



NEBRASKA COALITION
FOR ETHICAL RESEARCH

THE ETHICS OF STEM CELL RESEARCH AND THERAPY

Position Paper

POSITION SUMMARY

The Nebraska Coalition for Ethical Research (NCER) *supports* and *encourages* research in human adult stem cells (hASCs) (including umbilical cord blood stem cells) and their therapeutic application to debilitating and life-threatening diseases and injuries. Since the harvesting of hASCs does not destroy or harm the donor and since autologous stem cell transplants (those consisting of donor/recipient's own cells) will not be rejected by the recipient's immune system, adult stem cell derivation and transplantation promote human life, human dignity, and human well-being. Therefore, with proper consent and compliance with appropriate institutional review board guidelines and medical ethics, the research and therapeutic use of hASCs is ethical.

NCER does *not support* research in, and therapeutic use of, human embryonic stem cells (hESC) since they (1) necessarily involve the direct destruction of human embryos and (2) provide therapies to persons suffering from a degenerative disease by dismantling—destroying the life of—other persons at their embryonic stage. By violating human dignity and the right to life of embryonic human beings, ESC research and its therapeutic applications constitute unethical science and medicine.

ETHICAL ASSESSMENT OF STEM CELL RESEARCH AND THERAPEUTICS

Human adult stem cell research and its therapeutic applications are moral and should be supported because it does not violate the life, dignity, and rights of human beings if done in the proper context and with informed consent.

- **Every human being has a right to life**

Use of hASCs preserves life, whereas the harvesting of hESCs deliberately destroys human life at the embryonic stage of development.

- **Every human being has a right to be protected from discrimination**

Since hESC research destroys a living human embryo, this research discriminates against human beings on the basis of developmental immaturity.

- **Every human being is an end to be loved, not a means to be used for someone else's end**

Human ASC research allows a person to participate in scientific research to help find treatments for disease. With proper informed consent, one may donate hASC for his/her own benefit or the benefit of society. Human ESC research treats the embryonic human being as an object to be valued for its parts. To categorize so-called spare embryos as "having no future" or as "going to be destroyed anyway" is to rationalize the destruction of one human being as a possible benefit for the health of another.

- **Every human being is of equal value to every other human being**

Human ASC research does not place one person's life above that of another. Human ESC research treats the embryonic human being as less valuable than a fetus, a newborn, or an adult.

- **Human subject research requires that proxy or presumed consent can be given only if the research does not harm the subject**

Valid consent may be obtained for hASC research because the subject is not harmed. Human ESC research is, by its very nature, destructive. Therefore, proxy or presumed consent for such research is not ethically valid.

- **The goal of human subject research is to serve humanity by curing disease and relieving suffering**

Because someone who donates ASCs is not harmed in an attempt to help others who are sick and suffering, hASC research realizes the fundamental goals of medicine and medical research in a non-destructive way. On the other hand, harvesting hESC destroys, rather than heals, the human embryos involved. Any therapies developed from hESC's are ill-gotten gains because the benefit to some human beings who are sick requires the death of other human beings.

- **The rules of ethical research demand that researchers pursue the least morally controversial of available options when these prove to be equally beneficial**

Most of the goals of destructive hESC research can be obtained through the use of non-embryonic stem cells, without any destruction of human life. Therefore, the use of hASCs for research and therapies should be pursued.

- **Failure to protect embryonic and fetal human life, the most vulnerable of human beings, erodes the moral fiber of society**

The use of hASCs can save human life and strengthen society without the negative effects on the individual and society that are inherent in the use of hESCs.

Human ESC research does not accord embryonic human beings the protection that is their due as human subjects of research. An assault against any innocent human being is an assault on humanity in general. Since respect for human life is a cornerstone of our civilization, hESC research will weaken the moral foundation of our society.

EXPLANATION

What is the science of stem cells?

