Aging Hair
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“Aged? But he does not appear aged, just look, his hair has remained young!”
Marcel Proust, In Search of Lost Time (1913–27)

The appearance of hair plays an important role in peoples’ overall physical appearance and self-perception. With today’s increasing life-expectation, the desire to look youthful plays a bigger role than ever. The hair care industry has become aware of this, and capable to deliver active products that are directed toward meeting this consumer demand. The discovery of pharmacological targets and the development of safe and effective drugs such as minoxidil and finasteride also indicate strategies of the drug industry for maintenance of healthy and beautiful hair in the young and old.

The study of hair aging focuses on two main streams of interest: On the one hand, the esthetic problem of aging hair and its management, in other words everything that happens outside the skin; on the other hand, the biological problem of aging hair, in terms of microscopic, biochemical, and molecular changes, in other words the “secret life” of the hair follicle in the depth of the skin.

Hair aging comprises hair shaft aging, and aging of the hair follicle. The former involves weathering and photoaging of the hair shaft, while the latter manifests as decrease of melanocyte function (graying) and decrease in hair production (alopecia). The scalp and hair are subject to intrinsic or physiologic aging, and extrinsic or premature aging due to external factors. Intrinsic factors are related to individual genetic and epigenetic mechanisms with interindividual variations. Prototypes are familial premature graying and androgenetic alopecia. Extrinsic factors include ultraviolet radiation, air pollution, smoking, and nutrition.

Finally, basic scientists interested in the biology of hair growth and pigmentation have exposed the hair follicle as a highly accessible and unique model that offers
unequaled opportunities also to the gerontologist for the study of age-related effects. Its complex multicell-type interaction system involving epithelium, mesenchyme, and neuroectoderm, and its unique cyclical activity of growth, regression, rest, and regrowth provides the investigator with a range of stem, differentiating, mitotic, and postmitotic terminally differentiated cells, including cells with variable susceptibility to apoptosis, for study. Ultimately, a number of intrinsic and extrinsic modulating factors for hair growth and pigmentation have been identified and are being further tested. Current lines of research and future directions for therapeutic interventions are gene polymorphism diagnostics, the hair follicular route for targeted delivery of active compounds affecting the hair, stem cells of hair follicular origin, and tissue engineering of the hair follicle.

This monograph attempts to provide an up-to-date overview regarding all aspects of hair aging. It includes in-depth contributions from internationally recognized experts on the biologic basis as well as on current concepts for the diagnosis, treatment, and prevention of hair aging.

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Aging from Where to There?

Hair is part of the appearance of oneself as it is perceived by oneself and by others. The most remote representation that could be traced dates back around 30,000 years and the story is still ongoing in our society (Fig. 1; [1, 2]).

Figure reprocessed with permission from [1, 2]

In the early days, differences of hair patterns between species and between individuals within the same species (patterns, colors, length…) as well as dynamic changes of patterning (seasonal variations of hair coat, the fluctuations of hairiness during maturation…) reflect another scale of time and are part of a biological process that has been called “aging.”

Human intervention has long been limited to representation, cutting, and sculpturing the mass of hair by physical removal of fibers. Some centuries ago, these aspects of hair care were exclusively privileged professional activities sometimes overlapping with medical/surgical practice. While styling and hair care modalities became – rather recently – part of personal care along with beauticians’ and hairdressers’ facilities, the biological and medical aspects became more and more part of the dermatological field of expertise, including all sciences associated with it (surgery, bioengineering, biology, biochemistry, physics, mathematics, etc.).
As hair and the hair follicle became a material for scientific observation, renewed interest is proposed in this book regarding the phenomenon of aging. Clearly, the arrow of time can be measured with various parameters. The exceptional regenerative properties of the hair follicle may lead to discoveries that are unsuspected by the scientific community as many keep a superficial understanding of the visible part of the iceberg: hair!

Let me give just one example taken from Bartholyn’s book on anatomy. In 1658, hair was thought to be an excretory process for elimination of “bad bloody humors.” One of the scientific arguments was that females after the arrest of menstruation grew beards. As those bloody humors had to find a way, the mechanistic interpretation was wrong, but it may still be considered as an appropriate clinical observation related to the field of endocrinology. Hence more recently better documented links were made between hormones (humors?) and the hair follicle productivity!

As usual, it took a long time between the accurate clinical observation and the proper understanding and scientific demonstration of a biological process underlying the expression of a clinical phenotype. It is to be hoped that this book will become a milestone to help anyone interested in hair and in aging leading to new avenues for a better understanding of the hair follicle biology during aging.

Top row of the figure shows four drawings were taken from wall engravings in a prehistorical cave. It took about 30,000 years in order to categorize patterned hair loss in males, shown in the bottom row. Most clinicians appreciate this as “progress” and use it daily in the hair clinic, but many agree that it is not sufficient when time-related changes are to be measured.

The arrow of time plays a major role in this chronic regressive process that affects the function and structure of the hair follicle. During the past 50 years and along with time, many steps involved in this process have been unravelled including but not limited to genetic predisposition, proper secretion of hormones, transport, metabolism, fixation on specific receptors, and translation in the cell nucleus of these hormones.

More research specifically devoted to aging will undoubtedly clear-up the hair-scene in the near future.

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