



## Understanding Stem Cell Research

By Kouros Azar MD

### THE USEFULNESS OF ADULT STEM CELLS

Stem cell research has been a hot topic for several years, tapping into our excitement to both cure disease and explore new horizons in science and medicine. Adult Stem cells, usually derived from an adult as opposed to an embryo, are subject to much less controversy and are showing promise for treatment of a variety of conditions from debilitating blood diseases and neurologic conditions to heart failure and even cosmetic surgery.

### WHAT ARE STEM CELLS?

Stem cells are immature cells in the body that have not yet developed to the stage where they show a recognizable mature

identity- for instance - nerve cells, heart cells, liver cells, and so on. These 'un-committed' cells have some remarkable properties. First, in laboratory conditions, they can divide and keep on dividing to produce 'daughter' cells more or less indefinitely, as though they were immortal. Second, they are multipotent, or pluripotent, meaning that in appropriate chemical environments they (and their daughters) can transform into any one of a number of distinct adult cell types.

### THE POSSIBILITIES

The most attractive feature of stem cells for the medical scientist is the possibility of their being used to replace cells that

have died because of disease or trauma. The body actually uses pre-existing stem cells as a repair strategy, providing the particular chemical environment required to get them to develop into the adult cells needed to replenish a depleted population. In general, adult stem cells have the ability to produce additional stem cells (self-renewal) and to divide into daughter cells that are committed to a specific cell lineage, called committed progenitor cells. The latter category of cells can proliferate and further differentiate, but are unable to undergo self-renewal. Both adult stem and committed progenitor cells are found in all tissues and serve as a powerful reservoir for local tissue replacement during

normal cell turnover or after tissue injury, and they may provide an alternative cell source for tissue replacement.

Adult stem cells have been isolated from multiple adult tissues, such as blood (hematopoietic stem cells), skeletal muscle, adipose tissue, lung, testis, umbilical cord, and placenta, and can be induced to form a limited set of differentiated tissue types. Further, depending on the adult progenitor cell type, they can be directed to transdifferentiate (lineage switch), that is, form cell types of a different cell lineage, and are a promising, noncontroversial source of cells for in vitro tissue regeneration.

As you look at the list above of potential sources of stem cells, you notice adipose tissue or fat is on the list. This is of particular interest to plastic surgeons as we commonly remove and inject fat for both cosmetic and reconstructive procedures. Current research is closely examining the role of fat-derived stem cells for regeneration of everything from burn scars and open wounds, to breast cancer reconstruction and even enhancing the breast size. There is much preliminary data that shows (when properly isolated) that stem cells derived from fat injected back into the same person - has regenerative capacity. Once again, because plastic surgeons have patients with challenging reconstructive needs, we are currently leading the field of adipose derived stem cell research.

The most common source of adult stem cells is blood itself (hematopoietic stem

**Although it is difficult to predict the ultimate utility of stem cell-based therapy at this time, it is not difficult to conclude that this is an extremely important area of scientific research. Surrounded by controversy and excitement, stem cell research demands our attention to insure these miracle treatments will make it to those of us who might soon need it.**

cells). These cells have already been used for decades as a transplant for people with blood-borne illnesses and cancer in the form of bone marrow transplantation. These techniques have the potential for undesirable side effects such as rejection of the transplanted cells. The use of adult stem cells is showing promise in possibly eliminating some of these side effects through learning how to control the cells' behavior in different environments.

Mesenchymal stem cells (MSCs) are another type of adult multipotent cells - capable of differentiating into various specific (mesodermal) cell lineages.

These cells are present in almost all organs, but for therapeutic purposes, they are most conveniently isolated from bone marrow and umbilical cord blood and can be organ specific. The immunomodulatory capability of these cells is being

tested in the treatment of patients with systemic lupus erythematosus, multiple sclerosis, Crohn's disease, amyotrophic lateral sclerosis, and Type I diabetes mellitus. A recent study with 23 Type I diabetes patients who underwent stem-cell-derived treatment showed that 20 enjoyed a variable insulin-free period and 12 patients remained insulin-free for 31 months. All patients showed at least a reduction in the needed dose of insulin.

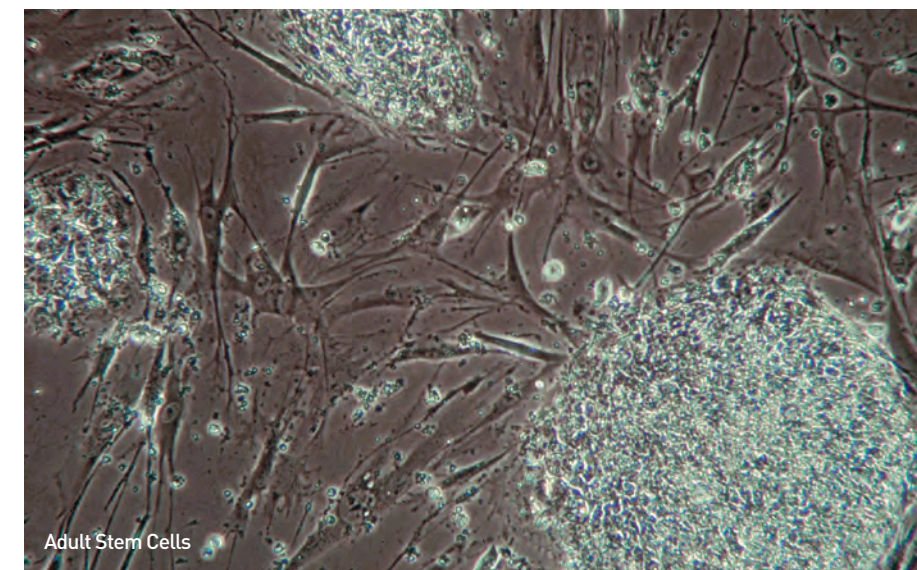
Other arenas where adult stem cell research is making strides include neurologic conditions from Parkinson's disease, stroke and spinal cord injury. These discoveries are wide in their scope and too complex for the purposes of this review. Some studies suggest much more research is needed till a clinical use can be found while others show earlier promise.

One word of caution worth noting is an April 2009 (Vol 10) article in the journal Lancet Oncology that draws attention to medical tourism surrounding stem cell research. There are accounts of families spending large amounts of money traveling overseas to get unorthodox stem cell treatments for loved ones with desperate conditions. The regulations in some of the countries outside the U.S. do not protect the patient or families from treatments that could not only lack benefits but could cause harm.

### THE FUTURE?

Although it is difficult to predict the ultimate utility of stem cell-based therapy at this time, it is not difficult to conclude that this is an extremely important area of scientific research. Surrounded by controversy and excitement, stem cell research demands our attention to insure these miracle treatments will make it to those of us who might soon need it. This will also require ongoing public support over many years to come as many of these treatments are still years into the future. Take it from the family members of those who are suffering: the future can never come too soon.

Kouros Azar, M.D.  
Board Certified Plastic and Reconstructive Surgeon  
425 Haaland Drive, Ste 200  
Thousand Oaks  
805.373.7073  
www.doctorazar.com



Adult Stem Cells