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## Scandalous 'firsts' from the Global South? The entanglement between epistemic injustice and Responsible Research and Innovation (RRI)

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RESEARCH ARTICLE



# Scandalous ‘firsts’ from the Global South? The entanglement between epistemic injustice and Responsible Research and Innovation (RRI)

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## ABSTRACT

This paper examines the critical role of epistemic injustice in Responsible Research and Innovation (RRI), particularly through the lens of reproductive medicine scandals in the Global South. It unpacks the perception of the Global South as a hotbed for scandalous ‘firsts’. That is, there seems to be a tendency for these regions to chase major scientific breakthroughs and global recognition, often at the cost of transgressing scientific and/or ethical norms. By analysing two kinds of scientific scandals – described as ‘science out of place’ and ‘science out of pace’ – this paper highlights both the challenges and opportunities for RRI to ‘de-link’ from hegemonic perceptions of legitimacy in science and to promote productive epistemic socialisation. This is essential to develop our ethical sensibility in the fast evolving and inherently contentious field of biotechnology.

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Epistemic injustice; India; China; Mexico; science governance

## Introduction

The Global South seems prone to scientific scandals and ethical lapses due to their ambitious scientific pursuits amid regulatory challenges (Bharadwaj 2013; Lee and Schrank 2010). From the creation of Asia’s first IVF baby, to the world’s first human-rabbit embryos to the more recent births of world’s first three-parent baby and CRISPR babies (Anand Kumar 1997; Begley 2018; Hamzelou 2016; Kuo 2018; Zhang 2012), the Global South *seems* to occupy the geography of scandalous ‘firsts’. That is, a general impression that their eagerness to achieve major scientific breakthroughs, often come at a cost of transgressing scientific and/or ethical norms. It must be stressed that ‘scandalous firsts’ are a specific type of scientific scandal. While such events can happen anywhere, those that occur in the Global South are often perceived and treated differently – by both Global North and Global South actors – reflecting deeper asymmetries in how scientific practices are judged and represented.

For some, the phenomenon of ‘scandalous “firsts”’ starkly illustrates and underscores a negligence of Responsible Research and Innovation (RRI) in the Global South. For example, China’s research and development has been portrayed by leading Western media as a nefarious ‘rising red moon’ that would ‘always be bad at bioethics’ (Cheng 2018; The Economist 2019), while India’s rapid advancement in experimental therapies has been framed as scientific misconduct becoming its ‘new habit’ (Kochhar 2019). For others, the perceived ‘scandalous “firsts”’ are consequences of deep-seated epistemic injustice, which unjustly skews perceptions and diminishes the contributions to scientific progress made by researchers in the Global South. Cases of scandalous firsts more easily illustrate the entanglement of RRI and epistemic injustice. Cases of scandalous firsts may not necessarily involve greater transgressions of ethical principles. However, as scientific ‘firsts’ often sit at the frontier of knowledge production, they more readily illustrate an relationship that has hitherto been under-explored: the entanglement of epistemic injustice and RRI in global *realpolitik* of science.

This paper fills this gap by unpacking four notable national and international scientific ‘firsts’ in reproductive medicine that have contributed to the scandalous image of Global South science. Following decolonial theorists, ‘Global South’ in this paper primarily refers to a collective’s epistemic positioning within global science (Bacevic 2023). The Global South functions as the epistemic Other, whose agency in RRI has been constrained by epistemic ‘Othering’ – a process intrinsic to modern disciplinary formations of knowledge

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(Keet 2014; Mignolo 2000; Quijano 2000). Building on previous studies that show how identity-based epistemic judgments perpetuate and reinforce inequalities in knowledge production (Bacevic 2023), this paper argues that fully understanding the extent and impact of epistemic injustice on global and local RRI.

In line with this special issue, the paper defines scandals as ‘publicized transgressions of moral or legal norms that cause public outcry’ (Zhang, Vogel, and Ouaghrham-Gormley 2023). The co-editors of this special issue provide a nuanced discussion of what constitutes a scientific scandal from system-structural, cultural-normative, and epistemic perspectives (see Zhang, Vogel, and Ouaghrham-Gormley 2023). The paper delves into the third perspective, and focuses on the transgression of epistemic pecking orders that structure common expectations of how science should be practiced. It examines how this transgression is rooted in the epistemic positioning of Global South scientific communities and their subsequent differences in epistemic visibility and influence, and how this transgression makes these cases particularly prone to collective outrage and gives rise to their scandalous nature.

In this case, scandals are a ‘contestation of expertization’, with would-be experts vying for authority and established experts contending for greater influence in the hierarchy of knowledge production (Levidow 1999). For example, new stakeholders in science that are brought in by new technical possibilities, new ways of organising science that are outside of conventional scientific establishment, or social needs that have been systematically deprioritised. As such, addressing scandals involves more than just correcting errors based on existing rules, but requires bringing to light social processes and special interests underlying contemporary research and innovation that are otherwise hidden from public knowledge, and reflecting on the overlooked or marginalised socio-technical relations that allow for exploitation.

This is why not only are scandals crucial to our understanding and practice of RRI, but RRI, with its procedural – and capacity-based framework, may be particularly useful in tackling the perceived or actual epistemic injustice exposed by scientific scandals.

The paper is structured as follows: It first unpacks the concept of epistemic injustice and explains why its emphasis on cultivating ‘responsible knowers’ through epistemic socialisation is both a political and an epistemic project, making it particularly instrumental for developing RRI (European Commission 2018; Owen et al. 2013; Owen, Macnaghten, and Stilgoe 2012; Von Schomberg 2013). However, discussion of RRI has a deficient engagement with empirical cases, and thus has limited ability to speak to epistemic asymmetry and power disparity in global science (Pandey 2024; Schuijff and Dijkstra 2020; Wiarda et al. 2021).