Stem cells are biological cells found in the human body (and all multicellular organisms) that have two properties: (1) *potency: the power to differentiate into various specialized cell types* (Dr. Marc Hedrick of UCLA School of Medicine explains the potency of stem cells with this metaphor: Just as a child might become a fireman, a doctor, or a plumber, depending on the influences in their life—or their environment, so stem cells can become many different tissues/organs by making certain changes in their environment), and (2) *indefinite self-renewal: stem cells self-renew or replace themselves, that is, after cell division, they maintain their undifferentiated state*. So, despite going through numerous cycles of cell division in which they produce differentiated or more specialized daughter cells, they also maintain themselves (or replace themselves by producing more undifferentiated [or stem] cells). Thus, based on its function, a stem cell has the potential to regenerate tissue over a lifetime. For example, we could transplant one bone marrow (or hematopoietic) stem cell into a person without hematopoietic stem cells (HSCs), and the bone marrow stem cell would produce new blood cells and immune cells over a long term, demonstrating *potency* by producing the more specialized cells needed to save that individual. Further, if we isolated HSCs from that transplanted individual, these cells could, in turn, be transplanted into another person who lacks HSCs with the same saving effect, demonstrating the capacity of SCs for *self-renewal* or self-replication throughout a lifetime. If this is true, why do we need stem cell transplants? Persons suffering from degenerative diseases such as Parkinson's, Alzheimer's or ALS—where the dopamine-producing neurons in their brain begin to die or malfunction—could be cured by a stem cell transplant that would replenish the patients' specialized dopamine-producing neuronal cells, thus regenerating the potency and self-replication of the brain's stem cells.

Stem cells have various levels of differentiation potential (or *potency*):

- Totipotent stem cells: the human zygote—the single cell that forms after the fusion of the human egg and sperm in the fertilization process—and the cells of the first few divisions of the zygotic human being (2-, 4-, 8-cell stage embryos) are totipotent stem cells. These stem cells, with their *potency to differentiate* into all of the embryonic and extra-embryonic cell types, have the power to construct a complete, viable human being in the course of nine months of gestation;
- Pluripotent stem cells: the descendants of totipotent stem cells that have the power to further differentiate into all the specialized cells of the body—all the cells and tissue derived from the three germ layers of the embryo: endoderm [giving rise to the gut and the lungs], mesoderm [giving rise to muscle, bone, blood] and ectoderm [giving rise to the nervous system and the skin]—are pluripotent stem cells. The grape-like cluster of

cells of the 3-4 day-old morula-stage embryo and the 30 or so cells constituting the inner cell mass of the 4-5 day-old blastocyst-stage embryo are pluripotent stem cells. These cells have the *potency*—when given sufficient and necessary stimulation—to develop into each of the more than 200 specialized cell types comprising the adult body. Harvesting pluripotent stem cells from a blastocyst-stage human being (through a process that destroys the embryo) and then, from these, producing pluripotent stem cell lines for use in transplantation for patients suffering from various degenerative diseases are the Holy Grail of embryonic stem cell research. Reprogramming multipotent adult stem cells to their prior, pluripotent state in order to form pluripotent stem cell transplants that could heal persons suffering from degenerative diseases is also the Holy Grail of adult stem cell research. Note: Since pluripotent stem cells do not contribute to the extra-embryonic membranes such as the placenta, they are less potent than their totipotent stem cell progenitors;

- Multipotent stem cells have the potency to differentiate into a number of more specialized cells, but only those of a closely related family of cells (e.g., multipotent blood cells have the power to differentiate into red blood cells, white blood cells and platelets). The stem cells of the adult (including neonates up to adult humans) are multipotent stem cells and have a more limited therapeutic capacity than pluripotent stem cells.
- Unipotent stem cells can produce only one cell type, their own (e.g., muscle stem cells produce muscle cells), but with this power to self-renew, they distinguish themselves from other non-stem cells.

A recommended resource for understanding the science of stem cells and their moral uses can be found at <http://www.micatholicconference.org/media-gallery/video-the-science-of-stem-cells-finding-cures-and-protecting-life/> or <http://www.youtube.com/watch?v=-8LeGL7FpJ4>.

What are the sources of stem cells?

