Therapeutic Possibilities of Stem Cell Research

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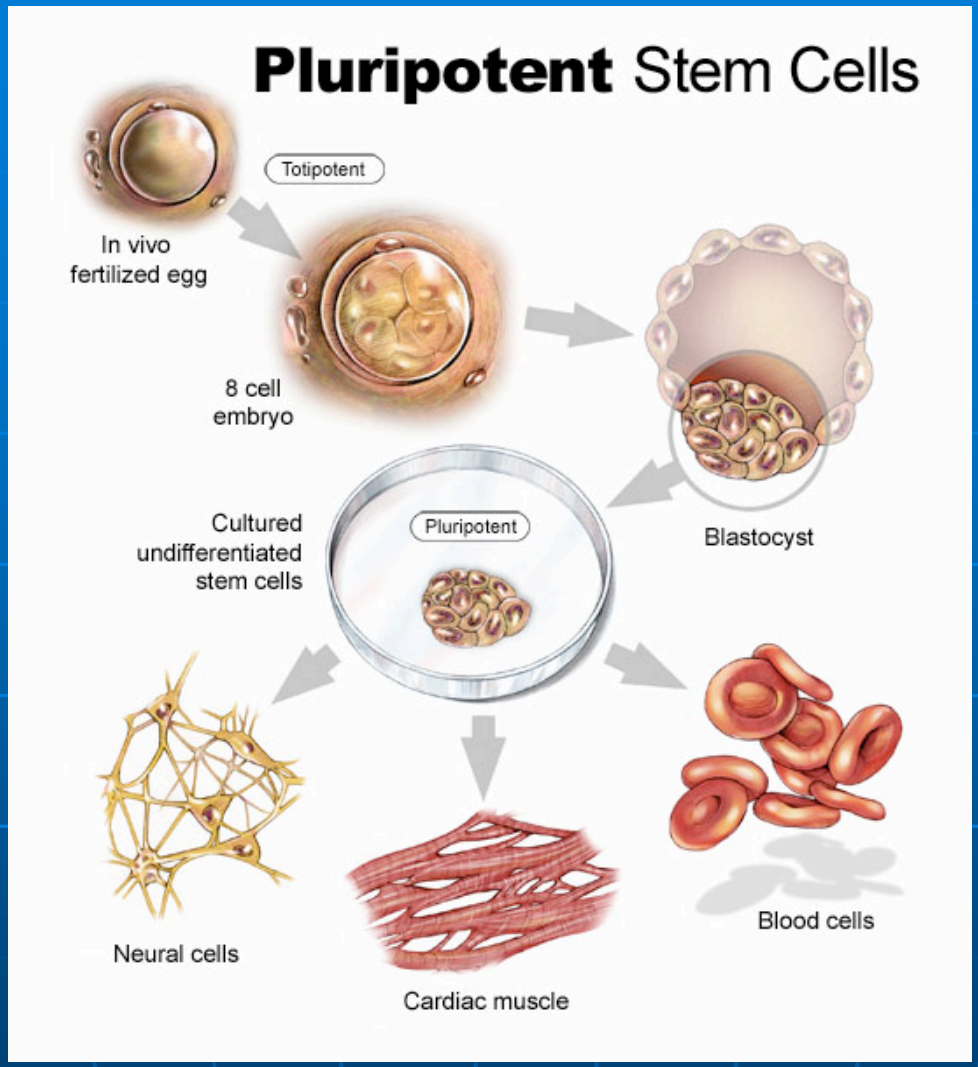
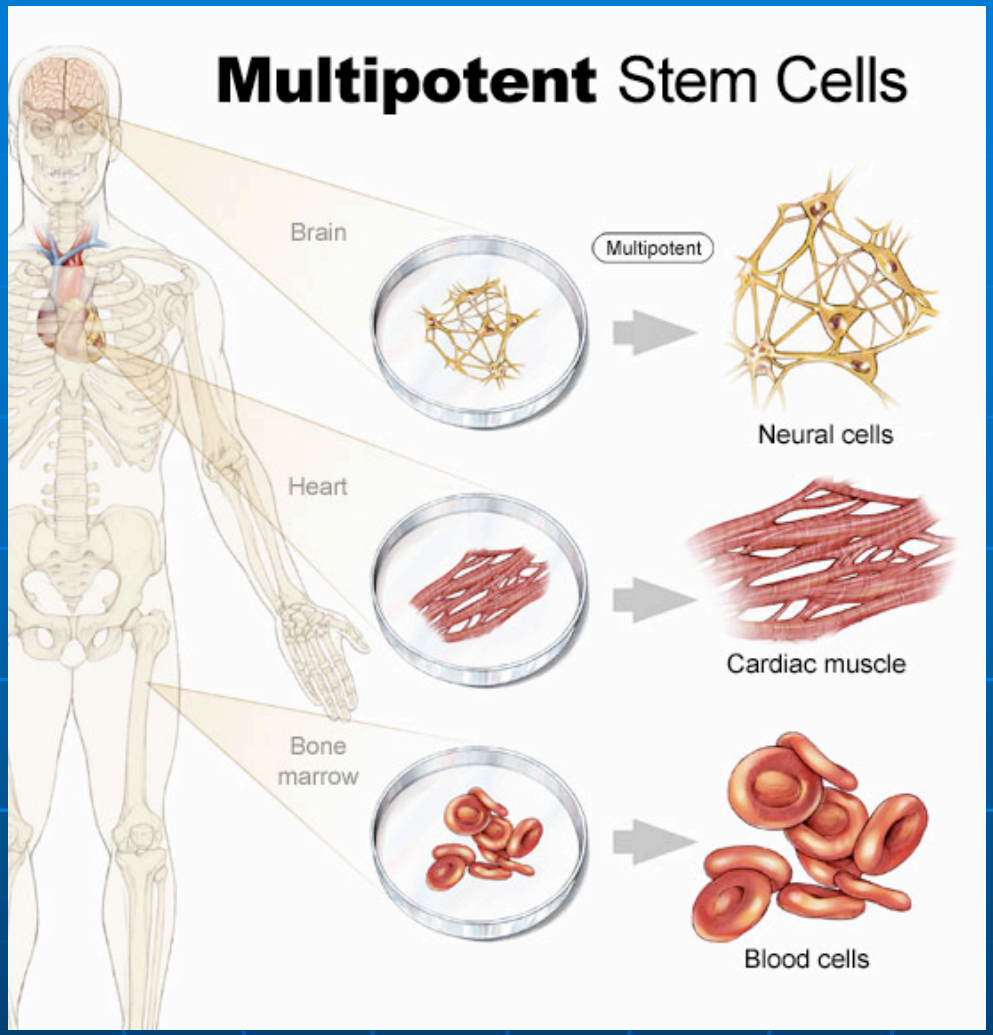