Following this conceptual discussion, the paper examines two sets of reproductive medicine scandals that took place in the Global South. I first examine the type of scandal that has been characterised as science ‘out of place’ (Bärnreuther 2016) with an analytical emphasis on testimonial injustice. This involves the scandals pertaining to the birth of Asia’s first IVF baby in India in 1978, and the creation of the world’s first hybrid embryos between 2001 and 2003. I demonstrate that epistemic inclusion that RRI promotes must be able to ‘de-link’ (Mignolo and Walsh 2018) from a hegemonic assumption of who are qualified knowers in science and its governance, so as to be able to anticipate and response to new science and practitioners that are ‘out of place’. The second set of scandals this paper examines constitute science ‘out of pace’. This involves the birth of the world’s first three-parent baby in Mexico in 2016 using mitochondrial replacement therapy (also known as the MRT baby) and the birth of the world’s first babies that have undergone CRISPR genome editing in China in 2018 (commonly known as the CRISPR babies). Both scandals consist of researchers knowingly outpacing local legislation and global ethical guidelines to gain scientific recognition. The discussion highlights how a chronic hermeneutical injustice towards Global South scientists has produced a new Othering effect that discounts the very agency of the stakeholders who are essential for promoting RRI.

The final section demonstrates that there are new forms of ‘science out of place’ and ‘science out of pace’ on the horizon, propelled by the increasing circulation and accessibility of knowledge and skills, a global boost of bioeconomy and civic innovation, and a social justice driven citizen science culture. I argue that, given the growing awareness and contestation of epistemic disparity, there is an urgency to bring epistemic inclusion to the forefront of RRI.

## **Epistemic injustice, decolonising ethical governance and RRI**

Epistemic injustice, coined by philosopher Miranda Fricker, refers to discrimination against one’s capacity as a knower. Fricker (2007, vii) invoked the concept to bring attention to human being’s real experience of

ethical value, and ‘puts questions of social identity and power [at] centre stage’ in understanding the moral dimension of our lives.

There are two interconnected types of epistemic injustice: One is testimonial injustice, which refers to a deflated credibility or importance subscribed to an individual’s account, based on the hearer’s unfair perception of the speaker’s capacity as a knower (Fricker 2007, 9–14). The other is hermeneutical injustice, which refers to a gap of interpretive resources or wilful ignorance on the part of the listener, placing the speaker at a disadvantage in making their experiences comprehensible to others (Fricker 2007, 152–161).

One example of testimonial injustice in science is the common frustration among scientists from the Global South, who find that their lab results are frequently met with a ‘can’t-be-good-enough’ bias by international journals (Smith, Hunt, and Master 2014). In comparison, hermeneutical injustice is prior to testimonial injustice and it reflects more of a structural prejudice. It is rooted in ‘hermeneutical marginalization’, in which the social meaning and significance of someone’s experience is deflated primarily as a result of unequal social power relations power (Fricker 2007, 174). An example of hermeneutical injustice is when women’s health issues have been chronically overlooked or misunderstood by a predominantly male medical establishment (Cleghorn 2020). Epistemic injustice not only negates marginalised experiences but also discourages idea exchange, erodes trust, and harms the epistemic system (Fricker 2007, 47–59; Posholi 2020).

Epistemic injustice is inherent in the theorisation and practice of mainstream bioethics, and many have warned against it sliding into ‘another instance of intellectual neocolonization’ (De Vries and Rott 2011; Pratt and de Vries 2023; Schuklenk 2022; Tangwa 2017). Modern bioethics remains dominated by Western Principalism, a ‘regime of normativity’, which serves as a heuristic tool that dictates the normative hierarchy of knowledge production and validation within networks of individuals and institutions (Pickersgill 2012; Martin and Turkmendag 2021, 385–387; Banerjee 2022; Tangwa 2023). Empirical studies have shown that this Western centrism has led to an ‘Othering’ effect in RRI, universalising differences and, in some contexts, counterproductively incentivising disengagement among scientific communities in the Global South (Koch 2020; Pandey 2024).

Feminist thinkers have pointed out that much of the ‘frontstage’ discussions of bioethics also ‘produc[es] silences’ and diverts attention from the ‘backstage’ issues, such as historical power imbalance and local moral process and intra-group differences (Kleinman 1999; Prainsack, Geesink, and Franklin 2008, 357). Decolonial scholars have highlighted a trend of epistemic appropriation stemming from colonial perceptions of the Global South, rather than embracing a contemporaneous understanding of these communities (Barugahare 2018; Kleinman 1999; Zhang et al. 2023). For example, despite the prevailing notion that communities in the Global South prioritise communal consent over individual consent, research in rural Ghana and Zimbabwe suggests a different reality. Individuals are demonstrating a growing reluctance to accept subordinate roles compared to chiefs or household heads in deciding their participation in research (Nyika, Wassenaar, and Mamotte 2009; Tindana, Kass, and Akweongo 2006). Other empirical studies also highlight that power structures and social ethics in the Global South are not static (see Aragaw et al. 2023; Kalofonos 2010; Ogunrin et al. 2018) and have spurred efforts to decolonise ethical governance in global life sciences.

For Fricker (2007, 81–84), one can widen their ethical sensibility and become a responsible knower through epistemic socialisation. That is, individuals open themselves to new experiences that life offers and actively reflect upon and develop their set of interpretive and motivational attitudes. Decolonial theorists argue that rectifying epistemic injustice in global knowledge production requires adopting a ‘zero-point epistemology’ (Mignolo 2000; 2011), which seeks to equitably prioritise all perspectives without privileging any single viewpoint (Posholi 2020). Thus, to become a responsible knower, epistemic socialisation demands not only critical reflection, but also demands ‘an ethos of care’, an ability to think from exteriority and with alterity (Koch 2020, 675; Mignolo and Walsh 2018).

