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

the social science stem cell initiative

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Introduction

This poster draws on our social research on medical and scientific aspects on 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).

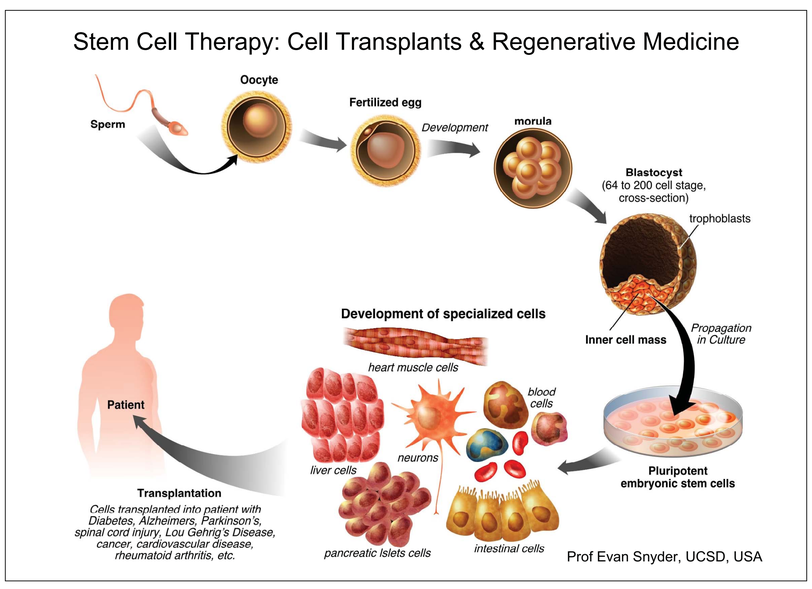
Disease in a dish: a new paradigm for hESC research?

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)

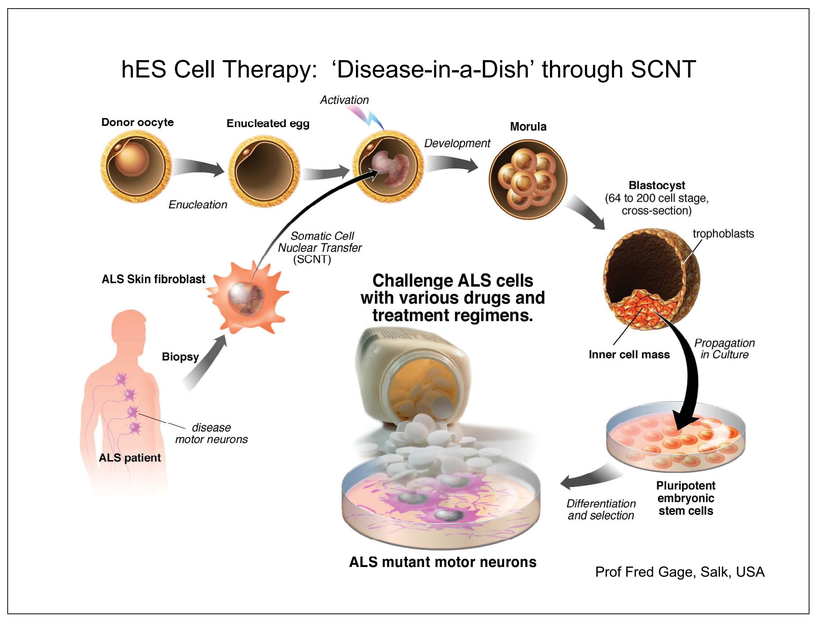
However, is this whole 'cell transplant approach' to translating hESC into therapies wrongheaded? – see **Figure 1**. Perhaps hESC should be used as tools to study potential new drug therapies rather than as cell therapies in their own right? – see **Figure 2**.