http://www.stemcellresearchfoundation.org/WhatsNew/EmbryonicStemCells.htm



http://www.stemcellresearchfoundation.org/WhatsNew/PSA_1.htm
http://www.stemcellresearchfoundation.org/WhatsNew/PSA_2.htm

Olfactory Bulb Stem Cells

- Primitive stem cells that normally feed the constant, life-long regeneration of odor-detecting nerves
- Like embryonic stem cells, they develop into many different types of cells in the right chemical or cellular environment
- Fairly accessible, readily obtained in all individuals and easy to grow and multiply
- Potential non-embryonic source for cells that could prove useful in replacing nerve cells lost due to injury or diseases like ALS and Parkinson's
- Transplant not subject to immune rejection

Lou Gehrig's Disease (ALS)

- Mouse experiments
- Neuronal stem cells transplanted into spinal cord
- Significantly prolonged lives by becoming neurons and interacting with existing neurons
- Symptoms developed at 137 days verses 90 days
- Treated mice lived 2 months longer

A neuromuscular disease that attacks the nerve cells and pathways in the brain and spinal cord

Heart Disease

- Cause of Death Rank: #1 (2002)
- Morbidity: 23 million diagnosed adults (2002)
- Hospital Inpatient Care: 4.4 million discharges, 4.6 day length of stay (2002)
- Hospice Care: 13,500 (2000)
- Nursing Home Residents: 165,100 (1999)
- Morality: 696,947 (2002)

Heart Disease

- University of Pittsburgh Medical Center
- Treatment for congestive heart failure and other heart disease
- CD34+ bone marrow-derived stem cells
- Cells and blood plasma injected into 25 to 30 sites of the diseased heart (25-45 m. cells)
- New heart cells and blood vessels
- Do stem cells take on the functional characteristics of heart cells and blood vessels, or do they recruit other cells and growth factors to help regenerate heart tissue?