The field of RRI potentially offers an effective means to advance epistemic justice in global ethical governance. This is because its conception marked a move from traditional rule-based ethical reviews to promote inclusivity, anticipatory governance, public participation and the interdisciplinarity of emerging technologies (Owen et al. 2013). By ‘opening up’ reflections on what constitutes good science and good governance, the evolving view invokes a ‘collective duty of care’ (Owen, Macnaghten, and Stilgoe 2012, 754, 757). Most notably, RRI is purportedly structured around a procedural framework of AIRR, that is,

Anticipation, Inclusion, Reflexivity and Responsiveness (Stilgoe, Owen, and Macnaghten 2013). Arguably, such a schema embodies key capacities for productive epistemic socialisation.

However, to date, the field of RRI has suffered from two inter-related shortcomings. One is that contrary to its original aim of ‘opening up’ governing discussions to more diverse stakeholders, RRI research has largely remained a top-down conceptual debate that ignores the politico-economic context and regional innovation studies (Jakobsen, Fløysand, and Overton 2019; Thapa, Iakovleva, and Foss 2019). A systematic review of publications in English between 2005 and 2015 shows that only 13% of the publications engage with ‘examples of, or suggestions for RRI practices’ (Schuijff and Dijkstra 2020). Another parallel study showed that only 6% of English articles between 2010 to 2019 on RRI engaged with case studies (Wiarda et al. 2021). Together, these findings indicate that, rather than broadening its empirical foundation as intended, RRI’s engagement with real-world practices remains limited and is not expanding as it should be. Relatedly, the discourse of RRI has largely remained Western-centric. More specifically, a ‘discursive disconnect’ exists between RRI scholars, who are comparatively closer to regulators, and feminist and decolonial theorists, who are more engaged with social relations and, consequently, the *realpolitik* of epistemic injustice in global science (Koch 2020, 674; Pandey 2024; Schuijff and Dijkstra 2020). In fact, Ludwig and Macnaghten (2020) have convincingly argued for a closer engagement between RRI and critical theory, enabling RRI to be more informed by and response-able to distributive and representational politics, as well as diverse communities’ struggles for recognition.

These two shortcomings constitute foundational hindrances to productive epistemic socialisation, which is central to RRI’s validity and influence. In connection with concerns about the inadvertent ‘Othering’ effect of RRI, Valkenburg et al. (2020) provide an incisive analysis of an often-ignored gap: the actions needed to translate social inclusion into epistemic inclusion and achieve epistemic empowerment. They point out that a key objective of an inclusive RRI is to foster ‘onto-epistemological trust’ (Valkenburg et al. 2020, 18) – the willingness of parties to acknowledge, value, and interact with knowledge from others who have different ways of conceiving the world (ontological positions) and different ways of knowing the world (epistemic positions). This trust is essential for the epistemic empowerment of non-Western actors and their active participation as supportive, engaged, and contributory members of RRI.

Builds on existing studies, this paper examines four scientific scandals to highlight how easily epistemic injustice can be perpetuated within RRI discourse – a shared challenge for both Global North and Global South actors. It further explores how RRI, with its procedural emphasis, can and should foster epistemic empowerment in the Global South. It should be reminded that scandals are challengers to the epistemic fiat of the science system and they arguably are sites of compulsory ‘epistemic socialisation’. This does not mean that they necessarily will change the course of moral paradigms, but they are critical venues to sharpen our ethical sensibilities so as to become a responsible knower.

## Science ‘out of place’: unpacking testimonial injustice

The locality of scientific advancement matters, because it is closely associated to (and sometimes a determinant of) an actor’s epistemic position in global knowledge production. Non-Western countries, such as India and China, occupy ‘the geography of blame’ (Bharadwaj 2013, 33). Their ambitious scientific agendas, coupled with persistent challenges in regulatory enforcement, appear to justify concerns that they are ‘particularly prone to scientific scandal’ (Lee and Schrank 2010, 1231). Some might categorically assert that they will ‘always be bad at bioethics’ (*The Economist* 2019). There are valid concerns regarding mavericks and fraudsters in any rapidly evolving field where investment is plentiful and regulation is insufficient. But it is equally important to note that when such concerns are entangled with historically rooted epistemic injustice, they tend to obscure rather than illuminate social discourse and responses towards more accountable research culture.

The section draws on the scandalous reception of two ‘firsts’ in reproductive science, one in the 1970s and one in early 2000s, to bring out different sides of testimonial injustice and their relations to understanding RRI. It deepens existing discussion by highlighting three points: First, these examples demonstrate that epistemic injustice is not merely a binary conflict of ‘West versus Rest’ or ‘Us versus Them’. Instead, both cases reveal that epistemic injustice is often perpetuated by domestic authorities. Moving beyond a Us-Them dichotomy in discussing epistemic injustice is essential to fully understand the



depth of the colonality of knowledge and the enduring dominance of hegemony in modern science (Mignolo 2000). This leads to the second point: the challenge of fully recognising responsible research and innovation and penalising irresponsible practices is not solely a geopolitical issue, but fundamentally an epistemic one. Thirdly, underlying testimonial injustice is not only the often-overlooked credibility cost of the Global South but also a lack of ‘onto-epistemological trust’ (Valkenburg et al. 2020), which validates and perpetuates existing hierarchies in global science. Over time, however, chronic testimonial injustice has evolved into a significant reasons of counterhegemonic efforts, perversely incentivising ‘disorderliness’ in scientific experimentation.

### ***The first IVF baby in India***

STS scholars Sarah Ferber, Nicola Marks and Vera Mackie (2020) opened their seminal work on the global history of in vitro fertilisation (IVF) with a scandal of epistemic injustice: 1978 is heralded as the inaugural year of IVF technology, celebrated through the birth of Louise Brown, the world’s first IVF baby, in London. This event marked the onset of IVF’s successful clinical applications. The groundbreaking contributions of Robert Edwards and his team were subsequently acknowledged with a Nobel Prize in 2010. A second IVF baby, Kanupriya Agarwal, was born in Kolkata, just under three months later. Yet, the similarly pioneering work of Indian scientist Subhash Mukherjee did not bring him recognition but repudiation, ultimately leading to his suicide in 1981 (Bärnreuther 2016).

