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Abstract: Three decades of work in the feminist studies of science and technology have shaped our evolving understandings of the relationships between sex, gender, and biotechnology. Sex, and gender are most often reduced to binary categories, severely limiting our conceptions not only of human diversity, but those of science and technology. Using two case study set in India, transnational surrogacy and the Indian Genome Variation Project, this paper explores how popular positions around biotechnology are reduced to binary positions promoting and opposing biotechnology as the solution for the economic and social development of India. By locating surrogacy and genomics within the larger geopolitical, historical, economic and cultural transformations of postcolonial India, the paper argues that both technologies are far more complex in their impact on women and gender. Why does technology become the major site of hope for the future? Why does genomics become the site for the promises of good health? Why has India become a site for reproductive tourism, and transnational surrogacy in particular? Drawing on the social studies of science, the paper argues that technology and human bodies are never neutral but always prefigured with a gender, race, caste and sexuality. Surrogacy and genomics should be understood within these colonial and postcolonial histories of science and technology.

Keywords: Transnational Surrogacy, Genomics, Feminism, Gender, Women

Introduction

In her famous essay, "Why it is difficult for us to count past two," Evelyn Fox Keller (1992) describes how when asked about her work, she tells people that she researches issues of *gender* and the sciences, yet, she is continually asked to discuss what she had learned about *women* in the sciences. Despite decades of feminist explication of the differences

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between sex and gender, she argues, most people constantly conflate the two. She laments about our incapacity to count past two. Two decades later, the binaries endure. The "binary" world we live in can be striking: we talk about men and women, masculine and feminine, upper class and lower class, upper caste and lower caste, black and white, homosexual and heterosexual, trans and cis, ability and disability, etc. In reality, none of these categories is binary, but rather represent a range of people in multiple categories if not a continuum. Yet the impulse to categorise this diversity into two categories, one superior and the other inferior, persists. The distinction between sex and gender is an important one, and while they are related, their relationship is far more complex than the linear correspondence that binary thinking implies, where the terms sex and gender are often used interchangeably. The idea of sex is most often grounded in the biological/material body, while gender has come to represent the profound consequences of the social meanings we have given to a binary sex system, i.e. gender represents the social rules of masculinity/femininity of inhabiting male/female bodies. Even this formulation shows binary thinking, where sex is biological, and gender is social, thus invoking yet another binary frame of a biology/social binary.[1] While human bodies may or may not be strictly binary in their phenotypic manifestations,[2] the idea of binary sex persists, as do claims of a vast apparatus of gender differences. We consistently see claims of gender differences in men and women, such as aggression, nurturing, logic, rationality, emotions, scientific and mathematical ability.

Decades of work in the social studies of science remind us that scientific claims of difference – be they about sex, gender, race, class, caste or sexuality – have been a persistent aspect of science. Claims of biological difference most often support the superiority of the political elite and the inferiority of those in the margins (Bleier 1984, Hubbard 1990, Birke 1999, and Fisher 2011). Science, it would seem, is ultimately a social institution that reproduces and replicates the power structures that it is located in. Science and society co-produce, indeed co-constitute each other (Reardon 2001). Scientific knowledge emerges from the circulation of knowledge, as knowledge continually travels between science and society, and back (Fausto Sterling 1987, 2003). Far from being removed from politics, or living up to its claims of value neutrality, science is deeply implicated in structures of power – and thus implicated in the histories of

sex, gender, race, and caste (Rose 1994). As it has grown to be a powerful institution, science has also been embraced and utilised by programmes and movements for social justice. Science is increasingly a contested zone, and has emerged as a tool for progressive movements and causes, and with its increasing democratisation it has also become a tool for liberatory movements (Campbell 2009 and Benjamin 2013). However, it should be no surprise that a history where women have been seen as inferior beings, would produce a science that is male dominated, and developed as a "world without women" (Noble 1992 and Schiebinger 1989). In the world with a "persistent patriarchy," scientific knowledge continues to be shaped by the interests of the powerful and against science's more democratic potential (Longino 1990 and Sur 2008). This history of science that developed as an all-male province has profoundly shaped scientific practices, its cultures and knowledge production (Subramaniam 2014). Furthermore, the development of science has shaped and been shaped by the politics of race, class, caste and sexuality, as well as by colonial expansion. Science and technology have been "the jewels in the crown of modernity" (Harding 2012:2), central to the expansion of empire and critical to the contemporary world. Sciences should, therefore, be understood as "sciences of empire" (Schiebinger 2004); indeed almost all modern science should be understood as "science in a colonial context" (Seth 2009).

