

## Activity 4: Stem Cell Technologies Applied to Public Health

### Assignment: Research Paper

Loss of cells is the underlying problem for a number of diseases including Parkinson's, diabetes, heart disease, AIDS, malaria, and anemia. Cell replacement therapy has been developed to aid patients suffering from these diseases with the most successful methods involving fetal or bone marrow pluripotent cells. Though moderately successful, these cells have a limited lifespan and are not always immunocompatible with the patient, nor can they adopt all cell fates upon transplantation. Recent work with adult and embryonic stem cells suggest that current cell therapies could be greatly improved by providing a source of easily accessible recipient-matched cells which are capable of regeneration and differentiation into a wide range of cell types. In this activity you will review the potential of stem cell therapeutics as it relates to a specific disease.

As is true of all human subjects based research, those involved must be aware of the risks and benefits of participating in such studies. The informed consent process and the role of institutional review boards were specifically articulated to protect vulnerable populations from unnecessary risk or harm. The long established protocols for ensuring appropriate consent and oversight have become outdated in the era of stem cell research. You should be aware of the new challenges that accompany this growing field of research and address these issues in this assignment.

Because this assignment is an extended research paper, it is important to set aside time for additional literature research, reading, interpretation, writing, and revising. The additional social and ethical dimensions of applying stem cell science to public health may be new to some students, and you should set aside time to become familiar with this material. Be sure to consider concerns about access to new therapies, including the concerns about universal access and the move to patent stem cell methods and lines.

The readings below will help you get started with your research. Each reading category contains introductory selections. Readings which include more advanced scientific content are designated by the '\*' mark. Since each student will choose a different topic, the category entitled "Therapeutic Applications of Stem Cells" is very general. Therefore, your literature research will expand this category to develop a customized bibliography specific to your chosen topic. . Selections that are essential for this assignment are marked by the '±' mark.

### Instructions

1. You may choose to write about one of the following diseases: Parkinson's, muscular dystrophy, diabetes, or sickle cell anemia. Alternatively, your instructor may allow you to describe how stem cell research can improve screening protocols for environmental toxins or the development of novel drugs.
2. Begin by reading some of the selections listed below. Your choice may depend on your background in these areas, or specific articles may be assigned by your instructor

#### Basic Science of Stem Cells

- \* ± National Institutes of Health. (2001). *Stem cells: Scientific progress and future research directions*. National Institutes of Health. Washington DC.

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<http://stemcells.nih.gov/info/scireport/>. A detailed scientific overview with appendices that are especially useful and contain detailed figures and diagrams.

- \* ± Stojkovic, M. et al. (2004). "Derivation, growth and applications of human embryonic stem cells." *Reproduction* 128(3): 259-267. This review is appropriate for biology majors. <http://www.reproduction-online.org/cgi/reprint/128/3/259>
- Council for Responsible Genetics.(2001). *What Your Mother Never Told You About Stem Cells*. Online. Council for Responsible Genetics. [http://www.genewatch.org/educational/stem\\_cells\\_mom.pdf](http://www.genewatch.org/educational/stem_cells_mom.pdf)
- Lanza R. and Rosenthal N. (2004). "The Stem Cell Challenge." *Scientific American* 290(6): 92-100. [http://www.sciam.com/print\\_version.cfm?articleID=000DFA43-04B1-10AA-84B183414B7F0000](http://www.sciam.com/print_version.cfm?articleID=000DFA43-04B1-10AA-84B183414B7F0000)

### Therapeutic Applications of Stem Cells

- ± National Research Board on Life Sciences. (2002). *Stem Cells and the Future of Regenerative Medicine*. National Academy of Sciences. Washington D.C. Online Book. p.112 <http://www.nap.edu/openbook/0309076307/html/>. Chapter one and four are most pertinent.
- Dunn, K. (2002). "Cloning Trevor." *Atlantic Monthly* 289(6): 31(16 pages). <http://www.theatlantic.com/doc/prem/200206/dunn>
- Stem Cell Network. (2002). "Adult Stem Cells Used to Repair Damage from Parkinson's Disease." Online. Stem Cell Network. April 8. <http://www.stemcellnetwork.ca/partners/jdrf/news/articles.php?id=27>.
- \* Paul, G. et al. (2002). "Stem cells: Hype or hope?" *Drug Discovery Today* 7(5): 295-302.
- \* Odorico, J.S., Kaufman, D.S. & Thomson, J.A. (2001). "Multilineage differentiation from human embryonic stem cell lines." *Stem Cells* 19 (3): 193-204. <http://stemcells.alphamedpress.org/cgi/content/abstract/19/3/193>
- \* Hwang, W.S. et al. (2005). "Patient-specific embryonic stem cells derived from human SCNT blastocysts." *Science* 308(5729): 1777-1783. Originally published on May 19, 2005 in *Science Express* retracted in January 2006.

