

Pluripotent Stem Cells: Progress and Potential

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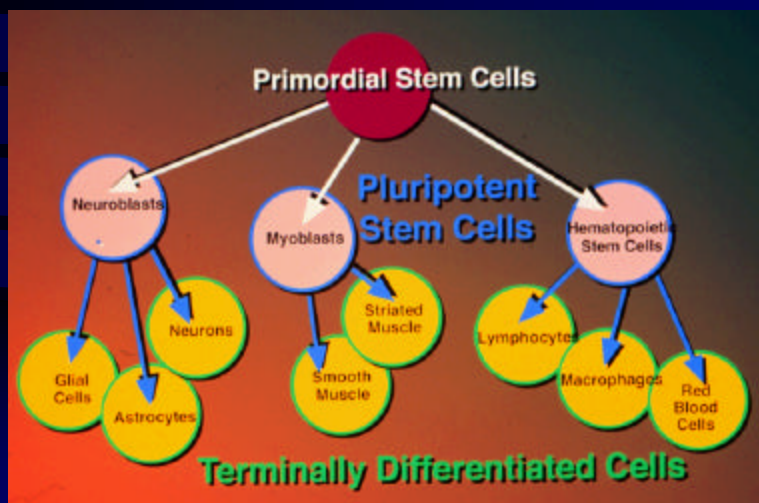
Issues:

- **What are pluripotent stem (PS) cells?**
- **What can PS cells do now?**
- **What is near-term (5-10 year) potential for PS cells?**

What are Stem Cells?

- Stem cells are unspecialized cells that can become specialized (differentiated).
- Stem cells are present in most body tissues, where they replace cells lost by normal wear and tear.

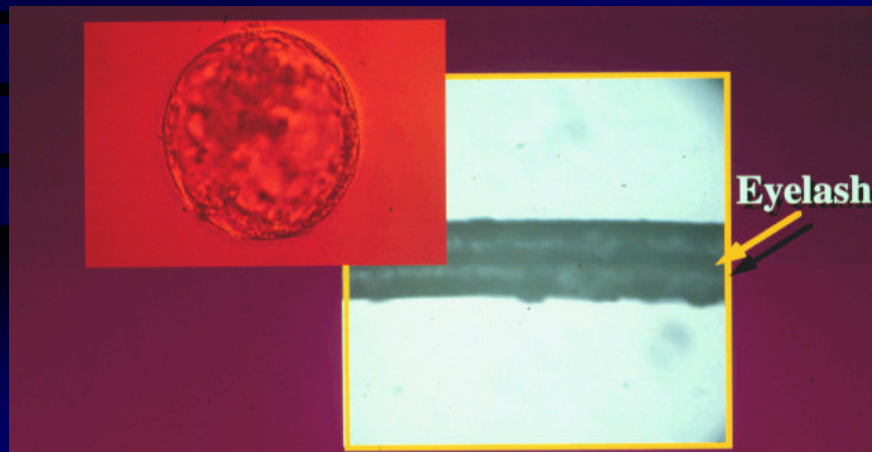
What are Stem Cells?



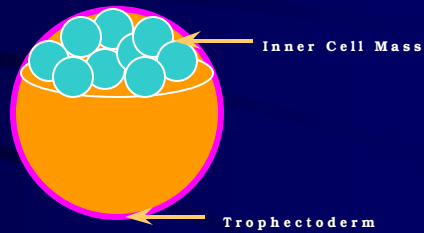
PS Cells are Derived from Early Developmental Stages of Mammals

- Mammalian eggs and embryos are quite small (~0.1 mm)

PS Cells are Derived from Early Developmental Stages of Mammals



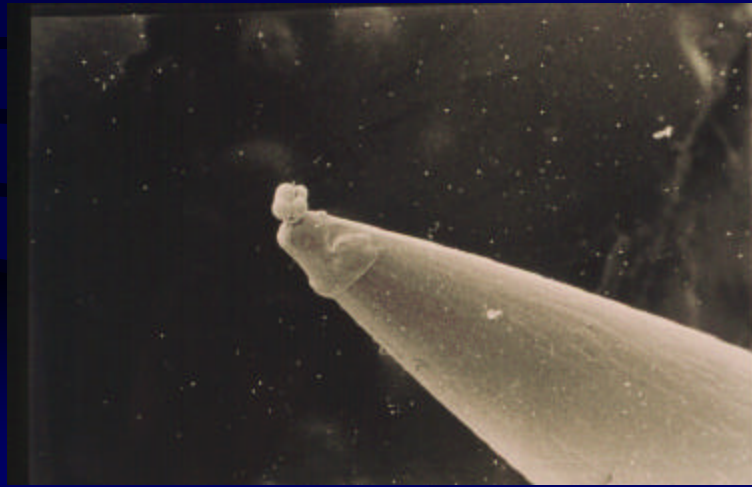
Blastocyst: PS Cell Source



Developmental Power

- **Totipotency:** ability to form all cell types of the conceptus, including entire fetus and placenta
- **Pluripotency:** ability to form several cell types

