

**MEDICAL, ETHICAL, AND SCIENTIFIC ISSUES  
RELATING TO STEM CELL RESEARCH  
CONDUCTED IN THE COMMONWEALTH  
(HJR 588 of 2005)**

**EXECUTIVE SUMMARY**

The Joint Subcommittee to Study the Medical, Ethical, and Scientific Issues Relating to Stem Cell Research Conducted in the Commonwealth was established as a 15-member organization pursuant to HJR 588 and directed to study the "policy implications of stem cell research, and the efficacy of research using both adult and embryonic stem cells."

The Joint Subcommittee held four meetings during which extensive and complex data was presented relating to stem cell research across the Commonwealth and the nation. The first meeting focused on background information, including the five citations to stem cell research in the Code of Virginia, Virginia's Human Cloning law, a short chronology of the stem cell controversy, and a survey of relevant websites.

Among the websites reviewed for the Joint Subcommittee were: the National Institutes of Health's "Stem Cell Research Information" page, the University of California Medical Center's *The Visible Embryo*, the "public" portion of the International Society for Stem Cell Research's website, the American Medical Association's *Report 5 of the Council on Scientific Affairs*, the Iacocca Foundation, and The National Academies' prepublication copy of the April 2005 Guidelines for Human Embryonic Stem Cell Research.

A panel of prestigious scientists and ethicists was convened for the Joint Subcommittee's second meeting: Dr. Gary S. Friedman, a transplant physician based in New Jersey and a trustee of the New Jersey Stem Cell Research & Education Foundation; Dr. John D. Gearhart, the C. Michael Armstrong Professor of Medicine, Institute of Cell Engineering, Johns Hopkins University and the leader of the Johns Hopkins University research team responsible for first deriving human pluripotent stem cells in 1998; Dr. Jonathan D. Moreno, the Emily Davie and Joseph S. Kornfeld Professor of Biomedical Ethics and the Director of the Center for Biomedical Ethics at the University of Virginia; Father Tadeusz Pacholczyk, an ethicist and the Director of Education at the National Catholic Bioethics Center in Philadelphia and a Catholic priest for the dioceses of Fall River, Massachusetts; and Dr. David A. Prentice, a Senior Fellow for Life Sciences at the Family Research Council in Washington, D.C. and an Affiliated Scholar for the Center for Clinical Bioethics at the Georgetown University Medical Center.

Dr. Friedman emphasized that he believes the existing structure for organ and bone marrow collection should be used for organized cord blood banking and the harvesting and banking of donor bone marrow in order to provide plentiful sources of stem cells for use in regenerative medicine.

Among other matters, Dr. Gearhart focused on the uniqueness of the stem cell---embryonic or adult, because it has the capacity to self-renew, i.e., it can produce another cell like itself and it can specialize into another cell type. Some stem cells can only divide one time and

others can divide many times and produce many different cell types. This conundrum is the central focus of stem cell science---trying to figure out which stem cells have the capacity for generating what tissues. The only major clinical application of stem cells, at present, uses bone marrow derived stem cells, which contains two kinds of stem cells, hematopoietic and mesenchymal. He noted that regardless of the stem cell source, certain criteria must be met: (i) self-renewal, (ii) stability, (iii) capacity to multiply and specialize, and (iv) reproducibility of the results for quality control.

Dr. Moreno served as co-chair of the National Academy of Science Committee on Guidelines for Human Embryonic Stem Cell Research. He cited the many reasons for developing the embryonic stem cell guidelines, such as: the significant public support for human embryonic stem cell research; the diverse funding for stem cell research (private, federal and state); the scientific concerns relating to the hodgepodge of federal regulations; the lack of regulation of privately supported human embryonic stem cell research; and public and scientific uncertainty about the appropriate procedures for conducting this research.

Father Pacholczyk's presentation focused on the moral arguments and ethical considerations raised by stem cell research issues. He framed his presentation to ask questions about the proper direction for legislatures in the future with respect to these issues, and whether medical efficiency should trump and triumph over ethics. He asserted that everyone in the room came from an embryo and acknowledged that an embryo is a very small object. He insisted, however, that once everyone accepts the fact that they started out as an embryo, the focus is drawn to a discussion of whether all human beings are created equal, regardless of size. Thus, he opined, if all human beings are created equal, the size of the human embryo doesn't matter, and consequently, the destruction of human embryos to help other humans is wrong.

Dr. Prentice discussed the current and potential problems with embryonic stem cells. He noted that stem cell lines are difficult to establish, handle, and maintain, and also carry the possibility for causing tumors and tissue destruction. Turning to adult stem cells, Dr. Prentice presented the subcommittee with the evidence that some adult stem cells show pluripotent capacity. Other studies have shown the placental amniotic stem cells can potentially form any tissue without producing tumors. Human cord blood stem cells--which are young stem cells---have been shown to be pluripotent.