+ Human embryo

Pluripotent stem cells are harvested from (1) cryopreserved, “spare” IVF embryos who are subsequently donated by their human progenitors to destructive embryonic research, or (2) in the future fresh human embryos may be cloned from patients who are suffering from degenerative diseases (see NCER’s “*Therapeutic*” Cloning white paper). As eventual recipients of a stem cell transplant, these patients’ immune systems will not reject their clone-derived stem cells since these cells share their own DNA.

The thirty or so cells comprising the inner cell mass of the blastocyst-stage embryo (4-5 day-old embryo) are pluripotent stem cells. In order to harvest these cells and turn them into pluripotent stem cell lines for research and eventual therapeutic use, the researcher first isolates the inner cell mass cells of the blastocyst-stage human embryo by siphoning off the embryo’s outer cell layer called the trophoblast. This juncture of the process dismantles (i.e., directly destroys or kills) the human embryo. Next the researcher separates the isolated pluripotent stem cell mass into

individual pluripotent stem cells and plates and re-plates these until the stem cells have duplicated themselves to the huge quantities needed to form a pluripotent stem cell line. These lines are then sold to researchers who will differentiate the pluripotent stem cells into the particular specialized cells needed for their respective line of research. Someone doing research on Parkinson's disease, for example, might coax these pluripotent cells to differentiate into neuronal stem cells so that the latter may be transplanted into the Parkinson patient's brain where they might regenerate the dopamine-producing neurons that are degenerating.

+ **Fetus**

Primitive stem cells (although not pluripotent) are located in the organs of fetuses and are referred to as fetal stem cells. Stem cells found in amniotic fluid is an example of fetal stem cells.

+ **Amniotic fluid**

Amniotic fluid, the nourishing and protective liquid that surrounds the baby during pregnancy, contains multipotent stem cells (known as mesenchymal stem cells) that are very versatile and able to be extracted during pregnancy from the second trimester forward in a procedure called amniocentesis. After amniotic fluid is collected, it is sent to the amniotic bank for processing, is cryopreserved, and then can be stored for decades. Because these cells are very young, amniotic stem cells are also very active, expand extensively without feeders, and are not tumor-forming. Amniotic stem cells can differentiate into fat, bone, muscle, skin, liver, cardiac tissue, and neuronal cells and tissues. The first US amniotic stem cell bank (Biocell Center) was opened in Medford, MA in 2009. Biocell Center is an international company specializing in the cryopreservation and private banking of amniotic fluid stem cells.

Amniocentesis, although previously considered to put Mom and baby at some risk, has been perfected so much in recent years that the Biocell Center states: "it is easy and safe to collect" amniotic fluid "during prenatal tests throughout ... an entire pregnancy" so that the baby can benefit from advances in future medical treatments.

+ **Umbilical cord blood**

Umbilical cord blood is the blood left over in the placenta and in the umbilical cord after the birth of the baby. The cord blood contains all the elements found in whole blood: red blood cells, white blood cells, plasma and platelets and is rich in hematopoietic stem cells. The hematopoietic stem cells found in the baby's cord blood are not as primitive as pluripotent stem cells since they have already started to specialize or differentiate into blood stem cells. They can, however, rapidly and efficiently create new blood for a patient. The uses for hematopoietic stem cells have grown dramatically over the years beyond treating blood cancers and genetic diseases of the blood and show great promise in also treating: brain injury, cerebral palsy, type 1 diabetes, stroke, hearing loss, and myocardial infarction.

Although there are several methods for collecting cord blood, the most commonly used is the "closed technique," which is similar to standard blood collection methods. The technician cannulates the vein of the severed umbilical cord using a needle that is connected to a blood bag,

and cord blood flows through the needle into the bag. On average, the closed technique enables collection of about 75 ml of cord blood. After the cord blood is collected it is cryopreserved and stored in a cord blood bank for future transplantation if and when needed.

Now expectant parents can also collect and preserve stem cells from the tissue of the umbilical cord whose medical name is Wharton's jelly. As indicated above, cord blood is a rich source of hematopoietic stem cells (HSCs) that differentiate to form the lineage of blood cells. Cord tissue is a rich source of mesenchymal stem cells (MSCs) that differentiate to build bone, cartilage and connective tissue, and are effective in mediating the body's inflammatory response to damaged or injured cells. 20-500 million MSCs can be harvested from the tissue of the umbilical cord. By comparison, typical cord blood collection in a private bank has a median total nucleated cell count of 470 million.