While one can explore how science has shaped and been shaped by various structures of power such as sex, gender, race, caste, colonialism, heterosexuality, ableism, etc., I will focus on sex and gender in this paper. Ideologies of sex and gender are not neutral – those qualities that are deemed to be masculine have been historically overvalued and overrepresented in the hallways of power, compared to those deemed feminine (Schiebinger 1989, 1993). Social studies of science shows us that these gendered ideas and ideologies go deep, permeating most aspects of knowledge, including science and scientific knowledge production (Collins 1999). Ideas and ideologies of sex and gender permeate our thinking beyond the human body. Early feminist work has argued that western science has historically been imbued with masculinist ideals - to control nature, develop reductionist models of nature, extoll an impossible "objectivity" in our studies of the natural world (Harding 1991, 2006, 2012). Scientific temperament extols the objective, logical, rational, unemotional, removed from the social and political world.

In contrast, we see less attention to ideas deemed feminine, such as less exploitative models of living with nature, interdisciplinary models of knowledge production and subjective explorations of the world. Feminists have long argued that masculinity and femininity together represent an important resource for all humans, and have called to dismantle our binary system for a set of values that embraces feminist ideals, appreciating the strengths of both the masculine and the feminine.

This special issue is dedicated to the topic of "women and biotechnology." Three decades of feminist scholarship have shown this to be a more complex topic than initially meets the eye. First, we can of course talk about women scientists who participate in biotechnology – we can ask about the demographics of women in biotechnology, and whether and in what proportion they are represented in different levels of research and administration. We can also ask if the presence of women shapes the kind of research that is undertaken. Second, we can explore the gendered dimensions of biotechnology, beyond the presence or absence of women. How have gendered ideas and ideologies shaped the innovations in biotechnology? What are the goals of biotechnology and whose interests do they serve? What questions have we asked, and what have we not? Finally, we can ask how biotechnology has shaped the lives of women at large. Has it empowered and improved the lives of women or has it continued to marginalise women and their interests? Each of these questions is related to the others.

According to Kiran Mazumdar Shaw, an Indian entrepreneur, and founder of biotech company Biocon Limited, "Today anything can be done – we the techniques." Whereas Vandana Shiva, Scientist and Environmental Activist said, "You are not carrying the world on your shoulder. It is good to remember that the planet is carrying you." The two statements show that the binary positions permeate our discussions around women/gender and biotechnology - is it good or bad? Is it progressive or reactionary? Is it good for women or harmful? Is it life affirming or life-killing? Should feminists support it or oppose it? Kiran Mazumdar Shaw sees the promises of technology, and believes it is a tool for the social progress of India. As a pioneer in the field, and as a woman, she sees technology as a site of social justice and believes in its promises for women in India (Weidmann 2014). As she says, technology can have wide impact and be a boon to India and that we should use it, and because with technologies' wide reach and its innovative

potential, "anything can be done." In contrast, Vandana Shiva, an Indian environmental and anti-globalisation activist and author has largely staked positions against biotechnology, which she sees as macho and masculinist and as a destructive system of people and the planet (Shiva 1988, 2005). Instead, she advocates that we return to traditional systems of farming in India, that are more woman-focused and that draw on the feminine *prakriti* to return to a more human and natural "nature." Both figures are beloved in their respective communities of pro-technology and anti-technology.

Rather than stake a pro- or anti-technology position, I ally with the emerging consensus in science and technology studies that technology is best understood not as always either good or evil, or as a neutral tool that is subsequently appropriated by political actors for either good or evil, bur rather as a site that is intricately interconnected with power and society. We, thus, need to trace and understand how *technology* becomes a site of knowledge and social action and how it is connected to other forces and structures in society (Wajcman and MacKenzie 1985 and Takeshita 2011).

