ADULT, EMBRYONIC STEM CELLS ARE CRITICAL TO ADVANCE SCIENTIFIC UNDERSTANDING OF DISEASES, THERAPIES, AND CURES

Both adult and embryonic stem cells are important potential tools for the development of therapeutic treatments for various medical conditions, from type 1 diabetes to Parkinson's disease to spinal cord injuries. It is far too early to tell which stem cell type will prove most useful in scientific research leading to therapies and cures for any specific disease.

Because of this uncertainty, JDRF's scientific position is aligned with leading stem cell scientists, prominent research organizations, and Nobel Laureates: Research should be vigorously pursued on both adult and embryonic stem cells. If there is one point on which virtually all stem cell scientists agree, it is that much more needs to be learned about how stem cells work in order to use them most effectively. Researchers have only begun to understand how the body grows and repairs itself, and increasing this knowledge base is necessary to achieving the full potential of stem cells.

PROPERTIES OF ADULT STEM CELLS

Adult stem cells exist in small amounts in several tissues in the body, helping maintain and repair those tissues. (This includes stem cells found in umbilical cord blood and amniotic fluid.) Adult stem cells typically have the capacity to become any cell type in that particular tissue. Scientists have been studying adult stem cells for about 50 years; the most notable success involves blood-forming hematopoietic stem cells, which have proven useful as replacements for the bone marrow in different blood-related illnesses. Research has suggested that certain kinds of adult stem cells, given the right conditions, may have the ability to differentiate into a number of different cell types, and that possibility is being pursued aggressively. Scientists in many laboratories are trying to find ways to grow adult stem cells in cell culture and manipulate them to generate specific cell types so they can be used to treat injury or disease.

PROPERTIES OF EMBRYONIC STEM CELLS

Embryonic stem cells are derived from 4-to-5-day-old embryos that develop from eggs that have been fertilized *in vitro.* Embryonic stem cells have two unique capacities: They are capable of seemingly limitless reproduction, and they can develop into any type of cell, tissue, or organ as they mature — an ability scientists describe as "pluripotency." At the same time, embryonic stem cells cannot themselves develop into a full organism. Human embryonic stem cells were first isolated in 1998. Their ability to replicate themselves indefinitely while remaining in an "undifferentiated" state means that embryonic stem cells provide a model system for drug discovery and the study of human development, and they offer a potentially unlimited source of cells for organ transplantation.

THERAPEUTIC POTENTIAL OF ADULT AND EMBRYONIC STEM CELLS

Unfortunately, to date, research reflects that adult stem cells do not offer the same (or better) potential as embryonic stem cells for understanding and treating disease. Adult stem cells have limitations that may hinder them from becoming effective treatments for many diseases, including type 1 diabetes. They are difficult to identify, isolate, purify, and grow. Adult stem cells may not exist for some tissues, including insulin-producing cells. Because of their limited numbers, it is not clear whether adult stem cells can be produced in quantities that would be clinically significant for the treatment of many diseases. And despite experiments suggesting adult stem cells can convert into other cell types, this is far from certain—other experiments have provided alternate explanations. In short, it is unclear at this point whether adult stem cells could serve as a cure for type 1 diabetes and many other afflictions.

While there are no federal funding restrictions in the U.S. for adult stem cells, the same is not true for embryonic stem cells. On August 9, 2001, President George Bush established a policy limiting federal funding for embryonic stem cells to only those cell lines already in existence on that date. While this decision was being contemplated, 40 Nobel Laureates sent a letter to President Bush stating: "It is premature to conclude that adult stem cells have the same potential as embryonic stem cells — and that potential will almost certainly vary from disease to disease ... Therefore, for disorders that prove not to be treatable with adult stem cells, impeding human pluripotent stem cell research risks unnecessary delay for millions of patients who may die or endure needless suffering while the effectiveness of adult stem cells is evaluated."

Although embryonic stem cells have great potential, the development of a robust research community focused on their investigation, especially in the U.S., has been slowed by political issues, religious differences, funding considerations, and the difficulty of recruiting and motivating scientists to concentrate their activities on a path not yet traveled by other researchers.

Federal funding for adult stem cells is currently about six times higher for human adult stem cells than for human embryonic stem cells. Last year, the NIH provided about $222 million for adult and $38 million for embryonic stem cell research.

JDRF SUPPORTS RESEARCH ON ALL STEM CELL TYPES

JDRF strongly believes that research should be pursued using both stem cell types. JDRF currently funds research on both adult and embryonic stem cells. Last year, the organization funded some $2 million in human adult stem cell research, along with $4.9 million in human embryonic stem cell research.