The Interim Plus + + + + + +

Curriculum Learning Resource

November, 2021 Volume 21 No. 9

The *Interim Plus* is a curriculum learning resource specifically designed to assist teachers in integrating life issues, from a moral perspective, into their lesson planning. The periodical is published bi-monthly by *The Interim* Publishing Company, 157 Catharine St. North, Hamilton ON L8L 4S4 TEL 416-204-1687 interimplus@theinterim.com
Editor: Dan Di Rocco

This next to last curriculum resource for 2021 focuses on the ethical quagmire of the CRISPR biotechnology. Also, included is a final reminder that December 1, 2021 is the deadline for submissions to the **Father Ted Colleton Scholarship.** The December edition will include a reflection on the meaning of Christmas in a pandemic-riddled era.

PART A

Last edition we introduced the emerging issue of CRISPR biotechnology and the scientists responsible for its creation. In this edition we want to dig a bit deeper into the questions facing humanity as it grapples with biological and business ethics. In this first section of *The Interim Plus* we explore the CRISPR technology's impact on fundamental convictions and beliefs when the biotechnology is used in germline gene editing. The introductory abstract broadly outlines the controversial views associated with the implementation of CRISPR, the problem in building a consensus and the trangressions of scientists in pursuing important but potentially dangerous breakthroughs. Although a long and difficult reading it is still manageable in a high school setting with teacher guidance. The many questions posed at the conclusion of the abstract can serve as both a guide for reading the document and a catalyst for class discussions on its major points. The title of the abstract states the intention of the authors.

CRISPR in Context: Towards a Socially Responsible Debate on Embryo Editing

By Michael Morrison & Stevienna de Saille

Palgrave Communications volume 5, Article number: 110 (2019) Cite this article

Following the birth in 2018 of two babies from embryos altered using CRISPR-Cas9, human *germline gene editing (GGE)* moved from abstract concern to reality. He Jiankui, the scientist responsible, has been roundly condemned by most scientific, legal and ethical commentators. However, opinions remain divided on whether GGE could be acceptably used in the future, and how, or if it should be prohibited entirely. The many reviews, summits, positions statements and high-level meetings that have accompanied the emergence of CRISPR technology acknowledge this, calling for greater public engagement to help reach a consensus on how to proceed. These calls are laudable but far from unproblematic. Consensus is not only hugely challenging to reach, but difficult to measure and to know when it might be achieved. Engagement is clearly desirable, but

engagement strategies need to avoid the limitations of previous encounters between publics and biotechnology. Here we set CRISPR in the context of the biotechnology and fertility industries to illustrate the lessons to be learned. In particular we demonstrate the importance of avoiding a 'deficit mode' in which resistance is attributed to a lack of public understanding of science, addressing the separation of technical safety criteria from ethical and social matters, and ensuring the scope of the debate includes the political-economic context in which science is conducted and new products and services are brought to market. Through this history, we draw on Mary Douglas' classic anthropological notion of 'matter out of place' to explain why biotechnologies evoke feelings of unease and anxiety, and recommend this as a model for rehabilitating lay apprehension about novel biological technologies as legitimate matters of concern in future engagement exercises about GGE.

Introduction

On 25 November 2018, on the eve of a major scientific summit in Hong Kong, a Chinese scientist named He Jiankui made a startling announcement: as a result of experiments conducted at his clinic, the world's first genetically edited babies had been born (Regalado, 2018b).

The news was tumultuous and unexpected. Deliberately making permanent, heritable changes to the genes of a human embryo and implanting it with the intent to establish a pregnancy has long represented a moral boundary, one that is prohibited in a number of countries, including the US (Araki and Ishii, 2014). The announcement was unexpected not because the technical possibility itself was unanticipated—techniques to alter the genetic material of living cells have been around since the 1970s, and scientists have long expected they could one day be used for this purpose—but because human applications have remained limited due to concerns about safety and efficacy, even as modification of bacteria, plants and animals has become routine.

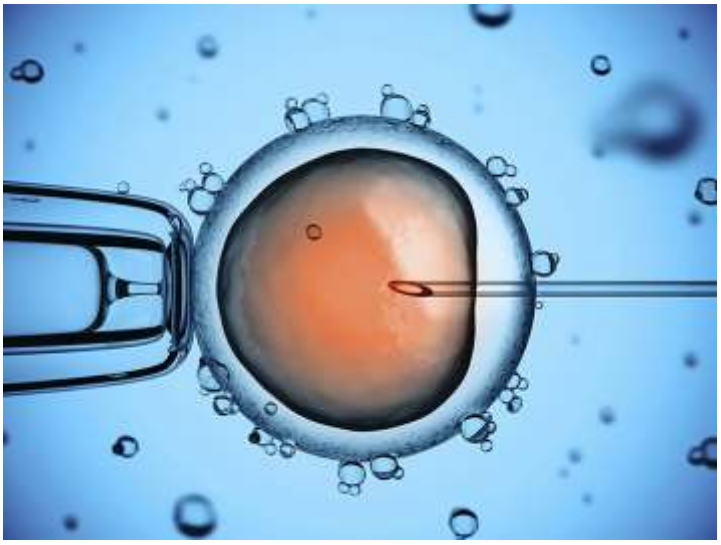


Image of IVF https://dphx.org/respect-life/know-the-issues/in-vitro-fertilization/

The discovery in 2012 of a system known as CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) has now substantially changed the field. CRISPR utilises a natural function of bacteria, which is faster, cheaper and easier to use than earlier techniques to target and change DNA. Such technologies are sometimes described as 'foundational' or 'gateway' because they have broad application and offer advances over existing practices, resulting in rapid, far-reaching adoption across a range of sectors (Feeney et al., 2018). By 2017 papers describing experiments using CRISPR-Cas9 (Cas9 being a protein 'scissors') were triple those of earlier techniques combined.Footnote1

The potential for CRISPR and similar tools to make inheritable changes to human embryos, known as germline genome editing (GGE), is particularly challenging to regulate at the global level. Where human clinical applications of somatic (non-heritable) genome editing must proceed through a framework of cost-benefit analysis, clinical trials and regulatory review prior to any marketing approval (Nicol et al., 2017), germline modifications are already being framed as an assisted reproduction technology (ART). Fertility services, which allow evaluation and selection of embryos bearing certain characteristics, including pre-implantation genetic diagnosis and in some countries sex selection, are already provided through an array of largely private clinics in countries around the world (Spar, 2006; Whittaker, 2011) and some scientists (including He) have already indicated interest in opening IVF clinics specialising in embryo editing (Begley, 2019; Cohen, 2019).

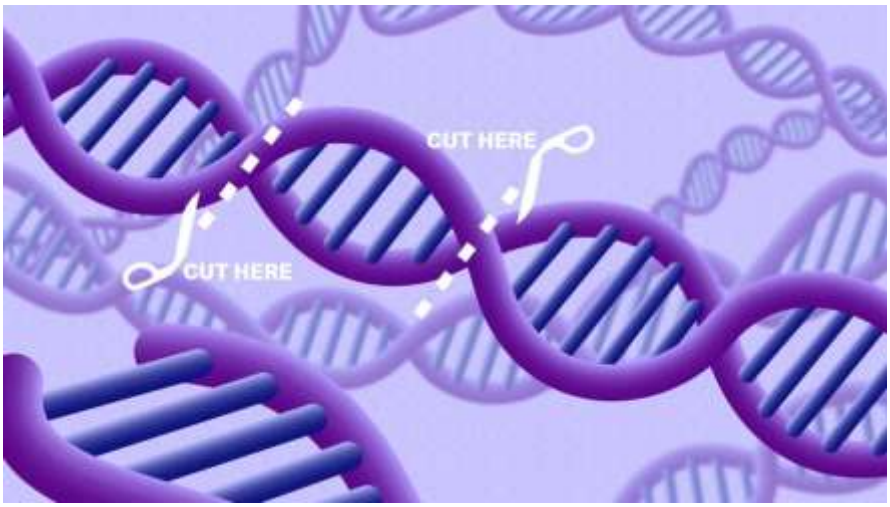
Some jurisdictions, such as the UK, take a 'strict but permissive' approach with stringent oversight from a national regulatory body, in this case the Human Fertilisation and Embryology Authority (HFEA). At the international level, however, the institutions, extent, and substance of regulation varies considerably between jurisdictions, depending on their resources, culture, legal framework, style of government and prevailing morality (Araki and Ishii, 2014; Roseman et al., 2019). This raises the very real possibility of GGE being incorporated into the existing phenomenon of 'reproductive tourism' where people cross national borders in search of assisted reproductive services, such as surrogacy or the use of anonymous donor gametes, that are not permitted in their own country (Roseman et al., 2019). The difficulty of regulating untested and unproven

medical interventions at the global scale has also previously been demonstrated with the growth of the private stem cell treatment industry (Petersen et al., 2017).

Recognising both the ethical issues and the rapidity with which the field was expanding, two of the scientists on the original CRISPR discovery team, Jennifer Doudna and Emmanuelle Charpentier, published a review paper in *Science* in which they concluded that:

The era of straightforward genome editing raises ethical questions that will need to be addressed by scientists and society at large. How can we use this powerful tool in such a way as to ensure maximum benefit while minimising risks? It will be imperative that nonscientists understand the basics of this technology sufficiently well to facilitate rational public discourse. Regulatory agencies will also need to consider how best to foster responsible use of CRISPR-Cas9 technology without inhibiting appropriate research and development. (Doudna and Charpentier, 2014, pp. 1258096–7). He Jiankui's revelation has added impetus and urgency to these questions, not so much because of *what* he did, but *when*. A number of prominent scientists have argued that there can be instances where editing the genome of an embryo may be not only ethical, but a moral obligation if a child would otherwise be born with a serious disease (Baltimore et al., 2015). However, He proceeded with his experiment before any general agreement that the science or the public were ready for this step. Several prominent CRISPR scientists have now issued calls for a global moratorium on editing embryos (Lander et al., 2019),Footnote2 while others insist that He's experiment, although badly done, shows that GGE is ready to move ahead with more rigorous, ethical oversight in place (Cohen, 2018), but calls for public dialogue to 'create a societal consensus' form the basis of legitimacy for both sides of the argument (Rosemann et al., 2019). Thus, a number of critical questions remain unanswered, even unasked.

Image courtesy https://kilobaser.com/crispr-cas9-a-manifold-tool-for-genome-editing/



Although the call for societal engagement is laudable, we argue it also requires careful examination. Despite the massive press coverage of He's announcement, there has so far been no major public protest about GGE, such as those that accompanied gene patenting (Parthasarathy, 2017), GM crops in Europe (Jasanoff, 2011) or recent plans to release genetically modified mosquitos in Florida (Mole, 2016). Moreover, survey after survey indicates that people are generally supportive of somatic (i.e., non-reproductive) genome editing, only somewhat supportive of editing which can be passed to future generations, and overwhelmingly against editing for non-medical reasons (see, for example, Hendriks et al., 2018; Lawton, 2018; Michie and Allyse, 2019; Pew, 2016; Wipperman and Campos, 2016). From this, one might even argue that the public's consensus position is already clear.

In order to understand why the call for consensus on GGE is still repeated by prominent scientists, clinicians and academics, we need to consider CRISPR in context. This means looking at GGE in light of the history and organisation of biotechnology, and of assisted reproductive technologies (ART), rather than viewing the 'CRISPR babies' as an isolated aberration. As we shall discuss, setting GGE in the broader context of biotechnological innovation reveals serious flaws in simplistic calls for dialogue, and highlights instead the issues that do need to be the subject of serious debate, but are rarely discussed: (1) the continued separation of 'technical' issues of safety and efficacy from 'moral' issues associated with the technology; (2) lack of attention to the infrastructure and practices of the for-profit fertility industry through which embryo editing will potentially be offered to the public; and (3) an over-simplistic formulation of 'consensus'. In the following sections, we will discuss each of these as part of the history of biotechnology. To clarify our analysis, we will use Mary Douglas' concept of 'matter out of place' as a lens through which to understand, and rehabilitate the concerns raised by various publics about novel biotechnologies, from Dolly the cloned sheep to 'designer babies'. Adapting this stance for future engagement activities about GGE, we argue, provides a way of avoiding a narrow separation of safety risks from broader societal concerns, and reintegrates discussion of science policy and the role of the private sector as a legitimate part of the public conversation.