Women, Gender and Science

Representations of scientists are strongly correlated with the demographics of power in a nation. Studies have shown that members of socially more powerful groups are better represented in more prestigious fields. A history of women in the sciences, both historically and in contemporary times, shows the continued marginalisation of women and minority groups across the globe (Alic 1986, Rossiter 1982, Abir-Am and Outram 1987 and Gupta 2007). In India, we see the strong effects of the politics of gender and caste in shaping science and the practitioners of science in India (Sur 2011). While the numbers of women in undergraduate and graduate education have risen, representation in the scientific workforce remains low (Huyer and Halfkin 2013). Furthermore, there are patterns to women's under-representation across the disciplines in the sciences. Like in several other countries, in India, women tend to be more highly represented in the life sciences than the physical sciences and engineering. Demographic patterns across the globe also suggest that women's representation is correlated with the status of the sub-discipline in the country. Disciplines with higher status and economic importance show greater male dominance. For example, computer science as a field began with a much higher proportion of women, and despite

considerable efforts, the proportion of women has dropped as the field has become more important and prestigious (Stross 2008). Despite being a 'hot' field, and despite efforts to increase the numbers of women scientists, the proportion of women in computer science has declined, leaving it very much a "boy's club" (Banerjee 2014). Such a pattern is a strong reminder that women's under-representation is tied to socio-economic and political factors rather than biological unsuitability (Campion and Shrum 2004, Subramanian 2007, Varma 2010). Women and gender are also not universal categories, always mediated by the politics, race, religion, caste, class, and sexuality (Beoku-Betts 2004 and Sur 2011). While there is scant data on the demographics of women scientists in India, the data that is available shows a similar pattern to the rest of the world. Women scientists remain under-represented across the fields in science and engineering (Gupta and Sharma 2002 and Kumar 2009). Women scientists are represented in higher numbers in the biological sciences, but women scientists in India still form a small proportion of women, and a minor portion of working women in India (Bal 2004).

Why the under-representation? Competing theories have postulated different reasons: whether women are not interested in science, not good at science or whether they leave the sciences because of a hostile or unwelcoming environment (Valian 1999, Cech and Blair-Loy 2010 and Garforth and Kerr 2009). Studies over the last several decades have documented that both historically and in the present, women show great interest in science and perform well academically (Rosser 2008). Indeed, women have persisted in their love of science, often under arduous conditions (Rossiter 1982 and Alic 1986). Despite decades of programmes to support and nurture women scientists, women have not achieved parity, especially at more senior levels. Studies suggest that this is because of continued inequities within science, and persistent barriers and systematic discrimination of women in science and technology (Bystydzienski and Bird 2006). To describe the under-representation, a recurring metaphor in the field is the "pipeline" and the women in science literature has documented a very "leaky pipeline" as women leave the scientific workforce at all stages of their travel from elementary school to the top echelons of science (Handelsman 2005 and Subramaniam 2009). Efforts to increase women in the sciences are often premised on "plugging" the leaks in the pipeline.

Others have argued that rather than "fixing" women to inhabit the culture of science, we should "fix" science to be a more inclusive institution (Rosser 2004). After all, increasing the number of women in the sciences does not automatically produce a culture that is more progressive or supportive of women (Garforth and Kerr 2009). Data suggests that women in sciences are participants in the scientific enterprise and thus often driven by the same goals and objectives of mainstream science (Acker 2000 and Garforth and Kerr 2009). Scientific culture that developed as a "world without women" continues to betray these histories (Traweek 1992). We need to see structural change, where the priorities of science, its mechanisms of judging merit, its policies for promotion, and advancement, and its methodologies of knowledge production need to change to recognise different life histories, priorities and needs of a diverse workforce. As a result, recent proposals to increase the representation of women in the sciences have shifted from a focus of changing "women," to a focus of making science a more hospitable space for all scientists. Ultimately, strategies to "decolonise," "degender," and "regender" science are necessary to imagine a more progressive and democratic science.