What ‘scientific proof’ is sufficient to verify Mukherjee’s work was central to his tragic death and to the Indian authority’s decision to systematically block its publication, dissemination and replication (Bharadwaj 2016). Mukherjee’s work was briefly celebrated locally at first. Although not achieving the world’s first IVF birth, it nonetheless achieved significant technical breakthroughs. This included the successful cryopreservation of an eight-cell embryo resulting in a successful and live birth, a milestone that predated similar achievements by five years (Anand Kumar 1997, 530). Three days after Agarwal’s birth, Mukherjee’s team was asked to provide scientific proof of their IVF claim to an inquiry committee lacking expertise in reproductive science. Despite the records of the procedure, the committee dismissed Mukherjee’s work as fantastical and demanded culturally insensitive evidence, including genetic test of the baby, parental testimonies and repeated medical exams to confirm blocked fallopian tubes (Bharadwaj 2016). However, from a conservative Marwari family, the parents feared publicity would further stigmatise them and saw repeated medical exams as treating the mother as a ‘guinea pig of the scientific community’ (Bärnreuther 2016, 78). More importantly, as many later noted, even if such ‘evidence’ were provided, it still could not unambiguously prove that the fallopian tubes were blocked *before* conception. More genetic information about the baby would still not prove she was conceived through IVF. In short, it seems the committee had already deemed his claim ‘incredible’ and steered the scrutiny towards a line of reasoning that was impossible to substantiate. Consequently, the Indian authority consider Mukherjee was not to be celebrated but ‘damage control’. He was denied from attending any conferences without prior permission from the authority, blocked his publication and transferred to a department which he could not replicate his result (Anand Kumar 1997, 530–531).

For anthropologist Sandra Bärnreuther (2016), the scandalous reception of Mukherjee’s groundbreaking delivery of India’s first IVF baby exemplifies testimonial injustice, reflecting what is perceived as science being ‘out of place’. This ‘out-of-place-ness’ has two dimensions. At one level, Mukherjee’s concurrent achievements with his British counterparts disrupted the expected ‘geographical hierarchy’ that typically positions the Global North as the hub of innovation and the Global South as mere imitators (Bärnreuther 2016, 85). Mukherjee was wronged specifically in his capacity as a knower (Fricker 2007): Trailblazing scientific successes *shouldn’t* be expected to take place in the Global South, thus it *couldn’t* be true.

This prejudice seemed to be further validated by an additional layer of out-of-place-ness. That is, Mukherjee’s clinical research took place in his flat in one of Kolkata’s upper-class neighbourhoods rather than within the confines of a medical institution. He chose this unconventional location because he believed the sanitation in his affluent neighbourhood was superior to that in local hospitals. Supporters of Mukherjee pointed to historical precedents, asking rhetorically, ‘look at Pasteur: what were his facilities?’ (Bärnreuther 2016, 81). Nevertheless, this unorthodox setting not only cast further doubt on the legitimacy of his scientific work but, more crucially, placed his discoveries outside the conventional research structure and thus

outside of the interest and protection of scientific establishment (Bärnreuther 2016, 80–82; Ferber, Marks, and Mackie 2020). It was not until the end of 1990s, when India started to be seen by the world, and indeed by itself, as a place for scientific innovations, that the verdict on Mukherjee been reverted to became a symbol of Indian ingenuity.

The scandalous nature of the Mukherjee case lies in the Indian authorities' failure to uphold the kind of testimonial justice that RRI seeks to promote – ultimately contributing to the tragic outcome of Mukherjee's suicide. The scandal was shaped by expectations about the appropriate setting for clinical research and the types of evidence deemed legitimate – standards rooted in Western frameworks, internalised and enforced by national authorities without cultural sensitivity. In doing so, the authorities not only undermined epistemic credibility but also reproduced the very asymmetries that RRI is intended to address.

### ***The world's first human-rabbit hybrid embryo***

A second example of 'science out of place' is the 'Wild East' controversy surrounding the creation of world's first human-rabbit hybrid embryos by two Chinese scientists between 2001 and 2003 (Zhang 2012). The research on creating chimeric embryos from animal oocytes and human cell nuclei using somatic cell nuclear transfer was mainly aimed at reducing the use of human embryos, especially the use of human oocytes in biomedical research (Mayor 2008). It should be reminded that at the beginning of the millennium, China was still a considered a new player in global cutting-edge science. According to statistics published in *Nature*, China then accounted for only 1% of the world's top 1% highly-cited publications, and ranked only 28th in terms of paper quality based on citations (King 2004).

In this context, it is perhaps not surprising that when Chinese scientist Chen Xigu announced in 2001 that he has created the world's first human-rabbit hybrid embryo, the news shocked the world. Despite the fact that Chen's research did not violate any domestic regulation or international consensus, and that Chen emphasised that he would 'never make any attempt in researching reproductive cloning' (Zhang 2012, 84), the socio-ethical benefits of reducing human embryo use were ignored by Western media, which swiftly labelled Chinese life sciences as a 'morally bankrupt "Wild East" of biology' (Dennis 2002, 334).

In parallel, a second Chinese team led by Sheng Huizhen, Chief Scientist for the national 973 Program, was conducting the same research. Not only had her research received full support from the Shanghai ethical review board, but Sheng herself was also a prominent figure in promoting the normalisation of Institutional Review Boards (IRBs) in China and in advancing regional ethical guidelines regarding embryo research (Zhang 2012, 87). However, her compliance with and efforts to promote responsible research in China could not counter the entrenched Western suspicion that pushing scientific breakthroughs in a place like China 'must' be morally questionable. Despite repeated assurances from the Chinese scientific community that reproductive cloning was banned, these statements were largely dismissed in the West. As one Chinese ethicist recalled, 'When Western media learned what Sheng was doing, there was so much misunderstanding. They suspected we were making cloned humans' (Zhang 2012, 47). Sheng's attempts to publish findings on human-rabbit hybrid embryos were also consistently rejected by Western journals, leading her to publish in *Cell Research*, a China-based, English-language journal (Chen et al. 2003).

