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Stem for Life Foundation

LifeLines

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Student Ambassador Update

A Student Ambassador's Journey

Angela Chlebowski

Angela is a graduate student in the DNP-FNP program at Fairfield University and a member of the inaugural class of The Stem for Life Foundation's Student Ambassadors for the Cellular Age program.

If you had asked me to describe myself two years ago, I would have said: I am a mother of three children, a wife, and a nurse. Today, I am extremely proud to say that I have added two important credentials to my personal and professional resume.

First, I am now a graduate student at Fairfield University in Connecticut in the United States. Twelve years after graduating with my BSN, I have enrolled in the DNP-FNP (Doctor of Nursing Program/Family Nurse Practitioner) program. My second credential, and one that I am equally proud of, is that I am currently serving as a Student Ambassador for The Stem for Life Foundation.

Angela and her family

I have always aspired to work with children and families with special needs. As a mother of a child with a rare genetic disease, I felt that I needed to continue my education to make a difference. And when I learned about the opportunity to become a Student Ambassador, I knew that this program would change my life.

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Welcome

Dr. Robin L. Smith

I hope you all had a happy and healthy holiday season, and are settling in well to the New Year.

2014 promises to be a bright year for adult stem cell research and development as scientists across the globe are hard at work in their laboratories and clinics to unlock the healing potential of adult stem cells. We at The Stem for Life Foundation continue our commitment towards fulfilling our mission of raising public awareness about adult stem cells and their therapeutic promise and to support the advancement of adult stem cell research and development.

In this issue, Angela Chlebowski, one of our Student Ambassadors for the Cellular Age, shares her passion and excitement for the field. I hope Angela's personal journey will inspire you to learn more about adult stem cells and the Student Ambassador program. We are so thankful to her for sharing her story.

Also in this issue, we have chosen to highlight some of the experts in our field. First, I am pleased to introduce Dr. Gary Schaer, a leading cardiologist and an expert in clinical trials. Dr. Schaer has worked on over 30 clinical trials, and we are excited to feature a Q&A with him about his work and to learn more about how clinical trials advance our cause. Next I am excited for you to meet an expert in the field of stem cell biology, and an important colleague of mine, Dr. Douglas Losordo. Dr. Losordo is widely considered to be one of the most knowledgeable experts regarding CD34+ cells (a type of adult stem cell), and he shares with us some insight into the field of adult stem cell therapies, and why we should be excited about what lies ahead.

We also feature a very interesting article by Dr. Ronald DePinho, President of the University of Texas MD Anderson Cancer Center, who shares some fascinating insight on an experiment that could perhaps one day control the aging process. Imagine a world where we could dramatically increase health and relieve some of the societal burdens of an aging population!

There are so many exciting studies happening around the globe today that are expanding the frontier of adult stem cell therapies. With your help we can continue to raise awareness of these important developments and work towards bringing stem cell therapies to the patients who so desperately need them. Thank you for supporting our cause. ■

Dr. Robin L. Smith
President and Trustee

Adult Stem Cell News Highlights

SFLF is pleased to share some recent developments happening around the world in the field of regenerative medicine:

- Researchers at the University of Illinois at Chicago have identified a protein expressed by human bone marrow stem cells that guides and stimulates the formation of blood vessels which may help improve the vascularization of engineered tissues.
  (Source: University of Illinois at Chicago News Release 10/14/13)
- University of Adelaide researchers are using adult stem cells to develop treatments for Hurler's syndrome, a genetic disease which is caused by a single defective enzyme essential for breaking down complex sugars in cells. Adult stem cells are modified to make them produce large amounts of the deficient enzyme, and then the modified cells replace cells which aren't functioning properly throughout the body.
  (Source: University of Adelaide Media Release 11/6/13)
- Harvard Stem Cell scientists have discovered that the same chemicals that stimulate muscle development in zebrafish can also be used to differentiate human stem cells into muscle cells in the laboratory making muscle cell therapy a more realistic clinical possibility.
  (Source: Harvard Stem Cell Institute 11/7/13)
- A 17-year-old girl in the UK has become the youngest person in the world to donate stem cells to a non-relative. Victoria Rathmill, from Macclesfield, England, decided to donate after a family friend was diagnosed with leukemia.
  (Source: Huffington Post 11/21/13)
- Researchers at UCLA's Eli and Edythe Broad Center of Regenerative Medicine and Stem Cell Research have discovered a mechanism by which certain adult stem cells suppress their ability to initiate skin cancer during their dormant phase–an understanding that could be exploited for better cancer-prevention strategies.
  (Source: Bioscience Technology 12/23/13)
- Dr. Shinya Yamanaka, a 2012 Nobel laureate, will create a network of researchers across Japan to speed up development of medicine for intractable diseases based on induced pluripotent stem (iPS) cell technology. As director of Kyoto University's Center for iPS Cell Research and Application, Yamanaka, an iPS cell pioneer, plans to bring together researchers to stay at the university and study iPS technology at the center's new research building.
  (Source: The Asahi Shimbun 12/28/13) ■

