Biocrossing Heterotopia: Revisiting Contemporary Stem Cell Research and Therapy in India

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Introduction

As I looked on, Dr. Bhatia and his attendant opened the Styrofoam box full of liquid nitrogen. As the vapors rushed to escape the confines of the box they had travelled in for the past four hours from Hyderabad to Delhi, Dr. Bhatia reached his gloved hands into the box and pulled out two vials. They both (the doctor and his attendant) then took each vial and gently started rolling them in their hands to thaw out the millions of frozen cells that had travelled across the country for a patient that was in the next room. Dr. Bhatia, while rolling the vial in his hands, continued to tell me about his patient, a lower-middle-class woman in her mid-fifties with optic atrophy who had tried all treatments and had recently turned to stem cell therapy as her last resort.

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> The doctor took the thawed cells and moved to the next room. Mrs. Padma lay on the single bed while her husband waited outside. She seemed visibly distraught about the insertion she was about to undergo, and as Dr. Bhatia assured her, he asked me to stand above her headrest, as I would get a 'better view' of the insertion. Instinctually, Mrs. Padma reached out and caught my hand; I decided to move closer and offer the support she needed as I watched Dr. Bhatia transfer the cells from the vial into a syringe with a specialized two-inch needle, used for optic nerves. During the transfer and organization for the insertion, Dr. Bhatia, while focusing on the process of what he was doing, continued to talk to me. (It almost seemed he did that to assure Mrs. Padma and perhaps me, about the everydayness of the procedure for him). As he took the needle and carefully inserted it into the patient's eye, he explained about stem cell therapies: 'This is what is being called a 'cocktail' of stem cells. These are not pure bone marrow-extracted cells that have been centrifuged, but rather cell lines that have been developed particularly for optic nerves. These aren't your embryonic cells nor the autologous cells that everybody now chooses to work with but somewhere in between because I find them more effective'. (Appleton field notes, 2014)

This conversation happened in early 2014. Since then, there have been numerous changes in clinical practices around therapeutic application because of the shifts in regulatory frameworks in India. The key factors driving changes in the field are the 'guidelines' offered by the Indian Council of Medical Research (ICMR) and Drug Comptroller General of India (DCGI) about permissible stem cell research and therapies (ICMR 2007, 2013). One of the direct implications of these regulations has been the shift in focus of both the research labs and clinical facilities to move away from human embryonic stem cells (hESCs) toward somatic stem cells. As Dr. Bhatia explained, 'We both know that Mrs. Padma's chances for her sight to return would be higher if we used embryonic stem cells, but I don't want to take on the government and the entire research world with what they have decided is outside the realm of acceptable stem cell therapies'.

He explained that he did not work with embryonic cells, because of the regulatory and scientific world viewing them so critically, but he did not like working with autologous stem cells because he found that efficacy

was limited and at times minimal. He felt that most clinics and physicians were happy to work with minimally manipulated autologous cells, since they were 'non-risky' and provided a safe way to 'new medicine'.

Over the 2 years that Appleton has worked with Dr. Bhatia, he has continued to work with allogeneic somatic cells he purchases from a lab in Hyderabad. However, as the regulatory framework pushes for the guidelines to become law in the next year or two, he suggests he will have to develop his own lab where he can seek clinical-trial funding to continue to do the work he does for his patients.

As research that drives stem cell therapy crosses the terrain of hESCs and moves toward cells derived and developed from somatic cells, it is perhaps timely to examine, following Sarah Franklin, the contours of stem cells as they are normalized and made 'curiousiour and curiousiour' (2013). The emerging politics and science behind the curious shift from embryonic to somatic cell research in India and the push to mainstream autologous somatic cell transfers therapies is a good example of 'biocrossing' (Bharadwaj 2008). That is, transfers achieved through twin processes of extraction and insertion and administered as an intended medical resolution of a pre-existing social or medial problem. Largely, biocrossing can be a conceptual or real movement between biology, biology, and machine and across geopolitical, commercial, ethical, and moral borders of varying scale (Bharadwaj 2008, p. 102). The notion of 'bio' implicit in this movement or 'crossing' is doubly articulate. First, bio is quite literally a biogenetic substance saturated with political, ethical, therapeutic, and commercial value accessed through these twin processes. Second, the notion of bio signals the presence of an implicit and explicit individual and/or institutional biography inextricably (re)written as crossings gain momentum. In this chapter we articulate the faint traces of utopic and dystopic logics underscoring these 'crossings' and the evolving biography of a contested terrain this (re)scripts. In so doing we engage with our ethnographic immersion into the lives of physicians, researchers, policymakers, and patients to conceptualize evolving scenarios that remain divergent and yet the source of emergent but shifting utopias and dystopias that get mirrored and experienced as a heterotopia.

