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Eugenics and enhancement in contemporary genomics

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The year 1989 marked not only the fall of the Berlin Wall, but also the birth of the first test-tube baby selected with preimplantation genetic diagnosis (PGD). PGD allows the screening of early embryos before implantation, and its first use marked the beginning of what, following geneticist Lee Silver (1997), we refer to as 'reprogenetics', or the use of genetic technologies in the context of reproduction to select what kind of children to bring into the world. In this chapter we draw on three examples – PGD, non-invasive prenatal testing (NIPT) and CRISPR genome editing technologies – to provide an overview of the discussion of reprogenetics at the intersection of enhancement and eugenics.

Socio-political contexts play an important role in policy-making. This is also the case for PGD and other reprogenetics practices, whose regulation varies greatly across countries. In the United Kingdom, for example, PGD is a service offered through the National Health System and is licensed by the Human Fertilisation and Embryology Authority (HFEA), which publishes and frequently updates a list of traits acceptable for screening out with PGD. This list includes traits considered 'severely' disabling, for example Huntington Disease (Huntington Chorea), cystic fibrosis, Tay-Sachs disease, and Muscular Dystrophy (Duchenne), as well as other less severely disabling conditions such as Down syndrome, achondroplasia (genetic dwarfism) and deafness. It also includes screening for genes that are implicated in the early onset of some conditions such as Alzheimer's disease (Types 3 and 4), increased susceptibility to breast cancer and to frontotemporal dementia (HFEA PGD List, 2016). In other countries in Europe, for example Switzerland or Poland, PGD is not allowed, whilst in Germany and Italy it is allowed only in very few cases deemed particularly severe, and only since 2011 and 2015 respectively (Biondi 2013, Gianaroli et al. 2016, Wilhelm et al. 2013).

While uses of PGD for such severe conditions have become more accepted over the years, one of the contentious areas around the use of PGD remains sex selection for 'non-medical reasons', i.e., for parents who want to choose the sex of their child independently of genetic conditions associated with the X-chromosome. In the United Kingdom, couples are not allowed to use PGD to choose the sex of their children unless it is for a 'medical reason', i.e., there are specific genetic conditions linked to the X-chromosome which would affect a male (XY) but not a female (XX) offspring, in which case selecting for females is allowed. In the United States, where there is no equivalent of a central regulatory system overseeing assisted

reproduction such as the HFEA, PGD is offered by private clinics and can be reimbursed through insurance plans. The American Society for Human Genetics (ASHG) and the American Society for Reproductive Medicine (ASRM) publish non-binding recommendations on how clinics should provide services. In a recently published opinion (2015), the ASRM Ethics Committee stated that they have not reached a consensus on sex selection via PGD for 'family balancing reasons' (ASRM Ethics Committee 2015). Thus, they conclude that the practice remains controversial and that clinics that offer this service are encouraged to publish their policies regarding this practice. In recent years, the international debate on the ethics of sex selection has been influenced by reported data on growing sex-ratio imbalances in Asia (Van Balen and Inhorn 2003, Croll 2000). In particular, scholars have begun to argue for the need for contextual sex-selection policies, which take into account extant patterns of discrimination and gender bias that could influence parental decision-making (Dawson 2010) and that build on social science literature on the topic (Sleeboom-Faulkner 2007).

Another controversial area is the use of PGD to select children with specific desired traits. Oxford bioethicist Julian Savulescu, one of the most ardent advocates of human enhancement, argues that we have a moral duty to use PGD to choose children's traits and to screen out disorders, including to screen out some relatively minor conditions such as asthma. According to his Principle of Procreative Beneficence (PPB) (Savulescu 2001, Savulescu & Kahane 2009), 'we should use that [genetic] information to select embryos that have the best chance of the best life, other things being equal'. Sociologist Richard Twine has noted how the PPB is problematic because it is dislocated from the social: decisions regarding the use of genetic technologies in reproductive are hardly 'private', as Savulescu claims, in at least two senses – they require assistance (it is called assisted reproduction) by a national health system or a private company, and they are socially shaped. Twine writes: 'presumptions are made over the content of "best life" and "best child" with insufficient attention to how these are socially and historically mediated' (Twine 2005, p. 292). The eugenics implications of such a principle have not been left overlooked. For one, Australian bioethicist Robert Sparrow argues that Savulescu's PPB, if followed through, would bring into the world white, tall, straight males – features that provide children with a competitive advantage in the society in which they find themselves (Sparrow 2011). He refers to this idea as the 'repugnant conclusion' and adds: 'I don't think we're as far from the history of the bad old eugenics as many bioethicists would like to think' (Sparrow 2016).