While women remain under-represented in the higher echelons in biological sciences, and while the women in the field have not transformed biotechnology in significant ways, the impact of the sciences on women goes beyond the number of women who are in biotechnological fields. The 20th century was labelled the "century of the gene" (Keller 2002), and the biological sciences, and biotechnology, in particular, represent the site of great investment and focus in contemporary times. The field has infiltrated nearly all walks of life – from manipulating DNA to large-scale biological warfare, from bio-nano-particles to industrial replicators. What has biotechnology delivered, for whom does it work, and what impact has it had on the lives of women?

Biotechnological Body

Biotechnologies involve technologies of biological organisms, but their relationships to gender are best explicated by looking at biotechnologies of human bodies. Our imaginations around the body and its workings have been thoroughly biologised in the 21st century. In a wonderful exploration of biotechnology in India, Shiv Viswanathan and Chandrika Parmar (2002)

conclude that the biotechnology controversy around genetically modified organisms (and I would argue other biotechnology debates) has all the makings of a great "moral debate." The two epigraphs that began this essay show us the contours of that great moral debate. Is biotechnology a tool we should embrace in our visions of a progressive and democratic society? Or is it a technology that ushers in a dystopic future for humanity? Viswanathan and Parmar (2002) argue that "biotechnology as a scientific venture in the populist and technocratic imagination is alive and well but biotechnology as a part of the new democratic imagination committed to the rule of law and regulation, and governance sensitive to the ideas of risks, is fragile. One needs to build concrete set of institutions around the practice of biotechnology and locate it within the wider debates on innovation, property and the commons." They remind us that biotechnology is best understood not just as a set of methods that can be deployed to varied means and ends, but as an institution that has been developed in the aid of particular political and ideological visions (Bliss 2012). The research questions asked and the innovations that are developed in biotechnology are tied to funding agencies, corporations or governments and their priorities. We can certainly imagine technologies that are in the service of women, and even feminist technologies of the body. However, biotechnology as a field and like much of contemporary science and technology, has often served the interests of the powerful. The interests of women, feminist and democratic ideals have often been marginalised in the founding and governing visions of the field. I use two very different examples, transnational surrogacy and genomic medicine to illustrate this point. Transnational surrogacy is a burgeoning privatised industry in India that commodifies the body of "individual" women, and relies on a local and regional infrastructure to foster economic transactions transnationally. In contrast, recent investments in an Indian Genome Variation Initiative Consortium (IGV) work at the molecular level, are imagined as a national database, and rely on a national infrastructure and imagination. India is not alone, as many such projects have been undertaken by other countries in Asia. These projects have strong backing from the state, creating new linkages between genetic identities and national sovereignty. The emerging biotechnology industry in Asia can be seen as a rising "bionationalism" that is reshaping the global development of genomics, as Asian and other developing countries are asserting their

"genomic sovereignty" (Benjamin 2009, Kelly and Nichter 2012 andOng and Chen 2013). Exploring these two very different cases, will illustrate how contemporary biotechnology is imagined and how in both cases, women and gender are impacted unequally in the goals, objectives and imaginations of biotechnology.

Bodies of Biotechnology: The Case of Transnational Surrogacy

Transnational gestational surrogacy is a commercial industry that has grown into a multi-billion dollar industry in India. Gestational surrogacy involves implanting an embryo created through *in-vitro* fertilisation (IVF) into a surrogate mother who carries the foetus to term. The child is then given to the commissioning parents. In contrast to genetic surrogacy, a gestational surrogate mother according to the law and medical understandings does not ostensibly contribute any "genetic" material and is, therefore, unrelated to the foetus. The exponential rise in this practice is evidenced by the sharp rise in estimates – from US$ 445 million in 2008 to over US$ 20 billion in 2011 (Nayak 2014:2). The term "surrogate" is derived from the Latin *subrogare*, which means "appointed to act in the place of" (Sama 2012). While commercial surrogacy is illegal in many parts of the world, it is a growing industry in India, largely unregulated since inception and only recently beginning to be regulated (Menon 2012). Technoscientific surrogacy employs high tech reproductive technologies utilising a low tech and economically marginalised workforce (Goodman 2008).