+ Adult

Adult stem cells are comprised of somatic stem cells (body cells) and germline stem cells (egg and sperm cells). These cells are found in humans from their neonatal to their adult stages. Adult pluripotent stem cells are rare and are found in umbilical cord blood and placental tissue. Most adult stem cells, then, are multipotent and lineage-restricted in their differentiation capacity (e.g., blood stem cells can only differentiate into specialized blood cells: red blood cells, white blood cells and platelets). These stem cells are referred to by their tissue of origin: e.g., mesenchymal stem cell, adipose-derived (fat) stem cell; endothelial stem cell, dental pulp stem cell, etc. [Interesting note: an extremely rich and versatile or "plastic" source for adult multipotent stem cells is the developing tooth bud of the mandibular third molar. The stem cells eventually form enamel (ectoderm), dentin, periodontal ligament, blood vessels, dental pulp, nervous tissues, and a minimum of 29 different end organs. Due to ease of collection at 8–10 years of age before calcification and minimal or no morbidity, these mandibular stem cells will probably constitute a major source of cells for personal banking, research, and current or future therapies. These stem cells have also been shown to produce hepatocyte or liver cells.]

Since the derivation and use of adult stem cells does not require the destruction of the adult donor, the use of adult stem cells is, all things being equal, uncontroversial. What's more, if adult stem cells are obtained from the intended patient- recipient, there is little or no risk of immune rejection of a stem cell transplant.

+ Induced pluripotent stem cells

Induced pluripotent stem cells (iPSCs) are adult cells that have been genetically reprogrammed to an embryonic stem cell-like state by being forced to express genes and factors important for maintaining the defining properties of embryonic (pluripotent) stem cells. The rapid development of iPSCs since they were first produced in 2006 has generated tremendous interest among researchers. (Kazutoshi Takahashi and Shinya Yamanaka. Mouse Induced Pluripotent Stem Cells, *Cell* [August, 2006.]) The ability to take easily obtainable adult skin cells and potentially make any tissues in the body eliminates the need to destroy human embryos. Also, because human iPSCs have the same genetic background as the person they come from, they enable scientists to create perfectly matched cells for patient-specific therapies that would not be

rejected. Although these cells meet the defining criteria for pluripotent stem cells, it is not known if iPSCs and embryonic stem cells differ in clinically significant ways.

A series of journal articles have raised the possibility of some significant differences between embryonic stem cells and iPSCs. For example, stem cell biologist Robert Lanza of the biotechnology company, Advanced Cell Technology, and his colleagues compared differentiated cells derived from a series of iPSC lines and ES cell lines. While both classes of cells differentiated—to form blood cells, vascular cells or retinal cells—the iPSCs did so at a significantly lower rate and had higher rates of cell death (results they reported in the April 2010 issue of *Stem Cells*).

Another study raises questions about whether iPSCs can serve as tools for modeling disease. As they reported in the May 7 issue of *Cell Stem Cell*, researchers at the Dana Farber Cancer Institute and Hebrew University compared ES cells and iPSCs that carried the mutation for the mental impairment disorder fragile X syndrome. They found that while the ES cells expressed the mutation, the iPSCs did not.

Some scientists are hoping that such problems arise from the retroviruses that are used to generate iPSCs. Several teams of scientists are now exploring virus-free modes of producing these cells.

What stem cell treatments are available?

+ Embryonic stem cell treatments:

Caveat: NCER does not support the research in and therapeutic use of ESCs. While most therapeutic ESC research has been in animals, there was a report of the first human ESC clinical trial on 11 October 2010 (“First trial of embryonic stem cells in humans,” *BBC News*). Only in the interest of keeping NCER membership abreast of ESC research do we include the following summary of the clinical trial that appeared in the June, 2012 issue of *Lancet*:

Steven Schwartz and colleagues’ study on transplantation of retinal pigment epithelium derived from human embryonic stem cells (hESCs) for the treatment of macular degeneration (Feb 25, 2012, *Lancet*, 713-720) is an important step towards treatment of such disorders.