Similar to Mukherjee's IVF achievement, Chen's and Sheng's work was briefly celebrated domestically. But the seemingly predetermined international skepticism overrode scientific reasoning and prior institutional ethics reviews, quickly undermining their scientific credibility. Notably, rather than defending their researchers, Chinese authorities also yielded to global perceptions. Not only did China effectively banned this line of research to silence the debate, but in Sheng's case, despite her significant contributions to advancing IRB practices in Shanghai, her funding was discontinued, and her university chose not to renew her contract.

Chen's and Sheng's respective breakthrough was 'out of place' in a country that, up to that time, was at the lower end of the 'geographical hierarchy' of scientific and bioethical innovations. What further highlights the epistemic bias embedded in the scandalous initial reception is that in early 2007, the UK's Human Fertilisation and Embryology Authority had endorsed cytoplasmic hybrid research, which was identical to Sheng Huizhen and Chen Xigu's previous studies (Mayor 2008). Sheng was among the select international experts consulted by the UK government on this matter. The UK's endorsement of this



line of research restored Sheng's credibility, making her 'onto-epistemologically trustworthy' again, as it reinvigorated domestic praise for China's pioneering work in this field. However, the Chinese government's earlier decision to suppress Chen and Sheng's research had cost China's leadership in this area. As noted by one Chinese newspaper during a visit to Sheng's facility, 'the research once directed by Sheng was already put to a halt, and the whole research building already looks empty' (Ji 2007 in Zhang 2012).

### **Further reflections**

Arguably, Mukherjee, Chen, and Sheng were all given the impossible task of proving themselves – whether their scientific claims or their moral intentions. But how could one prove oneself if there was no 'onto-epistemological trust' to begin with? (Valkenburg et al. 2020, 18). Nearly all major life science breakthroughs, such as India's first IVF baby and the world's first hybrid embryos in China, challenge existing ethics by broadening what is technically possible, inevitably sparking ethical debates. What makes these two 'firsts' scandalous, however, is not so much the ethics *per se* but the role scientific establishments including local authorities played in reinforcing testimonial injustice to the scientists involved.

Studies on the coloniality of power have long pointed out that being in the Global South does not automatically mean social actors and institutions are 'thinking from a subaltern epistemic location' (Grosfoguel 2007, 213; Quijano 2000). The true force of epistemic hegemony lies in its ability to mould the epistemic viewpoints of individuals in the Global South to mirror those held by dominant groups, often dismissing indigenous claims. The first point these two cases reveal is the nuanced nature of testimonial injustice, which transcends a simplistic North–South or Us–Them binary. In both cases, national authorities in India and in China were on *the same side* of Western norms on what constitutes a 'right' way of doing science and the necessary credibility to claim scientific breakthroughs. Ferber, Marks and Mackie's (2020, 27–70) examination on the early phase of IVF research showed that concurrent efforts could also be found in Australia, France and the USA. However, as different places possess different epistemic credibility, where an achievement takes place mattered.

To have a more nuanced view on how epistemic injustice is perpetuated is a prerequisite to recognise that RRI offers a regulatory praxis, but is also an epistemic project. For example, the reversal of judgement on the two cases depended on a prior epistemic change. That is to say, scientists from a particular locality are sanctioned as credible knowers, or that a particular scientific pathway is recognised by the upper echelons of the global knowledge hierarchy as credible knowledge.

Finally, the link between testimonial injustice and science 'out of place' is of particular relevance and a particular challenge to today's RRI. Seeing certain scientific practice or scientific claims 'out of place' is essentially about keeping certain actors and certain pathways out of science. Testimonial injustice plays a crucial role in determining who is allowed to participate in science and who has a voice in setting the research agenda and pace. However, as discussed in the final section, the social organisation and expectations of science have undergone substantial changes over the past few decades. Testimonial injustice based on hegemonic views on who 'should' steer science, will only blind us from recognising the capacity and impact of those who could shape the field.

### **Science 'out of pace': unpacking hermeneutical injustice**

Research and innovation are often perceived as a competitive race, especially in the contemporary global research culture which has been characterised as one 'that puts a premium on provocative research, celebrity, national scientific competitiveness, and firsts' (Begley 2018). As researchers strategise to surpass their peers, this competitive ethos has also led to controversies surrounding 'out of pace' science – research that, regardless of its scientific soundness, challenges the technical necessity and ethical suitability of certain scientific advancements.

Two of the most notable 'scandalous firsts' associated with individuals rushing to delivering clinical application are the birth of the world's first baby using mitochondrial replacement therapy (MRT) in Mexico in 2016, and the birth of the world's first 'CRISPR babies' – twin girls who underwent heritable human genome editing in China in 2018. While some considered that there are 'striking similarities' between the two cases, especially in their media announcement, exploitation of non-Western countries' legal enforcement

and impact on public trust (see Dimond, Lewis and Sumner, 2022, 4), there is also a key difference. That is, by 2016, MRT therapy has been legalised in the UK, while, at the time of writing, using CRISPR technology for heritable human genome editing remains prohibited globally.

This section discusses these two cases with a focus on hermeneutical injustice. As discussed earlier, testimonial and hermeneutical injustices are interconnected. But hermeneutical justice and inclusivity is critical to comprehend the necessity and desirability of a research agenda. For example, different patient and disability groups may have conflicting and equally valid views on the imperative of heritable human genome editing. Additionally, the urgency of technical solutions for individuals affected by the same condition can vary significantly between countries due to factors like social stigmatisation and the availability of other forms of support.