Over the last decade, India has emerged as a site of "reproductive tourism," where infertile couples from India, the Indian diaspora and non-Indians abroad have come to India to what has come to be termed as "rent a womb" for their potential embryos from a gestational surrogate (Carney 2010 and Voigt *et al.* 2013). This is a global industry with complex and multiple circuits of travel where intended parents enter into "reproductive exile" (Inhorn 2012) to go to another country for conceiving a child. The circuits are so complex and transnational that some Indian couples are priced out of India, and have to travel to foreign countries like Dubai for various forms of reproductive technologies (Inhorn 2012).

A growing number of academic and journalistic accounts have chronicled complex and fascinating narratives of the surrogacy and the experiences of surrogates (Pande 2014, and Vora 2015). These narratives on the business

of commercial surrogacy are striking, and in examining stories about media reports and research accounts of surrogacy, a consistent narrative has emerged. The framing of the debates as Susan Markens (2012) argues, have revolved around the questions of whether the globalisation of reproductive labour is an exploitation of the surrogate mother or an opportunity for her and in a related vein whether the surrogacy narratives are best understood as one of gendered altruism or one of gendered empowerment – the literature, thus, presents this as an ethical issue of reproductive liberalism versus exploitation (Banerjee 2010).

First, surrogacy is presented both to the surrogates and the world as a de-sexualised model of reproduction – this is a technologised mode of reproduction ostensibly without the relational or ethical messiness of sex or sexuality. Second, the bodies of women are commodified as a "rent a womb" enterprise. Depending on the region, caste, class, skin colour, and educational background of the woman, the value of the womb varies (Sama 2012). Third, the pregnancy is entirely scripted as a medical process rather than an affective model of mothers or mothering. Surrogate mothers carry the foetus to term through a medically regulated pregnancy. Indeed, various towns in India like Anand, called the surrogacy outsourcing capital of the world (Nayak 2014), have become famous for their surrogacy centers where surrogate mothers live in hostels for the length of their pregnancy, closely surveilled and monitored for optimum foetal development (Pande 2009, 2014 and Voigt *et al.* 2013). While there is variation across India, a dominant narrative of gestational surrogacy has emerged.

Those arguing for the positive impact of surrogacy, point to the opportunity that gestational surrogacy has opened up as a site of labour. While there is much criticism about the exploitative and coercive nature of gestational surrogacy, it is important to understand and contextualise surrogate bio-labour within other forms of labour. While surrogacy is a very intimate and physical form of biolabour, other forms of labour have their own exploitative regimes. As Sharmila Rudrappa (2015) shows in her excellent ethnography, for some women, surrogacy presents a less exploitative model of labour than others, like the garment industry. Rudrappa describes the long hours, the physically arduous work, the lack of control, the sexual harassment, and at times violence that surround women's experiences of labour in the garment industry. Is this really an improvement on surrogacy,

she asks? Surrogacy affords food, rest and relaxation (for some) during the duration of the pregnancy, and health care to a population that has little access to it – even though these benefits end with the birth. Surrogacy also gives women access to money (although there is considerable regional variation). Making money in nine months that would usually take her four to ten years to make is significant for the lives of women, and their role and power within the family and community. The technology of surrogacy has also revolutionised our conceptions of the family. It has allowed us to imagine and expand our notions of kinship and family (Thompson 2002). It has considerably expanded who can have babies and allowed the formations of new and more extended transnational family networks. For the affluent, surrogacy has opened up new options to deal with the stigma of infertility. Given that children and families remain the social net for old age in India, technologies of surrogacy have opened up new modes to build families that ensure individuals' future financial and bodily health.

However, critics of surrogacy have also raised important issues. Surrogacy has been presented into a medicalised and desexualised model, converting traditional ideas of pregnancy to be re-imagined as medicalised labour and clinical labour (Cooper and Waldby 2014). In this model, the woman's body becomes a receptacle of commerce (Sama 2012). The process of medicalisation is entirely regimented with clear steps and protocols that need to be faithfully followed. A prescribed meal, which is ostensibly based on western ideas of balanced nutrition, is consumed along with regimes of exercise, rest, and relaxation. The language of medicine frames so-called medical protocols into the legal contract of gestational surrogacy. Thus sexual abstinence, battery of tests and heavy medication (rarely explained to the surrogates), c-sections, lack of breast feeding, and regimented protocols of hygiene, nutrition and exercise are codified into the legal contract ostensibly based on the health of the foetus. Payment for the surrogacy (a large portion of which is only available after delivery) is dependent on following the medical protocols. The boundaries between private and contractual are very blurry leaving very little that remains in the private sphere of surrogate mothers, and thus giving them little control and agency in the process (Pande 2009, and Sama 2012).

