

## **Testimony on the Promise of Human Stem Cell Science**

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Thank you Chairman Harkin, Sen. Cochran, and distinguished Committee Members for the opportunity to present this information to you today. My name is Jean Peduzzi Nelson from Wayne State University. Please note that the testimony I am giving today is my own opinion and not necessarily that of the University. I am a translational neuroscientist who is working to bring using one's own olfactory mucosal adult stem cells for spinal cord injury, head injury and radiotherapy damage.

There are two major categories of stem cells: embryonic and adult. Human embryonic stem cells are derived from human embryos and remain controversial. I want to focus my comments on the science of adult stem cells that are treating patients for many diseases. This second category of stem cells can be obtained from adult tissues, as well as tissues from children. For my purposes, I will use "adult stem cells" to refer to these as well as stem cells from umbilical cord blood.

I wanted to share with you pictures of some brave pioneers who first explored the potential of adult stem cell treatment. The **progress of adult stem cells** has gone so far beyond these particular patients to long term follow-up results of numerous patients in peer-reviewed published clinical trials.

Stem cells are cells that can generate lots of cells and, under the right conditions, become one of the many cell types in the body. Adult stem cells are stem cells obtained from adults, children, even infants and umbilical cord after birth. These include cells from the bone marrow, nose, fat tissue, umbilical cord and other places. The great thing about these cells is that a person's own cells can be used which eliminates the problem of immune rejection and tumor formation sometimes observed with other types of stem cells. Adult stem cells are the best stem cells to replace lost or damaged cells in our bodies.

The financial challenge with adult stem cells is that usually when you use your own cells, there is usually no intellectual property or patents. So, the biotech industry that invests **billions** in research often does not fund this research<sup>1</sup>. Millions of dollars are needed to complete each clinical trial so all patients can benefit from a treatment, not the lucky few, and so that billions can be saved in health care costs. NIH has developed new programs to encourage translational research and clinical trials, but has a much smaller budget than private industry<sup>2</sup>. Much of the funding for adult stem cells by NIH is directed at older but important uses of bone marrow stem cells that were developed in the 50's and 60's for leukemia and other cancers. While bone marrow transplants have been used in patients for years, the successful isolation and characterization of adult stem cells is a very recent science. The first mouse adult stem cell was successfully

isolated and purified in the laboratory in 1988<sup>3</sup>. The first human adult stem cell was first successfully isolated and characterized in the laboratory in 1992<sup>4</sup>. New uses of adult stem cells for other diseases and injuries only started in the 90's, but have already reached patients with various diseases and injuries as I will demonstrate.

I would like to tell you about 5 patients who have been helped by adult stem cells. These patients were either part of a clinical trial, and their results are now published in a peer-reviewed journal, or sometimes a similar procedure was done in a clinical trial that is now published.

The first patient is Silvio who I met several years ago. I have been working with a group in Portugal led by Dr. Carlos Lima<sup>5,6</sup>. Dr. Lima, Dr. Pratas-Vital, Dr. Escada, Dr. Capucho, and Dr. Hasse-Ferreira have been using a person's own tissue from inside of the nose as a way of delivering adult stem cells. Silvio had a spinal cord injury at the base of his neck [cervical level 6/7, American Spinal Injury Association Impairment Scale (AIS) A, complete injury. Grade A is considered the worst, which indicates a "complete" spinal cord injury where no motor or sensory function is preserved in the sacral segments S4-S5.]. Silvio was left with no movement of his legs and minimal movement of his fingers. At 2 years after injury, he received his own adult stem cells and partial scar removal after intensive rehab failed to lead to an improvement.

Today he can maintain standing position and wave without help. With a walker and short braces, he can walk over 30 feet without anyone helping him. He can now move his fingers, which he could not do before. Because he was in a wheelchair for 2 years before treatment and could only move the chair using his wrists, a special rehab program called BIONT (brain initiated non-robotic/non-weight supported training) was used at

Centro Giusto in Italy so he could learn to walk again. Dr. Arcangeli and Dr. Lazzeri have developed an effective rehab program that, when combined with adult stem cells, helps patients recover. BIONT therapy is being used on some US patients who had this procedure in Portugal at Walk the Line in Detroit. With NIH and/or the Department of Defense (DOD) I would like to bring olfactory mucosal stem cell treatment to the people in the US.

