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hPSC culture for differentiating blood, cardiomyocytes, and other mesoderm cells

Researchers in Prof. Irving Weissman's laboratory have developed cell culture techniques to rapidly and efficiently derive pure populations of mesodermal cells from human pluripotent stem cells (hPSCs). This technology includes specific protocols with growth factors and chemical compounds that can differentiate hPSCs into hematopoietic (blood) mesoderm, cardiac mesoderm, or paraxial mesoderm (somites including skeletal muscle, bone, skin, blood vessels, etc.). The inventors have also identified cell-surface markers that can be used to further purify these cell lines. These methods can produce 80-90% pure cell populations in a few days (compared to conventional techniques, which invariably generate a heterogeneous mixture of cells unsuited for practical use). This technology could pave the way for providing an unlimited source of mesodermal cells for a broad range of pharmaceutical, biotechnology, and academic applications.

Applications

- **Stem cell culture** - growth factor and chemical cocktails to derive pure populations of cells with mesodermal linage, including blood, cardiac cells, skeletal muscle, and bone; with end user applications including:
    - regenerative medicine such as artificial generation of blood for transfusions
    - pharmaceutical drug development such as cell-based assays for screening compound or performing cardiotoxicity
    - research such as disease modeling and basic developmental biology studies

Advantages

- **Precise and efficient** - yields up to 80-90% pure population of desired mesodermal derivative
- **Rapid** - cells derived within 2-3 days depending on the cell type

Publications

- Loh KM, Chen A, Koh PW, Deng TZ, Sinha R, Tsai JM, Barkal AA, Shen KY, Jain R, Morganti RM, Shyh-Chang N, Fernhoff NB, George BM, Wernig G, Salomon REA, Chen Z, Vogel H, Epstein JA, Kundaje A, Talbot WS, Beachy PA, Ang LT, and Irving L Weissman (2016). Mapping the Pairwise Choices Leading from Pluripotency to Human Bone, Heart, and Other Mesoderm Cell Types. *Cell*, 166(2), 451-467.
- Researchers coax human stem cells to rapidly generate bone, heart muscle. Stanford Report, July 14, 2016.

Patents

- Published Application: 20180030410
- Published Application: WO2016141084
- Issued: 10,787,640 (USA)

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