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Looking Ahead

The Future of Cell Biology

In November 2007, researchers in the United States and Japan shocked the world of cell biology by successfully transforming regular adult cells into the equivalent of embryonic stem cells without using human embryos. The technique has since spread rapidly in the field, not only because it avoids ethical problems (and therefore political controversy and public funding restrictions) but also because it is a great deal easier and cheaper than working with embryos and seems so far to yield the same results. Researchers all over the world have been tinkering with the technique to improve its efficiency, to eliminate the need to use genetically engineered viruses to reprogram the cells, and to look for other applications of the lessons this discovery suggests about how cells function.

In August 2008, *Nature* announced an extremely important advance resulting from this flurry of work. A team at Harvard has succeeded in directly reprogramming one type of adult cell into another, without even the need for the intermediary step of reprogramming to a pseudo-embryonic state and only then differentiating to a new developed cell type. Working with a diabetic mouse, the researchers were able to transform regular pancreatic cells into beta cells (the rare cells that produce insulin and are destroyed in diabetes patients) by inserting only three genes into the pancreatic cells. The mouse began to produce insulin, and its blood sugar levels fell.

Diabetic mice have been cured before, to be sure, and the application of this method to human diabetics and patients with other diseases is by no means on the immediate horizon. But whatever the eventual clinical applications, the implications of the work for cell biology are extraordinary—that sound you hear is Ph.D.-level textbooks being thrown in the garbage all over the world.

The implications for the ethical debate over embryonic stem cell research are also quite significant, since this takes the locus of work in the field even further away from the embryo, and suggests yet again, and with greater force, that the outcomes researchers have valued about embryonic stem cell work could very well be achievable without the destruction of embryos, and without any ethical concerns whatsoever. Science and ethics, as President Bush has so often put it in arguing for his funding policy, need not be at odds, and can be championed together.

This stem cell breakthrough is an immensely significant step in regenerative medicine, not only because it doesn't involve embryos (or indeed stem cells at all) but because if it translates to humans it is work that can be done directly in living patients. It has created enormous excitement among cell scientists. And it shows that science guided by some basic ethical boundaries can find ways forward without violating human dignity or human life.