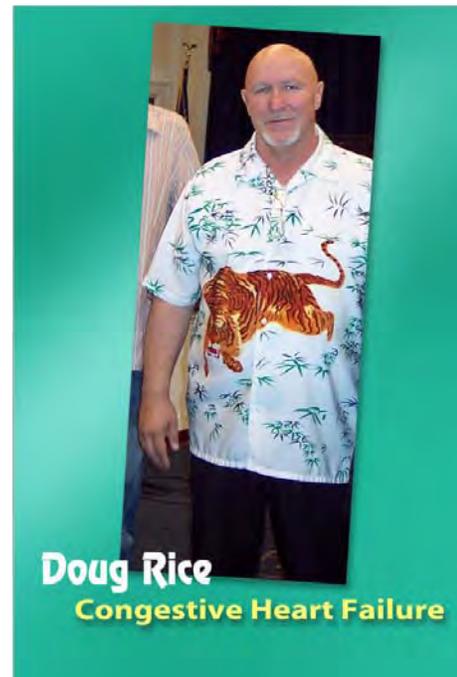
This is much more remarkable than a treatment of an acute spinal cord injury within the first few weeks after injury. Over 15% of the patients who are American Spinal Injury Association Impairment Scale (AIS) grade A improve in their classification in the first year after injury<sup>7</sup>. If a treatment is given acutely or subacutely, it is difficult to separate normal recovery and effects of a treatment unless a large number of patients are enrolled in the clinical trial and randomly assigned to treatment or control. If a treatment is given at 1 year or greater after spinal cord injury, only 5.6% of AIS A (32/571 patients) improve in grade from year 1 to year 5 after spinal cord injury<sup>8</sup>.

Silvio is not an isolated case. Here are the 2 peer-reviewed publications from the Journal of Spinal Cord Medicine and Neurorehabilitation and Neural Repair which reveal that more than half of AIS A patients improved in grade compared to the normal 5% without treatment. When the adult stem cells are combined with an effective rehab program, 12/13 AIS A improved in AIS grade and all of the patients



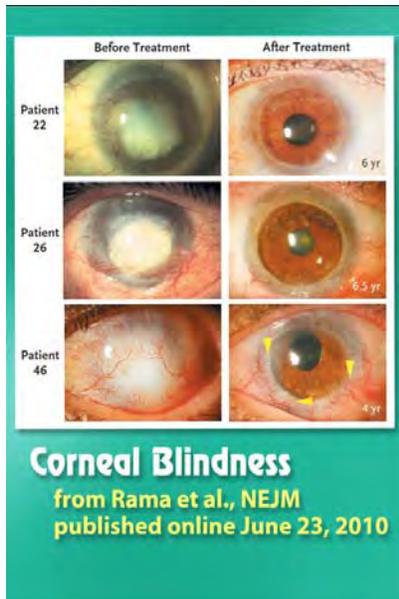
regained some muscle movement in their legs. These findings were documented with EMG and SSEP recordings.

The next picture is Doug Rice who was told in 1998 that he had 2 years to live due to chronic heart failure after multiple heart attacks. At that time he could hardly walk. He did not qualify for any US clinical trials, so he went to Thailand to have a treatment with adult stem cells. The cells were sent to a company in Israel where the cells were purified and allowed to multiply, then sent back to Thailand for injection. Since that time, he has more energy and is enjoying life. However, this is also not an isolated incident. This year an article was published in the European Journal of Heart Failure reporting the follow-up of 191 patients who received adult stem cells from their own bone marrow compared to 200 patients with comparable symptoms<sup>9</sup>. These adult stem cell treated patients lived longer and had a greater capacity to do exercises. Their heart functioned much better based on a large number of tests (left ventricular ejection fraction, cardiac index, oxygen uptake, and left ventricle contractility). This report of the STAR-heart study provides the controlled clinical trial data, and new trials are now proceeding in the US.



I have to apologize for the next picture. It isn't a photo of a single patient but somewhat gross pictures of the eyes of 3 patients with corneal blindness from an article just published in the New England Journal of Medicine<sup>10</sup>. Corneal disease is the 2nd leading cause of blindness after

