Hair Follicle Stem Cells Provide a Functional Niche for Melanocyte Stem Cells

IN MOST STEM cell systems, the organization of the stem cell niche is still largely unknown. Melanocyte stem cells (MelSC) and hair follicle stem cells (HFSC), which are originally derived from a completely different developmental origin, are located in the bulge area of mammalian hair follicles. While our previous studies indicated that the niche plays a dominant role in human COL17A1 fate determination1, the underlying mechanisms and the identity of niche cells for MelSCs are still unclear.

Our recent study published in Cell Stem Cell revealed that HFSCs provide a functional niche for MelSCs through transforming growth factor β (TGF-β) signaling to prevent premature hair graying2,3. These data indicate that HFSC-derived TGF-β signaling is crucial for the maintenance of MelSCs2,3. To explore the roles of HFSCs as niche cells, we focus on COL17A1 (Fig.1). Both HFSCs and MelSCs express COL17A1, but HFSCs show a higher expression of COL17A1 than MelSCs. In COL17A1-null mice, hair graying is accelerated2,3. These data indicate that HFSC-derived TGF-β signaling is essential for the maintenance of MelSCs.

Finally, forced expression of COL17A1 rescued hair graying through TGF-β signaling (Fig.3).

The interactions between different lineages of stem cells turned out to be crucial for cyclic regenerative growth of pigmented hair. This points to a complex but efficient crosstalk in stem cell niches. The maintenance of somatic stem cell populations by another type of somatic stem cells in a coherent cell mass might be a recurring strategy for somatic stem cell maintenance.

References:


Fig.1: Hair graying and hair loss found in a COL17A1-deficient mouse.

Fig.2: Mechanisms of stem cell maintenance in the hair follicle niche.

Fig.3: Stem cell regulation by stem cells in the hair follicle niche.