Focus on Humans 2.0

Almost 40 years after the birth of Louise Brown—the first baby created by *in vitro* fertilization—5 million test tube babies have now been born across the world. Preimplantation genetic diagnosis (PGD) is becoming increasingly commonplace, particularly in countries such as China. An Editorial looks at the application of new engineering technologies, such as CRISPR–Cas9 gene editing and mitochondrial replacement therapy (MRT), to human embryos and compares and contrasts them with PGD [**Editorial, p. 993**]. Similarly, a Correspondence to the journal questions the rationale for proceeding with germline engineering in its current context [**Correspondence, p. 1023**] and another looks at the attitude of the public with regard to disease prevention and trait enhancement in somatic and germ cells [**Correspondence, p. 1021**]. While next-generation sequencing and phenotyping projects in the wider population continue to widen our understanding of human genetic variation, advances in single-cell sequencing also promise to improve the detection of genetic variation in human embryos in ever-greater detail.

At the same time, our ability to culture human embryos *in vitro* has rapidly progressed to the point where they can be supported up to 14 days—the Rubicon determined in the 1984 Warnock report at which point all embryo research should cease. *Nature Biotechnology* brings together a group of experts to discuss whether in the light of recent methodological advances it is now time to reassess the 14-day rule [**Feature, p. 1029**].

MRT is the first germline treatment to be approved in the United Kingdom and is now nearing clinical practice. The approach allows disease-causing mitochondria in an oocyte to be swapped for healthy mitochondria from a donor oocyte. Greenfield *et al.* summarize the different MRT methods under development and the remaining technical challenges to ensuring safety and efficacy [**Review, p. 1059**]. Steve Connor looks at concerns around mitochondrial reversion in MRT and discusses the 30 or so individuals created through mitochondrial donation in the early 2000s who are now approaching adulthood [**News Feature, p. 1012**].

Elsewhere in the Focus, Amber Dance looks at a the controversy surrounding germline editing and the ethical and social issues that arise once its applications move from the prevention of genetic disease to a technology for human enhancement, especially in the context of the wide accessibility of facile and cheap gene editing technology like CRISPR–Cas9 [**News Feature, p.1006**].

The ability to use information about genetic markers to select prospective partners has long been the stuff of science fiction. Although matchmaking via DNA profiles has yet to catch on, Malorye Allison Branca discusses the boom in commercial services for preconception and prenatal testing [**News Feature, p.1016**].

Finally, as bioengineering and genetic technologies have increased in power and increasingly been applied to human somatic and germ cells, debates centered on who should have decision-making power have become more prominent. Following a conference in 2015 entitled "Biotechnology and the Ethical Imagination: A Global Summit (BEINGS)," a large group of scholars with wide-ranging backgrounds have generated a set of consensus principles to guide the application of bioengineering to human cells [**Perspective, p. 1050**]. They argue that as a community, we must together determine the proper application of these powerful biological tools. *KA & AM*

Patent roundup

Recent patent applications related to the human germline engineering
[**Patent Table, p. 1043**] *MF*

Written by Kathy Aschheim, Michael Francisco & Andrew Marshall

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