A paradigm shift in stem cell science? Reflections on scientists’ perceptions and practices on human embryonic stem cells as a cure for disease

Introduction
This poster draws on our social research on medical and scientific aspects of the prospects of human Embryonic Stem Cell (hESC) research in the fields of diabetes and neuroscience (Williams et al, 2003; Kitzinger & Williams, 2005, Wainwright et al, 2006a, 2006b, 2006c, Michael et al, in press; Wainwright et al, in press). Our objectives are to:

- Explore the views of scientists in leading stem cell labs in the UK and the USA. We argue initial expectations of a revolution in regenerative medicine have been dampened by the difficulties of making functioning cells from hESC.
- Examine how scientists are now arguing for a paradigm shift, from a stem cell transplant approach to a disease in a dish approach (i.e. hESC as tools for unravelling mechanisms of disease and for drug development).
- Outline three strategies for creating disease in a dish: hESC lines; Somatic Cell Nuclear Transfer (SCNT), genetic bioengineering, and Pre-implantation Genetic Diagnosis (PGD).

Disease in a dish: a new paradigm for hESC research?
Bioscience and business have become increasingly interdependent so that hESC are expected to move from lab to clinic to market. In the field of ‘stem cells for diabetes’, progress toward cell transplants has been slower than expected:

I think people were expecting to get to the clinic much faster. Now people are saying, ‘Hey, that’s not the issue right now, let’s see what we need to do to get it so that the field moves on’. (Scientist 25, USA)

However, this whole ‘cell transplant approach’ to translating hESC into therapies wrongheaded? – see Figure 1. Perhaps hESC should be used as tools to study potential new drug therapies rather than as cell therapies in their own right? – see Figure 2.

Figure 1: hESC and cell transplantation

Motor neurones are sprouted from the top of the motor cortex right down the spinal cord and they’re the biggest cells in the body. That doesn’t sound like a smart target in terms of cell replacement therapy? I really want to see the disease (ALS) stopped. I’m not really working on cellular therapy. We are still tempted to do some simple experiments with A50 cells transplanted in to our mouse model of disease (ALS). It’s one of the few really good mouse models of any neuron genetic condition. But that’s not the main thrust of my work. I still think that ALS is going to be tackled from a pharmacological point of view and that drug discovery is very important. So ‘diseases in a dish’, that’s exactly the kind of research I do. (Scientist/Clinician 33, UK)

Problems with this approach include needing to know the gene(s) to ‘knock-in’, and the complexities of polygenetic diseases. A third approach to ‘disease-in-a-dish’ hESC cell lines uses affected Pre-implantation Genetic Diagnosis PGD embryos – see Figure 3.

Figure 3: hESC and disease in a dish via PGD

PGD lines could be very important stem cells for therapy... This is a potential source to study genetic conditions. You could actually look through the early stages where the genes switch on. What actually happens? Can you change it? Could it be a pharmaceutical target? (Scientist/Clinician 16, UK)

Currently there are a few hESC lines created from affected PGD embryos, for example, with a key Cystic Fibrosis gene (Picking et al, 2005).

Concluding
Biotechnologies change what it is to be biological, but differences in science are invariably difficult to translate into therapies that make a medical difference. We argue that experts’ persuasive promises advance their interests in the uncertain hESC field, and this strategy helps stabilise the emerging ‘disease in a dish’ model.

Acknowledgements
We thank all those who participated in this research, and acknowledge the support of the Economic & Social Research Council (ESRC) Stem Cell Initiative (grant nos: RES-340-25-0003; & RES-350-27-0001). We thank all those who participated in this research, and acknowledge the support of the Economic & Social Research Council (ESRC) Stem Cell Initiative (grant nos: RES-340-25-0003; & RES-350-27-0001).

References


CBAS – Centre for Biomedicine & Society