

Embryonic Stem Cell Research

A Survey of the Science, Ethics and Social Impact

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Encore Pro-Life Science and Technology Symposium

Saturday, September 22, 2007
Engineers Club
110 E. Monument Avenue
Dayton, OH 45402

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Embryonic Stem Cell Research

- Introduction
- Background
- Stem Cell Science and Technology
- The President's Address (August 9, 2001)
- Side Issues
- Key Moral Issues
- Sociology and Prognostication
- A Theological Addendum

Sorry, no glitz!

ESC Research: Introduction

- It's therapeutic purpose is transplant therapies.
- President Bush put it on the front page.
- Hollywood made it an emotional issue.
- Scientists have hyped its promise.
- Misinformation is rife.
- The race is on: ESC vs. ASC.
- Official support for ESC will change the character of society.

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Stem Cell Science

- Differentiation: from ovum to mature function
- “Stemness” and the differentiation tree structure
- Differentiation and De-differentiation
- Totipotent, Pluripotent, Multipotent
- Genetic switches and the cell environment
- Parthenogenesis
- Somatic Cell Nuclear Transfer
- Cloning and Hybrids

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Accomplishments

- Many ASC types found, cataloged, cultured
 - Hematopoietic, Mesenchymal, Endothelial, Neuronal, etc.
- Many ad-hoc techniques for differentiation, de-differentiation and trans-differentiation
- Many tests for pluripotency, multipotency
- Some types of near-pluripotent cells found
 - Human cord blood SCs, amniotic fluid Scs
- Stem cells and cancer – the link (leukemia)

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Animal Experiments

- Cloned sheep, horses, chickens, cats, etc.
 - Using somatic cell nuclear transfer (SCNT)
- From skin cells to ESCs in mice
- Regeneration experiments

Areas of ASC Success

- Bone marrow transplants: blood regeneration
- Heart tissue regeneration
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Sources of ESCs

- Actual:
 - Human embryos – requires destroying the embryo
- Proposed:
 - Human cloning – basic SCNT
 - Cow/human hybrid cloning – altered SCNT, type 1
 - DOA human cloning – altered SCNT, type 2
- Not yet accomplished (Korean SNU scandal)

Technical Problems in SC Research

- Stem Cells in general:
 - Differentiation/De-/Trans- done by ad-hoc methods
 - Classification tests still ad-hoc
- Embryonic Stem Cells (for therapies):
 - Must be differentiated first, otherwise cancer
 - Tissue rejection issues
- Adult Stem Cells:
 - Rare in the human body
- Cloning: requires thousands of trials

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The President's Position

- Embryonic SCs
 - Universal application
 - Destroys embryos
 - Thousands are now “on ice”
 - 60 existing lines
 - Cloning is possible
 - “You-copy” on ice possible
- Fund existing lines
- Adult SCs, et. al.
 - Not all cataloged
- Fund

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Side Issues

- Economics
 - ESC tissue banks: donors, catalogs, matching
 - ESC “designer” patents: who owns
- Politics
 - Red vs. Blue and litmus tests
 - Defections
- How people see the value of a human being
- Changing Scientific Landscape

Key Moral Issues

- The value of a human being
 - Functional/derivative vs. absolute
 - Genetic/environmental uniqueness
 - Human free moral agency
 - The human soul
 - Where does God fit?
- When does “ensoulment” occur?
- The impact on culture and society

Sociology and Prognostication

- Literary precursors
 - 1984
 - Brave New World
- Historical precursors
 - Eugenics movement
 - Nazi death camp experiments
- History does not stand still
 - Choose: absolute vs. functional human value
 - Claim: no compromise can long survive (A. Lincoln)

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A Theological Addendum

- Relevant Scripture
 - Luke 1:39-45 – The Visitation
 - Mark 4:30-32 – Parable of the Mustard Seed
 - Matt: 17:20 – Faith the Size of a Mustard Seed
 - John 12:24 – The Fate of a Grain of Wheat
 - John 1:1-5 – In the Beginning was the Word
- Science and Philosophy
 - Words and information theory
 - Life from an ovum – the “genomic” Word
 - The universe from the Ylem – the “initial state” Word

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Important References

- Scientific Articles
 - “The Stem Cell Challenge” -- June 2004 Sci. Am.
 - “From skin cell to stem cell” -- June 2007 Nature
- Political Sources
 - “President Discusses Stem Cell Research” White House web site.
- The Vatican
 - “Declaration on the production and the scientific and therapeutic use of the human embryonic stem cells” Pontifical Academy for the Family, August 24, 2000