Biocrossing and Heterotopia

Medical anthropologists and science and technology studies (STS) scholars have started looking at stem cell technologies and therapies as a way to understand and unpack the complexities of the social lives of this latest biomedical intervention, which as a nascent science has managed to mobilize capital and labor (both specialized and nonspecialized) in a geopolitical moral battle (Franklin 2006, 2007; Bharadwaj 2012; Thompson 2013). Thompson's rich ethnographic account, for example, focuses on a time period she dubs 'the end of the beginning of stem cell research' (2013). What she refers to as the 'end of the beginning' of stem cell research coincides with a shift from ethical issues surrounding hESCs to a stem cell science based on somatic (adult) cell lines and autologous cells. Thompson's cautionary note about ethics in stem cell technologies is important when she writes, 'The end of the beginning of stem cell research must open up, not close down, what can be raised as ethically important in the field' (2013, p. 27). As we track the 'biocrossing' from embryonic to somatic cells, we must open up the conversation not only on ethics, but also on the curious way this crossing is enabled and its implication—both for science and society. We suggest that the undulating landscape of stem cell research and therapies in India is a curious mélange of utopian views of benign good science of cellular therapies offering 'cures' for some of the worst known intractable afflictions and dystopian fears of runaway bad science violently proliferating dangerous cellular interpolations. To a large extent the moves to facilitate a shift from embryonic to somatic cell research in India mirrors this curious mélange. The utopias (and dystopias) shaping this curious terrain can be understood as 'sites with no real place' (Foucault 1967, p. 24). According to Foucault, both utopias and dystopias are 'fundamentally unreal spaces' (p. 24). However, he does allow for 'real places'—discursive and concrete—in civilizational and societal contexts that are something like counter-sites, an effectively enacted utopia in which 'other real sites that can be found within the culture, are simultaneously represented, contested, and inverted. Places of this kind are outside of all places, even though it may be possible to indicate their location in reality'.

Foucault describes these places/sites as absolutely different from all the sites that they reflect and speaks about and christens them as heterotopias, the contrasting other of utopias. For Foucault these places contrast utopias significantly and are absolutely different from all the sites they reflect and speak about. In this formulation a contrasting figure to utopia is not dystopia, but rather a reflection of the utopia itself. It is seemingly real, connected to the utopian ideal and/or projection and yet unreal as it can only be perceived as mere approximation, a reflection of the utopic and everything material and otherwise that surrounds it. A heterotopia is a real, existing 'other' place that can be experienced. They are countersites within a culture, enabling life to carry on functioning in a nonnormative vein in the face of normative circumstances.

The most important question is what a heterotopia reflects. We suggest that a heterotopia is perspectival. It can conjure and seemingly concretize in space- and time-enacted utopias and dystopias. In other words, a heterotopia collapses the distinction between a utopia and dystopia to the extent that the reflected real is prone to mutate based on the concrete reality of the reflected site. The reflected real momentarily stabilizes to birth a perspectival reality. In other words, mythic and real as well as utopia and dystopia collapse and stabilize to form perspectival realities. Kevin Hetherington (1997) sees heterotopias as spaces of social ordering that are different. These spaces, he argues, can be transgressive or hegemonic. In the end, heterotopias are made up of multiple and often 'incongruous processes of social ordering' (Street and Coleman 2012, p. 9).