Although discussions of PGD and eugenics often revolve around selecting traits that could offer some kind of positional advantage in life (e.g. selecting for enhanced intelligence, looks, or resistance to diseases), in some cases PGD has also been used to select for traits that some would consider disabilities, such as deafness (Baruch 2007, Baruch et al. 2008). Australian legal scholar Isabel Karpin has referred to the use of PGD for the selection of such traits as 'negative enhancement'. The label 'negative', however, seems to run counter the intentions of parents who choose to select for deafness as a valued trait (Camporesi 2010). In the United States, selection for such traits has been allowed, on the basis of the exercise of rights of a minority to carry on their bloodline (Sanghavi 2006) with which state authorities should not interfere (Robertson 2003). Feminist scholar Jackie Leach Scully has criticised how the case of 'choosing deafness' has 'become something of a staple of bioethical teaching and debate', pointing out how this case has been discussed without any attention whatsoever to the empirical realities that, on the contrary, 'demand careful examination' (Scully 2017, p. 211).

Sociologists Sarah Franklin and Celia Roberts' innovative fieldwork on PGD in the UK (2006) has provided the first empirical (ethnographic) data on why and how parents choose PGD. Their work has shed light onto the experiential world of couples undergoing PGD

treatment and shown that one of the main reasons for resorting to PGD is the desire to eschew the emotional distress of repeated terminations, which can be avoided by selecting 'healthy' embryos. Franklin and Roberts also showed how assisted reproduction through IVF and PGD often becomes a means to re-establish traditional family norms, and meet societal expectations of forming a biological family (Franklin and Roberts 2006). Building on Franklin's work, anthropologist Charis Thompson (2005) has analysed the role of IVF and PGD in the US as biotechnological innovations 'to make parents'. Resonating with some of the findings of Franklin and Roberts' study, Thomson described the ways in which assisted reproduction clinics become normative and normalising of the ways in which couples, especially women, become 'good' fertility patients, and good parents. In other words how their bodies become 'disciplined' by the technology. The comparative work carried out by sociologist Yael Hashiloni-Dolev in Israel and Germany shows how social and religious factors can lead to dramatically different policies regarding PDG: liberal in the first case, very restrictive in the second (Hashiloni-Dolev, 2007).

Parallels between PGD and eugenics have been drawn since the very introduction of PGD in assisted reproduction (e.g. Duster 2003, King 1999, Testart 1995). The groundbreaking book by sociologist Troy Duster in 2003 was one of the very first works to connect essentialist thinking in genetics with a re-legitimisation of old mythologies typical of eugenics thinking. A comprehensive analysis of the literature on reproductive genetic technologies such as PGD and eugenics was conducted by one of the authors (Cavaliere 2018). The results show that while some scholars understand the relationship between the history of eugenics and these technologies in terms of continuity (Garver & Garver 1991, Garland-Thomson 2012, Habermas 2003, Koch 2010, MacKellar and Bechtel 2014), others do not and emphasise the discontinuity between past and present (Agar 2008, Selgelid 2000, Suter 2007, Douglas & Devolder 2013, Glover 2006, Savulescu and Kahane 2009). While the latter use the term 'eugenics' in a pejorative sense, the former have attempted to rescue the word from its negative connotation by adding the adjective 'liberal' or the prefix 'neo' or 'new'. The difference with past eugenics, they argue, is that the parents, not the State, are the *loci* of control for reproduction. Parental autonomy becomes an extension of the individual right to 'reproductive freedom' or 'procreative liberty' to make one's own choices regarding reproduction (Buchanan et al. 2001, Robertson 2003). Other scholars such as American political scientist Bruce Jennings (2000), American legal scholar and bioethicist Sonia Suter (2007) and Australian feminist philosopher Catherine Mills (2011; 2015) have discussed in their work why the discourse of 'choice' is not appropriate in the context of reproductive genetic technologies. In particular Mills (2011) argues that the discourse of 'choice' creates a false dichotomy between a duty to give children the best possible chance in life, and the duty of accepting them as they are. It is a false dichotomy because the existence itself of the genetic technologies shapes what kind of decisions are available to prospective parents, and because social conditions mediate the use of genetic technologies in a classic instance of co-production of science and society (Jasanoff 2004). Ultimately, as argued by historian of medicine Ilana Löwy (2014), it is very difficult to disentangle the intentions of the individuals when using reproductive genetic technologies, from the societal conditions that make those decisions possible.