This section expands the discussion on hermeneutical injustice and RRI by highlighting how socially embedded and institutionally reinforced interpretative bias may perversely turn the discussion on improving RRI into a form of ‘Othering’, which further alienates research communities in the Global South, and compounding existing disparities (Pandey 2024). Such Othering is not limited to the marginalisation of certain user groups or publics but has also created ‘epistemic marginalization *within* science’ (Koch 2020, 675, original emphasis). On this point, the CRISPR Baby case may be most illuminating. It is useful to be reminded here that ‘Global South’ in this paper refers to epistemic positioning. While China, as a nation-state, demonstrates incredible productivity in contemporary science, it is widely recognised that Chinese scientists remain the ‘epistemic Other’, subject to racial profiling, discrimination, and political distrust (Adam 2024; Sharma 2021). As this section further explores, the CRISPR Baby case demonstrates that scientists from a seemingly ‘powerful’ country like China cannot escape ‘epistemic Othering’, which makes the deep-rooted nature of epistemic injustice in ethical governance even more compelling.

### **The world's first MRT baby**

In April 2016, American clinician John Zhang made medical history by delivering the world's first MRT baby, Jessica Hamzelou, for a Jordanian couple residing in Guadalajara, Mexico. The procedure involved replacing the nucleus of a healthy donor egg with that of an egg from a woman carrying a rare neurological disease known as Leigh syndrome, while retaining the donor's healthy mitochondria (Reardon 2017). Zhang outpaced a general expectation that the first MRT baby would be born in the UK, the only country in the world that has permitted clinical mitochondrial replacement. It also outpaced clinical development in the US, where John Zhang practiced. While MRTs were, in principle, considered ethically acceptable within specified bounds in the US, Congress had effectively blocked the FDA from considering applications to carry out these techniques by prohibiting the creation or modification of human embryo to include a heritable genetic modification (Dimond, Lewis, and Sumner 2022; González-Santos, Stephens, and Dimond 2018).

The arrival of the MRT baby in Mexico evoked controversy. Zhang's haste to achieve the world's first raised concerns of ‘ethics dumping’ – a practice of outsourcing questionable experimental research to areas with lax oversight or inadequate law enforcement. His rush to commercialising the treatment as ‘Human Egg Rejuvenation (H.E.R.) IVF’, with broad ‘other applications ... in the future’ also received FDA warning (Everett 2017; Ishii 2017). Adding to the scandal was Zhang's response when questioned about choosing Mexico for the baby's delivery, stating simply, ‘there are no rules’ (Hamzelou 2016).

Zhang's ‘no rules’ remark soon became a tagline of global portrayal of the context of the MRT baby. While the clinical achievement was attributed to ‘American’ scientists, the scandal nevertheless remained a ‘Mexican’ one. That is, the international media's narrative reinforced the trope of Mexico as part of the Global South – an epistemic Other that lacks the culture or infrastructure for good governance (González-Santos and Saldaña-Tejeda 2023; Palacios-González 2018).

There are at least two layers of hermeneutic injustice need to be unpacked. Firstly, what has been largely ignored by Western media is that Mexico *had* rules (Ishii 2017). Legal specialists César Palacios-González and Maria de Jesús Medina-Arellano (2017) pointed out that Zhang violated Article 56 of the Regulations of the General Health Law on Health Research, which prohibited the use of MRT unless it was part of health research and its aim was to solve fertility issues that could not be solved otherwise. A later FDA report revealed the Zhang had violated US regulations by manipulating embryos more than the minimal permitted

allowance and exporting them to Mexico without due procedure (Everett 2017). In the Mexican state where Zhang conducted the clinical treatment, associated benchwork would also have breached state law, as the procedure involved the destruction of human embryos, which could result in criminal prosecution (Palacios-González and de Jesús Medina-Arellano 2017). Of all the Mexican national and state authorities that were responsible for such clinical research, Zhang did not consult any of them. He did consult the Federal Commission for the Protection Against Sanitary Risks on the legality of the treatment. However, clinical application of MRT was outside of the Commission's regulatory remit (Palacios-González 2018).

One could contend: Is the scandal rooted in a country with 'no rules', or does it stem from a deeper hermeneutical injustice – where Global North actors impose their own interpretive frameworks while dismissing and marginalising the Global South's legal customs and governance structures?

Secondly, the interpretive bias embedded in the global portrayal of the MRT baby had an Othering effect, provoking a nationalist counter-narrative in the Mexican media. To be sure, it is not that Mexican society denied that Zhang's case highlighted gaps in Mexican legislation that needed to be addressed as medical science progressed (Ishii 2017). But this case overlooks the 'subaltern anxiety' that pervades the daily research activities of many academics in the Global South (Zhang and Datta Burton 2022, 19–32). This anxiety fuels their frustration with the 'no rules' stereotype and underscores the need to refute such claims. In response to Western media coverage, Mexican media emphasise the financial and scientific contributions of the Mexican clinic, reframing MRTs as a revolutionary breakthrough and a national success. This narrative positioned Mexico as a producer of cutting-edge technology with strong governmental backing. Rather than facilitating epistemic socialisation, global scrutiny has instead fuelled counterproductive antagonism. As González-Santos and Saldaña-Tejeda (2023, 13, 14) rightly pointed out, this Othering effect has diverted the global scientific community from the real 'social injustice underlying contemporary biomedicine' and shifted attention away from the fact that controversial research is 'often not circumscribed to the nation-state' but rather 'involves a heterogeneous array of actors located in different countries and facilitated by an internationally permissive scientific culture'. The perverse alienation of Global South scientific communities and the derailment of concerns about socially just biomedical advancement into nationalist antagonism are also reflected in the differing responses of Chinese and Western academics to Jiankui He's CRISPR baby experiment.