A brief history of biotechnology

First generation' genetic modification is an important antecedent of contemporary genome editing technologies like CRISPR (Martin et al., 2019). Recombinant DNA (rDNA), in which sequences of DNA are cut out of, or added to the 'host' DNA in the living cells of an organism, was invented in the early 1970s by researchers working at Stanford University and the University of California, San Francisco. Although excited by the possibilities this new technique opened up, there was also concern about potential undesirable effects, especially since many of the first organisms to be genetically modified were bacteria. As an initial response, a moratorium on further genetic engineering was voluntarily imposed by the (relatively small number of) scientists working with rDNA. In 1975, at the now-historic Asilomar meeting, this temporary ban was replaced with a set of self-developed guidelines under which scientists felt the field could safely proceed Baltimore et al., 2015) and which has to some extent guided all experimentation involving manipulation of DNA since. The possibility of using rDNA technology to modify human genetic material has been part of the conversation, though not practice, from the beginning. Following an unapproved, and unsuccessful, attempt in 1980 to treat sickle cell disease using rDNA (see Beutler, 2001), the US President's *Commission for the Study of Ethical Problems in Medicine, and Biomedical and Behavioral Research* issued a report, 'Splicing Life' (1982), which codified and popularised two key distinctions that continue to shape discussions of human genetic modification to this day: treatment of disease versus enhancing normal human characteristics, and making non-inheritable changes to the genome of individual patients versus making changes to embryos, sperm or eggs that can be passed on to future offspring—often described pejoratively in popular accounts as creating 'designer babies' (Nerlich, 2017).

While these events were unfolding, research was being carried out in a number of seemingly unrelated areas that would nonetheless have an important role in eventually making GGE a practical reality. In 1977, Frederick Sanger and colleagues developed the technique known as 'Sanger sequencing', allowing scientists to better read the sequence of letters (or 'base pairs) in DNA. The following year, the birth of Louise Brown in the UK proved that conception could occur outside the human body, through the technique of in vitro fertilisation (IVF) developed by Robert Edwards and Patrick Steptoe. Together, these events made the human embryo available for direct experimentation and provided the beginnings of a toolkit for manipulating its DNA.Footnote3

By the early 90s, genetic sequencing had advanced sufficiently to make it feasible, if hugely ambitious, to attempt to sequence a complete set of human DNA, forming the basis of the international Human Genome Project (HGP). The 90s also saw the birth of Dolly the Sheep, the first large mammal to be successfully cloned; commercialisation of the first crops genetically modified using rDNA technology; derivation of stem cells from human embryos; and the 'ear mouse', produced by engineering a structure resembling a human ear on the back of a laboratory mouse. More recently we have seen the production of 'admixed' embryos containing both human and animal material and mitochondrial transfer (i.e., combining cytoplasm from one egg with the nucleus of another) to produce so-called 'three-parent babies'. These technologies have been highly controversial in some countries (Baylis, 2013; Cook-Deegan, 1994; Knoppers et al., 2017; Marris, 2001; Mulkay, 1997) but allowed in others. Pre-implantation genetic diagnosis (PGD), for example, is particularly contentious in Germany because of its association with Nazi-era eugenics, whereas the UK allows admixed embryos, PGD and mitochondrial transfer under specific circumstances, overseen by the HFEA. All of these advances have also involved contestation by various 'lay' publics,

Image courtesy **https://geneticliteracyproject.org/2019/02/18/public-opposition**

i.e., people and groups who are neither professionally trained in the life sciences nor officially charged with oversight of biotechnologies, such as the staff of regulatory agencies or members of ethics panels. Even when unsuccessful, such opposition is, we hold, still significant if calls for socially responsive steering of science and technology are to be taken seriously. By this, however, we do not mean to suggest there is some homogeneous 'general public' that has a single voice and set of concerns. on high-level consensus engagements that are not actually fit for the purposes of real governance.

Opposition typically comes from a variety of publics, brought into being around different issues through a variety of methods, and not necessarily in the same place or at the same time. These include protests and boycotts, official engagement events, attitude surveys and televised debates, all of which are seen as representing a 'public voice', yet this is by no means a *unified* voice.

In the following sections, we discuss these frictions as part of the business of science, detailing how previous encounters affect the context of deployment of CRISPR, the separation of technical from ethical issues, and place an emphasis

The business of science

The constant stream of new biotechnologies that began in the latter half of the twentieth century is not co-incidental. The era of biotechnology aligns with a profound shift in the political and economic landscape of science. National governments, the major funders of academic science, increasingly look for a return on their investment of public money in research in the form of new products and services that can foster national economic growth (Hessels et al., 2009). Scientific knowledge is privatised through intellectual property rights, and companies are commonly 'spun-out' of university departments to exploit knowledge and technologies developed by their academic scientists. For example, rDNA was patented in 1974 by the scientists who discovered it and subsequently licenced by Stanford University to various commercial developers for a fee, plus a share of royalties from subsequent products (Feeney et al., 2018). The Bayh-Dole Act of 1980 formalised this approach by incentivising US scientists and universities to patent and commercialise the products of government-funded research. A US Supreme Court decision of the same year, *Diamond* vs. *Chakrabarty*, allowed intellectual property rights to be granted on a living organism. Other nations, with greater or lesser alacrity, have adopted and adapted this US approach to science as a source of economic growth and national competitive advantage (Rajan, 2006). GM plants and animals, stem cells, genetic tests and processes for creating 'life itself' are all now commercial products, patented and traded by start-up firms and multinational companies in a highly lucrative 'bioeconomy'. Nowhere has this shift from publicly funded experiment to profit-driven sector been more evident than the fertility industry. Within a few years of Louise Brown's birth, in vitro conception had evolved from an experimental procedure in which few scientists were interested, into a rapidly burgeoning industry dependent upon aggressive marketing and constant innovation, the brunt of which is borne by women, upon whose bodies the entire process depends (Rowland, 1992). As IVF is a platform technology, making the human embryo scientifically accessible quickly gave rise to associated services such as surrogacy, sex selection and PGD, which have continued to be controversial, expensive and unevenly governed on a global basis.

In both the fertility and the larger biotechnology industry, national policy, which sees science as a source of international competitiveness, prestige and economic growth, has helped to foster rapid application of each new discovery. Australia, for example, funded IVF research with the explicit goal of putting the country on the international map, and by 1984, the team at Monash University in Melbourne had overtaken the UK as the world-leader with a series of other firsts, including twins, triplets, babies born from donor eggs and from frozen embryos (Kannegiesser, 1988). Thus, national aspirations also act as an engine for pushing biotechnologies out of the laboratory and into the public sphere, where they often become controversial because of their seemingly sudden impact on everyday life, from what we eat to how we reproduce.

Rapid innovation, particularly through embryo experimentation, also prompted regulatory responses from a number of nation states throughout the 1980s. The Warnock Commission (UK) proposed that research on embryos could be permissible up to 14 days, but that no embryo that had been altered could be returned to the womb with the intention of creating a child (Warnock, 1985). This regulatory model has had such a widespread influence that "almost every country in which embryo research is specifically permitted by regulation, soft or hard, employs a version of the 14-day rule" (Chan, 2018, p. 228).

The successful early reframing of IVF from 'experimental' to infertility 'treatment', even for conditions where infertility is not the issue (such as artificial insemination for single women, PGD for embryo selection, or surrogacy for social reasons) has relied upon the argument which supports most biomedical innovation: that it will alleviate human suffering. Moreover, the field has successfully embedded the logics of clinical experimentation, in which patients have a right to unproven treatments if they and their doctor think it may confer benefits worth the risks (Baylis, 2013). While public funding of basic research was essential to development of the field, private clinics have also existed almost from the start, including Bourn Hall in the UK, founded by Edwards and Steptoe in 1980. With most public healthcare systems now providing only limited access to IVF and related services, a global market for private assisted reproductive services has emerged, both in western countries (Spar, 2006;

Van Hoof and Pennings, 2011) and increasingly in Asia (Whittaker, 2011). As a result, what is now more broadly called *'fertility* treatment' has grown into a highly lucrative globalised industry where those with the money to travel can purchase services which are unavailable or even illegal at home, and innovation takes place in an atmosphere of secrecy and fierce competition. The recent birth of the Chinese twins shows that, as with virtually all innovation in assisted reproduction, experimentation can go unnoticed, even be deliberately hidden, until a 'success' can be announced.

Separating the technical from the moral

Unease, disquiet and even disgust at the rapid appearance of biotechnology has been memorably characterised as the 'yuck factor' by philosopher Leon Kass (1998), who identifies it as part of a 'wisdom of repugnance' stemming from a natural human recognition of things that are ethically dubious. However, other philosophers have viewed this as an uninformed and thus discountable emotional reaction, rejecting the idea of the 'unnatural' as having any moral validity (e.g., Kaebnick, 2012). In keeping with this line of thought, opposition to technology is often characterised by scientists, policymakers and technology companies as irrational or opposed to science and progress, a stance closely associated with what has become known as the 'deficit model' of public understanding of science (Davies, 2006; Marris, 2001; Simis et al., 2016; Wynne, 2001). Put simply, the deficit model posits that public unease about novel science and technology is a result of poor scientific literacy; therefore, educating the public about the science behind new technologies will foster acceptance.

Leon Kass *Image courtesy Hertog Foundation*

Governance of science and technology also tends to leave 'societal' concerns outside the scope of formal regulatory oversight (c.f. Levidow and Carr, 1997). For example, the US Patent and Trademark Office has argued it cannot incorporate consideration of the moral and social aspects of granting intellectual property rights on living materials into its remit because this would introduce an unacceptable element of uncertainty into assessment procedures which must remain objective (Parthasarathy, 2017). In other instances, societal concerns may be acknowledged by a regulatory agency but still considered separately from its technical remit, through public fora and engagement exercises such as those deployed by the HFEA during the debates over allowing the creation of admixed embryos to alleviate the shortage of human ova for stem cell research (Dyer, 2008). In the European debates over regulation of GM foods, most engagement occurred after vociferous public resistance to an approved product, in the hope of creating enough acceptability (often through attempts to de-legitimise non-technical concerns) to allow the original agenda to proceed. Particularly because of the continued European rejection of GM, 'upstream' (i.e., research-stage) engagement is now often regarded as a tool to prevent these kinds of market failure (Marris, 2015).

The equation of non-technical concerns with ethics (Levidow and Carr, 1997) also means that public debates are often framed in terms of whether it is *morally* permissible to undertake a particular scientific act, such as destroying an embryo or changing the genetic make-up of a living organism. This is perhaps most vividly illustrated in the creation of a separate line of scholarship about the ethical, legal and social issues (ELSI) arising from the HGP (Myskja et al., 2014). Combined with the deficit model, this means exercises are often framed so that technical assertions cannot be challenged, reinforcing the idea that objections reflect an ill-informed response. Wider discussions about the commercialisation of science, economic aspirations of national governments, and the role of the private sector in envisaging what future agriculture, medicine and reproductive health services should look like, are said to be outside the remit of regulation. Moreover, approaching each novel biotechnology as a discrete entity precludes adequate consideration of the way discoveries build on and integrate with one another, so that—as with designer babies until this year—controversial possibilities for application can then be dismissed as 'too far in the future to be worthy of debate'.

Oversimplifying consensus

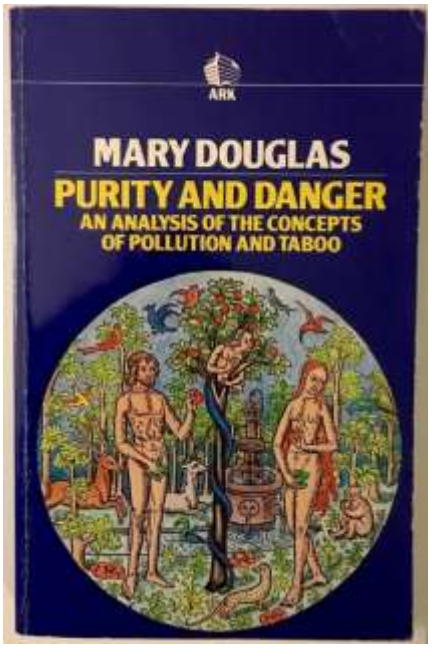
Well before He Jiankui's activities, genome editing was the subject of a plethora of high-level meetings, workshops, reports and position statements by groups ranging from national funding organisations to supranational political entities and learned societies (The Hinxton Group, 2015; Nuffield Council on Bioethics, 2016; National Academy Of Sciences; National Academy Of Medicine, 2017; Nicol et al., 2017; Garden and Winickoff, 2018). While these differ in their focus, e.g., whether they deal exclusively with human applications or consider genome editing in a variety of organisms, virtually all reports and statements call for robust public engagement in order to determine the trajectory of research and eventual applications of the technique.