Bone Repair

- NJ Institute of Technology – use of stem cells to induce bone repair
- Adult Stem Cells mixed with biomaterials known as scaffolds to regenerate bone growth
- Stem Cells from one person can successfully implant in another
- Diabetes, osteoporosis, cancer surgeries
- Also testing biomaterials that may repair cartilage, tendons and neuronal tissue

Type I Diabetes

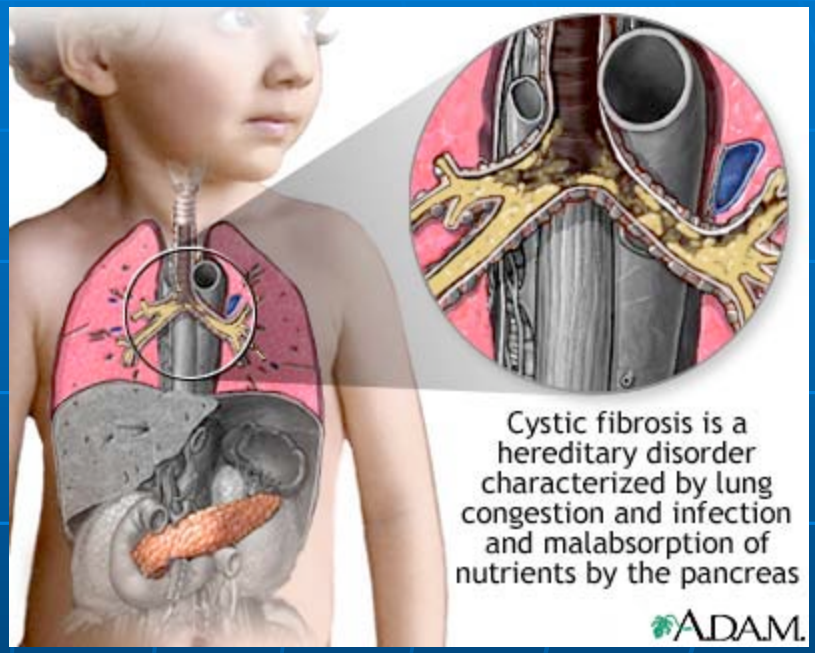
- Used protein transduction to promote pancreatic cell differentiation from adult bone marrow stem cells
- Enables development of more insulin-producing cells, or islets, for transplantation into patients with Type I Diabetes
- Know the genes to make a stem cell into an insulin-producing pancreatic cell, and found the signals involved in their activation
- Can turn genes on in the right order to get functioning cells
- Can add and remove proteins as needed from the developmental process which may give advantages over less flexible approaches such as gene therapy
- Bone marrow-derived stem cells may not have the same antigen as pancreatic beta cells, which would eliminate the potential for rejection or a negative immune response

Spinal Cord Injury

- Rat Experiments
- Sensory and motor deficiencies; paralysis
- Treatment derived from human embryonic stem cells and must occur in the acute phase of spinal stabilization
- Cells differentiate into early-stage oligodendrocytes, the building blocks of myelin
- Transplanted cells migrated to appropriate neuronal sites in the spinal cord
- 7 days post injury vs. 10 months post injury