Stem cells can be reimagined as heterotopias: manifest entities and discursive sites suffused with real and imagined, and utopic and dystopic alterations made manifest as biocrossings gain traction between the biogenetic, technoscientific, socioeconomic, and geopolitical landscapes of possibilities. Like a mirror image of the seemingly real, these cellular heterotopias are spaces that seem hegemonic but in practice are condemned to operate in a nonhegemonic, inconsistent manner. In this respect, biocrossing a heterotopia produces concrete social spaces fraught with opportunity and danger that on occasion can be calculated risk or a forced dislocation as the last resort (Bharadwaj 2008, p. 111–112). The biocrossings undertaken by actors in India are indeed complex moments that allow for a nuanced analysis, as they are not singular occurrences that

happen symbiotically, automatically, or 'naturally'. These biological and local biographies depart from the purportedly real, and it is this slippage that needs more focused analytical work.

Ethnography

This chapter is based on research conducted in India from October 2013 through December 2015. The data presented here is, in many ways, preliminary and a precursor to some of the realities and arguments that may emerge as we continue with this work in the future. It includes participation observations and informal interviews Appleton conducted with interlocutors in cities in India: Delhi, Mumbai, Bengaluru, Pune, Hyderabad, and Apela. While Delhi and Mumbai are 'tier-one' cities, Pune, Bengaluru, and Hyderabad are 'tier two', with all boasting multiple 'stem cell clinics' (irrespective of whether they are doing lab research or patient therapies). The last of these cities, Apela (a pseudonym, since it is a small town with easily identifiable clinics where Appleton worked), is in the western part of the country with a small hub of clinics and faculty at a teaching hospital involved in stem cell research and therapeutics. Appleton did most of her clinical participant observations in two hospitals in Mumbai that specialize in stem cell therapies; with two physicians in Delhi who worked out of different hospital operation rooms; one leading hospital with a top-of-the-line research lab and facility in Delhi; one clinic and one lab in Apela; shorter visits to two clinics in Pune; and multiple physicians, clinicians, and researchers in all these cities. In the course of the research, she spoke to over 100 participants (some of them multiple times) and spent 2 years fully immersing in the everyday lives of patients, physicians, clinicians, and policymakers involved with stem cell research and therapies in India. Bharadwaj's research has mainly focused on the emergence and spread of stem technologies across India. His research, supported by the European Research Council, engages with the scientific, policy, and everyday experiences in culture and therapeutic nurture of stem cells attracting global traffic in patients suffering from a range of incurable and terminal conditions to India.

The data in this chapter is drawn from a larger research project supported by a European Research Council grant (#313769). In this chapter, all names are anonymous to preserve confidentiality, per the ethical protocols at the Graduate Institute of International and Development Studies, Geneva, and the European FP7 framework guidelines. All respondents were informed about the nature of the research project and their ability to withdraw at any point from the study. Further, all research ethics protocols per the European FP7 were rigorously followed.

Biocrossings and Regulatory Frameworks: Physicians

While there are more registers to examine when studying the biocrossing(s) from embryonic to somatic, we focus on regulatory frameworks in this chapter as a way to examine the role of one scientific artifact from various perspectives. Talking to patients, physicians, and policymakers, it is evident that the stem cell terrain in India is indeed very complex, with multiple stakeholders (with new complexities and stakeholders emerging every day), so the focus here on regulatory frameworks is just the start of a conversation rather than an attempt to foreclosing boundaries. In this section, we look at the role of the state in promoting this latest of biocrossing, by privileging one form or therapy over other. The current regulatory 'guidelines' in India—while providing various ways physicians, researchers, and clinicians could develop and use stem cell therapies—had clearly marginalized hESCs as 'unethical', 'non-permissible therapies', and 'dangerous'. The DCGI and ICMR made certain forms of cellular permissible but are not willing to even remotely regulate but rather outright make hESCs outside their purview set the tone for how the country discusses stem cell therapy. An automatic 'good/permissible' science versus a 'bad/rogue' science has been established. While this establishes a certain utopian and dystopian hierarchy, heterotopic topography, these moves produce, often as an unwitting corollary, destabilizing effects.

Let us examine the responses to two documents written in 2013 by the Ministry of Health and Family Welfare (MoHFW). The first is a draft guideline issued in February 2014 by the Central Drugs Standard Control Organization (CDSCO) of the MoHFW, Government of India, called 'Guidance Document for Regulatory Approvals of Stem Cell and Cell Based Products (SCCPs)' (Guidance Document henceforth) (Central Drugs Standard Control Organization 2013). The other was issued by the ICMR and is the 'National Guideline for Stem Cell Research' (2013). Since they were both relatively new, often the people Appleton spoke to conflated the information in these documents.