Campbell (1992) argues that "contemporary medicine has transformed the human body into a source of instrumental value, a resource of value

to others: patients, physicians, and researchers…Such practices seem to presuppose a basic feature of property, that is, the capacity and power of alienation or transfer." Indeed, gestational surrogacy disaggregates women's bodies as resources rendering the womb as a disembodied, "empty" and "not being used" resource that is available to make money. Like sperm, ova, and organs, wombs have also been isolated as an individual commodity (Cohen 2009 and Nayak 2014). The body is entirely abstracted and commodified and transformed into a "manufacturing mode" of (re)production (Darling 2014).

No doubt that we can imagine the technology of surrogacy in an equitable, non-coercive or altruistic model. However, the inequalities in the world transform such a vision into one riddled with inequities and exploitation. Today, techno-scientific surrogacy has reframed the role of women in reproduction, one that renders pregnancy and the postcolonial female body invisible. In desexualising, medicalising and commodifying reproduction in gestational surrogacy, the language of mothers and mothering is discarded for a new language of bio-labour, commodified organs, and disposable bodies. The affective politics of love, of mothers and motherhood is only available to the commissioning parents and their future families. Thus, techno-scientific surrogacy allows the erasure of some women as women and mothers, while enabling the womanhood and motherhood of others. This is particular ironic given that infertility rates among the poor and marginalised are often higher than richer communities (Roberts 1997). Like other innovations around reproduction, such "stratified reproduction" organised around hierarchies of race, gender class, ultimately replicate and reinforce underlying inequalities rather than erase them (Colen 1995). In the practices of contemporary surrogacy, surrogate mothers have little bargaining power in the process. This is precisely what some feminists have been pushing for – not an end to surrogacy, but in developing regulation that protect the rights of surrogate mothers (Sama 2012). Biotechnology and its imaginations it would seem replicate the interests of power within the larger political economy. It enables the desires of the elite through the bodies of the poor. Whether it is good for women or not, depends on *which* women we care about, whose interests are the basis of the laws and regulations that govern surrogacy. An attention to the power and inequities that shape the system of surrogacy can allow us to imagine the more progressive possibilities of bio-technology. Realising them is possible only when the

nexus between power, gender and technology is understood and forms the basis for regulation of technology.

The Biotechnology of Bodies: The Indian Genome Variation Project

From women's bodies and their pregnancies, let us move to the molecular level. Over the last few decades, we have seen the "molecularisation" of life (Rabinow and Rose 2006, Rose 2006, and Egorova 2013). The biology of organisms, rather than being considered in their entirety, and in the context of their environments, are increasingly reduced to their molecular selves. The Human Genome Project, the HapMap Project, the Genographic projects are all projects about the molecularisation of life. India has embarked on its own indigenous genomic database. As critics have pointed out, the molecularisation of life has shifted our conceptions of ill health and disease from a focus on the social contexts of poverty and access to nutrition and care, to a presence of a genetic propensity to ill health or disease (Kahn 2009, Dumit 2012, and Chambers *et al*. 2014). Like transnational surrogacy, we can imagine the progressive possibilities of molecular biology – enabling drug production, histo-compatible tissue, interventions in the genetics of some modes of cancer, the possibilities of stem cells and other forms of regenerative medicine. However, ignoring the social contexts of disease and illness (as we have seen in the recent pandemic of Ebola) can be severely limiting to global health and welfare.

