

The Regulation of Hair Cycle Resting Phase by Growth Factors

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The expression of several Fibroblast growth factors (FGFs) is synchronized with the hair cycle in the skin and some FGFs play a key role in regulation of the hair cycle. In particular, the expression of FGF18 peaks in the telogen phase, and maintains the telogen phase to determine its duration. Although the expression of FGF13 also peaks in the telogen phase, the role of FGF13 in the hair cycle remains unknown. This study investigated the involvement of recombinant FGF13 in the duration of the telogen phase and produced Fgf13 hemizygous knock-out mice using CRISPR-Cas9 system to examine the physiological effects of FGF13. Recombinant FGF13 was administered intraperitoneally to three-week-old female C57BL/6 mice harboring uniform telogen phase hair follicles three times a week and the duration of the telogen phase was determined by assessing the dynamics of skin color changes in a previously shaven telogen skin. FGF13 significantly prolonged the telogen phase to delay the transition into the anagen phase. In addition, FGF13 pretreatment of eight-week-old mice harboring uniform telogen phase hair follicles suppressed the proliferation of hair follicle cells to delay the process of anagen phase induced by depilation. In contrast, Fgf13 gene knock-out using CRISPR-Cas9 system failed to produce homozygous Fgf13 knock-out mice, but produced only heterozygous knock-out mice. However, heterozygous Fgf13 knock-out mice did not significantly show the prolongation of the telogen phase. These results indicate that recombinant FGF13 prolongs the telogen phase, suggesting that FGF13 plays an essential role in maintaining the telogen phase. Assessing the fetuses from the edited embryo suggested that constitutive Fgf13 knock-out mice might be embryonic lethal. Therefore, conditional keratinocyte-specific Fgf13 knock-out mice must be generated to examine the physiological mechanism of the hair cycle regulation by FGF13.