One of the key issues of concern was that in the latest version of the second of the documents ('guidelines' in the remainder of this chapter), the authors and policymakers had removed the word 'therapy' from the title. The 2007 'guidelines' issued by the ICMR had 'Therapy and Research' in their title as a way to provide guidelines for researchers and clinicians involved with therapeutics along with research. However, according to the 2013 'guidelines', the term 'therapy' had been removed to the effect that anyone conducting therapeutic stem cell work was effectively involved in malpractice. Rather, the other document, issued by the CDSCO ('guidance document' in the remainder of this chapter) became the guiding point for physicians involved in clinical therapeutics with stem cells. If you were a physician working in any capacity to provide stem cell therapies, you were no longer under the purview of the 'guidelines'. Between both documents, these physicians and their work were now under the governance of the DCGI office, effectively labeling their stem cells as 'drugs' that needed to comply with the Drug and Magic Remedies Act of 1954. This limited their abilities to conduct 'cutting-edge research', since any 'drug' had to go through several phases of very expensive clinical trials before being approved.

The guidance document was issued just before Appleton attended a conference on stem cell therapies in Mumbai, and the tension was palpable at the conference as various clinicians tried to figure out which side of the law they operated on (even though these were not legislations but rather 'helpful guides for ethical' stem cell development in India). In large part these interlocutors simultaneously appreciated and bemoaned these documents as a foretelling of what was to be the future of stem cells

in India. However, the seeming hegemonic oversight crumbles when its enforcement is scrutinized. None of the above guidelines and guidance documents can be legally enforced. The negotiation with the state and its organs such as ICMR and DCGI remains contingent and context sensitive with tremendous elbowroom for individual and collective bargaining, petitioning, and expedient subversion.

While hESC research continues on a global level, the current regulatory and state-funding environment has made such research (and therapies) a fringe endeavor in India. Often the response would be to point out that in the post-Bush era the funding for hESCs research has been permitted. But in India, it is still considered too volatile to touch. One physician joked, 'You think their embryos are better or less volatile than ours'. He went on to explain, in detail, how the lack of funding for embryonic and fetal research leads to lack of true innovative work in India. He pointed out that physicians and researchers wanting to work with embryonic and fetal cells had crossed over to working with 'simplistic' autologous bone marrow transplants as a way to stay in the 'business' and support their practices. Given that the Indian medical establishment is largely privatized, physicians and clinicians pay their bills by performing these particular therapies and publish these results in academic and scientific journals, which in turn means they become specialists in those treatments versus being able to take on more innovative research. Yet, because heterotopias are inherently plastic and adapt at bringing together several incompatible sites, hESCs in India, as chapters in this volume amply testify, are truly thriving and producing dramatic results.

Biocrossings and Regulatory Frameworks: Policymakers

The other side of the debate about crossing over from embryonic to somatic autologous cells was composed of the policymakers working toward situating Indian stem cell research and therapeutics on an international platform of respectability and recognition. This was a goal quite similar to those of the physicians, who also wanted India to be the

forerunner in this nascent medical innovation. Of course, although the end points were the same, the policymakers' relationship with the physicians was quite a contentious one. The two main problems identified by the policymakers in regard to stem cell therapies were that some physicians were providing 'unproved' medical treatments at very high costs and no safeguards were in place for patients who might not benefit or, worse still, suffer from negative consequences of these experimental therapies.

When talking to policymakers about why embryonic stem cell research and/or therapies in India were not being recognized (and thus perhaps regulated), one of the former members of the regulatory bodies pointed out that what the ICMR and the Ministry were doing was for the benefit of the science itself. She gently reminded Appleton in the interview,

> See, nobody understands this, but every regulation that is put in place is not to restrict science but to protect and enhance it. When these policies are put in place, it is not to punish 'bad' medical practitioners but to prevent the 'good' ones from getting a bad name because of the others. If not controlled now, and if India gets a bad reputation for providing dangerous treatments, then nobody … not one single doctor will benefit. We are trying to protect the field of stem cells by putting regulations in place and using international ethics as our guiding principles. We want India to be a place for the best medical treatments, both for Indian and non-Indian patients.