Special Education Segment

The Science and History of Adult Stem Cells

Dr. Max Gomez

Medical Correspondent, *WCBS News*
Member of the Board of Directors, *The Stem for Life Foundation*

Dr. Max Gomez

Many scientists and medical professionals around the globe are working tirelessly to raise awareness of the potential for stem cell therapies to end the suffering of millions. But for those of you who are new to the subject, let me explain where we are today in the field of adult stem cell research, and share some of the milestones and achievements along the way.

The term "adult stem cells" is a scientifically imprecise, possibly even misleading, term since these cells are actually found in infants as well as adults. We use "adult stem cells" as a kind of shorthand to reference a variety of cells, in fact almost any stem cell that is not a true embryonic stem cell. Adult stem cells are found in virtually every tissue and organ of the body, from bone marrow and brain, to fat, teeth, heart, gut and liver. What makes these cells exciting is that they have the remarkable capacity to transform or become any number of different cell types, with some limitations.

The term "stem cell" first appeared in scientific literature in 1868 in a paper by German biologist, Ernst Haeckel. Over the next few decades, the concept of a stem cell evolved to mean early stage cells that can divide and self-renew indefinitely to produce more stem cells.

Moving into the modern history of stem cells, in 1957, human bone marrow transplants were pioneered by Dr. E. D. Thomas. At the time, Dr. Thomas didn't realize that it was actually stem cells in bone marrow that made the transplants successful. In 1961, Drs. James Till and Ernest McCulloch proved the existence of stem cells and later showed that blood cells come from what came to be known as hematopoietic, or blood forming, stem cells. In 1986, Drs. Andrew Lassar and Harold Weintraub converted rodent fibroblasts (connective tissue cells) directly into myoblasts (muscle cells) demonstrating that one type of adult cell could be converted into another type of adult cell. Scientific development continued until 2007 when Wake Forest and Harvard scientists announced that stem cells from amniotic fluid resemble embryonic stem cells in their potential to become various different tissues. The researchers turned these stem cells into brain, liver and bone cells.

The same year Drs. Shinya Yamanaka and James Thomson independently reported reprogramming adult skin cells into embryonic-like cells using viruses to insert specific genes into the skin cells. These induced pluripotent stem cells (IPS) cells have been coaxed into becoming beating heart cells and nerve cells. In subsequent years, scientists developed other more efficient and possibly safer ways to create IPS cells, as well as transform them into other cell types.