### ***The world's first CRISPR babies***

In November 2018, Chinese biophysicist Jiankui He, through an interview with the Associated Press, announced the birth of the world's first twin girls with their genomes edited by the latest CRISPR technology so as to keep them from being infected by HIV (Marchione 2018). The announcement quickly sparked global outcry because it blatantly disregarded an international consensus to pause human genome editing until further clarity on safety, efficacy, and ethical issues was achieved (National Academies of Sciences, Engineering, and Medicine 2015).

For the Chinese scientific community, Jiankui He was undeniably a 'rogue' scientist who has broken the law. His actions were particularly egregious given that he was a biophysicist without medical training, and that China had prohibited human embryo research for reproductive purposes since 2013. Within a day of his controversial announcement, 122 Chinese scientists collectively issued a statement strongly opposing and condemning his research. This forceful denunciation served as critical 'boundary-work' for the Chinese scientific communities. It was essential to demonstrate to both Western counterparts and Chinese authorities the type of research environment that the overwhelming majority of law-abiding, conscientious scientists in China strive for (Cyranoski and Ledford 2018, 608; Zhang, Ouaghrham-Gormley, and Vogel 2023). After a one year investigation, the Chinese authority sentenced Jiankui He to three years in jail.

The irony, however, was that the global discussion surrounding He and the Chinese scientific community's reaction to the case carried a pronounced 'Othering' effect. While the swift and unequivocal rejection of He's practices by the Chinese scientific community could have been a moment of epistemic empowerment and global unity on the issue of RRI, the reaction instead revealed a deeper layer of *hermeneutical injustice* – the second dimension of epistemic injustice. Chinese communities were perceived as lacking the 'hermeneutical competence' to arrive at the 'right' resolution regarding He's case without the guidance

and critique of their Western peers, implying that meaningful interpretation of RRI violations could only take place through a Western lens. This can be demonstrated through three aspects of Western discussion.

Soon after the Chinese scientists' denouncement of He's illegal practice, Western academics started to argue that labelling He as a 'rogue' might be considered unfair, as his actions were part of the ethical slippery slope that often accompanies the competitive nature of global research (Dickenson and Darnovsky 2019). Some noted that He's fault lies not in ignoring Western debates on this issue, but in 'listening too intently' to views circulated in 'the inner spaces of science' (Hurlbut 2021). Along this line, some have argued that the heart of the problem was 'not so much because of *what* he did, but *when*' he did it (Morrison and De Saille 2019, 2). The 2022 documentary film, *Making Better People*, portrays He as a scientist potentially misled and manipulated by an overly ambitious regime, who may have been wrongly prosecuted. In contrast to such problematisation, the Chinese scientific and ethical communities seemed to lack the sensibility or sophistication to acknowledge that He was scapegoated, despite the fact that his practice was categorically illegal in China (Zhang and Datta Burton 2022).

There is some truth to the Western scapegoating theory, especially since it later became public knowledge that US-based academics played 'an instrumental role' in He's project (Qiu 2019). The irony, however, is that Western-led discussion simultaneously reiterated chronic concerns over Chinese legal loopholes, inconsistent ethical compliance and non-transparency, while reinforcing an impression of discounted agency (and possibly credibility) of the scientific community within China. He's experiment was quickly described as the latest evidence of the 'Wild East' biology in China, and some pointed to the Chinese authoritarian regime as a root cause for such scandals to happen, despite the fact that He did his experiment during sabbatical and with private funding (Zhai et al. 2019). In other words, Western RRI discourses simultaneously dismissed the Chinese scientific community's condemnation of He as missing the bigger picture while also generalising He as a representative of the very community that denounced him.

A further example of the structural deflation of the epistemic agency of the Chinese scientific community was demonstrated through a high-profile media report on an online meeting held on 11 February 2023. After Jiankui He was released from prison, his pursuit of gene therapy for Duchenne muscular dystrophy and other genetic diseases gained support from desperate patients but also sparked public concerns. On 11 February 2023 an online meeting was held in which Chinese academics confronted He about the scientific and ethical validity of his new experiment. *Nature* was the first to report this online event. However, the report focused solely on the disappointment and regulatory concerns of Western academics, omitting the views of Chinese scholars, despite the presence of over 70 Chinese researchers at the event who posed about two-thirds of the questions (Mallapaty 2023; Zhang et al. 2023).

In short, global RRI practice is shaped not only by societal concerns but also by enduring epistemic asymmetries – particularly in whose voices are heard, validated, and given authority over emerging biotechnologies. Despite China's rapid rise in research power, its scientific community remains epistemically constrained. Their response to He's case – swift and unequivocal – was largely dismissed as inadequate or secondary to Western ethical judgments. This reflects a deeper entanglement between RRI and epistemic injustice: while RRI aspires to inclusivity, its implementation can also reinforced the Othering effect – perpetuating stereotypes of China as a regulatory failure while dismissing the legitimacy of its internal scientific and ethical deliberations.

### Further reflections

Epistemic injustice is invariably embedded within a matrix of power relations. As such, the emergence and effects of epistemic injustice are multifaceted and these power dynamics are often obscured from view with mounting tensions. It is useful to remember that many biomedical innovations will remain *controversial* even after full legalisation and after long periods of social dialogue. For example, when the first MRT baby was born in Britain in 2023, ethical disputes remained (Knapton 2023). Yet it is exploitative practices that were out of sync with expected social and structural norms that made them *scandalous*. To some extent, scandals of 'science out of pace' represents 'cracks' in our knowledge and governance structures, offering a glimpse into the underlying hierarchies of influence that fuel these scandals and shape the diverse responses they provoke.