However, it remains unclear how any resulting public consensus should be measured, let alone how it is expected to be achieved.

Whether by design or serendipity, calls for public consensus allow science to continue pushing at the moral boundaries already in place, testing for strengths and weaknesses to see where pressure may be applied. In part, this is because public engagement has generally been the task of ELSI scholars, while the natural scientists and clinicians get on with the work. This is clearly demonstrated in both the discussions and the division of expertise in the panels at the Human Gene Summits of 2015 and 2018. However, there is virtually no likelihood that, should consensus fail to appear, further research and application of CRISPR to the human germline will not proceed.Footnote4 Just as assisted reproduction has expanded into a cross-border industry where would-be parents frequently travel in order to obtain reproductive services that are illegal in their own country, IVF doctors pursuing controversial innovation also move or open satellite clinics in jurisdictions that are less restrictive (Rosemann et al., 2019).Footnote5 Because courts tend to rule that preservation of family bonds, including non-prosecution of parents who break the law, is in the best interest of the child (Van Hoof and Pennings, 2011), this has meant almost any prohibited procedure is available somewhere. Similar dynamics have also been seen with the spread of stem cell clinics (Petersen et al., 2017) which rests on the patient's perceived 'right to try' even risky, unproven procedures. Ultimately, there is a real danger that the stand-in for 'public consensus' will simply be that some people are willing to go anywhere and pay any price to have what they want.

To be meaningful and useful, public debate must therefore move beyond the goal of consensus, which implicitly suggests that there is a single voice, or agreement on how to move forward, that can and must be found. Taking public concerns seriously (that is, as rational and legitimate) also means recognising that there are multiple publics and indeed multiple rationalities, and that debate over any particular biotechnology will almost certainly play out differently in different contexts. If consensus means that everyone, or at least the vast majority of people, must agree that a technology is acceptable, then true consensus is very rarely if ever achieved at a societal level—never mind on a global scale. If debates about using CRISPR to create genetically modify human embryos are to avoid simply repeating the same arguments which have existed since the 1970s, then new approaches are needed that go beyond the polarised notion of rational science versus irrational ignorance, and technical versus moral concerns. This means opening up debates involving both lay people *and* scientists to include discussion of the context—including the economic and regulatory context(s)—in which GGE will be deployed. Achieving this is not simply a matter of doing 'better' engagement—at least not without a discussion of what 'better' might mean. In the next section, we present an alternative approach to understanding public concerns with biotechnologies, with a view to informing our recommendations on the future of germline genome editing debates.

Biotechnology, hybridity and matter out of place



In her now-classic anthropological study, *Purity and Danger*, Mary Douglas (1966 [2001]) set out to explore why some objects, behaviours, or situations are considered 'clean' or 'pure' while others are regarded as 'dirty', 'polluting' or 'contaminating'. One of her key findings was that there is rarely any universal substance or action that is considered 'dirty', but what almost all societies think of as 'dirt' is something that is *not where it is supposed to be*, i.e., it is 'matter out of place'. Boundaries and categories, whether formal and official or tacit and unspoken, produce order, the sense of how things are supposed to be, but what is applicable in one context may cease to make sense, may even be offensive, when transposed to another. This can be illustrated with a simple example: soil found in a flowerbed is not dirt. That is where we expect it to be. However, the same soil on the kitchen floor is considered dirt and the normal response is to clean it up. It is not that 'soil' is never or always 'dirt'; rather it depends on the context and on our prior expectations of where soil ought and ought not to be.

Although Douglas' work primarily explored beliefs and practices of ritual pollution in tribal societies, the underlying anthropological understanding is equally applicable to modern cultures. Thus, it helps us see how investigation of the plasticity (or malleability) of life, which has proved so productive and useful in the laboratory, also challenges categories and distinctions that have meaning and are important in everyday life outside the laboratory.

Categories and distinctions—for example between soil and dirt, animal and human, or between the embryo in the body and the embryo in the dish, define what we think of as 'normal', 'proper', and 'expected', to the extent that we rarely recognise that they result from particular judgements and assumptions until they are in some way challenged. Things, situations or actions that cross boundaries or appear to simultaneously belong to distinct oppositional categories (hybrids) become viewed as 'dirty', 'dangerous', 'unnatural', 'monstrous' or 'impure'. Each of these accusations evokes a sense of some sort of order being transgressed, whether that order is imposed by nature, divine fiat or aesthetic and moral sensibilities. Cell culture, for example, problematizes the boundary between what is alive and what is dead or inert. Consider Henrietta Lacks, who died many years ago but whose cancer cells, in the form of the immortalised HeLa cell line, are still alive and growing in many laboratories round the world (Skloot, 2011). Reproductive cloning, mitochondrial and gamete 'donation' and surrogacy all challenge conventional ideas of family relations in terms of who counts as a parent or a sibling. Reproductive cloning also blurs distinctions as it makes a new person whose genome replicates someone already living, or perhaps already dead (the difference in age typically distinguishing cloning from ordinary twins). Genetic modification of human embryos using genome editing produces a similarly troubling hybrid: the CRISPR babies are both 'natural' given persons and engineered 'objects' of laboratory science, both who and not who they were originally 'intended' to be. Thus, hybrid biotechnologies appear to pose a threat to the shared meanings, values and rules of conduct that make communal social living and organisation possible. Part of what constitutes the yuck or fear response to these technologies, we argue, is a shared (though often tacit) sense that matter has somehow been shifted out of its 'correct' or natural place.

The hybrid-generating power of the life sciences is rarely experienced by the scientists themselves as unnatural or disturbing because the techniques they use have long since been normalised within the field. This perspective is the result of years of training to seek knowledge in a particular manner, encompassing both ontology (what kinds of objects genes, cells, embryos, etc. *are*), and epistemology (how they should best be studied and how experiments should be designed). The array of practical tools and techniques for manipulating cells, genes, proteins and other elements of living systems are learnt, along with the cognitive stance that makes sense of them, through the process of training from undergraduate to post-graduate to postdoctoral to senior scientist. This combination of a particular way of looking at the world and a set of techniques for producing knowledge based on that perspective is what Karin Knorr-Cetina (1999) described as the peculiar 'epistemic culture' of a discipline.

As Douglas (1966, p. 45) notes, "our pollution behaviour is the reaction which condemns any object or idea likely to confuse or contradict cherished classification". It is, therefore, culturally specific, but contemporary societies are much more heterogeneous and fragmented than tribal groups or the epistemic cultures of scientific disciplines. Accordingly, there is often a range of different responses and attitudes to novel biotechnologies within any given population, some of which are voiced more loudly than others. Different forms of pollution may produce a similar result, despite different cultural or epistemic rationales, or vice versa. For example, while religious groups may object to embryo experimentation because it pollutes the embryo, feminists might object to the pollution of women's bodies, because the arduous process of egg extraction means women are being asked to bear unnecessary medical risks purely to advance science and scientists' careers (see e.g., Waldby, 2008; Baylis, 2013). Thus, while both groups might oppose creating embryos for stem cell research, it would be for very different reasons and require different 'rituals of purification'.

The designation of a thing, event, deed, or person as 'dirty' and 'out of place' is rarely an unalterable verdict as "most pollutions have a very simple remedy for undoing their effects. There are rites of reversing, untying, burying, washing, erasing, fumigating, and so on" (Douglas, 1966, p. 168). Just as 'matter out of place' can be a cultural and symbolic judgement rather than a literal material one, so too can acts of purification operate as symbolic restitution, rebalancing the social order rather than fixing a physical problem. In contemporary societies, a public engagement exercise that is perceived as meaningful might act as a suitable 'rite of purification'. It is publicly enacted, so its message would be transmitted to the wider society, and its procedures must symbolise some form of democratic accountability and legitimacy sufficient to dispel lingering doubts about the danger of a 'messy' new hybrid technology. Similarly, in the widespread condemnation of He Jiankui's GGE experiment by scientific authorities and bioethicists we can see an attempt at purifying human GGE research by designating Jiankui as a 'rogue' scientist, symbolically expelling him from the global community working on the topic, and distancing his 'dirty' work from the 'pure' realm of legitimate science (e.g., Regalado, 2018c; Harper, 2018; Belluck, 2019).

At the same time, the infrastructure and practices of the biotechnology industry have become increasingly universal as more countries compete to enter the global market. Intellectual property regimes now apply to living organisms and their components (such as genes, cells and proteins), with material from plants, animals, and even people with particular characteristics extracted and invested in as sources of 'biovalue', while biotech start-ups commercialise novel discoveries through speculative investment and academic scientists increasingly act as entrepreneurs (Rajan, 2006; Waldby and

Mitchell, 2006). The sense of matter out of place can be very strong here as most cultures have not historically considered these kinds of biological material as a resource which can be patented and sold, particularly in a way that allows others to profit from our bodies in ways we cannot, as in the case of Henrietta Lacks' cancerous cells.

Thus the infrastructure of the biotechnology and fertility industries pushes matter across normative boundaries between private and public property, between publicly funded academic science and for-profit industry, between the body and the patent office, and between pure science—investigating what something is or how it works—and forms of applied science which are meant to see what things *can be made to do*. As Smits (2006, also following Douglas) has observed, hybrid entities are often seen as 'monstrous' in that they simultaneously and inextricably arouse both fear *and* fascination (see also de Saille and Martin, 2018). This makes highly visible biotechnologies like Dolly the Sheep or the 'designer baby' a focus for airing broader concerns about purity and impurity in the scientific endeavour that may otherwise fail to find an outlet. The outpouring of scientific condemnation for He's GGE procedure, although intended to 'purify' the field of genome editing, also served to reopen discussion about the moral appropriateness of the incentive structures in modern science, including the prestige associated with being the first to make each advance and the pressure to commercialise research. Ultimately, each new symbol of biotechnology evokes culturally specific reactions *and* simultaneously becomes a new instance to refight old battles.

Chimera

Applying the 'matter out of place' approach to GGE means that, rather than accepting the charge that expressions of disgust, monstrosity or unnaturalness are evidence of irrational fear and ignorance in public debates, we should actively look for what is being designated as 'dirt' by different speakers and different constituencies, and what kinds of purification rituals are being called into play. This in turn reframes GGE not as an abstract ethical question about the moral boundary of a particularly technology, but as a systemic question about the wider context of existing social structures, and the kinds of checks, incentives and rituals which will be needed to keep it—and indeed whether it is even possible to keep it—'clean'.

At the beginning of this paper, we noted that it was not just a matter of *what* He did, but *when*. He's experiment invited condemnation on a number of *what* grounds: that there are better treatments to prevent HIV transmission, that his consenting procedure was highly unethical, and that his own tests showed the edits were de novo mutations that would be ineffective to prevent HIV in one, perhaps both embryos, so there was no scientifically supportable reason to continue. These arguments would be enough to designate the experiment 'dirty', even if GGE was legal and accepted. But perhaps more important, He contravened what might be the most important cleanliness taboo because it is the only one approaching unanimous agreement by all parties in the field: that GGE is not safe enough to be used *yet*. This could be seen in arguments that the experiments were premature, and could damage the legitimacy of the field. However, He could also be seen as polluting the sacred ritual of public consensus seeking by the timing of the announcement, which effectively hijacked the carefully curated agenda of the second Human Gene Summit, turning it instead into a media circus which—as feared from the start—forced the entire field into a defensive position from which it is still trying to emerge.

CRISPR in context-towards a socially responsive debate on embryo editing?