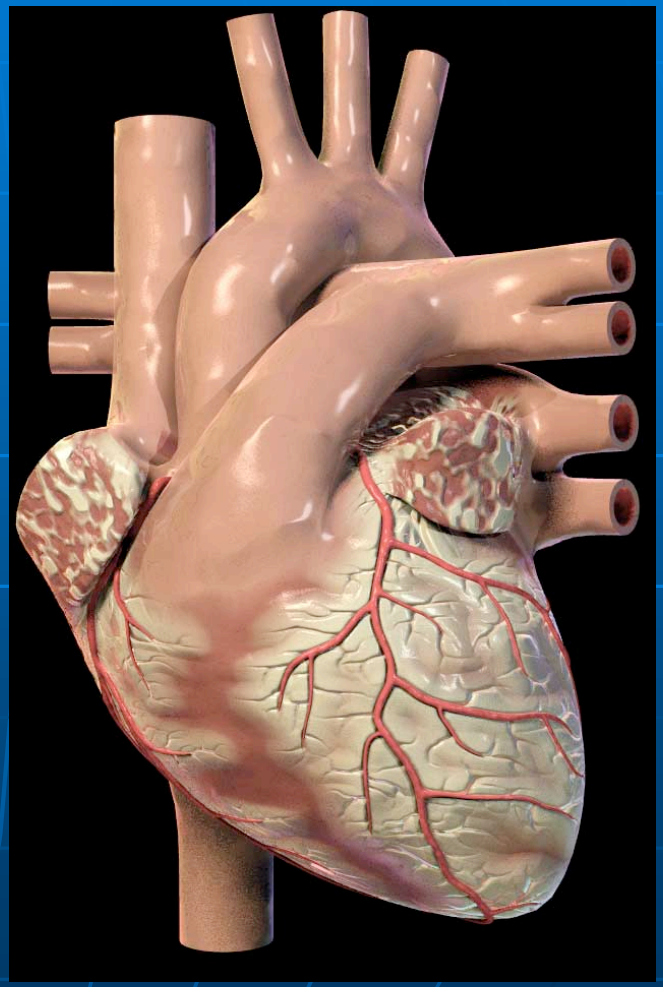
Cystic Fibrosis: Stem Cell-Gene Therapy Approach

- Human bone marrow-derived stem cells can differentiate into airway epithelial cells
- Encoding these cells with the gene that is defective in CF restores cellular function
- Keep airways clear of mucus and air-borne irritants
- Hope to perform clinical trial in next 2-3 years



Biological Pacemaker

- Human Embryonic Stem Cells genetically engineered and coaxed to become heart cells
- Clusters of cells beat on their own triggered the unified beating of rat heart muscle cells
- Triggered regular beating when implanted in guinea pigs
- Cells responded to drugs used to slow or speed up heart rate
- Use genetic engineering to customize the pacing rate of the cells



Hemophilia

- UNC Chapel Hill Medical School treated embryonic stem cells with fibroblast growth factor for seven days prior to injection
- Differentiate into early endoderm precursors
- Engraft, persist, differentiate further and function following injection - resulting in persistent production of Factor IX (hepatocytes)
- Robustly engrafted in the liver and not recognized as foreign by immune system
- Cells became hepatocytes
- 4 months later mice still producing Factor IX without immune rejection or suppression
- Low incidence of teratoma

Hearing Impairment

- Indiana University School of Medicine transformed adult bone marrow stem cells into cells with many characteristics of sensory nerve cells found in the ears
- Marrow-stromal cells develop into fat, bone and cartilage
- Autologous cell-based therapy to stimulate growth of nerve cells often missing in the inner ear of patients with profound hearing loss

Tooth Replacements

- Adult stem cells harvested from baby or wisdom teeth to grow new teeth naturally
- Contain rich supplies of stem cells that can develop into a variety of cell types including tooth generating cells
- Gingivitis and periodontis

Cosmetic and Reconstructive Surgery

- Conventional soft tissue implants lose 40 to 60% of volume
- Stem cell generated natural tissues instead of synthetic implants
- Avoid problems of saline and silicon
- Won’t shrink or lose shape
- Mouse experiments: bone marrow stem cells placed under the skin for four weeks; stem cells differentiated into fat generating cells and implants retained original size and shape
- Breast cancer surgery, post-cancer facial soft tissue reconstruction, trauma surgeries

Retinal Degeneration

- Mice predisposed for Retinitis Pigmentosa: a degenerative disease that destroys retinas
- Injected bone marrow-derived stem cells into the back of mouse eyes during development
- Dramatically curtailed retinal degeneration
- Completely normal vasculature, improved retinal tissue and light response
- Disorders of the retina that have vascular and neuronal degeneration: genetic disorders known collectively as retinitis pigmentosa