For her, safeguards against hucksters of stem cell therapies prevented the entire Indian medical community and medical tourism enterprise from suffering in the future. Again, a risks and benefits analysis formed the framework, where the risks needed to be minimized in the short term to ensure long-term benefits. hESCs proved to be riskier, and crossing over to autologous cells was one way the state minimized/mitigated its risks while being able to participate in the benefits of being an aspirational 'scientific hub'.

This conversation was held alongside other conversations about protecting the financial wellbeing of 'poor' patients who were desperate for a cure, but at no point was the issue raised of providing this form of

personalized medicine at government hospitals or government-subsidized prices. It should be noted that, historically, the health budget in the GDP has been shrinking, and in the 2015 budget it was reduced to the smallest slice of 1.2 percent of the GDP (Rajagopal and Mohan 2015). The reality of India's public-health sector constantly shrinking and becoming ever-dependent on private health providers, international aid, and philanthropic agencies (each with their own problematic agendas) has implications for stem cell therapies. Even though some preliminary work (following some of the most stringent international standards of ethics and medical development) was ongoing in government institutions in India, policymakers' focus was on private stem cell clinics, hospitals, and institutions. The focus remained on 'enhancing' these spaces by encouraging them to operate within internationally established norms rather than focusing on enabling the government-sponsored stem cell to excel in order to provide personalized medicine to the largest portion of India. The 'poor' within this framework were available as docile experimental bodies but never viewed as worthy citizens deserving top-tier medical care from their government-medical establishment. The tensions were real. The aspirations of the medical community alongside the policymakers' were palpable. The biocrossing from one form of cellular therapy to the other was not an 'organic' move but a calculated risk the Indian state promoted/approved in order to mitigate future risks.

The state, in its endeavor not to be dubbed a 'rogue nation' and continue to make itself available as a site for scientific endeavors (in terms of attracting global capital for clinical trials, pharmaceutical intervention, etc.), regulated and disciplined itself along global logics of acceptable and permissible science. In conversations with clinicians and physicians, one would often hear grumblings about the US FDA's and US pharmaceutical companies' vested interests in not allowing hESC research to continue outside Euro-American labs, so as to maintain a monopoly on biomedical breakthroughs. However, when bringing up these issues with policymakers, the focus was often on safeguarding the poor and protecting the image of the nation while promoting India as a 'safe scientific space' for global science.

The inherent need to encourage one form of cellular research and therapy as safe and 'manageable' while deeming the other as 'dangerous',

'rogue', and 'unmanageable' makes visible the geopolitical machinations that drive this latest biocrossing. This self-disciplining and regulation allow for a crossing that eventually appears non-problematic and 'natural' while gradually erasing the tensions and debate that drive the science in the global biomedical market. It is not our intention to suggest that either embryonic or somatic cellular therapies are better or worse than the other or that one should be encouraged or discouraged, but rather to show how this latest biocrossing has been naturalized and left un-problematized by the state and following it, media, its publics, and even the local medical and scientific communities.

Further, we do not suggest that all physicians, clinicians, or policymakers thought similarly about crossing over from embryonic to somatic cells. Quite the contrary was evident in the research, as a majority of the physicians who worked with autologous somatic stem cells (i.e., one's own adult cells) thought their therapies were clearly superior and safer (largely considered superior *because* they were safer). Rather we focus on the contention above as a way to show the tensions that were impacting the naturalized crossing of one particular form of cellular therapy over others. What one group viewed as dystopia another articulated as utopia. The resulting heterotopia reflects these tensions that continue to author the biography of stem cell science in India.

Biocrossings and Regulatory Frameworks: Patients

Nowhere was the dichotomy between the dystopic futures bought on by cellular therapies versus the utopic potential of said therapies more pronounced then in the patient and patient-advocate narratives. The imagined utopic futures ranged from articulations of being able to gain access to stem cells from pharmacies, to being able to participate in everyday life by patients receiving or aspiring to receive stem cell treatments. On the other end of the spectrum were criticisms from patients and patient-advocate groups that found embryonic stem cell therapies 'experimental', risky, and without benefits. Often, narratives of patients whose therapies

had not worked and had felt violated materially and beyond were reported in newspapers (Jayaraman 2014), which along with other critics imagined dystopic futures for patients receiving these therapies. These dystopic futures included fears of mass cancerous growths in patients who could not afford to treat and/or manage those future diseases. Interestingly, the dystopic futures often included future fears of different illnesses and current financial burdens on patients but not any concerns about the immediate negative effects of stem cell therapies. An enduring irony underscores these fears. The patients and advocates voicing them had not tried hESCs in India. In large part, the terrain of fear and anxiety was built up on purported evidence from globally dispersed sources of normative science that the Indian state in turn resurrected as proof for its regulatory concerns and a need for a calibrated shift from embryonic to somatic.