CRISPR excites scientists and clinicians because it opens new possibilities for research and innovation, but mindful of past controversies, they also worry that a public backlash against germline genome editing could threaten both somatic (i.e., non-reproducing) genome editing and embryo research in general. This fear of a public backlash shapes the field in particular ways; even those who champion GGE for human enhancement are enjoined to limit the scope of their research to what is within their so-called social licence to operate.Footnote6 Calls not to operate before there is public consensus are a key part of this protective strategy. Thus, condemnation of He Jiankui was a necessary part of 'purifying' a polluted field.

Let us be clear that we are not arguing *against* dialogue and engagement. Our concern is that, if dialogue is to be meaningful, it must have a different purpose, as 'consensus' already appears to exist insofar as survey instruments show that public opinion is broadly similar across time and place. We offer instead the idea of 'matter out of place' as a way of working through the three main lacunae identified in discussions about novel biotechnologies: (1) persistence of a deficit model framing that presents lay opposition as resulting from irrationality, fear and/or ignorance; (2) separation into technical criteria to be assessed by

scientific experts, and moral concerns to be addressed by ELSI scholars and public engagement exercises and (3) discussion of each new technology as a separate 'ethical' issue with little or no consideration of the context within which science in general and assisted reproduction in particular is organised, funded and commercialised. These elements are best considered as acting cumulatively, with each reinforcing the other. In the preceding sections, we have tried to situate CRISPR in its context as a new biotechnology, but one which does not represent a significant departure from the trajectory of the field. Rather, the birth of two genetically edited children is the long-expected, yet still seemingly premature, culmination of experiments aimed at manipulating DNA which began in the 1970s. The history of the life sciences (especially molecular biology) is one of progressively investigating the malleability of life, so that for its practitioners moving, mixing and mutating its elements has become a perfectly normal, acceptable way of producing knowledge. However, these manipulations also transgress boundaries that are meaningful and significant in everyday life: alive/dead, old/young, human/animal/plant, etc. This may not matter when scientific research remains 'behind the scenes' in the laboratory, unless it involves things that already have a special social status, such as human embryos. However, the contemporary emphasis on the life sciences as a source of economic growth and national prestige, combined with a 'translational imperative' which regards the overriding purpose of academic research as the generation of new products and services, serves to accelerate both the volume of hybrid entities being produced and the speed at which they move 'front stage' into the public gaze.

As with the muddy road from IVF to human cloning to mitochondrial donation, sustaining boundaries between therapeutic and reproductive applications may be more difficult than might be hoped. While the boundary between somatic and germline editing is reinforced through the Human Gene Summits and other such discussions, the context in which those boundaries have been constructed (and will likely be dismantled) is not discussed. Whether one approves of GGE or not, it must be noted that He Jiankui already considered it as a 'therapeutic assisted reproductive technology' (He et al., 2018), and there are already IVF clinics eager to learn his technique (Begley, 2019). In such a highly competitive industry, history has already shown us that once one clinic innovates, the sector will shortly follow.

There is, therefore, a real danger that the lack of public protest over He's announcement will be taken for public consensus to proceed. To some extent, this lack may have been an artefact of a particular political moment in which other things—climate change, far-right extremism and an unstable White House—were dominating both news cycles and the public mind, exhausting the capacity to worry about two children born through some obscure technology in China. However, it can also be seen as a reflection of previous battles over biotechnological innovation, a kind of weariness stemming from the public's sense that we have been here many times before and there is little to be said that is new. Rather than a social license to operate, this indicates a not entirely unfounded pessimism that whatever objections might be raised, the science will continue, as has been the case with embryonic stem cells or GMOs.

We see this weariness as the inevitable result of a deficit approach which frames rational science as struggling against an ignorant public. One reason this practice continues is because it privileges scientific expertise and the scientific worldview as *the* starting point for being able to have any valid say in these discussions (Jasanoff, 2011). This allows those with technical expertise to remain on familiar, quantifiable ground in which science is a value-free account based on reason and evidence alone, and avoid questions which are non-quantifiable and outside their narrow expertise. This dualistic stance actively favours the silo approach, where scientific research is permitted to continue unimpeded with the justification of amassing the data needed to satisfy objective regulatory criteria for safety and efficacy, while non-technical societal concerns are dealt with separately as subjective matters that cannot be adjudicated by evidence. Within this context, potential harms can only be considered as issues of safety and efficacy, while contextual factors such as facilitating markets, distribution of benefits and risks, and complexities of global governance are bracketed out. Thus, the debate narrows down to the moral permissibility of a scientific procedure in the abstract, so that 'to alleviate human suffering' becomes a moral trump card, an unassailable justification for proceeding, regardless of whether human suffering is being *created* at the same time.

We find this approach unsatisfactory for a number of reasons. First, the deficit model privileges expert definitions of the problem and of what is at stake over those of lay publics who nevertheless have to live with the consequences. The separation of 'ethical' and 'technical' aspects precludes meaningful discussion of the social contexts in which technologies are developed and made available. Consequently, the interests of states and technology developers are prioritised over those of the people and communities affected by the implementation of new technologies, in ways that lack democratic legitimacy and may inhibit socially responsible innovation. Further, debates on effective governance solutions tend to remain the preserve of technical experts who may not have sufficient information to see the bigger picture.

We initially introduced 'matter out of place' as a way of seeing lay concerns about new technologies as rational, understandable, socially responsive reactions to the hybrid nature of many biotechnologies. However, like the technologies in question, publics also appear to simultaneously elicit both fear and fascination for the scientists who must ultimately justify their research in order to ensure their social license to operate. While publics worry about risks both expected and unforeseen, scientists also worry that engagement exercises can risk uncovering serious negative responses, or that 'unruly' publics may turn confrontational and begin to actively resist, as in the case of GMOs. Thus, although the agency of publics in technical decision-making may be limited and reactive, it is not non-existent. We propose further extending the idea of 'matter out of place' to bring this context—especially the context(s) under which science is produced, new technologies are made available, and people make choices based on their own needs and desires—back into public debates about GGE. This shows us that publics themselves are often treated as 'matter out of place' in scientific engagement exercises, subjected to a variety of rituals to ensure they are 'clean', such as pre-screening focus groups to weed out those with existing or unfavourable opinions, limiting responses in written consultations to technical issues only, or requiring that audience questions at expert panels be submitted to a moderator, who then chooses which will be answered. This erodes both democratic legitimacy and trust (Marris, 2015; Wynne, 2001).

Image courtesy Wired

Second, we do not believe it is appropriate for public approval to be measured by take-up through the market. This cannot stand in for social licence to operate because the latter requires a collective, rather than individualist, view which must consider what will happen if the technology is taken up in aggregate. Many technologies cause little harm when only a few use them, but have substantially different effects once they become ubiquitous. If, for example, it becomes a moral obligation to edit all of our embryos to make the "best possible babies", as Savulescu (2007) and others have suggested, that would also require all women who want children to undergo IVF, a context which is not mentioned.

Third, as long as the goal of achieving public consensus remains a priority for many policy makers and scientific authorities (Rosemann et al., 2019), our (modest) recommendation is that these must engage robustly with what is meant by 'consensus' and how we will know that it has been achieved. It also means recognising generic, recurring concerns about the nature of the biotechnology industry and understanding these as not wholly separable from concerns specific to a particular technology. Rather than consensus about acceptable and unacceptable uses of technology in the abstract, we suggest the aim of engagement should be to try to find new and alternative ways of interrogating the *context* of technological deployment as much as the technology itself. Adopting a 'matter out of place' approach directs attention to how GGE's specific inseparable but incommensurate categories might be pointing to a genuine threat to values, meanings, ways of life, and hopes for the future, as well as traditional scientific understandings of harm, and consider opposition as rituals of purification and/or containment which have a rational purpose. This includes debates on the acceptability of commercial delivery of GGE through private clinics, the possibility of reproductive tourism, and the way contemporary science is incentivised. This, as we have argued, is not aimed at producing consensus, but at making debates about GGE more sensitive to the variety of perspectives and concerns (as well as hopes) it calls forth. Ultimately, 'matter out of context' is not a panacea for all issues of responsible research and innovation in GGE—a wicked problem with no easy solutions if ever there was one—but we believe it can provide a more useful way of framing an equitable public debate.

Data availability

No datasets were generated or analysed.

Notes

1. **Elsevier (2017) Gene Editing Research. https://www.elsevier.com/research-intelligence/campaigns/crispr.**
2. **Including Feng Zhang of the Broad Institute, who holds the patent He licensed for his work (Regalado, 2018a).**
3. **Robert Edwards himself was acutely aware of this potential (see Edwards and Glass 1976).**
4. **Indeed, as we were writing this article, a Russian scientist claimed he would replicate He's CCR5 experiment because he was 'crazy enough' to try (Cyranoski, 2019). Then, after widespread condemnation, he decided to edit for deafness instead (Le Page, 2019).**

5. **John Zhang, the IVF doctor trying to commercialise nuclear spindle transfer (a form of mitochondrial donation) for older women, is explicit about this: the embryos are made in his New York lab but are implanted in his satellite clinic in Mexico because this is illegal in the US. Designer babies are his declared next step (Mullin, 2017), having discussed the 'potential' of setting up a clinic in China with He in the summer of 2018 (Cohen, 2019).**
6. **However, this does not seem to stop clinics from promising 'better babies' by pre-advertising PGD-related services which do not yet exist, such as selecting embryos for intelligence (Devlin, 2019).**

Questions

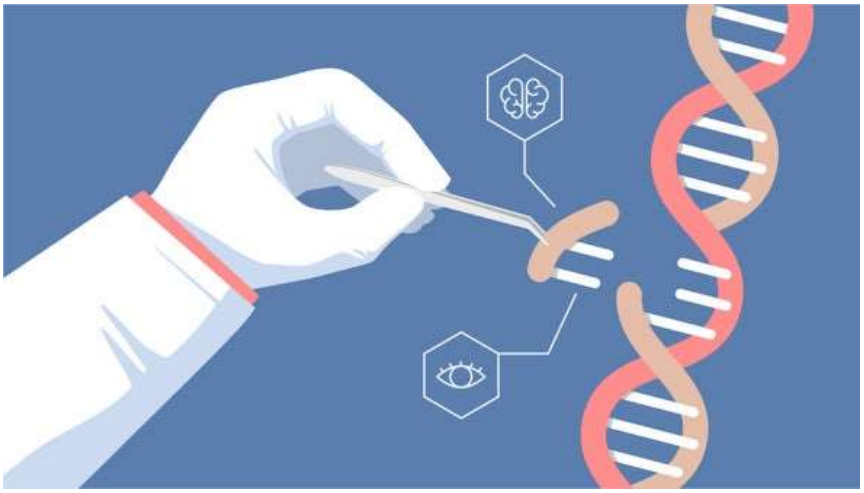
1. Why were many scientists, and even colleagues of He Jiankui, shocked and appalled by his announcement of germline editing of the twin girls?
2. What is meant by "a genetically edited baby"? Why is this a problem?
3. Two of the scientists on the original CRISPR discovery team, Jennifer Doudna and Emmanuelle Charpentier, raised the issue in this way*: How can we use this powerful tool in such a way as to ensure maximum benefit while minimising risks.* But are there more fundamental questions or concerns than this?
4. According to the authors of this abstract why was the lack of public outcry a problem?
5. Note and list the steps that scientists follow when doing research in a sensitive field. What changing circumstances may accelerate the process or lead to the freer or looser approach? What human factors make any type of regulation or control difficult regardless of rules and regulations?
6. Briefly outline several breakthroughs that made it possible to manipulate the human embryo. What prevented people from shuddering at these novel procedures or at least offering some effective opposition?
7. How does the complexity of the issue serve to stymie a unified response? (consider the social, economic and ethical aspects of these technologies and whether they should be used at all, and if used under what regulations/rules or ethical framework)
8. How has the political and economic relationship between science and government shifted significantly in the past half-century?
9. Has this been a good development or is it the death-nell for civilization as the levers on control are frayed and virtually broken? (consider Australian example with IVF)
10. What is the "14 day rule"?
11. How and why was IVF procedure successfully reframed from 'experimental' to infertility 'treatment'?
12. What argument is used to justify morally dubious biomedical innovations? Is this argument legitimate or just a lame excuse for the assertion of personal will for justifying the unjustifiable, leading to practices like "reproductive tourism"?
13. Explain the phrases "wisdom of repugnance" "deficit model"? What roles could they play in the public debate and difficulties in reaching a "consensus"?
14. How might the person's basic philosophy (regarding the nature of human beings, the purpose of human life, creation itself help determine the person's (scientist, politician, average man or woman) views concerning germline gene editing (GGE)?
15. How does Mary Douglas' thesis in her book *Purity and Danger* apply to the debate on GGE? Why would certain biotechnologies be considered 'dirty', 'dangerous', 'unnatural', 'monstrous' or 'impure'?
16. Why would many people find the use of "biological material as a resource which can be patented and sold" troublesome and repugnant, something that in fact is inhuman, disordered?
17. Why might others celebrate and welcome eagerly the hybrid, the radically new which upsets received wisdom and the normal way of doing things?
18. How and why are the life sciences (especially molecular biology) apt to be on the edge of transgressing boundaries that are meaningful and significant in everyday life: alive/dead, old/young, human/animal/plant, etc.?