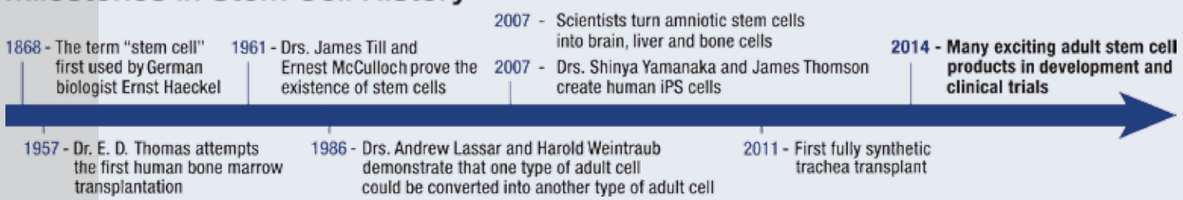
The pace of discovery has accelerated in recent years as stem cells have moved into clinical practice. In 2008, a team of doctors transplanted a trachea grown by seeding a donor windpipe with the patient's own bone marrow stem cells, thereby preventing rejection. Three years later, a fully synthetic trachea was transplanted, made by covering a biodegradable scaffold with the patient's own stem cells, showing the potential that donor tracheas may be unnecessary one day. In recent years, stem cells have been used to grow bladders, blood vessels, heart valves and functional mini livers raising the possibility of made-to-order replacement body parts.

The past five years have seen dozens of other potential clinical uses for adult stem cells. In the heart, adult stem cells have been shown to improve cardiac function in patients with congestive heart failure and ischemic heart disease. Adult stem cells are being used to heal heart muscle scarring, treat unstable angina and prevent worsening of heart function after heart attacks. Stem cells from bone marrow and placentas have treated peripheral artery disease and limb ischemia, preventing amputations. In the nervous system, adult stem cells have been used to stop the progression of multiple sclerosis and lupus through a procedure that resets the immune systems into tolerance. Umbilical cord, bone marrow and olfactory stem cells have helped cerebral palsy and spinal cord injuries. And early work looks promising in the areas of Alzheimer's disease and other neurodegenerative diseases.

In orthopedics, adult stem cells have healed shattered bones, prevented hip replacements and grown new bones for dental applications. In a surprising development, blood stem cells succeeded in curing an HIV positive patient by replacing his T-cells with stem cells that are naturally genetically immune to the virus. Researchers have been using adult stem cells to successfully treat type 1 diabetes, a major public health problem.

But out of all of this successful scientific investigation, the real reason we care about stem cells is because of what they can and will be able to do for real people, and the countless patients struggling with difficult diseases. The revolution is just beginning. ■

Milestones in Stem Cell History



The Impact of Science on Controlling the Aging Process and Associated Diseases

Dr. Ronald A. DePinho

President, *University of Texas MD Anderson Cancer Center*

Dr. Ronald A. DePinho

We are in a period in history that is redefining the human experience, a period of major scientific advances that have increased life expectancy and positioned us to understand and control many diseases. The pace of progress has accelerated dramatically in recent years as a result of major technological and conceptual advances, enabling us to understand biological and disease processes on the most elemental levels, and illuminating preventive and therapeutic strategies for many diseases. Our understanding of the instigators of cancer, heart disease, diabetes and other disease has provided an unprecedented opportunity to be more proactive, as opposed to reactive, in managing public health.

The importance of this effort is underscored by the world's changing demographics. By the year 2025, the world population will include 1.2 billion individuals over the age of 60, an age beyond which major diseases such as cancer, diabetes, heart disease and Alzheimer's disease doubles every 5 years. In the United States, there is an anticipated 45% increase in cancer by the year 2030 due to the fact that advancing age is the most important risk factor for cancer. Similarly, the 45% chance of developing Alzheimer's disease by age 85 will result in a four-fold increase in expenditures from today's $250 billion dollars. This disease burden is unsustainable. Given that the aging process itself is a major driver of these diseases, we are working towards an understanding of the molecular circuitry of aging that could be used to prevent age-associated diseases.

