedures.

We hope the wide spectrum of skin aging research presented in this issue will provide an effective basis for supporting efforts to acquire further background information regarding skin aging and associated diseases and increase awareness for prevention and treatment according to therapeutic standards.

Additionally, we hope that this joint effort of numerous scientists active in aging research has produced a comprehensive and useful overview that readers will benefit from and enjoy reading as much as we did.

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