19. Why do the authors proffer their view that "sustaining boundaries between therapeutic and reproductive applications" may be more difficult than one might hope?
20. Is that argument of safety and utility convincing enough to justify transgressional actions and innovations? Is there an echo of this in the Covid -19 crisis claims of "follow the science"?
21. Have the methods/efforts at consensus building strengthened confidence in public authorities/experts or undermined the general public's trust in them?

PART B

The Dark Side of CRISPR I

There is a less benevolent aspect to the application of CRISPR technology. Both Sandy Sufian and Rosemarie Garland-Thomson suffer from a disability that limits them to a degree but does not take away their basic human dignity and their rights as human beings. Sandy and Rosemarie warn that technologies pose ethical choices.The CRISPR technology and other related innovations have the "ability to eliminate from the gene pool what medical science identifies as faulty or abnormal genes that cause difference in individual people".



In the article *The Dark Side of CRISPR* they state it upfront. CRISPR's potential ability to "fix" people at the genetic level is a threat to those who are judged by society to be biologically inferior. They have an existential worry "that the use of these 'genetic scissors' will, in the future, cut people like us out of existence without others even noticing". Understandably, they take a very personalized approach to the debate. They consider themselves "whole beings, with our genetic conditions forming a fundamental part of who we are [and] still many consider lives such as ours as not worth living as they are". There are millions of people, as much as 10%, who have a disability of one sort or another, but as they assert, "improved medical treatments, social progress, and political equality movements raised our quality of life in ways that people like us in generations prior to ours could not have imagined". They are concerned about the eugenics movement and its modern supporters, those who speak about 'good genes' and 'bad genes'. Utilizing genome manipulation tools and performing genetic selection is tantamount to engaging in what Rosemarie calls "velvet eugenics," that is, a kind of compassionate purging of unacceptable human variations (people assumed to be suffering from their disability). The eugenicists feel mandated to exclude people with disabilities from coming into the world, as is already happening with people diagnosed with Down Syndrome in certain nations like Denmark. Sandy and Rosemarie believe in the equal value of all members of a society and that innate value should not be determined by social judgments regarding their relative contribution to the good of society.

Question
1.How strong a case do they make that CRISPR should not be used to eliminate genetic differences, but rather to treat and reduce/ameliorate the defective gene's negative impact?

Sandy Sufian is an associate professor of health humanities and history in the Department of Medical Education at UIC School of Medicine and associate professor of Disability Studies in the UIC Department of Disability and Human Development.

Rosemarie Garland-Thomson is a professor of English and co-director of the Disability Studies Initiative at Emory University.
To read the full article follow this link https://www.scientificamerican.com/article/the-dark-side-of-crispr/

These other links are useful for the reasons given below.

https://www.verywellhealth.com/is-there-a-cure-for-cystic-fibrosis-998216 explains advances in treatment of cystic fibrosis

https://www.sciencedirect.com/topics/neuroscience/cell-lines explains and provides definition of cell lines, through articles and books of references.

https://www.genome.gov/For-Patients-and-Families/Genetic-Disorders website of National Human Genome Research Institute, article on genetic disorders, types, nature, cause or relation to diseases. Excellent resource, lists disorders and explains and illustrates.

The Dark Side of CRISPR II

The darker side of biotechnology is also dicussed in this interview with Jamie Metzl, author of Hacking Darwin . *For the sake of saving space the full interview has been slightly abbreviated, as has the excerpt which deals with eugenics aspect of biotechnology. Both can be read in their entirety at https://www.economist.com/open-future/2019/04/25/how-genetic-engineering-will-reshape-humanity.*

Open Future How genetic engineering will reshape humanity

A book excerpt and interview with Jamie Metzl, author of *Hacking Darwin: Genetic Engineering and the Future of Humanity*.

BY K.N.C., Apr 25th 2019

NEW GENETIC technologies are exhilarating and terrifying. ….What is certain is that people will be able to make decisions about their lives in ways that were impossible in the past, when we relied more on random evolution than deliberation……..

The Economist: What are the ways in which people are able to "hack Darwin" today and over the next 15 years or so?
Jamie Metzl: We have always fought against the inherent cruelty of natural selection, one of the two essential pillars of Darwinian evolution. We are now beginning to hack away at the second pillar, random mutation. Our growing understanding of how genes and biology function is opening the door to incredible medical applications like using genome sequencing and gene therapies to fight cancer and other diseases. But the healthcare applications of genetic technologies are only a station along the way to where these technologies are taking us.

Our ability to select embryos during in vitro fertilisation (IVF)—based on informed genetic predictions of both health-related traits and intimate characteristics like height, IQ and personality style—will grow over the coming years. We'll use stem cell technologies to expand the number of eggs that prospective mothers can use in IVF and therefore the range of reproductive options for parents. We'll deploy gene editing tools far more precise than today's CRISPR systems to make heritable genetic changes to our future offspring. Over the coming decades, Darwin's original concept of random mutation and natural selection will gradually give way to a process that is far more self-guided than anything Darwin could have imagined.

The Economist: Changing the nature of what it means to be human has huge consequences. What are the main ones?
Mr Metzl: We have internalised the idea that information technology is variable, which is why we expect each generation of our phones and computers to be better than the last. It's harder for us to come to grips with the idea that our biology could be as variable as our IT, even though we understand intellectually that somehow we evolved from single cell organisms to complex humans over the past 3.8 billion years. Starting to see all of life, including our own, as increasingly manipulable will force us to think more deeply about what values will guide us as we begin altering biology more aggressively.

If we want to avoid dividing our species into genetic have and have-nots—a dangerous reduction in our diversity—or a genetic determinism that undermines our humanity, we'll need to start living our values. But though we need to be mindful of the dangers, we must also keep in mind that these technologies have the potential to do tremendous good. Someday they might well help us avoid extinction level events like dangerous synthetic pathogens, a warmer climate, the fallout from a nuclear war or the eventual expiration of our sun.

Jamie Metzl

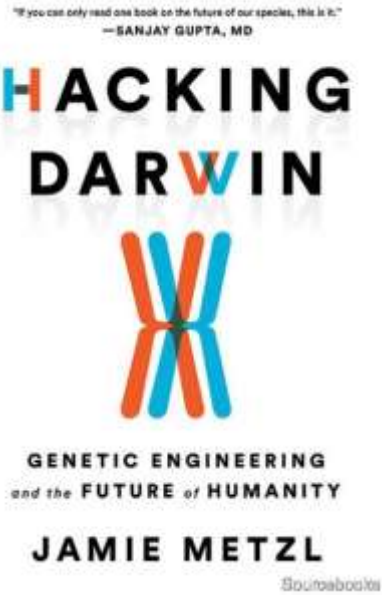
The Economist: Do we have the ethical framework to handle this? If not, what might it look like if things go wrong?

Mr Metzl: ….. The "better angels of our nature" remain primary drivers in our development of genetic technologies, but the dark side of human nature could also be empowered through these same tools. We need a very strong ethical and cultural framework to increase the odds that we'll use these technologies wisely, not least because access to them will be decentralised and democratised……Like Icarus, we could fly too close to the sun and get burned if we hubristically assume we know more than we actually do. Our gene drives could crash ecosystems. We could use these tools to undermine our common identity as a species and social cohesion. The good news is that while the technologies are new, the values we'll need to use them wisely are often old.

The Economist: What sort of regulations need to be in place to "enable" these technologies—and what rules should "constrain" them?

Mr Metzl: Genetic technologies touch the source code of what it means to be human and must be regulated. This job is all the more difficult because the technology is racing forward faster than the governance structures around them can keep up. On both the national and international levels, we'll need enough governance and regulation to prevent abuses and promote public safety while not so much to impede beneficial research and applications.

To avoid dangerous medical tourism, every country should have a national regulatory system in place that aligns with international best practices and the country's own values and traditions. We also have to start developing global norms that can ultimately underpin flexible international standards and regulations. These systems must be guided by core values rather than inflexible rules because what may now seem unthinkable, like actively selecting and even editing our future offspring, will increasingly become normalised over time. We urgently need to start preparing for what is coming.



The Economist: This takes the issue of human liberty to a new level (people should be free to change themselves or offspring), as well as the potential for unbridgeable inequalities (not just of wealth or life outcomes, but of capabilities encoded in oneself and family). How must the idea of liberalism adapt to address this? What does the "liberal agenda" look like for the 21st century vis-à-vis "hacking Darwin"?

Mr Metzl: If and when it becomes possible for some parents to give their children enhanced IQs, lifespans and resistance to disease, we will have to ask what this means for everyone else. ….Whatever the case, differences within and between societies, fuelled by competition, will drive adoption of these technologies and present societies with stark choices. Too few regulations could lead to a dangerous genetic engineering free-for-all and arms race. But trying to ban genetic manipulations would increasingly require the trappings of the most oppressive police states. Some liberal societies may choose to provide a basic level of access to assisted reproduction and genetic-engineering services to everyone, not least to save the expense of lifetime care for people who would otherwise be born with preventable genetic diseases.

Societies already struggling to define the balance between the parental and state interests in the context of abortion will have an even tougher time drawing this line for parent-driven assisted reproduction. But if we thought the debates over abortion and genetically modified crops were contentious, wait until the coming debate over genetically modified people arrives. If we don't want this to tear us asunder, we must all come together in a public process to figure out the best ways forward.

The disgraceful history of eugenic

The 1859 publication of Darwin's The Origins of Species didn't just get scientists thinking about how finches evolved in the Galapagos but about how human societies evolved more generally. Applying Darwin's principles of natural selection to human societies, Darwin's cousin and scientific polymath Sir Francis Galton theorized that human evolution would regress if societies

prevented their weakest members from being selected out. In his influential books *Hereditary Talent and Character* (1885) and then *Hereditary Genius* (1889), he outlined how eugenics could be applied positively by encouraging the most capable people to reproduce with each other and negatively by discouraging people with what he considered disadvantageous traits from passing on their genes. These theories were embraced by mainstream scientific communities and championed by luminaries like Alexander Graham Bell, John Maynard Keynes, Woodrow Wilson, and Winston Churchill.

Although his work was partly in the spirit of the Victorian England times, Galton was then and even more now what we would call a racist. "The science of improving stock," he wrote, "takes cognizance of all the influences that tend in however remote degree to give the more suitable races or strains of blood a better chance of prevailing speedily over the less suitable than they otherwise would have had." In 1909, Galton and his colleagues established the journal *Eugenics Review,* which argued in its first edition that nations should compete with each other in "race-betterment" and that the number of people in with "pre-natal conditions" in hospitals and asylums should be "reduced to a minimum" through sterilization and selective breeding.
Galton's theories gained increasing prominence internationally, particularly in the New World. Although eugenics would later accrue sinister connotations, many of the early adopters of eugenic theories were American progressives who believed science could be used to guide social policies and create a better society for all. "We can intelligently mold and guide the evolution in which we take part," progressive theologian Walter Rauschenbusch wrote. "God," Johns Hopkins economic professor Richard Ely asserted, "works through the state." Many American progressives embraced eugenics as a way of making society better by preventing those considered "unfit" and "defective" from being born. "We know enough about eugenics so that if that knowledge were applied, the defective classes would disappear within a decade," University of Wisconsin president Charles Van Hise opined…….
****
****
****
It's not that hard to imagine future scenarios when humans would need to genetically alter ourselves in order to survive a rapid change in our environment resulting from global warming or intense cooling following a nuclear war or asteroid strike, a runaway deadly virus, or some kind of other future challenge we can't today predict. Genetic engineering, in other words, could easily shift from being a health or lifestyle choice to becoming an imperative for survival. Preparing responsibly for these potential future dangers may well require we begin developing the underlying technologies today, while we still have time.