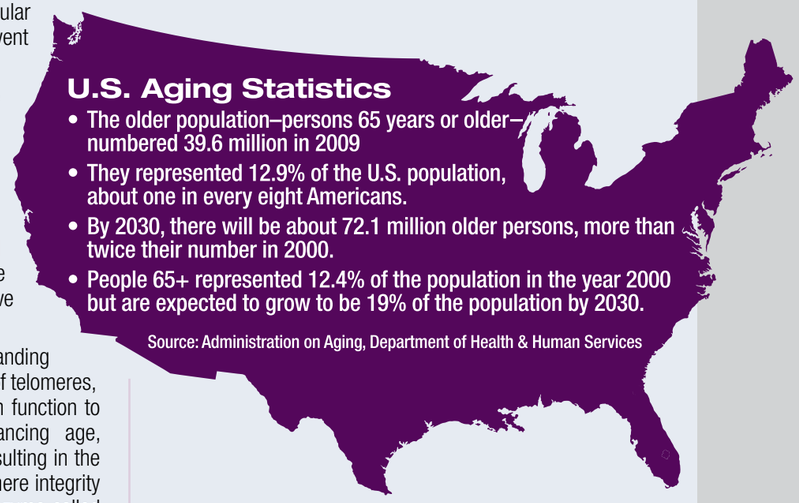
Our laboratory has been dissecting the molecular pathways governing the aging process and how these pathways are linked to the diseases of aging such as cancer, Alzheimer's, diabetes, or cardiomyopathy. A number of studies have indicated that the intimate link between advancing age and age-related diseases relates in part to core pathways of aging being commandeered to drive the pathogenesis of those major diseases.

Our principal experimental approach to understanding the aging process has been through the study of telomeres, the 'caps' at the ends of chromosomes which function to maintain chromosomal integrity. With advancing age, telomeres become progressively damaged, resulting in the eventual activation of the aging process. Telomere integrity can be restored by a telomere synthesizing enzyme called telomerase, however this enzyme is low in adult cells leading to eventual activation of aging signals.

In early studies, we engineered knockout mice that lacked telomerase and showed that this deficiency resulted in premature aging. Building on these early studies, our laboratory engineered a second strain of mice in which telomerase expression could be turned on or off. In the telomerase "off" state, the mice aged prematurely. They were very feeble physiologically and their lifespans were shortened significantly. When we reactived telomerase activity in the animal, telomeres were restored and aging signals in the mice were extinguished. We saw a dramatic reversal of aging signs and symptoms, including restoration of fertility, increased physical activity, improved cognitive function and increased brain size, among other widespread tissue changes. In addition, lifespan was restored significantly towards normal levels.

These findings convey the fundamental point that tissues, even those in a very severe state of degeneration, retain a remarkable capacity to renew themselves. It is tempting to speculate that a detailed understanding of the circuitry of aging could provide a framework for pharmacologic manipulation of the aging process.

While aging statistics are daunting, I am optimistic that science will deliver a dramatically increased health span of humans. I believe that, when history views our generation, we will be recognized as the first to understand the genetic basis of life and disease and to harness such knowledge to change the human experience. With these advances will come important political, societal and moral issues that will challenge future generations as the world population continues to age and expand. The scientific quest will continue as there is nothing more central than our desire to exist and exist in a healthy state. ■



To read the full article, please visit **www.stemforlife.org/blog.**

Dr. Douglas Losordo

Chief Medical Officer, *NeoStem*

Dr. Douglas Losordo

SFLF is pleased to introduce Dr. Douglas Losordo, a well-known cardiologist and an expert in stem cell biology. The following interview with Dr. Losordo shares some of his insights in the field and his excitement about a future where cell therapies will make a meaningful difference in the lives of millions.

Dr. Losordo, why did you choose to focus your career on adult stem cell therapies?

We in the field of cardiology have been extremely fortunate in the past decade to have seen the treatment of patients with heart disease improve dramatically, with new drugs, procedures, and devices that keep people alive. However, despite the great improvements in saving lives, many of our patients are still disabled by their disease. This sad reality has always kept me searching for ways that the medical community can do better.

Was there a moment that inspired you to specialize in cell biology?

When I was in medical school, I had a roommate who had a daughter with a serious medical condition involving her arteries. I will skip the medical jargon, but the reality was that her condition was really serious. She had some serious complications along the way, but fast forward 15 years and this little girl was going off to college. She recovered from her injury because her young body figured out how to heal itself. That was one of a few moments that inspired me to think how we can recreate this healing and regeneration in adults.

How did we get to this precipice of a paradigm shift in medicine?