Although medical genetics as a discipline has strived to distance itself from a history of gruesome eugenics by being non-directive in the context of reproduction (Biesecker 2001, Broberg and Roll-Hansen 1996), fears of eugenics remain central in both public and scholarly debates around reprogenetics. Scholars debate the definition of 'eugenics', which practices should be labelled 'eugenic' and whether labelling a practice as eugenic warrants its moral condemnation. However, all definitions share an understanding of eugenics as 'the attempt to

improve the human gene pool' (Wilkinson 2010). Contrary to conventional wisdom, eugenics programmes were not limited to Nazi Germany; they were carried out in France, Italy, South America, the United States and Scandinavia. In addition to their geographic ubiquity, eugenics programmes, ideas and policies carried forward from the end of the nineteenth century well into the twentieth century, up to the 1970s in certain countries such as Sweden (Bashford 2010, Broberg and Roll-Hansen 1996, Lombardo 2008). It is a fear of a slippery slope to 'bad' eugenics that underlies restrictive regulations in assisted reproduction and screening technologies in countries such as Germany (Brown 2004). In Italy, it is the influence of the Catholic church and the associated belief that human life starts at conception that have had a major influence on the drafting of strict legislation against 'eugenics' programmes (Fenton 2006). Despite the effort of many scholars to provide a nuanced account of a multifaceted movement (Bashford 2010, Koch 2004, Lombardo 2008, Paul 1984, 1992), a common reference point for discussions of reproductive genetic technologies remains Nazi Eugenics.

Critics of enhancement, or as they are sometimes referred to by those in favour of enhancement and proponents of transhumanist agendas, 'bioconservatives', approach the discussion of genetic technologies in reproduction from the point of view of what it means to be a good parent. In his well-known 2004 essay 'The Case Against Perfection', American political philosopher Michael Sandel argues that we should 'appreciate children as gifts' and accept them as they are, and that doing so is a hall-mark of the virtuous parent. Sandel is not completely opposed to reproductive genetic technologies, but refers to the therapy/enhancement distinction to argue that these technologies should be used only for therapeutic purposes. According to this interpretation, a therapeutic intervention aims at restoring health (or, following Boorse [1977], species-typical normal functioning) and hence is ethically sound, whereas an enhancing intervention is aimed at going beyond this allegedly 'normal' status and, hence, is ethically problematic. However, from an ontological perspective, as scholars such as Kingma (2007), Scully (2014), Scully and Rehmann-Sutter (2001), Miriam Eilers et al. (2014), Mills (2011, 2015), and Christina Schües (2014) have pointed out, no definition of health can ever be value-free: what counts as normal and as healthy is context-dependent and value-laden, and, consequently, so is the concept of enhancement. It is in this sense that the normal is always inescapably normative. Daniels (2000) adopts a limited defence of the therapy/enhancement distinction, which seems to be a plausible middle ground for an initial demarcation of what counts as therapy (which, according to Daniels, should be prioritised), and what counts as enhancement (which should be handled with more caution). Bioliberals such as Savulescu and Harris argue instead that the therapy/enhancement distinction is not only ontologically on fragile grounds, but also irrelevant from a moral point of view. They argue that both therapy and enhancement should be granted in order to promote individuals' well-being, regardless of statistically imposed measurements and evaluations.

While PGD allows us to genetically test human embryos and to implant subsequently only those free from the prospective parents' genetic mutation, CRISPR genome editing technologies, instead, allow the targeted editing of human embryos in order to 'correct' specific mutations and possibly modify other traits before implantation. This technology is a RNA-guided tool composed of two parts: CRISPR (clustered regularly interspaced short palindromic repeat) and CRISPR-associated proteins (CAS). The RNA tool (CRISPR) functions as a guide for the CRISPR associated proteins to target and cleave specific sites in the genome (Dance 2015). The publication in April 2015 by a group of Chinese scientists of their experiments using CRISPR on human embryos (the first such reported case) ignited the controversy around CRISPR genome editing and eugenics (Cyranoski and Reardon 2015). Public responses in the United Kingdom and in the United States on the ethical standing of doing research with CRISPR on

human embryos have diverged (Camporesi and Cavaliere 2016). While in the United States the announcement of the Chinese scientists raised calls for moratoria from the scientific communities (Baltimore et al. 2015), in the United Kingdom reactions have been generally more positive with scientists such as Robin Lovell-Badge and bioethicists positioning themselves against a moratorium. Among the voices arguing in favour of a moral obligation to allow CRISPR genome editing on human embryos we can find 'bioliberals' such as Julian Savulescu (Savulescu et al. 2015), and John Harris (Harris 2016). Bioliberals view the individuals' right to enhance as an extension of the sovereignty on one's own body (Agar 2008, Glover 2006, Harris 2005, Robertson 2003).