Thinking about genetic choice in the context of imagined future scenarios is, in many ways, abstract. But potentially helping a child live a healthier, longer life is anything but. Every time a person dies, a lifetime of knowledge and relationships dissolves. We live on in the hearts of our loved ones, the books we write, and the plastic bags we've thrown away, but what would it mean if people lived a few extra healthy years because they were genetically selected or engineered to make that possible? How many more inventions could be invented, poems written, ideas shared, and life lessons passed on? What would we as individuals and as a society be willing to pay, what values might we be willing to compromise, to make that possible? What risks would we individually and collectively be willing to take on? Our answers to these questions will both propel us forward and present us with some monumental ethical challenges.

https://www.economist.com/open-future/2019/04/25/how-genetic-engineering-will-reshape-humanity article from The Economist whose own approach and value systemcan be seen in this editorial statement:

Published since September 1843 to take part in "a severe contest bewteen intelligence, which presses forward, and an unworthy, timid ignorance obstructing our progress".

Questions

1. Why and in what way is Darwin's original concept of random mutation and natural selection being changed?
2. Are these technological breakthroughs an expression of man's God-wish, the desire to act in place of God? Is that the power that biologists see, that all of life, including our own, is manipulable?
3. What does Metzl mean by "genetic have and have-nots? Why would this be a dangerous development?
4. What solutions does he suggest to prevent possible misuse of these technological systems so they don't result in the unthinkable, the likely normalization of selecting and even editing our future offspring? (Metzl recognizes that once a practice is given the green light it cannot be stopped. Abortion is a prime example of this. More than 500,000,000 unborn children have been killed by abortion worldwide since 1970.)
5. What happens to the concepts of human rights, freedom, equality before the law if CRISPR is used in genome gene editing?

6. Did the interviewer demonstrate any bias in his questions? Why or why not?
7. Why does Metzl object so strongly to the eugenics aspect of the CRISPR technology?
8. Does Metzl successfully address the idea of creating a balanced approach, that is, keeping our core values, but at the same time permitting research even with the prospective dangers of a modern eugenics movement?

PART C

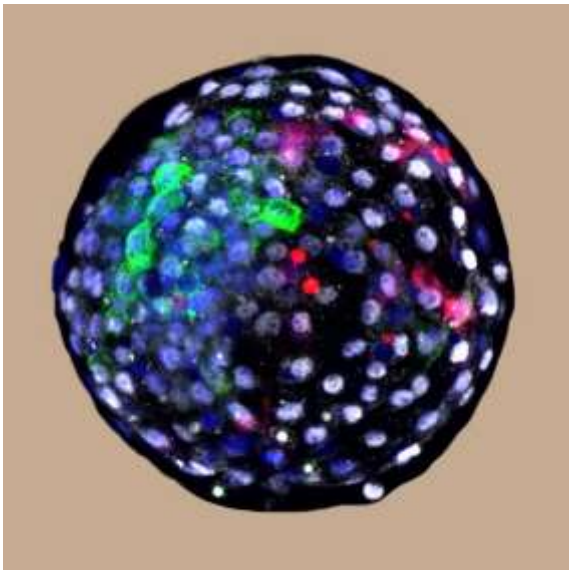
An Even Darker Side of Biotechnology I

An example of what frightens people about biotechnology is this short report about chimeras produced in the labs. This is one of those developments that makes people wonder about science and scientists and what they are prepared or willing to do to chase glory or profit.

First monkey–human embryos reignite debate over hybrid animals

By Nidhi Subbaraman, 15 April 2021
Scientists have successfully grown monkey embryos containing human cells for the first time — the latest milestone in a rapidly advancing field that has drawn ethical questions.

In the work, published on 15 April in Cell1, the team injected monkey embryos with human stem cells and watched them develop. They observed human and monkey cells divide and grow together in a dish, with at least 3 embryos surviving to 19 days after fertilization. "The overall message is that every embryo contained human cells that proliferate and differentiate to a different extent," says Juan Carlos Izpisua Belmonte, a developmental biologist at the Salk Institute for Biological Studies in La Jolla, California, and one of the researchers who led the work.



A blastocyst of the monkey–human chimaeras.Credit: Weizhi Ji, Kunming University of Science and Technology
Researchers hope that some human–animal hybrids — known as chimaeras — could provide better models in which to test drugs, and be used to grow human organs for transplants. Members of this research team were the first to show in 20192 that they could grow monkey embryos in a dish for up to 20 days after fertilization. In 2017, they reported a series of other hybrids: pig embryos grown with human cells, cow embryos grown with human cells, and rat embryos grown with mouse cells3.

Japan approves first human-animal embryo experiments

But the latest work has divided developmental biologists. Some question the need for such experiments using closely related primates — these animals are not likely to be used as model animals in the way that mice and rodents are. Non-human primates are protected by stricter research ethics rules than are rodents, and they worry such work is likely to stoke public opposition.
"There are much more sensible experiments in this area of chimaeras as a source of organs and tissues," says Alfonso Martinez Arias, a developmental biologist at Pompeu Fabra University in Barcelona, Spain. Experiments with livestock animals, such as pigs and cows, are "more promising and do not risk challenging ethical boundaries", he says. "There is a whole field of organoids, which can hopefully do away with animal research."

Touchy subject
Izpisua Belmonte says that the team does not intend to implant any hybrid embryos into monkeys. Rather, the goal is to better understand how cells of different species communicate with each other in the embryo during its early growth phase.
Attempts at growing human–mouse hybrids are still preliminary and chimaeras need to be more effective and healthier before they can be useful. Scientists suspect that such hybrids might have trouble thriving because the two species are evolutionarily distant, so the cells communicate through different means. But observing cellular cross-talk in monkey–human embryo

chimaeras — which involve two more closely related species — could suggest ways to improve the viability of future human–mouse models, Izpisua Belmonte says.

In the study, researchers fertilized eggs extracted from cynomolgus monkeys (Macaca fascicularis) and grew them in culture. Six days after fertilization, the team injected 132 embryos with human extended pluripotent stem cells, which can grow into a range of cell types inside and outside an embryo. The embryos each developed unique combinations of human and monkey cells and deteriorated at varying rates: 11 days after fertilization, 91 were alive; this dropped to 12 embryos at day 17 and 3 embryos at day 19.

"This paper is a dramatic demonstration of the ability of human pluripotent stem cells to be incorporated into the embryos of cynomolgus monkey when introduced into the monkey blastocysts," says Magdalena Zernicka-Goetz, a developmental biologist at the California Institute of Technology in Pasadena. She noted that this team, like others in the past, was not able to control which cells developed into which tissues — a key step to master before such models can be used.
Martinez Arias was not convinced by the results. "I expect better evidence," especially of the later stages of development, he says. That embryo numbers rapidly plummeted as they approached day 15 of development suggests to him "that the things are very sick".

Combining human cells with closely related primate embryos prompts questions about the status and identity of the resulting hybrids. "Some people may see that you're creating morally ambiguous entities there," says Insoo Hyun, a bioethicist at Case Western Reserve University in Cleveland, Ohio. He says this team was thorough in following existing guidelines. "I think they did quite a bit of due care to be mindful of regulations and ethical issues."

Research restrictions

Meanwhile, international guidelines are catching up to the field's advances — next month, the International Society for Stem Cell Research (ISSCR) is expected to publish revised guidelines for stem-cell research. These will address non-human-primate and human chimaeras, says Hyun, who is leading an ISSCR committee discussing chimaeras. That group's guidelines currently prohibit researchers from letting human–animal chimaeras mate. Also, the group recommends additional oversight when human cells could integrate with an animal host's developing central nervous system.
Many countries — including the United States, the United Kingdom and Japan — have at points limited research on chimaeras involving human cells. Japan lifted its ban on experiments with animal embryos containing human cells in 2019 and began funding such work that year.

In 2015, the US National Institutes of Health (NIH) announced a moratorium on federal funding for studies in which human cells would be injected into animal embryos. In 2016, the funding agency proposed lifting the ban but restricting research to hybrids created after gastrulation, when the early nervous system begins to form. More than four years later, the funding ban is still in place. An NIH spokesperson says the agency is awaiting the May ISSCR update "to ensure our position reflects the input from the community", but did not provide a timeline for release of the agency's rules.

Nature 592, 497 (2021) doi: https://doi.org/10.1038/d41586-021-01001-2

References

1.Tan, T. et al. Cell 184, 2020–2032 (2021).
Article Google Scholar

2. Niu, Y. et al. Science 366, eaaw5754 (2019).
PubMed Article Google Scholar

3. Wu, J. et al. Cell 168, 473–486 (2017).
PubMed Article Google Scholar

https://thepostmillennial.com/scientists-create-embryo-with-human-and-monkey-cells-in-historic-first/
https://mail.yahoo.com/d/folders/1?.intl=ca&.lang=en-CA&.partner=none&.src=fp

Questions
1. What potential gains could be derived from this kind of experimentation?

2. What disaster could result from such research efforts?
3. Is it moral to create hybrid animals? Why or why not?
4. Why does the world need half-human and half-mouse creatures or part-horse and part-human creature?
5. Should this type of research be allowed under any circumstances?
6. There is a bar scene in the first episode of Star Wars where all kinds of creatures cavort together. Does that sort of cinematic presentation serve to accustomize humans to a novel future and reduce fear of the unkown or does it further strengthen the need to stop the science fiction type of experimentation?

The Paradox of Turnkey Totalitarianism II

The danger posed by public and private research teams is mentioned in an interesting article by Max Borders, **The Paradox of Turnkey Totalitarianism. For the full article go to** https://www.aier.org/article/the-paradox-of-turnkey-totalitarianism/. The first paragraph provides the nightmare scenario. The second article is an excerpt from Bostrom's book, *The Vulnerable World Hypothesis.* Borders and Bostrom are not necessarily on the same page with respect to the need or effectiveness of "ubiquitous surveillance and tight restrictions". It's almost as if Borders has a much more sceptical approach than Bostrom, Their thoughts about the present Covid-19 issue would be different. The latter is likeloy to approve of or justify the actions taken by governemnts, while the former would tend to be much more questioning both as to motives and the effectiveness of the measures taken.

Somewhere a brilliant but troubled biotech engineer is doing CRISPR in his garage. He has all he needs: a computer, a fridge, a centrifuge, some animal cages, and an assortment of microorganisms in tubes, which he has labeled and stored until he's ready. Today he will use a gene-editing technique to make a deadly, fast-spreading bacterium. Oh, and he plans to unleash it upon the world tomorrow. He just needs to make a few finishing touches.
Why is he doing this?

Maybe he's gone mad. Maybe he's lonely and wants to get revenge on the world. Maybe he read Ted Kaczynski's manifesto and thinks humans are a plague. In some sense, it doesn't matter. Out of a thousand other brilliant gene researchers, he has broken bad. And nobody really knows what he's working on in that garage. He is as invisible to his neighbors as he is to the girls he likes.

Turnkey Totalitarianism

A handful of people have begun to study existential threats like the ones described above. One such individual is philosopher Nick Bostrom who in the policy summary of his "The Vulnerable World Hypothesis", writes:

"In order for civilization to have a general capacity to deal with "black ball" inventions of this type, it would need a system of ubiquitous real-time worldwide surveillance. In some scenarios, such a system would need to be in place before the technology is invented."

Nick Bostrom

After a unipolar surveillance regime is put in place, Bostrom thinks that dangerous materials that could go to the development of existential threats would have to be supplied by a "small number of closely monitored providers."

