A New Feasibility Scale to Rate Adult and Embryonic Stem Cell Applications

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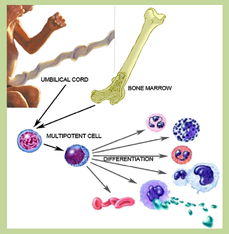
INTRODUCTION

Why Stem Cells?[1,2]

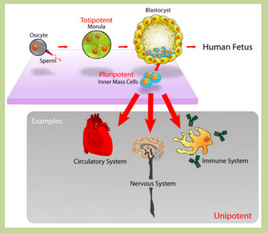
- Primal cells with ability to renew and differentiate into wide range of specialized cells
- Fewer side-effects than most drugs
- Economic potential of trillion+ dollars
- Reaches impossible limits in regeneration medicine
- Worldwide R&D spending of over 500 billion dollars

Types of Stem Cells

Adult



Embryonic



QUESTION

Much interest and money is being spent on stem cell research, but is this research **feasible and applicable to medicine** in the near future?

METHODOLOGY

Clinical Trial Feasibility Scale

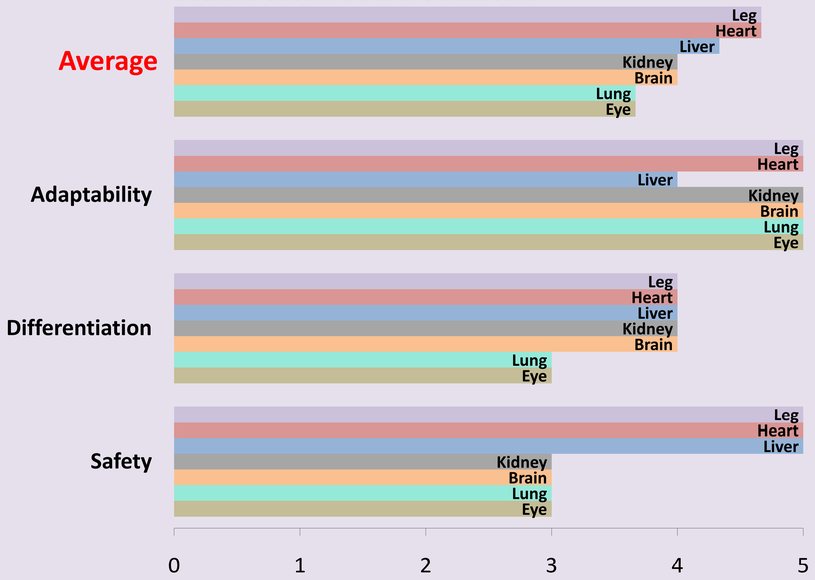
- Selected journals reporting results of clinical trials and animal model studies
- Adaptability: Measures **vitality** of stem cells initially injected
- Differentiation: Measures **proliferation** of stem cells after injection
- Safety: Probability of **side-effects or tumor growth** long after injection

Scale	Adaptability	Differentiation	Safety
5	100%	> 100 times	0%
4	80%	> 50 times	20%
3	60%	> 10 times	40%
2	40%	> 5 times	60%
1	20%	> 2 times	80%
0	0%	No growth	100%

RESULTS

Clinical studies show potential for medical treatments…

Adult stem cell treatment[3,4,5,6]



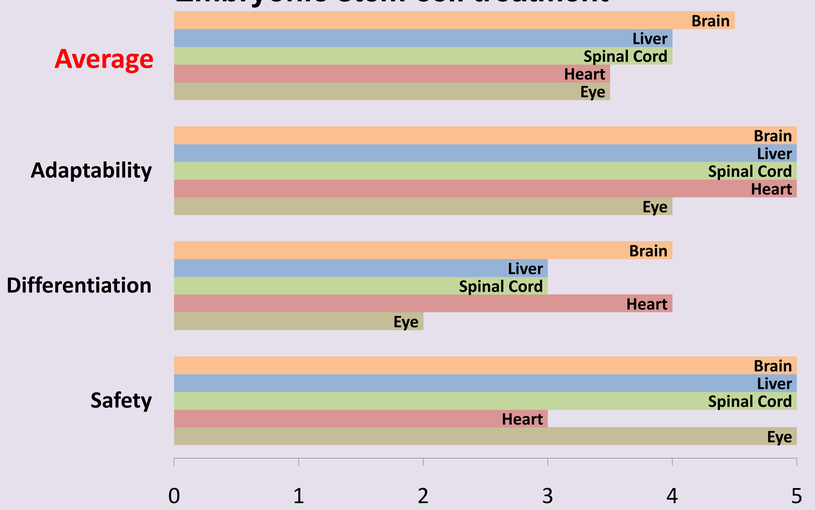
Average
- All studies rated over 3.5
- Shows potential for medicine

Adaptability
- No major problems in cell adaptation to recipient organ

Differentiation
- Proliferation adequate for treatment
- Strength of adult stem cell use

Safety
- Small potential for tumor development
- Most studies show improvements

Embryonic stem cell treatment[6,7]



Average
- All studies rated over 3.5
- Shows potential for medicine

Adaptability
- No major problems in cell adaptation to recipient organ

Differentiation
- Proliferation almost adequate
- Most studies are improving

Safety
- No major problems shown
- Strength of embryonic stem cell use

…but complications must be addressed

Ethical issues
- Stem cells may lead to human cloning
- Embryonic research banned in US
- Most countries allow research within strict boundaries

Plasticity of cells[8]
- Adult stem cell development restricted to range of cells
- Embryonic stem cell plasticity hard to control
- Recent research shows possibility to cross borderline

Low success rate
- Successful fertilization trashes thousands of eggs
- Many cells dead during culture and development
- Success rate significantly improved since initial research

DISCUSSION

Adult Stem Cell

- Clinical and experimental results show potential and proximity to applicability
- Highly capable of differentiation *in vivo*
- Most cells need to grow *in vivo*, limiting ability to track down cells after growth
- Number of stem cells in bone marrow and peripheral blood vessel very low
- Restrictive outcome due to plasticity
- Cells show aged properties thus less effective sometimes

Embryonic Stem Cell

- Experimental results suggest feasibility in applications to medicine
- Easy manipulation and growth *in vitro*
- Shows strength in safety after injection
- Requires a donor egg, raising ethical problems
- Successful fertilization rate low, implying high costs and need for better laboratory cell growth technique

FUTURE DIRECTION

- Use scale rating in future studies to serve as guidelines for research
- Funding opportunities for both types of stem cell research
- Plasticity research for adult stem cells
- Ethical issues for embryonic stem cells
- Increasing success rate of growth as well as differentiation *in vitro*

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