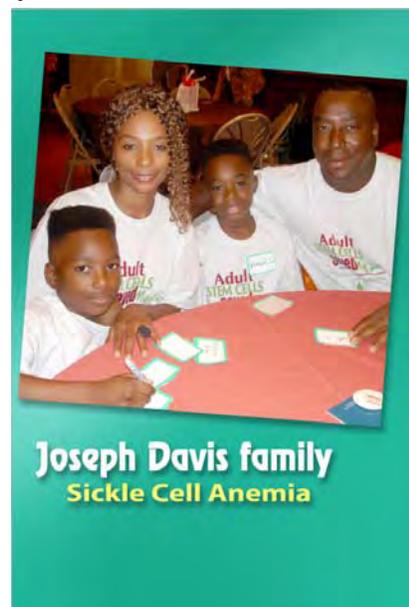
cataracts in the world<sup>11</sup>. Corneal transplants are commonly used, but the transplants are rejected in about 20% of the cases<sup>12</sup>. On the left are



pictures of the eyes of patients who had severe burns or damage to their eye and suffered from corneal blindness. These patients had surgery on their eyes, but these surgeries did not help. Several years later, adult stem cells were removed from the opposite eye and implanted in the damaged eye. The results of the adult stem cell transplant are shown on the right several years after the procedure. The patients went from barely being able to see hand movements to

normal sight in these eyes. This procedure was successful in more than 75% of the 112 patients. Some of these patients were followed for 10 years. We need more clinical studies in the US to treat US patients with corneal blindness.

The next patient is Joe Davis, Jr. Joe is the boy between his mom and dad; he was born with severe sickle cell anemia. Sickle cell anemia is a blood disease that affects 1/500 African-Americans. The doctors thought that Joe might not live to see his teens. When Joe was 2 years old in 2002, he received a transplant of stem cells from his younger brother's umbilical cord. Joe no longer has sickle cell anemia. So, where are we now? About 72,000 people in the US have



sickle cell anemia that causes pain, chronic tiredness from anemia and severe infections, usually beginning when they are babies<sup>13</sup>. In a published study last year in the New England Journal of Medicine that was supported by NIH, ten adults were treated with adult stem cells from their brother or sister. Of these patients, nine no longer had symptoms of sickle cell anemia and were doing well at 4 years after their treatment<sup>14</sup>. A similar study was published in 2008 showing that 6/7 of the children with severe sickle cell anemia treated in a similar manner were without sickle cell symptoms when they were examined at 2-8 years after treatment<sup>15</sup>. It would be great if we could have everyone with sickle cell anemia treated.

The last picture is Barry Goudy who was suffering from multiple sclerosis. He had numerous relapses and the medication was not helping his condition. He was part of a study conducted at Northwestern Memorial Hospital in Chicago and received his own stem cells in 2003. His MS

symptoms disappeared in 4 months, and he continues to be symptom free today. Results were published last year by Burt and colleagues in Lancet<sup>16</sup>. Patients had what is known as relapsing-remitting MS. These were patients who were still having relapses despite interferon beta treatment. All of the treated patients did not show the normal progressive worsening associated with MS, and a significant functional improvement was noted in

these patients. In a similar study published this year, they describe the one year follow-up of 6 patients who showed improvement when their muscles were evaluated using electrophysiology<sup>17</sup>. Their condition either stayed the



same or improved in a disease that is characterized with progressive decline in function.

The 5 pictures and their related clinical trials using adult stem cells show amazing progress for severe spinal cord injury, chronic heart failure, corneal blindness, sickle cell anemia, and multiple sclerosis. However, this is not an exhaustive list of the recent clinical trial findings using adult stem cells. I would just like to mention the amazing progress using adult stem cells in juvenile diabetes. A recent clinical trial report<sup>18</sup> in the Journal of the American Medical Association found that the majority of the 23 patients who received adult stem cells achieved insulin independence in the 2 year follow-up. Many may remember the news report of the person who received a new trachea using adult stem cells. An article published this year details the recovery of 20 patients with upper airway problems that received adult stem cells<sup>19</sup>. Another break-through article was published this year in Blood which calls the use of adult stem cells “. . . the gold standard in the frontline therapy of younger patients with multiple myeloma because it results in higher complete remission (CR) and longer event-free survival than conventional chemotherapy<sup>20</sup>.

Only with the help of NIH and the DOD Congressionally Directed Medical Research Programs, can these successful treatments reach all the people that desperately need them. I applaud Senator Harkin's efforts to increase the NIH budget in the past and ask all of the Senators and Representatives to make the people with diseases and injuries a major priority and put the patients first when considering funding stem cell research. These pioneers need to be joined by many other people to help those suffering from diseases and injuries. Adult stem cells aren't just showing great promise but are treating people now. Much more of the

limited funding needs to be directed at adult stem cells that are showing success right now.

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