So, we get ubiquitous surveillance plus tight regulation, which some such as privacy policy analyst Julian Sanchez have referred to as "turnkey totalitarianism." The question before us then, is, would it work?

Regulating the Regulators

In a separate article titled "Fawning Over Fauci," I suggested the media better investigate a situation that is not very different from the one I imagined in the opening vignette. However, the major difference is that there wasn't some kid in a garage in this real-world scenario. There were government-sanctioned scientists in a research center — The Wuhan Institute of Virology — who used largesse dispensed by our own government.

Indeed, one of the best ways to provide oversight in various research endeavors is to control the funding sources for such research. I have suggested that it is plausible that the infectious diseases branch of the National Institutes of Health (NIH/NIAID), run by none other than Anthony Fauci, was responsible for funding research into zoonotic viruses of the sort that includes Covid-19.

In other words, without Fauci and his agency's regulatory failure, there might have been no pandemic.
Let's assume that Anthony Fauci and the functionaries at the NIAID presided over the funding of dangerous research, which was to be tightly controlled and regulated (if not outright banned). Let's stipulate that such research did lead to a pandemic that has already killed millions of people. And as the virus mutates, it evades not only vaccines, but all manner of bureaucratic mandates. It could soon be endemic.

In this scenario, though, all of the criteria for reasonable regulation ought to have been satisfied. Yet we still got mass death. In other words, there was neither a mad scientist nor a monstrous incel, at least not as far as we know. It could have been as simple as bureaucratic incompetence combined with negligence at one of the labs serving at the NIH's behest.

For now, I'll leave aside questions about whether or to what extent the Chinese government knew about the research and could have co-opted it for nefarious purposes. Despite the Communist Party's sorry track record, the most likely explanation is that this was a terrible accident. We simply can't say. Nor are we ever likely to find anything but lies coming out of Beijing (or Washington for that matter).

But one thing is clear: there is currently no way to regulate the regulators. Instead, we have no choice but to live with them. Otherwise, they are entirely unaccountable. They alone hold power to take such enormous risks, presumably in the name of science.

The Problem of Power

When it comes to the idea of government, most people suffer from both a *great blind spot* and a *failure of imagination.*
The *blind spot* is a refusal to believe the state is *itself* the greatest of all existential threats to humanity. Whether in Hollywood's depiction of corporate baddies or general concerns about gigantism, most people can't or won't appreciate the fact that nation-states hold all the records for mass killing. Compare individuals and corporations to that record. It ain't even close. Yet most people want desperately to believe the state's job is to protect us. Unicorn governance. Again, the state is the greatest source of violence in human history.

The *failure of imagination* lies in a widespread inability to see how it might be possible for humanity to mitigate existential threats without the linear model of state control. Whether we're talking about "reasonable regulation" or "turnkey totalitarianism," the linear model originates in Hobbes's Leviathan rationale, which holds most people in its thrall. Simply put, the Leviathan rationale prompts us to entrust a powerful monopoly to protect us and work in our interests.

But then, somehow, we have to oblige that powerful monopoly to *stay in its place.* The problem is, it rarely does. As Edmund Burke wrote:

In vain you tell me that [government] is good, but that I fall out only with the Abuse. The Thing! The Thing itself is the abuse! Observe, my Lord, I pray you, that grand Error upon which all artificial legislative Power is founded. It was observed, that Men had ungovernable Passions, which made it necessary to guard against the Violence they might offer to each other. They appointed Governors over them for this Reason; but a worse and more perplexing Difficulty arises, how to be defended against the Governors?

Checks and balances last for a while. But as soon as they fail, the proxies of that powerful monopoly seize yet more power. Any remaining checks and balances are crushed under Leviathan's weight, well, unless Leviathan can no longer swim in an ocean of red ink. By then, it might be too late.

The Nihilism of the Vulnerable World

Thinkers such as Nick Bostrom aren't wrong about the world's vulnerability to exponential technologies in the hands of bad actors. What they too often forget is that politics selects for arrogance and sociopathy. Politicians and technocrats are no angels, despite how badly we might wish them to be. Even if we find the occasional wise leader to hold the ring, the ring invariably gets passed along. There is always a sociopath waiting. And that's why the upshot of Turnkey Totalitarianism is deeply problematic, even though there are evil geniuses among the citizenry. Acknowledging all this threatens to leave us in nihilism. After all, wasn't it very likely a small group of government technocrats and regulators who unleashed the Covid-19 pandemic?

My friend and mentor, entrepreneur Chris Rufer reminds us that the best defense against violence isn't a panopticon or a global superstate.

"The best defense against violence is to minimize the number of people in the world who are willing to use it," Rufer said. And I think he's right.

I suspect it can't hurt to have more people of basic morality checking up on each other, too. I admit, though, that preemptive morality can only *reduce* the number of black balls in the existential threat bucket. But that's something. So we must start to think of morality not as a set of abstract rules but rather as an active, continuous practice to be set alight in everyone. And we must practice morality even as we admit to ourselves that the risks of our extinction will never be zero.

Questions
1. Are we moving toward a future of The Matrix, where even thought crimes are stopped and prevented as we write (in light of pandemic restrictions, social credit cards in China, and subcutaneous QR codes)?
2. What is one way to limit the potential abuse of surveillance and dangerous experimentation by governments/ubiquitous real-time worldwide surveillance?
3. Max Borders says that currently there is no way to regulate the regulators. What is he referring to and why is this a big problem?
4. In what sense can one conclude that the state is *itself* the greatest of all existential threats to humanity?
5. What does Borders hint at with respect to the origins of the Covid -19 virus?
6. What did Edmund Burke warn about governments? Does history bear him out?

Excerpt from *The Vulnerable World Hypothesis* III

A general ability to stabilize a vulnerable world would require greatly amplified capacities for preventive policing and global governance. The vulnerable world hypothesis thus offers a new perspective from which to evaluate the risk-benefit balance of developments towards ubiquitous surveillance or a unipolar world order.

What can be done to prevent disaster

Beside influencing the direction of scientific and technological progress, or altering destruction-related preferences, there are a variety of other possible countermeasures that could mitigate a civilizational vulnerability. For example, one could try to: • prevent the dangerous information from spreading; • restrict access to requisite materials, instruments, and infrastructure; • deter potential evildoers by increasing the chance of their getting caught; • be more cautious and do more risk assessment work; and • establish some kind of surveillance and enforcement mechanism that would make it possible to interdict attempts to carry out a destructive act. For a picture of what a really intensive level of surveillance could look like, consider the following vignette:

High-tech Panopticon

Everybody is fitted with a 'freedom tag' – a sequent to the more limited wearable surveillance devices familiar today, such as the ankle tag used in several countries as a prison alternative, the bodycams worn by many police forces, the pocket trackers and wristbands that some parents use to keep track of their children, and, of course, the ubiquitous cell phone (which has been characterized as 'a personal tracking device that can also be used to make calls').42 The freedom tag is a slightly more advanced appliance, worn around the neck and bedecked with multidirectional cameras and microphones. Encrypted video and audio is continuously uploaded from the device to the cloud and machine-interpreted in real time. AI algorithms classify the activities of the wearer, his hand movements, nearby objects, and other situational cues. If suspicious activity is detected, the feed is relayed to one of several patriot monitoring stations. These are vast office complexes, staffed 24/7. There, a freedom officer reviews the video feed on several screens and listens to the audio in headphones. The freedom officer then determines an appropriate action, such as contacting the tagwearer via an audiolink to ask for explanations or to request a better view. The freedom officer can also dispatch an inspector, a police rapid response unit, or a drone to investigate further. In the small fraction of cases where the wearer refuses to desist from the proscribed activity after repeated warnings, an arrest may be made or other suitable penalties imposed. Citizens are not permitted to remove the freedom tag, except while they are in environments that have been outfitted with adequate external sensors (which however includes most indoor environments and motor vehicles). The system offers fairly sophisticated privacy protections, such as automated blurring of intimate body parts, and it provides the option to redact identity-revealing data such as faces and name tags and release it only when the information is needed for an investigation. Both AI-enabled mechanisms and human oversight closely monitor all the actions of the freedom officers to prevent abuse.43

AI-enabled content analysis, it may soon become both technologically feasible and affordable. For example, if the cost of applying this to one individual for 1 year falls to around US$140, then the entire world population could be continuously monitored at a cost of less than 1 per cent of world GDP. At that price, the system would plausibly represent a net saving – even setting aside its use in preventing civilization-scale cataclysms – because of its utility for regular law enforcement. If the system works as advertised, many forms of crime could be nearly eliminated, with concomitant reductions in costs of policing, courts, prisons, and other security systems. It might also generate growth in many beneficial cultural practices that are currently inhibited by a lack of social trust.

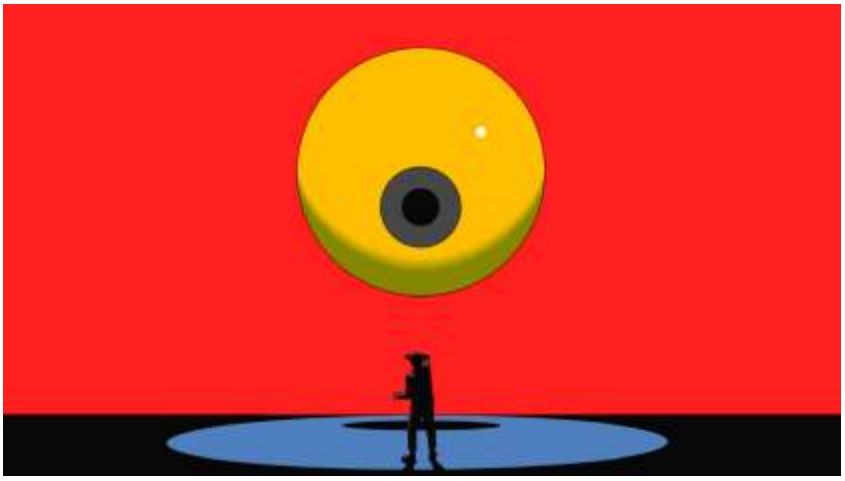
If the technical barriers to High-tech Panopticon are rapidly coming down, how about its political feasibility? One possibility is that society gradually drifts towards total social transparency even absent any big shock to the system. It may simply become progressively easier to collect and analyze information about people and objects, and it may prove quite convenient to allow that to be done, to the point where eventually something close to full surveillance becomes a reality – close enough that with just one more turn of the screw it can be turned into High-tech Panopticon.44 An alternative possibility is that some particular Type1 vulnerability comes sufficiently starkly into view to scare states into taking extreme measures, such as launching a crash program to create universal surveillance.*[like the present pandemic or climate change?]* Other extreme measures that could be attempted in the absence of a fully universal monitoring system might include adopting a policy of preemptive incarceration, say whenever some set of unreliable indicators suggest a greater than 1% probability that some individual will attempt a city-destroying act or worse.45 Political attitudes to such policies would depend on many factors, including cultural traditions and norms about privacy and social control; but they would also depend on how clearly the civilizational vulnerability was perceived. At least in the case of vulnerabilities for which there are several spectacular warning shots, it is plausible that the risk would be perceived very clearly. In the 'easy nukes' scenario, for example, after the ruination of a few great cities, there would likely be strong public support for a policy which, for the sake of forestalling another attack, would involve incarcerating a hundred innocent people for every genuine plotter.46 In such a scenario, the creation of a High-tech Panopticon would probably be widely supported as an overwhelmingly urgent priority. However, for vulnerabilities not preceded or accompanied by such incontrovertible evidence, the will to robust preventive action may never materialize.

Effective global governance would also help with those Type-1 and Type-2b scenarios where some states are reluctant to institute the kind of preventive policing that would be needed to reliably prevent individuals within their territories from carrying out a destructive act. Consider a **biotechnological black ball** that is powerful enough that a single malicious use could cause a pandemic that would kill billions of people, thus presenting a Type-1 vulnerability. It would be unacceptable if even a single state fails to put in place the machinery necessary for continuous surveillance and control of its citizens (or whatever other mechanisms are necessary to prevent malicious use with virtually perfect reliability). A state that refuses to implement the requisite safeguards – perhaps on grounds that it values personal freedom too highly or accords citizens a

constitutionally inscribed right to privacy – would be a delinquent member of the international community. Such a state, even if its governance institutions functioned admirably in other respects, would be analogous to a 'failed state' whose internal lack of control makes it a safe haven for pirates and international terrorists (though of course in the present case the risk externality it would be imposing on the rest of the world would be far larger). Other states certainly would have ground for complaint.