The question remains whether Schwartz and colleagues’ two human cases can be taken to illustrate a therapeutic response. The outcome measures used were anatomical appearance, visual acuity, and subjective response. Some evidence of pigmentary changes occurred in the patient with Stargardt’s disease, but not in the patient with age-related macular degeneration (AMD). However, both patients showed an apparent improvement in visual acuity. Unfortunately, this level of change is within the repeatability limits of the test. Thus, the success of this surgery depends on subjective observations. Therefore, although interesting, the finding needs objective confirmation and continued evaluation for any tumorigenicity or deterioration, rather than improvement of symptoms.

+ Adult stem cell treatments

NB: NCER membership can keep abreast of the very latest adult stem cell treatment clinical trial successes by requesting the NCER e-newsletter which comes out bi-monthly.

Adult stem cell treatments have been used for many years to successfully treat leukemia and related bone/blood cancers utilizing bone marrow transplants. In 1968, bone marrow transplant between two siblings successfully treated Severe Combined Immunodeficiency Disease (SCID).

Early regenerative applications of adult stem cells have focused on intravenous delivery of blood progenitors known as hematopoietic stem cells (HSCs). HSCs have been clinically applied to treat various diseases including spinal cord injury, liver cirrhosis, and peripheral vascular disease. Other early commercial applications have focused on mesenchymal stem cells (MSCs). Clinical case reports in orthopedic applications have been published. Wakitani has published a small case series of nine defects in five knees involving surgical transplantation of mesenchymal stem cells with coverage of the treated chondral (cartilage) defects. Centeno et al. have reported high field MRI evidence of increased cartilage and meniscus volume in individual human clinical subjects as well as a large n=227 safety study (March 2008, *Pain Physician*, 343-353).

Spinal Cord Injuries

Spinal cord injuries are one of the most severe forms of debilitation. Many times they result in different forms of paralysis, including paraplegia and quadriplegia; other times they involve the immediate or imminent death of the patient. Laura Dominguez is an example of the former. Living in San Antonio, Texas, she was a sixteen-year-old girl attending summer school in 2001. On her way back from class, she and her brother encountered an oil spill on the highway that caused their car to careen out of control. The accident left her paralyzed from the neck down with a C6 vertebrae burst fracture. She subsequently entered various hospitals to be emphatically informed that she would never walk again.

After relocating to San Diego, California, Dominguez and her mother checked into a protracted physical therapy program. While there, they consulted with many spinal cord injury specialists and concluded that the most promising option existed in Portugal, where a cutting-edge procedure was being performed.

This procedure, known as olfactory mucosa transplantation, involves transplantation of stem cells found in the nasal region into the injured area (these cells include renewable neurons, remyelinating olfactory ensheathing cells, and progenitor stem cells). Dr. Carlos Lima, a neuropathologist of Egaz-Moniz Hospital in Lisbon, led the procedure. Lima's procedure has proven successful in 26 patients, Dominguez was the tenth person in the world and the second American to undergo the surgery.

Completion of the surgery permitted a return to the United States, which ushered in the continuation of the therapeutic process and the resumption of home life in San Antonio. After an MRI was conducted, physicians informed her that her spinal cord had begun healing and that 70 percent of the lesion had recovered into normal spinal tissue. Within six months she had acquired sensation down to the abdominal region. By 2004, she had gained upper body agility and the

ability to stand for extended periods of time with the aid of a walker. In addition, she reported improved motor skills, including the ability to stand on her toes and contract her quadriceps and hamstring muscles. She also announced that she had walked more than 1400 feet with the use of braces and outside help. Laura is inspired by the results and hopes to walk unassisted by the time she turns 21.

Susan Fajt of Austin, Texas, experienced a similar spinal cord injury in a car accident in 2001. The wreck left her lower body paralyzed. After researching available treatments and opportunities, she discovered the adult stem cell procedure being conducted by Lima's team. She thus commenced her journey to Lisbon to acquire the treatment in June 2003. As with Laura Dominguez, the stem cells were extracted from her own body's sinus region and transplanted into the spinal injury site. By 2004, she was able to walk with the aid of braces.

