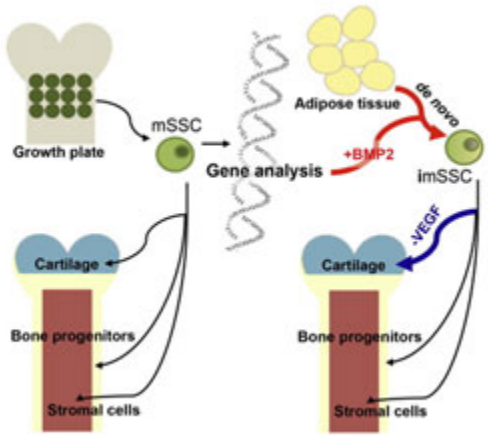
Docket #: S12-250

Cells and Factors for Generating Cartilage, Bone and Bone Marrow

A team of Stanford researchers have identified a skeletal stem cell (SSC) along with the protein factors needed to direct differentiation toward bone, cartilage or bone marrow stroma. In addition, they discovered a method to induce skeletal stem cells by reprogramming other differentiated cells (such as adipose or muscle cells). These techniques could be used ex vivo or in situ for regenerative medicine applications to repair cartilage, heal bone or restore damaged bone marrow.



Mouse Skeletal Stem Cell (mSSC) Formation: *mSSC have seven downstream progenitors, including cartilage, bone progenitors and stromal cells. Progenitor fate can be directed from bone to cartilage and vice versa. mSSC can be induced from other tissues (imSSC) and subsequently directed to form specific progenitors.*

Stage of Research

The inventors identified the mSSC, mapped the downstream progenitors, and demonstrated that niche factors can be potent inducers of osteogenesis. They also showed that specific combinations of those niche factors can activate mSSC genetic programs in situ, even in nonskeletal tissues.

Applications

- **Cell therapy** using skeletal stem cell, adipose or muscle tissue sources to treat a range disorders and injuries of skeletal cells, such as:
  - fractures, brittle bones, osteosarcoma
  - damaged cartilage (from injury or aging)
  - impaired bone marrow niches
- **In situ therapy** - protein factors to amplify and direct regenerative response of nascent skeletal stem cells to repair damaged tissue

Advantages

- **Effectively regenerates** functional skeletal tissue
- **Short turn around time** - patient cells can be harvested, combined with skeletalgenic factors and delivered to patients immediately (compared to other stem cell sources which take from weeks to months)
- **De novo formation of skeletal stem cell** - could accelerate healing by providing alternate source of progenitors
- **Efficient cartilage formation:**
  - specific protein cocktail dramatically increases chondrogenesis by driving SSC differentiation into cartilage while suppressing bone and stromal fates
  - potential adjunct treatment for osteoarthritis to inhibit formation of bone spurs

Publications

- Chan, C. K., Seo, E. Y., Chen, J. Y., Lo, D., McArdle, A., Sinha, R., ... & Longaker, M. T. (2015). Identification and Specification of the Mouse Skeletal Stem Cell. *Cell*, 160(1), 285-298.
- Researchers isolate type of stem cell taht gives rise to bones, cartilage in mice, *Inside Stanford Medicine* January 26, 2015.

Patents

- Published Application: WO2016112111
- Published Application: 20170360838
- Published Application: 20210393699

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