Discussion

Comprehensive surveillance and global governance would thus offer protection against a wide spectrum of civilizational vulnerabilities. This is a considerable reason in favor of bringing about those conditions. The strength of this reason is roughly proportional to the to the probability that the vulnerable world hypothesis is true.



It goes without saying that a mechanism that enables unprecedentedly intense forms of surveillance, or a global governance institution capable of imposing its will on any nation, could also have bad consequences. Improved capabilities for social control could help despotic regimes protect themselves from rebellion. Ubiquitous surveillance could enable a hegemonic ideology or an intolerant majority view to impose itself on all aspects of life, preventing individuals with deviant lifestyles or unpopular beliefs from finding refuge in anonymity. And if people believe that everything they say and do is, effectively, 'on the record', they might become more guarded and blandly conventional, sticking closely to a standard script of politically correct attitudes and behaviours rather than daring to say or do anything provocative that would risk making them the target of an outrage mob or putting an indelible disqualifying mark on their resume. Global governance, for its part, could reduce beneficial forms of inter-state competition and diversity, creating a world order with single point of failure: if a world government ever gets captured by a sufficiently pernicious ideology or special interest group, it could be game over for political progress, since the incumbent regime might never allow experiments with alternatives that could reveal that there is a better way. Also, being even further removed from individuals and culturally cohesive 'peoples' than are typical state governments, such an institution might by some be perceived as less legitimate, and it may be more susceptible to agency problems such as bureaucratic sclerosis or political drift away from the public interest.48

It also goes without saying that stronger surveillance and global governance could have various good consequences aside from stabilizing civilizational vulnerabilities (see also Re, 2016)) ; Bostrom, 2006; cf. Torres, 2018)). More effective methods of social control could reduce crime and alleviate the need for harsh criminal penalties. They could foster a climate of trust that enables beneficial new forms of social interaction and economic activity to flourish. Global governance could prevent interstate wars, including ones that do not threaten civilizational devastation, and reduce military expenditures, promote trade, solve various global environmental and other commons problems, calm nationalistic hatreds and fears, and over time perhaps would foster an enlarged sense of cosmopolitan solidarity. It may also cause increased social transfers to the global poor, which some would view as desirable

One important issue that we still need to discuss is that of timing. Even if we became seriously concerned that the urn of invention may contain a black ball, this need not move us to favor establishing stronger surveillance or global governance now, if we thought that it would be possible to take those steps later, if and when the hypothesized vulnerability came clearly into view. We could then let the world continue its sweet slumber, in the confident expectation that as soon as the alarm goes off it will leap out of bed and undertake the required actions. But we should question how realistic that plan is.

One could take the position that we should not develop improved methods of surveillance and social control unless and until a specific civilizational vulnerability comes clearly into view – one that looks sufficiently serious to justify the sacrifice of some types of privacy and the risk of inadvertently facilitating a totalitarian nightmare. But as with the case of international cooperation, we confront a question of timing. A highly sophisticated surveillance and response system, like the one depicted in 'High-tech Panopticon', cannot be conjured up and made fully reliable overnight. Realistically, from our current starting point, it would take many years to implement such a system, not to mention the time required to build political support. Yet the vulnerabilities against which such a system might be needed may not offer us much advance warning. Last week a top

academic biolab may have published an article in Science; and as you are reading these words, a popular blogger somewhere in the world, in hot pursuit of pageviews, might be uploading a post that explains some clever way in which the lab's result could be used by anybody to cause mass destruction.

What may theoretically be feasible is to develop the capabilities for intrusive surveillance and real-time interception in advance, but not initially to use those capabilities to anything like their full extent. This would be one way to satisfy the requirement for stabilizing a Type-1 vulnerability (and other vulnerabilities that require highly reliable monitoring of individual actions). By giving human civilization the capacity for extremely effective preventive policing, we would have exited one of the dimensions of the semi-anarchic default condition.

https://www.nickbostrom.com/papers/vulnerable.pdf

Questions
1. What kinds of mass vulnerabilities does human life and civilization potentially face? Which are real and very proximate and which are very remote or fantasy-like?
2. What solutions does Bostrom propose? Do these make sense to you? Why or why not?
3. Why does he settle on a twin solution of preventive policing and one world government?
4. How does the "freedom tag" work? Would people accept such a restriction in order to be safe?
5. Is such a sytem of survellance affordable economically or acceptable politically?
6. Is such a system operational right now in some nations?
7. Bostrom mentions preventive incarceration as a solution. Is this desperate or simply realistic given the dangers society faces?
8. What other extreme international restrictions would need to be enacted in the case of a "biotechnological black ball"?
9. Weigh the positive benefits and negative consequences that might flow from a centralized global government system?
10. Given Bostrom's hypothesis do you see anything resembling his scenario within the context of the Covid-19 pandemic?
11. Many people have grave misgivings regarding governnments on the basis of what Edmund Burke has to say about them. Does Burke and his sympathizers have a good point? Why or why not?

A Darker Afterthought IV

One should hope that, collectively, we are not squandering centuries of civilization. What can we make of this sobering reflection or musings from Rod Dreher who alludes to the experiences of an Englishman living in Ireland (Kingsworth) and then to citations from the works of a French pholsopher (Jacques Ellul).

(Kingsworth) *A few days after I lost my game of chess, a couple of friends came to visit us from England. We hadn't seen them for nearly a decade, and they hadn't travelled anywhere since the pandemic began, so they were blinking excitedly in the sunlight. They had taken the ferry across the Irish Sea, which had necessitated them performing a particular technological ritual, one which went beyond even the longstanding norm of scanning their digitally-enabled passports and sitting on a boat full of CCTV cameras.*
This time they had to have their photo taken, and show their digital proof of vaccination. They also, for some reason they didn't understand, had to recite a string of numbers into a recording device. If I were being paranoid – and these days I usually am – I would guess that this was part of the creation of an embryonic digital voice recognition system, which will be used in future to supplement the eyeball scans, passport chips and smartphone-enabled health certificates which are already forming the basis of our glorious future of freedom and plenty.

Sometimes I lie awake at night, or I wander in the field behind my house, or I walk down the street in our local town and think I can see it all around me: the grid. The veins and sinews of the Machine that surrounds us and pins us and provides for us and defines us now. I imagine a kind of network of shining lines in the air, glowing like a dewed spiderweb in the morning sun. I imagine the cables and the satellite links, the films and the words and the records and the opinions, the nodes and the data centres that track and record the details of my life. I imagine the mesh created by the bank transactions and the shopping trips, the passport applications and the text messages sent. I see this thing, whatever it is, being constructed, or constructing itself around me, I see it rising and tightening its grip, and I see that none of us can stop it from evolving into whatever it is becoming.

I see the Machine, humming gently to itself as it binds us with its offerings, as it dangles its promises before us and slowly, slowly, slowly reels us in. I think of the part of it we interact with daily, the glowing white interface through which we volunteer every detail of our lives in exchange for information or pleasure or stories told by global entertainment corporations

who commodify our culture and sell it back to us. I think of the words we use to describe this interface, which we carry with us in our pockets wherever we go, as we are tracked down every street and into every forest that remains: the web; the net. *I think:* these are things designed to trap prey.

(Dreher) Here, Kingsnorth comes to the end of a long passage in which he discusses Jacques Ellul and his theories about how our world is being taken over by "technique." For Ellul, this means establishing by mechanical means a world in which all things are controlled:
But then, if Ellul is right, this is the direction in which the reign of technique will ultimately take us: towards the dictatorship of the Machine. Claiming in 1964 that technique had already 'rendered traditional democratic doctrines obsolete', he suggested that the new way of seeing would overcome any democratic objections, and would always tend towards total control. 'Efficiency is a fact', he wrote wryly, 'and justice a slogan.' Technique, through sheer dominance, would accrue power to itself until there could be no rational argument (the only kind of argument now accepted) against controlling the minutiae of our lives for the greater good:

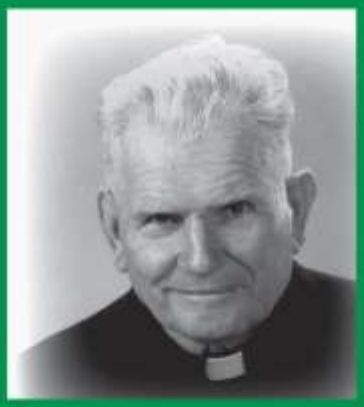
(Ellul) *Finally, technique causes the state to become totalitarian, to absorb the citizens' lives completely. We have noted that this occurs as a result of the accumulation of techniques in the hands of the state … Even when the state is liberal and democratic, it cannot do otherwise than become totalitarian. It becomes so directly or, as in the United States, through intermediate persons. But, despite differences, all such systems come ultimately to the same result.*

(Kingsworth) *By using the word 'totalitarian', Ellul was not suggesting that all nations would become dictatorships, let alone adopt an ideological framework like Nazism or Marxism to guide them. In fact, he said, such ideologies interfere with the direction of technique, which seeks efficiency rather than ideology. 'Totalitarian', in this context, simply meant that it would be impossible to escape the Machine and its assumptions. Everywhere you looked, there it would be: staring you in the face, directing your actions, digging into every facet of your life, giving you fewer and fewer escape routes each year.*
I don't think it's an exaggeration to say that the times we are currently living in would be regarded by many of our ancestors as apocalyptic. The degree of control and monitoring which we endure in 'developed' societies, which has been accelerating for decades and which has reached warp speed in the 2020s, is creating a kind of digital holding camp in which we all find ourselves trapped. The rising paranoia that extends now across the political spectrum and across the Western world – the anger and confusion; the sense of promises broken and established systems gumming up – all of this, I think, can be traced to the rise and consolidation of the Machine, this great matrix which strips from us our understanding of what a human life is, and makes us instead lonely cogs in its drive for self-creation.

https://www.theamericanconservative.com/dreher/the-age-of-antichrist-is-here/

Questions
1. Are we being manipulated psychologically? Why or why not?
2. Are we too willing to let human life be redefined for us by intellectuals, scientists, or other cultural elite groups?
3. Are we on the cusp of an absolute totalitarianism based on fear?
4. Are we obligingly permitting the creation of a new being, a transhuman, part human and part machine?
5. As CRISPR biotechnology, artificial intelligence, business structures and politics intersect to bring about global governance, is there room for a Creator God in this new world order?
6. Is human nature immutable, in all its dignity, majesty and poverty? Or, is it infinitely malleable, always subject to evolution into a higher life form?
7. How is the *techne* or skilled *modus operandi* of the scientist a problem when divorced from the why of an action or innovation?
8. Should we be afraid of the Machine or simply be very vigilant?

FATHER TED COLLETON SCHOLARSHIP



NIAGARA REGION RIGHT TO LIFE

Niagara Region Right to Life is once again pleased to offer The Father Ted Colleton Scholarship essay contest as part of its mandate to reach out to society in an educational format. In particular, Niagara Region Right to Life wishes to help educate and inform the younger generation about the preciousness and possibilities of human life from conception to natural death and how certain threats affect those possibilities in its beginnings.

All students in grade 11 or 12, attending a Canadian high school (or being home schooled in Canada) are invited to participate.

Three prizes of $2000 (1st), $1500 (2nd) and $1000 (3rd) respectively will be awarded. Candidates are required to submit a personal profile, a letter of recommendation and a 1200 word essay on the theme outlined below:

Describe how one could help build a *culture of life* (one that uncompromisingly respects and cherishes the dignity of all human life from conception to natural death). Your suggestions may range from a plan to protect the conscience rights of both current health professionals and of those contemplating medical studies - to more effective regulations regarding biomedical research, or from new peaceful public activism - to more effective strategies in the various fields of communication. This is an open-ended, non-exhaustive list.

SUBMIT DOCUMENTS VIA EMAIL BY DECEMBER 1, 2021

Email:dirocco@theinterim.com Or leave a message for Dan Di Rocco at (416) 204-1687