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Distinguished Women in Science: A Lecture Series

Stem Cells of the Skin: Biology and the Potential for Regenerative Medicine

by Elaine Fuchs
Rebecca C. Lancefield Professor of Mammalian Cell Biology & Development at Rockerfeller University
and Investigator, Howard Hughes Medical Institute

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Stem cells can self-renew and to differentiate along multiple lineages to generate different tissues. In the embryo, multipotent stem cells respond to various cues to undergo morphogenesis and produce these tissues. Many adult tissues retain a reservoir of multipotent, relatively undifferentiated stem cells to be used for normal tissue homeostasis and for repairing damaged tissue from injuries. Such reservoirs are typically small, reflecting the fact that stem cells are used sparingly, dividing infrequently, but able to give rise when called upon to generate rapidly proliferating and differentiating progeny. The long-term potential of stem cells makes them beneficial for rejuvenating tissues but also makes them prone to accumulating mutations over time, a process that could lead to cancer. Moreover, if a stem cell acquires cancer-causing mutations but retains the abilities to divide infrequently and possess undifferentiated characteristics, it could display very different features from the tumor mass it generates. The development of successful cancer therapies is thus predicated upon a fundamental knowledge of stem cell biology and its role in cancer development. The Fuchs' laboratory uses mouse as a model organism and skin as a model system to explore the embryonic origins of adult stem cells and to understand how stem cells maintain their remarkable ability to undergo self-renewal, maintain their undifferentiated state and respond to extrinsic signals that prompt these cells to differentiate to make epidermis, sebaceous glands and hair follicles. Using their basic knowledge of stem cell biology, they are beginning to understand how these normal mechanisms malfunction in skin cancers, the most prevalent of all human cancers world-wide.