Unless sufficient effort is made to empirically engage with diverse communities and enable meaningful epistemic inclusion, RRI risks remaining Western-centric. This not only reproduce inequalities in knowledge validation (as demonstrated in the ‘science out of place’ section) but also reinforces stereotypes and alienate well-intentioned actors (as discussed in the ‘science out of pace’ section). Understanding this inadvertent effect help to explain some of the disinterest or perceived resistance towards RRI among scientists and policy makers in non-Western context (see Pandey 2024; Zhang and Datta Burton 2022). For example, it is noteworthy that in both the clinical application of MRT and CRISPR technology, inadequate law enforcement in Mexico and China facilitated the ensuing scandals. In both countries, academics were eager to combat the old image of ‘no rules’. It is not that scientists in these countries were unaware of the regulatory gaps; rather, it underscores a consistent overlooking of the Global South scientific community’s vulnerability to Western bias and domestic regulatory failures. For example, at least in these two high-profile scandals, the global demand for responsible and prudent research could paradoxically impose the reputational costs of these incidents on law-abiding and conscientious scientists.

My analysis resonates with existing research that identifies a prevalent unconscious hermeneutical bias in bioethical and RRI discussions concerning the Global South (Chan, Palacios-González, and De Jesús Medina Arellano 2017; Pandey 2024; Pratt and de Vries 2023; Tangwa 2023). An excessive focus on developmental and regime differences can lead to a new ‘Othering’ effect which deflates rather than empowers the epistemic agency of key stakeholders essential for implementing change. This, in turn, prevents ‘epistemic socialization’ (Fricker 2007; Pandey 2024, 11). This may divert attention from actual governance gaps, how they have been exploited, and by whom.

It is useful to reflect on what (else) is ‘out of pace’ in these two cases. Egoistic and competitive research culture alone was not sufficient to enable these two ‘firsts’. They also underlines a profound change in the evolving diversity and contested nature of how cutting-edge science is being organised. A top-down prescription of Western-centric RRI discourse is out of pace with the increasing interconnectedness and entangled nature of contemporary science. Rather, RRI must ‘de-link’ from hegemonic perceptions of who are qualified knowers in science, and ‘re-link’ with bottom-up onto-epistemic diversity (Mignolo and Walsh 2018).

### **Keeping pace with science in place(s): why RRI is essential to counter future scandals**

RRI is essentially about curating collective dialogue and stewardship over ‘what sorts of futures we want science and innovation to bring into the world’ (Owen et al. 2013). Both ‘science out of place’ and ‘science out of pace’, with their varied ethical and human cost, sharply bring up a wider question of whom the term ‘we’ encompasses and should encompass in that future.

It is increasingly the case that scientific authorities worldwide struggle to keep pace with how cutting-edge biomedical technologies are and may be applied in different places with different incentives. An expanding multiplicity of incentives and diverse societal resources are enabling cutting-edge biomedical research to be conducted outside of conventional institutional science. For example, since 2018, increasing global public awareness of the affordability and unequal access issues surrounding gene therapy has bolstered the rise of ‘Robin Hood’ biohacking (Pearlman, 2019). That is, a band of independent and amateur biologists start to pirate commercialised or experimental gene therapies and promote self-experimentations, disregarding warnings from medical authorities, such as the American Society of Gene + Cell Therapy (2017), that ‘the practice of unregulated gene therapies... are potentially dangerous and highly unlikely to provide therapeutic benefit’. Some see such bottom-up initiatives as providing much-needed pressure to democratise biomedical research, while others consider these initiatives as scandalous for they provide no credible alternatives to the existing system yet adding new biosafety and biosecurity risks. Yet in the eyes of these activists, their scientific practice ‘should be seen as a political statement’, aimed at ‘disrupting the narrative’ of Big Pharma and institutional science (Mullin 2017; Pearlman, 2019), for epistemically, they and the public they represent are the Global South. This has been further complicated by the pluralisation of new configurations of research practices supported by novel forms of public-private partnerships and crowdsourcing.

Although these forms of social activism differ from the ‘scandalous “firsts”’ discussed in this paper, they are similarly driven by perceptions of epistemic injustice, whether justified or not. More specifically, they



represent a response to the ‘hegemonic status’ of norms upheld by mainstream institutional science and the repressive impact of capitalist logic in knowledge production (Prainsack, Geesink, and Franklin 2008; Rosemann et al. 2016, 17). They signal a shifting paradigm in the relationship between science and society, and a contention over epistemic jurisdiction – the authority to produce or validate technical knowledge for a specific political community (Winickoff and Mondou 2017, 25).

The imperative of ‘onto-epistemic empowerment’ – a critical foundation for decolonising RRI and fostering meaningful epistemic socialisation, both between science and society and within scientific communities – has never been more pressing (Koch 2020; Valkenburg et al. 2020; Zhang 2023). While the RRI framework is commonly referred to as AIRR, in the sequence of Anticipation, Inclusion, Reflexivity and Responsiveness (Stilgoe, Owen, and Macnaghten 2013), I, like many others, believe its practice may be better captured by adapting the order to IARR (Koch 2020; Pandey 2024). This highlights that epistemic Inclusion is a prerequisite for informed Anticipation, which can help steer potentially scandalous ‘out of place’ and ‘out of pace’ science towards more constructive and less disruptive avenues of discovery and innovation. True epistemic inclusion also facilitates a *Reflexivity* that extends beyond a self-referential contemplation but embodies the epistemological trust (and confidence) to critically engage with knowledge claims and human experiences from different communities, hereby expanding one’s epistemic horizons (Mignolo 2000; Valkenburg et al. 2020). *Responsiveness*, then, entails not only to address social or technical concerns but also the capacity to recognise and rectify epistemic injustice that render innovation irresponsible or insensitive to social values.

RRI, with its procedural rather than rule-based approach, offers great adaptability to the evolving and interwoven nature of contemporary life sciences. Foregrounding epistemic Inclusion is critical for RRI to keep pace with scientific advancements occurring in diverse places. It requires a commitment to empirical studies but, more importantly, a willingness to extend onto-epistemological trust to different communities and to empower non-Western epistemic communities rather than merely instructing them. Ethical governance of emerging technologies can effectively minimise potential scandals and their impact only when it becomes a venue for epistemic socialisation aimed at broadening, not constricting, ethical sensibilities.

## Author contributions

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