A panel of scientists representing Virginia medical schools was convened for the Joint Subcommittee's third meeting: Dr. Roy C. Ogle, Professor of Neurosurgery, Cell Biology and Plastic Surgery, and the Director of the Center for Human Stem Cell Translational Research at the University of Virginia's Medical School; Dr. Jerome F. Strauss, Dean of the Virginia Commonwealth University School of Medicine and Executive Vice President for Medical Affairs of the VCU Health System; and Dr. William J. Wasilenko, the Associate Dean for Research and an Adjunct Associate Professor in the Department of Microbiology and Molecular Cell Biology at Eastern Virginia Medical School.

Each type of stem cell, Dr. Ogle noted, has strengths and weaknesses and embryonic and adult stem cell research is complementary. The strengths of embryonic stem cells are that they are pluripotent, i.e., capable of differentiating into any cell type, and have infinite replication

capacity. The weaknesses of embryonic stem cells, particularly the human embryonic stem cell lines that are currently approved for federal funding, are that differentiation is difficult to control; they have the potential for tumor formation; only limited immunotypes are covered; and the approved lines are contaminated with bovine and murine proteins/pathogens. The strengths of adult (multipotent) stem cells, Dr. Ogle remarked, are their abundance, more uniform differentiation, restricted differentiation potential, and their potential for use in autologous therapies (using the patients own tissue). However, the weaknesses of any adult stem cells are their limited replication potential (not immortal), and limited plasticity (ability to be build tissue).

Dr. Strauss elaborated on the appeal of embryonic stem cells, explaining that they are immortal, can be cloned, are undifferentiated, and have wide developmental potential. The challenges in the development of embryonic stem cell therapeutics are: the definitive proof of the embryonic stem cell capabilities has not yet been discovered; purity is a problem in the approved cell lines because of contamination with bovine and murine cells; limited available immunotypes; apparent genetic instability and risk of cancer; difficulties in production; and the ethical issues. Further, stem cell biology research challenges include the controversy concerning whether embryonic or adult stem cells are more efficient; the various alternative proposals for generating pluripotent cells; the appropriate development of preclinical models; and whether any intellectual property is in the public or private domain. Dr. Strauss mentioned several alternatives to stem cell therapeutics, such as isolation of stem cells from extraembryonic fetal tissues (e.g., the placenta); activation of endogenous stem cells; chemical or genetic initiation of nuclear reprogramming of adult cells to be like the embryonic cell; and various biomaterials and devices.

Dr. Wasilenko noted that Eastern Virginia Medical School (EVMS) is the cutting edge institution in reproductive technology, with the Jones Institute being a highly regarded infertility program throughout the world. In 2001, researchers at EVMS derived three embryonic stem cell lines from human blastocysts created through in vitro fertilization using donor gametes. Dr. Wasilenko clarified that, at this time, no human embryonic stem cell research is being conducted and the researchers who conducted the 2001 published study have left the institution. Eastern Virginia Medical School does have stem cell related activities in regenerative medicine, for example, in diabetes. The Strelitz Diabetes Institutes at EVMS include The Research Institute, which has conducted pioneering research relating to the pancreatic islet neogenesis associated protein, commonly referred to as INGAP. In 1997 the Strelitz Diabetes Institutes announced the discovery of the INGAP gene, as part of ongoing research relating to genes and protein products that may cause pancreatic islet cells to regenerate and produce insulin. In addition, EVMS does collect cord blood, if the parents so wish.

The Joint Subcommittee's fourth and final meeting completed its 2005 review of stem cell research activities in the Commonwealth with a presentation by Dr. David L. Ayares, the chief executive officer of Revivicor, Inc., based in Blacksburg, Virginia.

Revivicor, a recent spin-off company of PPL Therapeutics, is a biopharmaceutical company that has produced products used in treatment, for example, alpha-1-antitrypsin (AAT), which was awarded "orphan drug" status by the federal Food and Drug Administration in 1999 and has been used in clinical trials for treatment of hereditary emphysema and cystic fibrosis.

Revivicor is a world leader in animal cloning technology, being a subsidiary of the company in Scotland that produced Dolly, the Sheep, the first cloned animal. Revivicor concentrates on advancement of biomedical products and regenerative medicine, with a diverse product development pipeline focused on creating genetically modified pig organs and cells for xenotransplantation applications (between species, such as from pigs to humans), stem cell therapies for diabetes, and development of human polyclonal antibodies from genetically modified livestock for biological warfare countermeasures. Revivicor's mission is to produce pig tissue and cells that can be used to treat humans without requiring life-long treatment with immunosuppressants, e.g., pancreatic islet cells for the treatment of diabetes.