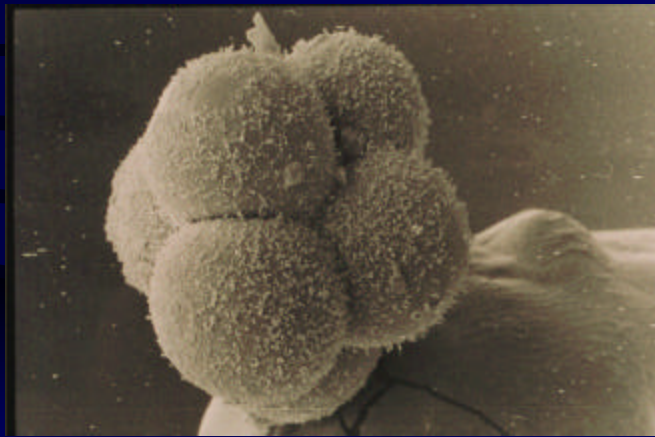
**Early Embryos are Clusters
of Totipotent Cells**



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PS Cell Power

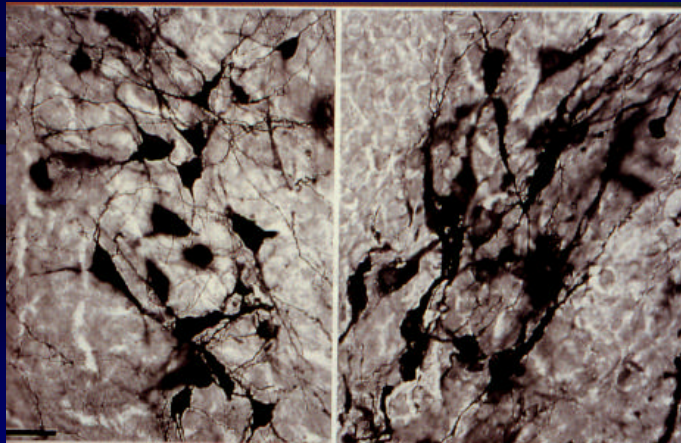
- **PS cells are Pluripotent**
 - Can contribute to all tissues of fetus
 - Cannot form placenta
- **PS cells are not Totipotent**
- **Therefore, PS cells are not Embryos**

Known capabilities of PS Cells

- Differentiate into heart cells
- Differentiate into blood
- Differentiate into neurons

Known capabilities of PS Cells

- PS-derived neurons can engraft.



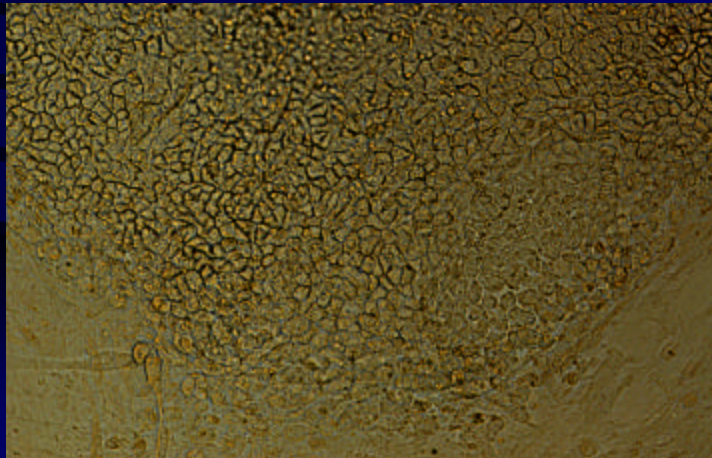
Derivation of hPS cells

- Removal of outer cell layer
(ancestors of placental cells)



Derivation of hPS cells

- Culture of inner cell mass



What is Proof of hPS Pluripotency?

- **In vitro differentiation**

Potential Near-Term Applications of hPS Cells

- **Basic studies of early human development**
- **Discovery of novel genes and proteins**
- **Derivation of tissues for transplantation**
- **Testing of toxic environments**

Controlling PS Differentiation to make Clinically useful Materials

What are Needs for hPS Future?

- **Better understanding of mammalian development**
 - Identify chemicals normally surrounding the developing tissues
- **Better understanding of hES *in vitro* growth requirements**
 - Provide these chemicals to PS cells in the petri dish.