

Somatic Cell Nuclear Transfer (SCNT) or Therapeutic Cloning

By Richard Mollard

The major problem facing widespread use of embryonic stem cells in cell therapies and organ replacement is their anticipated rejection by the patient's immune system, which will recognize them as foreign. One way around this problem would be to produce "custom" embryonic cells, matching the patient's immunologic profile.

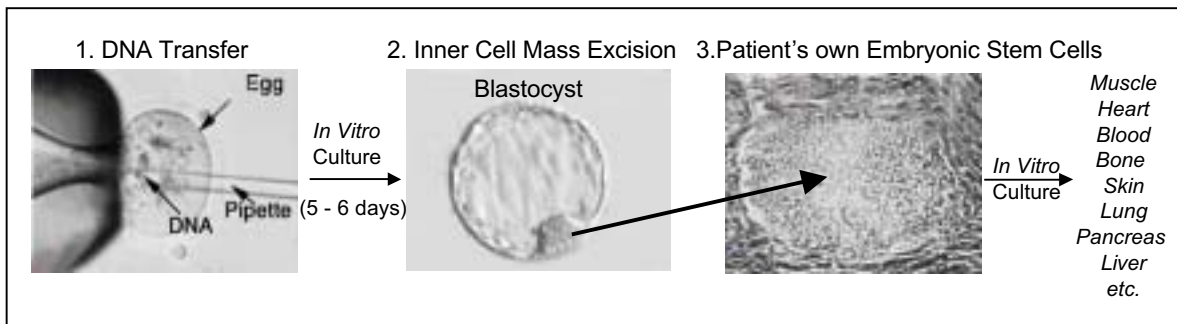
The approach, known as "therapeutic cloning," would lead to the production of cells and tissue matching one's self, that would not elicit rejection when the cells are transplanted into the patient.

For therapeutic cloning, also called somatic cell nuclear transfer (SCNT), the DNA from any one cell in the body of a patient (usually a skin or muscle cell) could be removed and transferred through a microscopic glass tube into an unfertilized egg that previously had its own DNA removed, as shown below. (first image below). In a culture dish, the egg is then coaxed into developing as if it had been fertilized. The

one egg cell divides rapidly and generates a ball of cells, called the blastocyst, in only 5-6 days. The inner cell mass, a part of the blastocyst (middle image below), is then removed and embryonic stem cells grown out of it.

These embryonic stem cells, containing the patient's DNA, now match the patient's immunological profile and will not be rejected by the patient's immune system. These embryonic stem cells can now be used to generate cells and tissues for the patient.

While this procedure sounds straightforward and is being performed quite successfully to a certain degree in animal models, there are still technical hurdles that need to be addressed before widespread use in humans. For example, it is not yet clear how successfully entire sophisticated organs could be generated in culture from embryonic stem cells. Culture conditions are not sufficiently developed to



Therapeutic cloning procedure: Image 1: under the microscope, the DNA of the patient is introduced into the egg, through a microscopic glass tube. Image 2: After 5-6 days, the egg has developed into a ball of cells, the blastocyst, of which is removed the inner cell mass. Image 3: After culture in a plastic dish, the inner cell mass has grown to aggregates which contain the embryonic stem cells that match the patients immunologic profile.

mimic perfectly the environment that contributes substantially to regulation of cell fate during organogenesis.

In the nearer future, therapies would probably be restricted to injection of tissue-specific progenitors that have been generated from the "custom" embryonic stem cells, which then will contribute to the repair of damaged organs in the patient.

An alternative approach to finding compatible stem cells for a given patient is to establish banks with embryonic stem cells from a wide array of donors, as is done for blood banks.

However, this approach will have the same limitations as organ donor and bone marrow registries, i.e. the problem of limited availability of compatible donors. This problem particularly affects ethnic minorities who are of rarer type and are severely underrepresented in the organ and bone marrow registries.

Richard Mollard, Ph.D., is an embryonic stem cell specialist at the Institute of Reproduction and Development at the Monash University in Australia.