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Elaine Fuchs to Receive National Medal of Science

President Barack Obama announced today that Elaine Fuchs, a Howard Hughes Medical Institute (HHMI) investigator at The Rockefeller University, will receive the National Medal of Science for contributions to the biological sciences.

Fuchs, who has been an HHMI investigator since 1988, is being honored for her studies on the biology of mammalian skin and skin diseases.

President Obama will present Fuchs and eight other scientists with the medal, which is the nation's highest honor for science, at a ceremony on October 7 at the White House.

Congress established the National Medal of Science in 1959 as a Presidential Award to be given to individuals "deserving of special recognition by reason of their outstanding contributions to knowledge in the physical, biological, mathematical, or engineering sciences." This recognition now also includes the social and behavioral sciences. A committee of 12 scientists and engineers is appointed by the President to evaluate nominees for the award. HHMI investigator Robert J. Lefkowitz of Duke University Medical Center received the National Medal of Science from President George W. Bush in 2008.

Fuchs earned her B.S. in chemistry in 1972 from the University of Illinois, graduating with highest distinction. She received her Ph.D. in biochemistry in 1977 from Princeton University, where she studied with Charles Gilvarg. Fuchs did her postdoctoral studies with Howard Green at the Massachusetts Institute of Technology.

Early in her career, Fuchs set out to understand how cell growth and differentiation influence human disease. Using cultured cells as her experimental model, she learned all she could about key skin proteins, their genes, and the developmental pathways they control. "I felt that if you want to understand the basis of human diseases, you need to understand what's normal before you can attempt to understand what's abnormal." Shifting between cultured cells and transgenic mice as model systems, Fuchs' team discovered the genetic bases of two key classes of skin blistering diseases,

epidermolysis bullosa simplex and epidermolytic hyperkeratosis, and their various subtypes. Fuchs extended this work to elucidate the gene responsible for a related muscle degenerative disorder and set the paradigm for more than a dozen disorders involving a cytoskeletal structure called the intermediate filament.

Fuchs is now studying skin and hair—two very distinct structures that develop from the same skin stem cell. By unraveling the biology of skin stem cells, she hopes to answer a question that has intrigued her for more than two decades: How does a skin stem cell decide to become skin or hair? Understanding skin stem cells' normal behavior is also helping Fuchs learn what happens when their growth goes awry. Her studies have already uncovered the genetic basis of blistering skin diseases and clues to the way skin cancers and inflammatory skin disorders develop.

Her research may also hold clues for deciphering the extraordinary characteristics that enable stem cells to develop into distinct tissues and organs. "While there is much promise for stem cells in revolutionizing medicine, we must first learn more about stem cells before we can know whether this might be possible," she contends.

Unlike most other adult stem cells, skin stem cells can be easily grown in the laboratory. Studies by Fuchs have shown that multiple signaling pathways, including the Wnt and BMP pathways, influence how stem cells are coaxed to develop into hair follicles. Together, positive Wnt signals and antagonistic BMP signals lead to activation of transcription factors, which induce the formation of a hair follicle bud. In the absence of these signals, stem cells develop into skin epidermis. This line of research may eventually lead to new ways to restore or inhibit hair growth. By exploring how the stem cell reservoir (niche) forms and how stem cells are activated to proliferate and differentiate, Fuchs' work is having an impact on understanding how defective stem cells can cause cancers.

Fuchs is the recipient of numerous prizes and awards, including the FASEB Excellence in Science Award (2006), the Dickson Prize in Medicine (2004) from the University of Pittsburgh, and the Lounsbery Award (2001) from the National Academy of Sciences. She is a member of the Institute of Medicine, the National Academy of Sciences, the American Philosophical Society, and the American Academy of Arts and Sciences.