Figure 1: hESC and cell transplantation



Stem cells have been sold to the public as potential therapeutic applications for transplantation, almost explicitly, and it is the simplest way to think about it… But, people are now asking when are we first going to see the real cure? When are the benefits going to be in the clinic? Is it going to be diabetes? Is it going to Parkinson's Disease? And I think some opportunists have jumped into this field, done some rat studies with hESC and some changes occurred. People were shaken and some scientists started backing off and saying it's all hype. There are no real cures in this domain… For the last year or so I've been talking about how you can study 'diseases in a dish' through cell culture. This is a revolution in human biology. This is a paradigm shift… This is going to happen. It's too clear. It's too right. (Scientist 29, USA)

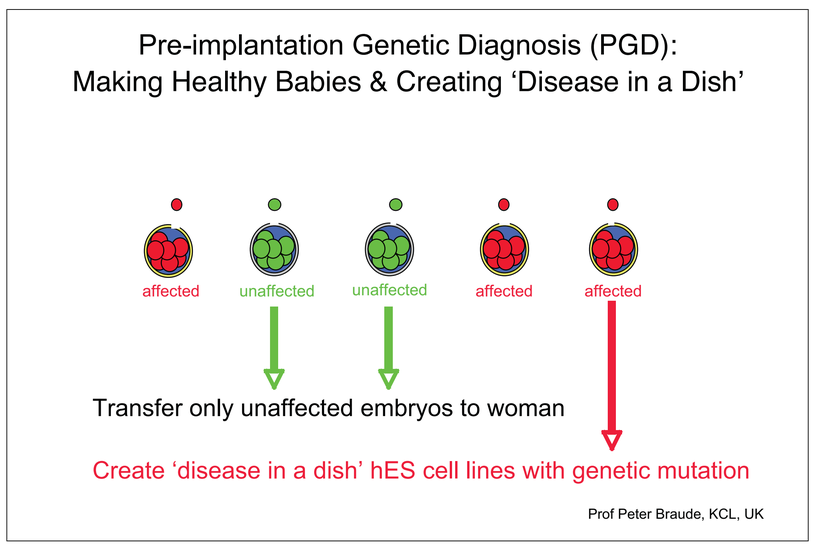
Figure 2: hESC and disease in a dish via SCNT



Motor neurons are sprayed 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 hES 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 pharmaceutical 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' hES 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 very 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 (Pickering et al, 2005).

Conclusion

Biotechnologies changes 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).

References

Kitzinger, J. & Williams, C. (2005) Forecasting science futures: legitimising hope and calming fears in the embryo stem cell debate. *Social Science & Medicine* **61** 731-740.

Michael, M. Wainwright, S.P. Williams, C. Farsides, B. & Cribb, A. (in press) From core set to assemblage: on the dynamics of exclusion and inclusion in the failure to derive beta cells from embryonic stem cells. *Science Studies.*

Pickering, S.J. Minger, S. Braude, P.R. et al (2005) Generation of a human embryonic stem cell line encoding the cystic fibrosis mutation deltaF508, using preimplantation genetic diagnosis. *Reproductive Biomedicine Online* **10** 390-7.

Wainwright, S.P. Williams, C. & Michael, M. Farsides, B. & Cribb, A. (2006a) From bench to bedside? Biomedical scientists' expectations of stem cell science as a future therapy for diabetes. *Social Science & Medicine* **63** 2052-2064.

Wainwright, S.P. Williams, C. Persaud, S.J. & Jones, P.M. (2006b) Real science, biological bodies and stem cells: constructing images of beta cells in the biomedical science lab. *Social Theory & Health* **4** 275–298.

Wainwright, S.P. Williams, C. Michael, M. Farsides, C. & Cribb, A. (2006c) Ethical boundary work in the embrysonic stem cell laboratory. *Sociology of Health & Illness* **28** 732-748.

Wainwright, S.P. Williams, C. Michael, M. Farsides, B. & Cribb, A. (in press) Remaking the body? Scientists' genetic discourses and practices as examples of changing expectations on embryonic stem cell therapy for diabetes. *New Genetics & Society.*

Williams, C. Kitzinger, J. & Henderson, L. (2003) Envisaging the embryo in stem cell research: discursive strategies and media reporting of the ethical debates. *Sociology of Health & Illness* **25** 793-814.

Professor Steven Wainwright
Co-Director Centre for Biomedicine & Society – CBAS
Professor of Sociology of Medicine, Science & the Arts
School of Social Science & Public Policy, King's College London
University of London, UK. Email: steven.wainwright@kcl.ac.uk
Webpage: www.kcl.ac.uk/schools/sspp/cbas/

Professor Clare Williams
Co-Director Centre for Biomedicine & Society – CBAS
Professor of Social Science of Biomedicine
School of Social Science & Public Policy, King's College London, UK

Professor Mike Michael
Professor of Sociology of Science & Technology
Department of Sociology, Goldsmiths College London, UK