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Proceed Cautiously When Funding New Technologies

Definitions can help protect life or can promote unethical practices

David Prentice, Ph.D. February 2010

Science and technology keep bringing us exciting new discoveries. Hardly a day goes by without a news story of the latest breakthrough, and promises of wonderful outcomes. But when funding initiatives in science and technology, taxpayers need to pay attention to how new technologies are defined, and whether protections for all human life are incorporated.

The citizens of Missouri are no strangers to "definition manipulation" — the debate on Amendment 2 in 2006 was really about the definition of "cloning." Amendment 2 claimed to ban human cloning, but redefined cloning as putting the cloned embryo into the womb and gestating it. However, the recognized scientific definition of cloning of a new organism (termed "somatic cell nuclear transfer") is technically completed once the single-celled embryo is formed; the cloned embryo can then be placed into a womb in an attempt at a born clone, or used for experiments in which the clone is destroyed. With the linguistic somersaults of Amendment 2, cloning is allowed but the clone must be destroyed by law to fit the newly minted definition.

The Missouri legislature is now considering funding for areas of science and technology investigation. Science and innovation funding can encompass many areas, including "biology", "biochemistry", and "biotechnology." These areas as broadly defined can include areas of concern, in particular involving research with embryos, embryonic stem cells, and cloning.

Other areas of particular focus for potential funding include "nanotechnology" and "biomaterials." In these cases, definitions as well as limits are particularly important to focus the research on ethical methods and ethical ends. Generally, nanotechnology would be the study of sub-microscopic particles (smaller than the size of a single cell). In the biological realm, such research may have valuable applications for diagnosis or drug delivery. But nanotechnology can also be used in the growth or tracking of stem cells. And the question then becomes, which stem cell — ethically challenged embryonic stem cells, or adult stem cells? For example, nanoparticles have been used to mark bone marrow adult stem cells, and show that they can indeed transform into heart cells.[1] But nanotechnology can also be used in the growth of human embryonic stem cells,[2] or even for growing embryos in the laboratory.[3]

Likewise, biomaterials in general would be defined as nonliving materials, whether derived from living or nonliving sources, and would normally include areas such as construction of artificial joints, cartilage for scaffolding, and other structural support, etc. And again, they can be used in conjunction with stem cells, raising the same question as before. For example, biomaterials can be targeted for valuable research, such as stimulating repair of spinal cord injury by encouraging the body's own cells to regenerate.[4] But again, biomaterials can be used in human embryonic stem cell research, for the growth and selection of the embryonic stem cells.[5]

In the end, the only way to protect human life from unethical research with certainty is to specifically and narrowly define the areas of investigation that receive funding, or specifically to prohibit unethical uses of the technology.

(Endnotes)

1 Rota M *et al.*, Bone marrow cells adopt the cardiomyogenic fate *in vivo*, *Proceedings of the National Academy of Sciences USA* 104, 17783-17788, November 6, 2007

2 Salli U *et al.*, Propagation of undifferentiated human embryonic stem cells with nano-liposomal ceramide, *Stem Cells and Development* 18, 55-66, February 2009

3 Urbanski JP *et al.*, Noninvasive Metabolic Profiling Using Microfluidics for Analysis of Single Preimplantation Embryos, Analytical Chemistry 80, 6500–6507, 2008

4 Researcher finds natural hydrogel helps heal spinal cord, September 17, 2009, http://www.physorg.com/news172404620.html

5 Chayosumrit M et al., Alginate microcapsule for propagation and directed differentiation of hESCs to definitive endoderm, Biomaterials 31, 505-514, January, 2010

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