

Letter: Regaining Perspective on Stem Cells

I am often asked “Why is there so much confusion about stem cells?” The truth is that this is a complex field, which extends well beyond science and the art of healing. It includes matters of an ethical, religious and emotional nature for which there is often no clear answer. In some cases one has to accept that it is impossible to obtain a consensus, and the best we can do is agree to disagree. I will try to explain.

Based primarily on pre-clinical experimental studies, stem cells have been proposed for the treatment of a wide range of diseases including heart disease, spinal cord injury, diabetes and many others. With the possible exception of heart disease (myocardial infarction and heart failure), the use of stem cells in all of these areas remains for the moment experimental, and has not become part of routine clinical practice. Although the promise that stem cells provide is immense, they are surrounded by much speculation and controversy, fuelled partially by ignorance. Two areas in particular require clarification.

The first concerns umbilical cord blood stem cell banking. Banking may be either private or public. Private banking is controversial because of the negligible recall rate on stored samples, whilst public banking is universally accepted and encouraged.

The controversial nature of private banking, compounded by the fact that until recently, and with one or two exceptions, there has been little else going on in South Africa in the stem cell field, has pushed it into the spotlight. It must be appreciated however that banking constitutes a very small part of the whole stem cell field, and one should not equate stem cell research and therapy only with banking. Fortunately research in the stem cell field is now gaining momentum in our country.

The second area that needs clarification is that of embryonic stem (ES) cells. ES cells are derived from early human embryos, more precisely from the inner cell mass of the blastocyst. ES cells can develop into almost every cell type in the body, which means that they have the potential to be used for the treatment of many diseases. The ES controversy centers around the origin of these cells and the potential destruction of life that occurs in their preparation. There are several ways of thinking about when life begins, some of which include:

- at the moment of fertilisation (i.e. before the development of the blastocyst)
- when organs start to develop (the first being the heart)
- at the moment of perceived consciousness (i.e. when the embryo can feel pain)
- at the moment the foetus is able to survive outside the womb (somewhere between 22 and 24 weeks).

If one believes that life begins at the moment of fertilization then harvesting cells from the inner cell mass would be seen as destroying life. These conflicting views are at the heart of this controversy.

Despite their promise, ES cells have, to date, not produced any successes in humans, and the first Phase I clinical trial involving a limited number of patients with spinal cord injury has been placed on hold because of concerns about the potential for serious side

effects. Whether ES cells will ever form part of the therapeutic landscape is debatable and it may never prove necessary to confront the moral and ethical issues that they evoke. Once again, as with private banking, ES cells form a very small part of the current practice and future promise of stem cell therapy, despite the vigorous debate that surrounds them.

To recapitulate: despite the extensive and often emotionally-charged publicity that private banking and ES cells incite, these two areas constitute only a very small part of the entire stem cell landscape. If this is the case, then what constitutes the rest? The answer lies with adult stem cells. Many organs and tissues in the body contain stem cells, whose role is one of regeneration and repair. Perhaps the best known of these is bone marrow. Bone marrow transplantation is the only routinely utilised form of stem cell therapy. It is universally accepted and has been used for many years.

Indications for bone marrow transplantation broadly include hematological and genetic disorders, some of the best known being leukemia, myeloma and aplastic anemia. Bone marrow is home to hematopoietic stem cells that maintain our supply of red cells, white cells and platelets. When hematopoietic stem cells are destroyed as an indirect consequence of chemotherapy (which targets dividing cells, both malignant and normal), patients are at risk of developing anemia, of being unable to fight infection and of bleeding. This is the reason why stem cells are given back to these patients after chemotherapy in the form of a bone marrow transplant, replacing the hematopoietic stem cell population and restoring function.

In addition to bone marrow, many other types of adult stem cells have been described including those in hair follicles (which explains why our hair grows continuously and why it falls out after chemotherapy), the intestinal lining, skeletal muscle (so-called satellite stem cells), teeth and many more. One of the most interesting from a therapeutic perspective is mesenchymal stem cells, which are found in bone marrow and adipose tissue. These cells can be induced to form bone, cartilage and of course adipose tissue itself. However, one of their most interesting properties is to dampen the immune response, which, when co-transplanted with hematopoietic stem cells, may reduce rejection of donor stem cells in an unrelated recipient (termed allogeneic).

What about the future? Could adult stem cells be the solution to the controversial issues of private banking and ES cells?

The answer is a qualified yes. It is now possible to generate cells of a stem cell-like nature from virtually any differentiated adult cell in the body. Because these so-called induced pluripotent stem (iPS) cells could potentially be derived from any patient and used to treat the same patient (termed autologous), there should be no issue of rejection, and hence no need for life-long immuno-suppression (with all its attendant consequences).

But that is a story for another time.

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