Dr. Curtis Thorpe, technical advisor to the Joint Subcommittee from the Virginia Department of Health, presented information on cord blood banking that had been researched by staff. Three states, Florida, Massachusetts, and New Jersey have different models of public cord blood banks. Florida's program is a consortium between the University of Florida, University of Southern Florida, the University of Miami, and the Mayo Clinic in Jacksonville. Massachusetts' program is a partnership with the University of Massachusetts Medical School at Worcester, established as a public cord blood bank for umbilical cord blood and placental tissue donated by maternity patients at certain participating hospitals. New Jersey's program provided for a \$5 million loan to the Coriell Institute for Medical Research, an internationally known, not-for-profit biomedical research institution with a long history of cell banking, cryogenic storage, and retrieval of human cell cultures, to establish the New Jersey Cord Blood Bank.

In a growing number of countries across the world, cord blood banking initiatives have been established. For example, Brazil has a public cord blood bank at one maternity hospital in Rio de Janeiro. Colombia recently established a cord blood banking program through the University of Antioquia. India also recently announced government cord blood banking initiatives in four locations through a contract with a private firm. In Korea, the Seoul Cord Blood Bank is not a government program and is run by the same private firm contracted to run India's initiative. Singapore has a government-supported cord blood bank, established in 2004, that will provide free cells to any child whose cord blood has been donated; others are charged for the units. Australia has a national network of cord blood banks in Melbourne, Sydney, and Brisbane and registers cord blood in the Australian Bone Marrow Registry. In the United Kingdom, the National Health Service collects cord blood for the public good, with 80 or more units having been released for transplantation. Italy prohibits private cord blood banking and has a network of public cord blood banks, maintained by its national health system.

The United States' National Marrow Donor Program is part of a worldwide network of 500 medical facilities that searches for a donor or cord blood match when a patient needs a transplant and facilitates an average of 200 bone marrow or blood cell transplants each month. The National Marrow Donor Program has a registry of more than 45,000 cord blood units in cord blood banks across a number of states.

In Virginia only approximately five percent of umbilical cord blood is currently being banked in the medical schools, primarily for the use of pediatric oncologists for the treatment of children with cancer. Most stored cord blood in Virginia is being deposited at parents' expense in private storage facilities.

Three speakers registered and spoke during the public hearing and two statements were submitted and read for the record. The submitted statements were from Dr. John T. Bruchalski, an obstetrician/gynecologist practicing in Fairfax, in support of cord blood banking and adult stem cell research, and Ms. Moira Hall, a 20 year old diagnosed with Hodgkin's Lymphoma, who was treated with high-dose chemotherapy with stem cell support, using cells donated by a twin sister, and when this treatment was not successful, a second transplant of cells donated by a younger brother, with successful remission.

Representing the Virginia Society for Human Life, Ms. Dorothy Tims expressed strong opposition to human embryonic stem cell research and support for the use of adult stem cells. Mr. Richard M. Doerflinger, Deputy Director of the Secretariat for Pro-Life Activities, United States Conference of Catholic Bishops, presented a notebook of supplemental materials to the Joint Subcommittee. Mr. Doerflinger, while noting that the Catholic Church does not oppose stem cell research, stated that destruction of human life at any stage was opposed, thus, human embryonic stem cell research is opposed. Dr. Michael Valente, a physician practicing neurology in the Commonwealth, came as a taxpaying citizen who objects to the possibility of using state tax money to fund human embryonic stem cell research. He stated that embryonic stem cell research using mice has not produced any cure for diseased mice.

The Joint Subcommittee's work session was based on prior consideration of an issues paper outlining stem cell characteristics, stem cell therapies and therapeutic cloning, and stem cell issues.

The Joint Subcommittee's 2005 deliberations resulted in two recommendations---the establishment of a Virginia cord blood banking initiative and continuation of the study for another year. These recommendations were implemented through HB 413 (Marshall) and SB 370 (Saslaw), identical provisions relating to cord blood banking, and HJR 48, a continuing study resolution, all of which were introduced and approved during the 2006 Session.

House Bill 413 and Senate Bill 370 establish the Virginia Cord Blood Bank Initiative as a public resource for Virginians for the treatment of patients with life-threatening illnesses or debilitating conditions, for use in advancing basic and clinical research, and, in the event of a terrorist attack, to be used in the treatment of the injured citizens of the Commonwealth. House Joint Resolution 48 (Marshall) was approved to continue the study during the 2006 interim, with the directive to "review new developments in stem cell research and treatment and seek to fulfill its recommendation to establish an umbilical cord blood bank initiative in the Commonwealth.

In addition to this executive summary, a report will be published, detailing the work of and information received by the Joint Subcommittee.