A third spinal cord injury patient, Melissa Holley, is another individual who experienced the wonders of non-embryonic medical treatment. An 18-year-old from Ridgway, Colorado, Holley's spinal cord was severed in a car crash on June 25, 2000. Her physicians offered her no hope for the future and stated that, in all probability, she would not walk again. Her family looked into various treatments and found one offered in Tel Aviv, Israel, by a company called Proneuron Biotechnologies Ltd. The operation was headed by Dr. Valentine Fulga and Dr. Nachshon Knoller. The procedure involves macrophages, adult immune cells that possess remarkable healing properties. After being injected with her own cells, she regained bladder control and arm and leg movement.

Heart Tissue Regeneration

Recent years have seen the emergence of successful adult stem cell treatment for those who have suffered from heart attacks and heart failure. Dr. Andreas M. Zeiher, the chairman of the department of internal medicine at the University of Frankfurt, and Dr. Stefanie Dimmeler, head of the division of molecular cardiology at the same institution, conducted a study of 28 heart attack patients in 2003.

The subjects received a transplantation of their own blood and hematopoietic (blood-forming) stem cells into their heart arteries on an average of 4.7 days after their respective heart attacks. Two of the patients experienced difficulties stemming from personal arterial conditions. The remaining 26 demonstrated higher levels of heart-pumping capability.

The researchers reported that the heart's ability to pump blood increased from 44.1 percent to 48.9 percent. The report also indicated the average amount of dead tissue for the subjects decreased by 20 percent within four months of the stem cell implantation.

In a French study, doctors found that skeletal muscle stem cells taken from a patient suffering from heart disease and implanted back into his heart successfully treated the condition. This was the first adult stem cell treatment that successfully treated cardiac degeneration.

Another study investigating 14 patients in Brazil showed that there was notable improvement in their heart capacities after implantation of their own stem cells. Scientists stated that oxygen capacity increased from 17 percent to 24 percent.

The capability of adult stem cells to regenerate a damaged and malfunctioning heart was clearly seen in the case of Dmitri Bonnville. A 16-year-old from Almont, Michigan, he was accidentally shot in the chest by a nail gun while conducting house work on February 1, 2003. The injury was exacerbated by cardiac arrest a few days later.

His family examined the available effective treatment options. Physicians informed the parents of the possibility of a heart transplant or the use of extended medication while noting the risks and failures of such procedures. The doctors also notified the parents of a procedure that involved stem cell extraction from Bonnville's own body and subsequent transplantation into his heart. Predicting success, they determined to go forward with the surgery under the direction of Dr. Cindy Grines, Dr. William O'Neill and Dr. Steven Timmis at Beaumont Hospital in Royal Oak, Michigan. The treatment had never been conducted on a human patient in the United States prior to this occasion. Within a week of the February 21st surgery, Bonnville's heart pumping capacity had increased from its previous 25 percent to 35 percent.

Corneal Reconstruction

Another area in which adult stem cell therapy is demonstrating rapid advancement is the field of ophthalmology. A surgical procedure known as limbal stem cell transplantation offers hope to those suffering from corneal degeneration, blindness, and other ocular diseases. The procedure involves the extraction of stem cells from the limbus, the region of the eye between the epithelial layer of the cornea and the sclera, the eye's outer layer. The cells are typically extracted from a healthy eye of the patient himself, from a family member, or from cadaveric tissue. Once extracted, the limbal stem cells are implanted into the patient's defective eye. The stem cells then differentiate into corneal epithelial cells which improve the health of the outermost layer of the eye.

Michael May, a business owner in Davis, California, was exposed to a chemical explosion as a child, losing his left eye and becoming blind in his right. Forty-three years later, he regained his sight in the right eye after a limbal stem cell transplant complemented by a corneal transplant. Five months following the operation, May had reacquired limited vision and within two years had recovered his sight.

Jon Newton is another example of successful limbal stem cell transplantation. After being diagnosed with a rare ocular disorder known as Stevens-Johnson syndrome, he lost his sight as a teenager and was blind for thirty years. On January 22, 2001, at the age of 46, he underwent the stem cell operation in New Jersey in hopes of reacquiring any level of vision. Less than 18 months later he had 20/30 vision.