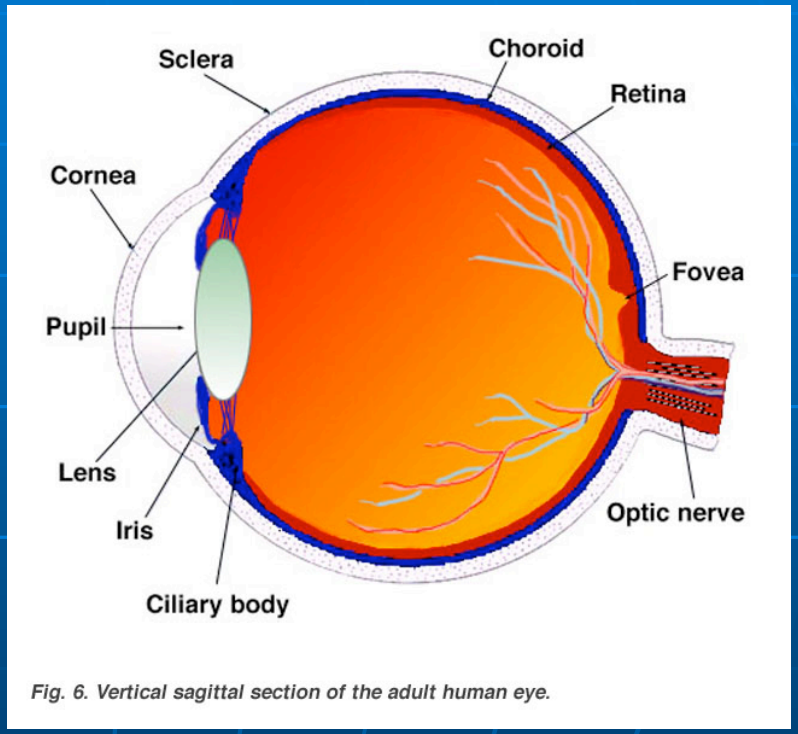


Fig. 6. Vertical sagittal section of the adult human eye.

Potential of Embryonic Stem Cells

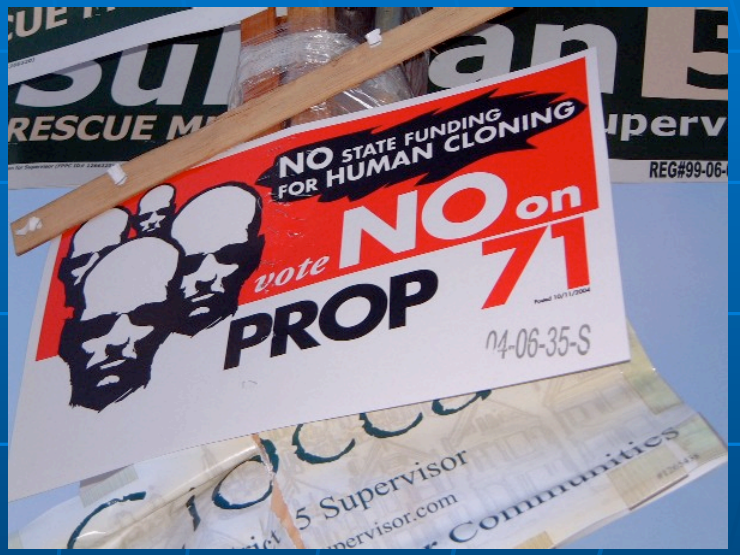
- Research Promise: Fundamental new tools to study everything from cancer to Alzheimer's
- Medical Promise: Therapies that might eventually treat dozens of diseases