Two decades ago, scientists were vigorously exploring gene therapy, thinking if they could repair a gene, they could fix a defect or mutation at its source. Efforts quickly moved towards cells, proteins, RNAs–all trying to leverage the body's natural pre-programmed biology, or as I like to say, using "nature's toolkit" for repair. There are plenty of areas in the body where self-repair happens in adults every day. The skin repairs itself; the liver repairs itself-even some people who have heart attacks actually get better. The biology is sound. The question was how to harness it.

Tell us about your work in the lab of Dr. Jeffrey Isner, a celebrity in the field of adult stem cell research

Dr. Isner was a beacon in the world of cardiovascular research. I worked with him and Dr. Takayuki Asahara to develop a program in therapeutic angiogenesis and cell-based tissue repair. Drs. Isner and Asahara were the first people to describe the existence of adult stem cells capable of forming blood vessels. Their paper changed the paradigm of blood vessel formation; we now understood that new blood vessels could be grown independent of existing vessels. We now had a tool for building new blood vessels in patients whose own vessels had been damaged by heart disease.

That sounds like an exciting time to be in the field. What else did this spark?

The research of Dr. Isner's lab triggered the imagination of scientists who worked in different organ systems, and stem cells have now been discovered in every organ and tissue in the body. As science was advancing, new cell culturing techniques were leading to new applications and technologies. Today there are a number of small companies like NeoStem that are trying to move the field of adult stem cell therapies forward. The paradigm shift towards reversing chronic disease is really underway.

What do you see as the future for adult stem cell therapies?

The biology is solid, and now that the science has been borne out, doctors are beginning to appreciate the potential and get more excited about the possible use of adult stem cells. We need to continue our scientific exploration while carefully moving forward in clinical studies. Seeing evidence of benefit in human trials gets people excited. In recent years, stem cell sessions at medical conferences are usually the best attended. I believe that medical students in the year 2030 will use and embrace stem cell therapies as standard course of treatment and that we will look back at medical techniques used in the year 2000 with disbelief, and say "I can't believe they used to do it that way."

What advice would you give for people considering a career in medicine or medical research?

The research side of medicine is one of the few areas where one has the opportunity to make a huge impact on large numbers of people. Also, for doctors, the one-on-one doctor/patient relationship is truly unique and you have this great opportunity to really take care of people in a time of need. There are not many professions out there that allow you to have such a positive impact on the lives of others. ■

About Dr. Losordo

Dr. Douglas Losordo is the Chief Medical Officer at NeoStem and previously the Director of the Feinberg Cardiovascular Research Institute at Northwestern University School of Medicine. His major research interests encompass angiogenesis/vasculogenesis, progenitor/adult stem cells, tissue repair/regeneration, and vascular biology.

Investigator Spotlight

Dr. Gary L. Schaer

Dr. Gary L. Schaer

A leading cardiologist and a primary investigator on numerous clinical trials, Dr. Gary L. Schaer is one of the many distinguished physicians that have committed their time and resources to the pursuit of research gathered from clinical trials. As adult stem cell therapies will never get to the patients that need them without well-documented, well-performed clinical trials that demonstrate safety and efficacy, SFLF would like to thank Dr. Schaer and his team for their hard work and dedication to the cause.

Dr. Schaer, how do we get more people excited about clinical trials?

People need to realize that most of the great medical achievements in treatment and prevention of heart disease are the result of clinical trials. These trials are an essential part of bringing drug and device advances to patients. They may sound scary, but the public should welcome and be excited about these trials. They prove whether a drug or device is safe and effective before it becomes commercially available. And it's not just safety that we are studying–clinical trials teach us how to use the product, how much to inject, etc. We wouldn't have any of this information without clinical trials.

So why don't all doctors participate in clinical trials?

Clinical trials are complicated to perform and they can be daunting. There are many parties involved besides the doctors and patients, including nurse coordinators, attorneys, finance experts, and IRB (review boards) at the hospitals. The trials are also very expensive with numerous regulatory requirements. Most doctors just don't have the resources. You have to be at an institution with a supportive infrastructure, and have the passion to take it on.

Where does your passion for science come from?