### The Ethics and Protocols Associated with Clinical Trials Using Stem Cells

- ± Kahn, J. et al. (2004). "Creating a stem cell donor: A case study in reproductive genetics." *The Kennedy Institute of Ethics Journal* 14(1): 81-96.
- ± Magnus, D. et al. (2005). "Issues in oocyte donation for stem cell research." *Science* 308(5729): 1747-1748. Originally published on May 18, 2005 in *Science Express*.
- ±Fairclough, G. (2005). "Women Offer Eggs to Doctor in South Korea." *Wall Street Journal*. November 25: 1.
- ±Normile, D. et al. (2006). "South Korean team's remaining human stem cell claim demolished." *Science* 311(5758): 156-157.

### Legal and Economic Issues Related to Universal Access to Stem Cells

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- ± Shaw, J. (2004) "Stem-cell Science: When Medicine Meets Moral Philosophy." *Harvard Magazine* 106 (6). July-August: 36-45. <http://www.harvardmagazine.com/online/070483.html>
- ± Rabin, S. (2005). "The gatekeepers of hES cell products." *Nature Biotechnology's Cell Therapies Focus Online* 23(7): 817-819. <http://www.nature.com/nbt/journal/v23/n7/pdf/nbt0705-817.pdf>
- ± Walters, L. (2004). "Human embryonic stem cell research: An intercultural perspective." *The Kennedy Institute of Ethics Journal* 14(1): 3-38.
- ± Gibbs, W. (2005). "The California Gambit, in Special Report: The Future of Stem Cells." *Financial Times and Scientific American*: A24-27. [http://www.sciam.com/print\\_version.cfm?articleID=00074394-3130-12BC-ADB783414B7F014C](http://www.sciam.com/print_version.cfm?articleID=00074394-3130-12BC-ADB783414B7F014C)
- ± Gardner, R. et al. (2005). "A Patchwork of Laws, in Special Report: The Future of Stem Cells." *Financial Times and Scientific American*: A16-A21. [http://www.sciam.com/print\\_version.cfm?articleID=00031AB9-D9A9-12B9-969983414B7F0000](http://www.sciam.com/print_version.cfm?articleID=00031AB9-D9A9-12B9-969983414B7F0000)
- Cookson, C. (2005). "Universities and Companies Rush To File Stem Cell Patents in Spite of Controversy." *Financial Times*. June 20: 1.
- Fukuyama, F. (2002). "The Clone Traders Advances in Human Biotechnology Have Highlighted the Need for International Regulation." *Financial Times*. May 18: 01.
- Andrews, P.W. et al. (2005). "The International Stem Cell Initiative: toward benchmarks for human embryonic stem cell research." *Nature Biotechnology's Cell Therapies Focus Online* 23(7): 795-797. <http://www.nature.com/nbt/journal/v23/n7/pdf/nbt0705-795.pdf>

### 3. Visit these web sites.

- University of Michigan. (2006). "Stem Cells Explained and Explored." Online. University of Michigan. March 21. This site reviews ASC and ESC procurement and their applications with good animations. [http://www.umich.edu/news/stemcells/022706\\_TabA.html](http://www.umich.edu/news/stemcells/022706_TabA.html) or <http://www.lifesciences.umich.edu/research/featured/tutorial.html>.
- Dolan DNA Learning Center. "Cloning 101." Cold Spring Harbor Laboratory. This site demonstrates the Roslin and the Honolulu techniques with animations. <http://www.dnalc.org/stemcells.html>
- Public Broadcasting Service. (2004). "Stem Cell Research." Online. Online News Hour With Jim Lehrer. Productions. August 10. [http://www.pbs.org/newshour/bb/health/july-dec04/stemcell\\_8-10.html](http://www.pbs.org/newshour/bb/health/july-dec04/stemcell_8-10.html).
- Schindler, L. et al. "Science Behind the News: Understanding the Immune System." Online. The National Cancer Institute. An excellent **slide show** reviewing the basics of immunology with colorful graphics 295-302. <http://newscenter.cancer.gov/sciencebehind/immune/immune01.htm>.
- FDA. (1995). "FDA consumer: From Test Tube to Patient: New Drug Development in the United States." Online. Food and Drug Administration. This site reviews animal and clinical studies and the regulations that safeguard patients and consumers including informed consent. [http://www.fda.gov/fdac/special/newdrug/ndd\\_toc.html](http://www.fda.gov/fdac/special/newdrug/ndd_toc.html).

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4. Outside of class conduct additional literature research and write a paper that will:
  - Explain the biological basis of your disease (including inherited or environmental).
  - Review available treatments or preventions (including cost, duration, efficacy, and limitations).
  - Describe how stem cell research will affect current options for treatment or prevention (including access, immune system compatibility, cost, duration, efficacy, limitations, increased understanding of pathology, ability to screen for causative agents).
  - Consider the legal and ethical implications of using various stem cell technologies (including economics, human rights, funding sources).
5. Your instructor may ask you to exchange papers with a peer and revise your paper based on the peer's feedback and review.