Genome editing could potentially become a tool for enhancement because it allows parents to express preferences on the genetic endowment of their future offspring. As a result, the 'ultimate' comparison with eugenics is drawn, as one could imagine that if CRISPR genome editing were used by a large enough number of people, it would change the composition of the human species, or lead to two different kinds of sub-species within *H. Sapiens*: the genetically engineered, and the 'natural'. This scenario is opposed by bioconservatives who fear that the modification of the human genome will eventually lead to a world of post-human creatures (Fukuyama 2003) and to the loss of typically human qualities (Sandel 2004), whereas it is welcomed by bioliberals such as Harris and Savulescu who do not grant any moral value to the 'natural' status (whatever that means) of our genome. A two-tier society of enhanced and un-enhanced, however, would lead to the exacerbation of existing societal inequalities between the haves and have-nots. There are reasons for a cautious approach to the governance of reprogenetics that takes into account such disparities.

American sociologist and bioethicist Erik Parens adopts an intermediate view between bioliberals and bioconservatives. In his 'Made to Order' essay discussing CRISPR genome editing technologies (2015), Parens points out the intrinsic tension between parental duty to nurture and cultivate their children's talents, and parental duty to accept their children as they are. Parens adopts a genetic exceptionalism position where he argues that there is a morally relevant difference between intervening on existing children with genetic technologies (or other more traditional means of intervening in education and childrearing), and intervening on human embryos with genome editing technologies to 'tailor' children.

While applications of CRISPR genome editing to human embryos are still speculative, another genetic technology called non-invasive prenatal testing (NIPT) has recently entered the moral economy of reproduction. NIPT is based on the analysis of cell-free DNA fragments (cfDNA) that originate from both the mother and foetus and can be found in the maternal blood circulation. It is used during the first trimester of pregnancy to make a decision about whether or not to carry forward the pregnancy. The NIPT test requires taking a small maternal blood sample at about 8–10 weeks of pregnancy; cfDNA in the maternal blood is then analysed to screen for any chromosomal abnormality in the foetus. NIPT allows for highly accurate detection rates (over % 99.5) for the three most common trisomy conditions present at birth (Down syndrome, Edwards syndrome and Patau syndrome). In 2016, the UK Government recommended that NIPT should be implemented through the NHS as part of prenatal screening. Disability activists immediately raised the concern that the introduction of a screening test apparently free of 'risks' for the mother (if we understand 'risk' only in a narrow sense as risk of miscarriage) could increase the number of terminations for children with Down syndrome, and that in the future the technology coupled with whole-genome-sequencing could lead to the eradication of a plethora of different traits. Tom Shakespeare (2006, 2013) author of 'Disability Rights and Wrongs' is now chairing a working group of the Nuffield Council on Bioethics on NIPT (Nuffield Council NIPT 2017). A report from this work, while having no

binding power, will be used as evidence in the Parliament in the discussion of the type of conditions for which NIPT should be used.

Tensions arise from the use of genetic technologies in the context of reproduction, which are reminiscent of dilemmas that have been the crux of parenting and childrearing for as long as humanity has been reflecting upon childhood. What has changed are the resources available to parents – for example, the availability of genetic technologies not only to screen which children to bring into the world (through PGD or NIPT), but also to intervene directly on human embryos (through CRISPR genome editing). Genetic technologies offer us new ways of shaping future generations, both at the level of identifying among existing children those who will have a better potential for a certain path and at the level of editing the human embryo and shaping what kind of people to bring into the world. Some authors (including the authors of this chapter) reject the underlying genetic exceptionalism (the view that our genes raise some special claim of ethical concern) that motivates this thinking. In doing so we are in agreement with Lewens (2015) who argues that genetics means to impact future generations should be put on the same level as other, more traditional, ways of impacting future generations. Unfortunately, as pointed out by American evolutionary biologist and historian of science Stephen Jay Gould (1996), biological determinism (of which genetics is only the latest form of biological measurement, after the measurement of skulls or of 'intelligence' through IQ tests) comes and goes in cycles. It also appears to rise in popularity in times of political retrenchment, when the latest advancements in science are used as a means to explain social differences.

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