However, in between these extremes of people who either imagine stem cells as absolute cures or medically impossible 'scams', are hopeful and ambivalent patients often described as being duped into embracing stem cell therapies based on 'bad name science' (Bharadwaj 2015). As Sarah Franklin reminds us, all technological breakthroughs are imbued with certain levels of ambivalence. She writes,

> The ambivalence that characterizes the IVF encounter, while specific in its form to IVF treatment, is also more generic, and I refer to it throughout this book as 'technological ambivalence', arguing that it is a constitute component of biological relativity. As many social scientists have noted, such as Ulrich Beck (1992), ambivalence is one of the defining characteristic of the modern relationship to technology—be it television or email, robotics, or biotechnology, electric kettle, or plastic bags. (2013, p. 7–8)

The heterotopia of embryonic and somatic autologous cells reflects this form of ambivalence. The emerging regulatory attitude also reflects globally established ambivalence toward human embryonic source of cells and mythic fears of inherent dangers clinically interpolating such cellular entities. To cross this terrain is to both witness the emerging biography of the political anatomy of hESCs as well as geopolitical interests on the intersections of capital, science, and the state that favor one particular

discursive production over another. True to form, the resulting heterotopia of stem cell remains both closed and open (Foucault's fifth principle of heterotopia), thus making the terrain both isolated and open to newer future permutations of biocrossings.

Popular narratives and global scientific discourse suggests that hESC therapies in India operate in 'unregulated' ethical and medical terrains (Sleeboom-Faulkner and Patra 2009), a charge provoking the search for a more disciplined form of cellular therapy, such as somatic autologous cell therapy. Thus, we can argue that all interested stakeholders involved in the production of a particular biotechnological innovation do not so much experience ambivalence but rather gradients of uncertainty. This in turn allows one particular lobbying or interest group to impact the technology and shape its heterotopic present and future. And it is in this heterotopic space the contestations are lively and important, as we know from previous scholarship on science and technology, that debates at these times of transition shape futures of technologies (Winner 1980). Patients and patient advocates, particularly those who sought out stem cell treatments in the absence of any other options for improving their conditions, were often not ambivalent about the somatic autologous cell therapies they undertook, but rather felt definitive about their decision to *choose* one form of therapy or clinic over another.

This was evident in many meetings with patients across the country. For example, Mr. and Mrs. Vishand Deb had come from Mumbai with their 13-year-old son (Sushant), who had been diagnosed with autism at the age of 6. They had chosen to work with autologous somatic cells rather than embryonic because of the 'less-risky' nature of somatic autologous cells, as they were their own son's cells coming back to him in an enhanced form. The state-supported discourse around the riskiness of hESCs had clearly taken hold and to a large extent had shaped the eventual treatment modality. The first round of stem cell therapy for Sushant was at the age of 9 that started 5 years earlier; he showed reduced signs of aggression and verbal outbursts, could be asked to do chores around the house, related to his parents, and often hugged and kissed his younger sister fondly. Over the 5 years of treatment, the parents became advocates for autologous stem cell therapy because of his improvements (while considering that his symptoms have not deteriorated as he grows older). They particularly felt

comfortable advocating autologous cells after making the initial decision not to seek out hESC therapies.