My specific interest in regenerative medicine began with an inspiring high school biology teacher. He taught us the biology of salamander limb regeneration, and I was fascinated. Salamanders are amphibians, and if they were to lose a limb, they can regenerate that limb. Their bodies have a mechanism where stem cells accumulate at the stump of the lost limb and that mass of stem cells develops into a fully functional new limb. The process is similar to developing a limb in a fetus. I continued studying salamander limb regeneration on a more advanced level in college, and these experiences kindled my interest in regenerative medicine.

As a cardiologist, I have spent more than a decade researching ways that regenerative principles can be applied to the treatment of heart disease. I have been involved in several pivotal clinical trials that use various biological therapies to treat heart diseases.

Primary Investigators in clinical trials are responsible for personally conducting or supervising the conduct of human-subjects research and for protecting the rights and safety of the patients.

How do patients react when you explain to them what an adult stem cell therapy is?

We get quite a range of reactions. I practice at an inner city university hospital with a great diversity of ethnicity, race and income, and a wide range of knowledge (or lack thereof) about stem cells. Some people approach me with the expectation that they will receive the stem cell treatment. They are surprised that there is a chance they could receive a placebo and they refuse to participate for this reason. Occasionally, patients travel to Mexico or Thailand to be sure they will receive an active stem cell treatment. I have emphasized that those therapies have not been proven to be safe or effective and strongly advise against this approach. Some people have no interest in being part of a research study where the play of chance will determine the treatment. But for many patients and their families, they agree to participate if the trial is recommended by their physicians. If a patient has a good relationship with their doctor, they are often more receptive to learn more about a clinical trial.

What can people do to inspire others to learn more about adult stem cell therapies?

Sharing individual patient stories can be very influential. Hearing about a patient who was on at death's door after a large heart attack and improved dramatically after treatment in a clinical trial of a stem cell therapy is so powerful, even with the understanding that receiving a placebo is a possibility.

How will adult stem cell therapies change the face of medicine?

The therapeutic potential of adult stem cells is substantial. The body can create everything it needs. The instructions for tissue repair and regeneration is written in our DNA, and we need to understand how these processes are controlled to unleash the therapeutic potential. I am confident that our current and future efforts will bear fruit over the next 10 to 20 years, yielding safe and effective cell based treatment for a variety of heart and vascular diseases. Indeed, these treatments will likely be the standard practice of the future. ■

About Dr. Schaer

Dr. Gary L. Schaer is Professor of Medicine and Director of Cardiac Research and Strategic Development at Rush University Medical Center. He is a graduate of Yale University School of Medicine and was a medical resident at The New York Hospital-Cornell Medical Center. Dr. Schaer's research has focused on new interventional, drug and biological therapies for patients with ischemic heart disease, with a special focus on regenerative medicine.

"A Student Ambassador's Journey" - Continued from page 1

I was selected to represent Fairfield University at The Second International Adult Stem Cell Conference: Regenerative Medicine–*A Fundamental Shift in Science and Culture,* held at the Vatican this past spring. Never did I imagine that my life would be changed by four days. I was inspired by the scientists and medical professionals, politicians and bioethicists. The Student Ambassadors were encouraged to listen, to learn, to question, and most importantly, "to light a spark." The idea was brilliant and simple; to have the students return to their schools and become the next generation of leaders, thereby generating awareness and spreading the word about the benefits of adult stem cell therapies.

The Conference motivated me to make changes in my education. I want to be a leader. I want to be part of the change that brings awareness of adult stem cell therapies to our society, particularly those with special needs.

The Student Ambassador Program has changed my outlook on the future of medicine. I am committed to helping this program continue, so that many more people can benefit from the healing potential of adult stem cell science.