In 1991, a jewelry designer by the name of Shawn Smith was working with emerald carats in an acid-filled beaker. In an accident, the beaker exploded into his eyes, immediately blinding him. After ten years of blindness he sought consultation from Dr. Edward J. Holland, the director of corneal services at the Cincinnati Eye Institute. After their meeting, Smith decided to go forward with a limbal stem cell transplantation. His half-brother donated the cells, which were implanted

into his eyes. Dr. Holland followed this procedure with corneal transplantation a few months later. After its completion, Smith had reacquired his vision.

Autoimmune Disease Treatment: Diabetes, Lupus, Crohn's, Multiple Sclerosis

Adult cell treatment has also shown significant results in the treatment of various autoimmune disorders. Researchers reported that, of 250 diabetics, 200 were able to discard their insulin needles for over a year after islet cell transplantation from cadavers. A research team at Harvard has shown complete reversal of juvenile diabetes in mice using adult spleen cells, and is now preparing for the first patients' trials using these adult cells.

Other individuals have experienced remarkable successes with adult stem cell therapy. A girl found that she had systemic lupus erythematosus, a highly detrimental kind of lupus in which organs of the body lose proper functioning. She had experienced pneumonia, lung weakness, and blood deficiency, among other ailments. At eighteen, she underwent a transplantation of blood stem cells. Fifteen months after the operation, she had attained complete and vibrant health, free of the disease's effects.

In another clinical study, nineteen patients suffering from various autoimmune disorders such as refractory polychondritis and systemic lupus erythematosus were treated with their own stem cells. After the procedure, ninety percent had improved or experienced disease remission.

Another example of the success of adult stem cell utilization is found in the treatment of Crohn's disease. The disorder is characterized by an immune system that attacks the sufferer's digestive system. One patient, a 22-year-old female who had suffered from it for more than ten years, was treated with her own blood stem cells. Within three months of the operation, her health had dramatically improved, she could eat comfortably, and her acute abdominal discomfort was no longer present.

Another clinical study presents the case of two Crohn's patients who received their own hematopoietic adult stem cells (i.e., stem cells derived from bone marrow). They have been in remission for a year following the transplant.

One report on patients shows that adult stem cell treatment holds promise for combating multiple sclerosis (MS). David Hassenpflug, a Long Beach resident who suffers from MS, has experienced some improvement in health as a result of receiving adult stem cells. He reported that the pain in his legs and hips is gone.

A four-year-old girl suffering from severe intestinal Behcet disease is another case in point. Behcet disease is an inflammatory disorder that creates oral ulcers, genital ulcers, and skin lesions. After two years of various unsuccessful treatments, she underwent autologous hematopoietic stem cell transplantation. Two years after the operation, she is in total remission.

Parkinson's Disease

Parkinson's disease is a disorder of the central nervous system in which the substantia nigra, a part of the brain, ceases to produce dopamine, a chemical that allows for effective motion.

Dennis Turner is a man who suffered from the disorder for fourteen years. His condition was characterized by strong shaking on the right side of his body, making arm coordination virtually impossible. He underwent years of medication and watched his condition gradually deteriorate. After consultation with a neurologist, he discovered the option of adult stem cell therapy and decided to have the procedure done. His own stem cells were extracted from his brain and subsequently transplanted into the left side of his brain in a 1999 procedure.

Turner announced in a July 2004 United States Senate subcommittee hearing that he has since experienced dramatic improvement in daily activity. He stated that he went four years without symptoms of the disease. He also affirmed that he would pursue another treatment involving his own stem cells to further improve his condition. The procedure would involve a second extraction of stem cells from his brain and implantation into the right side. Meanwhile, he explained that his treatment had enabled him to remain active; he has since gone on safaris, photographic excursions to Africa, and swimming sessions in the Atlantic.

In another study, five Parkinson's patients received an injection of a normal protein known as glial cell line-derived neurotrophic factor. The factor stimulates the adult stem cells of the brain. Within a year, the patients demonstrated a 61 percent increase in physical coordination and lessening of symptoms.