Potential of Embryonic Stem Cells

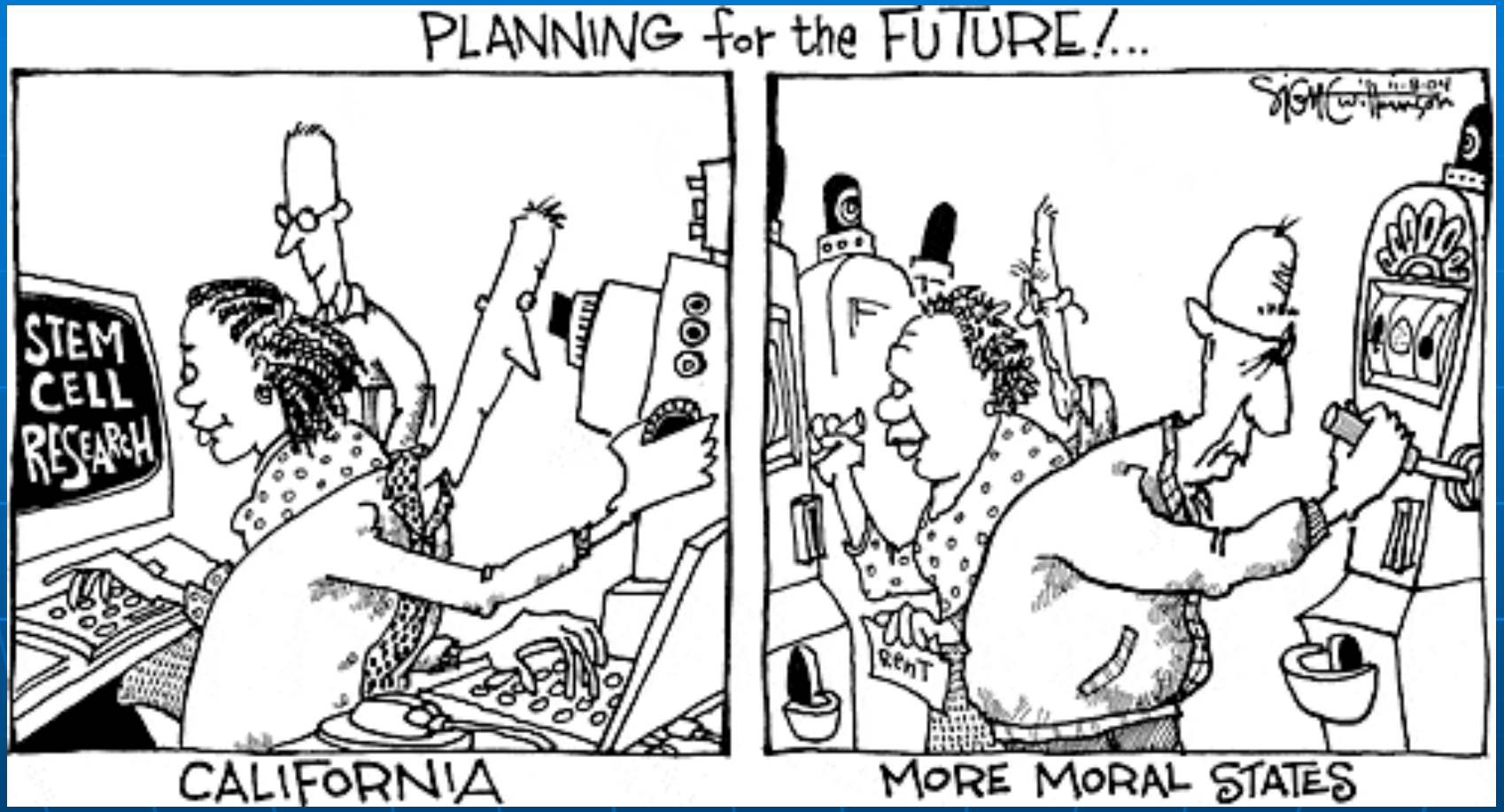
- Cancer therapy: stem cells to replace organ tissue or regrow organs
- Transplants for autoimmune disorders like Lupus
- Organ transplants without risk of rejection
- Grow insulin producing Beta cells to treat Type I Diabetes
- Neurons to restore brain function to patients with Parkinson's Disease
- Rebuild an injured spine
- Create replacement skin for a burn victim
- Alzheimer's Disease, Lou Gehrig's Disease, "Bubble Children"

Opposition

- Human embryo moral status
- Opens the door to reproductive cloning - implantation to difficult to enforce
- Perfecting nuclear transplantation techniques that can be used to clone humans
- Destruction of innocent human life for research
- Biotechnical abolition of the human family
- Degradation of human procreation, manufacturing children without normal familial bonds, turning pregnancy into a research



Weldon-Stupak Bill
&
Brownback Bill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