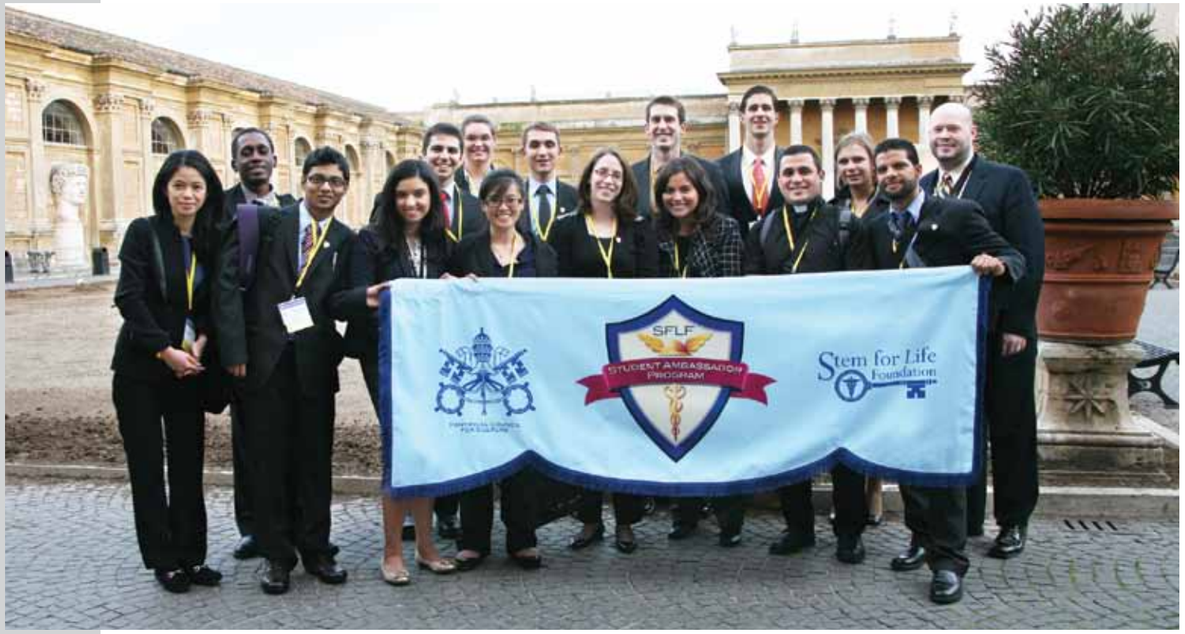
Using adult stem cell therapies is going to change the face of healthcare in the world. To advance this cause is to enlighten society. There is a grave misconception surrounding stem cell therapies. The public is unaware that there is a difference between adult stem cells and the controversial embryonic stem cells. Without the education of leaders, and new leaders (i.e., the Student Ambassadors) these misconceptions will continue. Research and funding are necessary to continue the growth in adult stem cell research. We must dispel myth and controversy so that as stem cell therapies continue to evolve and develop, more therapies will get to patients who so desperately need them.

I was fortunate to be part of the 2013 inaugural class of Student Ambassadors for The Stem for Life Foundation. I have learned how adult stem cells can potentially help patients with multiple sclerosis, cardiac issues, orthopedic problems, neurologic disease, the regeneration of organs, and much more. If I could use one word to describe adult stem cell research, it would be "HOPE." Hope for your mother, father, or child. More research support is needed so that further advancement of adult stem cell therapies can take place to help children like my son, who has a disease called PMD, and has no hope for treatment outside of stem cells.

Awareness of the potential of adult stem cell therapies does not need to be advanced solely by researchers and scientists. I am a Student Ambassador, a nurse, and a mother and I am vested in this cause. Raising awareness can and will help millions. I ask you then to become knowledgeable, bring correct information to the world, and continue the amazing work being done by The Stem for Life Foundation. Join me by inspiring those around you to want to learn and be passionate about adult stem cell therapies and the hope they bring to the world. ■

The Student Ambassadors for the Cellular Age program aims to inspire the next generation about the potential of, and advances in, adult stem cell science and the role that cellular therapies will play in medicine and in alleviating human suffering.

To learn more about the Student Ambassador program, please contact studentambassadorprogram@stemforlife.org



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Visit **www.stemforlife.org/donate**

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The Stem for Life Foundation
420 Lexington Avenue, Suite 350
New York, NY 10170

To learn more about becoming a Student Ambassador:

Email **studentambassadorprogram@stemforlife.org**

The mission of The Stem for Life Foundation is to raise public awareness about adult stem cells and their therapeutic promise and to support the advancement of adult stem cell research and development.

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