With each decision by the Indian regulatory bodies, news stories reporting these regulations, the reconfiguration of physicians and clinicians to meet the regulatory frameworks requirements (i.e., not working with embryonic cells but rather autologous cells under certain conditions), the lack of availability of clinics performing non-autologous cell therapies, the increase in the clinics performing somatic autologous cells therapies, the reporting of these claims and efficacy of their therapies, the Deb family feel validated in their choice. They, like many of the patients and patient families Appleton spoke with, may or may not have been ambivalent (they don't remember) about embryonic over autologous cells therapies at the start of their 'search for cures', but grew to feel rather strongly about preferring autologous over somatic cell therapies. The idea that patients and patient advocates symbiotically chose one form of therapy over the other or are ambivalent in their decision-making process is not evident in our data. Rather, what is evident is that particular geopolitical motivations created a choreographed moment where particular forms of cellular therapies were deemed problematic. This had the intended effect of creating spaces for alternative forms of therapy thriving and creating patients and patient advocates for particular treatments. This in turn created publishable scientific data in forms of studies and number of patients being treated, creating public opinion (both global and local) that autologous stem cell therapies in India were under the purview of regulatory bodies but clearly safer than the dystopic futures promised by unregulated embryonic stem cell therapies. Yet, as we have seen in foregoing chapters, this sharp distinction is somewhat unsustainable. The emerging biocrossings reflect how the every distinction between embryonic and somatic has become a product of conscious policy and its discursive reverberations rather than being based on tangible data on hESCs lacking efficacy or being inordinately riskier than somatic cell transfers.

Within STS, looking at scientific knowledge/breakthroughs at moments when the debate is most intense about the future of that particular scientific 'discovery' allows us to see that the shape of scientific and technological 'progress' is not inevitable; it is a result of political

decisions. Langdon Winner proposes that the moment of introduction of a particular technology is a moment of contemplation and debate about the eventual benefits of that technological innovation (Winner 1980). At the moment of introduction into wider markets, the politics and cultures that lead to scientific knowledge and technological innovations should be examined. For Winner, the technologies and the technological artifacts contained within them politic for two reasons: first, for settling within communities debates about what technology to adopt, and second, man-made technologies were inherently aligned with particular politics over others. The data in India is emerging from fieldwork at a crucial moment of scientific and medical history making. Here a very obvious and particular biocrossing occurred that allows for a nuanced understanding of contemporary and future articulations of cellular therapies and research. Patients participated in and enabled this biocrossing from embryonic to autologous just as much as policymakers and physicians. Discourse emerging from and managed by media, policymakers, and particular interest groups over others had a crucial role in promoting this biocrossing rather than a purely scientific evaluation. A cyclical relationship evolved where patients wanted to gain access to cutting-edge biomedical interventions; however, they were made cognizant of the possible risks/dangers and thus refrained from being 'too experimental'. What may be naturalized as patient preference for autologous somatic cells is far from a natural or symbiotic process but is rather a carefully constructed and politically motivated paradigm of permissible science.

Conclusion: Biocrossing Utopias and Dystopias

This 'biocrossing' from embryonic to somatic sources of cells is only the latest development in the stem cell research and therapy heterotopia. The heterotopia is indicative of a conceptual space in which cellular cultures gestate in contemporary India. It shows in no uncertain terms that cellular science is far from stabilizing anytime soon and in a perpetual state of movement and crossing(s) onto other terrains; how-

ever, to look at the factors and impetuses of these movements and biocrossings allows us to lay bare the political, economic, and ethical forces that attempt to naturalize (and perhaps de-politicize) one form of cellular medicine over others. However, there are notable exceptions to these moves, as evidenced by the presence of hESC therapy in India and emerging biographies of global patients embodying these cells (Bharadwaj 2013).

Perhaps, by either utilizing or building on biocrossing as a conceptual term, we can account for the emerging reality of stem cells as a global heterotopia when viewed from a vantage point that is uniquely Indian. The efforts to establish and partake in a globalized research system are leading the Indian state to prefigure the field in very particular ways. Rather ironically, hESC therapies in India are establishing a global presence attracting therapeutic citizens from around the globe to partake in a cellular breakthrough being ostracized in some quarters (see Bharadwaj 2015). This irony only enlarges the scope of biocrossings on a global scale. As Foucault observed as part of his third principle on heterotopias, a 'heterotopia is capable of juxtaposing in a single real place several spaces, several sites that are in themselves incompatible' (1967, p. 25). The contingent and context-sensitive ordering within a heterotopia is a fertile ground for assembling incompatible compatibles that continually reflect and refract the politics of making and unmaking.

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