Anemias, Cancers, and Immune Deficiencies, and Other Diseases

Adult stem cell transplants are also widely used to treat such diseases as anemias, leukemias, lymphomas, and other cancers. Additional treatable diseases are Fanconi anemia, pure red cell aplasia, juvenile chronic myelogenous leukemia, juvenile myelomonocytic leukemia, immune deficiencies, and some genetic diseases.

Keone Penn is a young man who had sickle cell anemia. He was diagnosed when he was six months old and he suffered from its symptoms until the time he was eleven years old. He experienced extreme joint pain and underwent several blood cell transfusions. After receiving stem cells from umbilical cord blood under the direction of Dr. Andrew Yeager, his body stopped producing the sickle cells. He is now cured of the disease. More than two hundred sickle cell patients have undergone hematopoietic stem cell transplantation with a 80-85 percent success rate.

Beta thalassemia is a disease of the hemoglobin genes that can be treated with adult stem cell transplantation. In a recent clinical study, 33 patients under 17 years of age underwent the procedure. The treatments resulted in a 93 percent survival rate. Relapse decreased from 30 percent to 8 percent.

Leukemia is a cancer of the blood-making tissue in which excessive amounts of abnormal lymphocytes, i.e., white blood cells, are produced. This can result in infections, bleeding and shortness of breath among other things. Savannah Jantsch was four years old when she was diagnosed with leukemia along with another rare blood disorder. She was treated with stem cells obtained from the umbilical cord of a newborn baby. The cells, once transplanted into her body, developed into the bone marrow necessary to produce healthy blood cells. Five years later, she is cured of the cancer and enjoying childhood. Another study regarding leukemia involved 18

patients who also received adult stem cell transplantation. In this study, physicians used cells obtained from umbilical cord blood. After the procedure, 14 of the 18 patients emerged free of the disease.

There are many other examples of successful treatments involving adult stem cells. Five patients diagnosed with ovarian carcinoma were treated with donor-derived hematopoietic stem cell transplantation. After treatment, four of the patients had tumor regression of at least fifty percent.

In another study, seventeen patients with advanced multiple myeloma were treated with autologous stem cell transplantation. Within one and a half years, twelve of them were free of disease advancement.

Another study presents the medical treatment of two patients who were suffering from non-Hodgkin's lymphoma and multiple myeloma, respectively. After allogeneic (donor) stem cell transplantation, both of them are in remission and in great health 17 months later.

A 59-year-old female suffering from a pancreatic tumor received peripheral-blood stem cell transplantation and subsequently experienced a decrease in tumor size of 80 percent.

Adult stem cells have shown success in treating immune deficiencies as well. As one example, three Los Angeles boys with congenitally impaired immune systems were cured through implantation of adult stem cells. These adult stem cells were acquired from umbilical cord blood.

An interesting study was conducted on twenty children diagnosed with Hurler's syndrome. The disease attacks and destroys the central nervous system. Stem cells were procured from umbilical cord blood and implanted into their bodies. Seventeen of the 20 survived and showed improvement in nervous system functioning.

Conclusion

The above examples are a strong testament to the amazing power of adult stem cells. These "miracle cells" have provided real treatments for real people. They have provided hope for those suffering from spinal cord injuries, Parkinson's disease, multiple sclerosis, diabetes, lupus, Crohn's disease, ocular degeneration, blindness, heart disease, leukemia, non-Hodgkin's lymphoma, aplastic anemia, and sickle cell anemia.

While the potency and success of adult stem cell treatments are becoming evident, as of 2012, only one very small human clinical trial using embryonic stem cells has produced very limited success.

This section on the various adult stem cell treatment successes was compiled by *Bradley Hughes, a former fellow at the Witherspoon Fellowship - Family Research Council's professional fraternity for civic and cultural leadership development*. For all citations see: <http://www.lifeissues.org/cloningstemcell/adultstemtreatment.htm>.

For similar results please refer to the Web MD Stem Cell Clinical Trials article by Katherine Kam and Miranda Hitti at http://www.webmd.com/a-to-z-guides/features/stem-cells-clinical-trials?src=RSS_PUBLIC