In keeping with global trends in biotechnology, India has launched its own biotechnology revolution. The Indian Genome Variation Initiative was initiated in 2003 involving six constituent laboratories of the Council for Scientific and Industrial Research (CSIR), and with funding from the Indian government. They include: Institute of Genomics and Integrative Biology (IGIB), Delhi; Centre for Cellular and Molecular Biology (CCMB), Hyderabad,; Indian Institute of Chemical Biology (IICB), Kolkata; Central Drug Research Institute (CDRI), Lucknow; Industrial Toxicological Research Centre (ITRC), Lucknow; and the Institute of Microbial technology (IMTECH), Chandigarh.

This is an ambitious project, conceived as the "first large-scale comprehensive study of the structure of the Indian population" (Narang *et al.* 2010) with wide-reaching implications. As the project organisers argue, India is a large, populous and diverse country on many levels. It

comprises "more than a billion people, consists of 4693 communities with several thousands of endogamous groups, 325 functioning languages and 25 scripts." The project argues that to "address the questions related to ethnic diversity, migrations, founder populations, predisposition to complex disorders or pharmacogenomics, one needs to understand the diversity and relatedness at the genetic level in such a diverse population" (Indian Genome Variation Consortium 2005). The project has been touted as one of disease gene exploration (Indian Genome Variation Consortium 2008). They have identified over a thousand genes to study. These genes have been "selected on the basis of their relevance as functional and positional candidates in many common diseases including genes relevant to pharmacogenomics." (Indian Genome Variation Consortium 2005).

The Indian project joins a global shift in turning human health into a biotechnological project, with a specific end goal, a pharmaceutical solution, ushering in the "pharmceuticalisation" of life. International genomic efforts, such as the HapMap projects are interested in the global distribution of genomic variation. To be sure, the development of biotechnology – infrastructure, methods, instruments, scientists, methods, data – can be important and revealing. With the onset of such investments India has arrived as an international player and an emerging power in biopolitical governance. In particular with the geneticisation of biomedicine, such projects attempt to ascertain both the global distribution of genetic diseases, as well as the distribution of disease susceptibilities, arguing that such distributions will powerfully shape future health care globally. These aspirations are very much linked to the pharmaceuticalisation of medicine (Pollock 2014), and the development of pharmacogenomics whereby genetic susceptibilities spawn new classes of drugs. Countries such as India and Mexico are seen as "Pharma's Promised Lands" (Benjamin 2009).

While one can no doubt argue that it is important for a nation like India to assert their bio-political independence, nurture local talent and build a strong infrastructure, and pursuing a purely genomic solution to health is also severely limiting and short sighted. We must ask why millions of dollars of public funding is invested into sequencing the Indian genome. Why would a country still reeling from extreme poverty, where preventable and communicable diseases consume most of its citizen deaths invest so much in DNA technology? India's health statistics still looks so abysmal

even after decades of strong economic growth; less than one per cent of its GDP is spent on public health care and has only nine hospital beds per 10,000 people, compared to an equivalent rate of 41 per 10,000 in China (New York Times, Editorial, 2014).

The "Indian Genome Project" argues that DNA technology will aid the health and wellbeing of its citizens through sequencing genomes and uncovering disease vulnerabilities. In one of their publications they suggest that the genetic landscapes of India provide us with "a canvas for disease gene exploration." Yet the vast majority of deaths in India are due to causes that are well recognised, and preventable with current technology. Transforming ill-health into a genetic problem with a pharmaceutical solution supports a particular ideological and economic agenda. If ill-health is a problem due to individual's genetic propensity to be ill rather than the inequities of an every day life of poverty, polluted environments, and the lack of access to good health care, then the problem and the solutions shift from the state and public policy to the individuals and their faults. Similarly, a solution that is about pharmaceutical drugs rather than access to good air, water, and nutrition similarly benefits certain economic players; the solutions support the development of (most often) a privatised drug industry rather than public infrastructure that is accessible for all. Strong political, economic, and ideological assumptions undergird these biotechnological assumptions and priorities. In the United States, we have seen similar moves as the category of "race," once argued to be a social and not biological category, has been re-biologised in recent times (Stepan 1982, Gannett 2001, Kahn 2005, Reardon 2005, and Hammonds and Herzig 2009).

Surely, improved health in India can be imagined to be both social and technological? Studies on the ill health of the Indian population point to the need for important social and political interventions.

In a country where women feed themselves last, the health statistics of women are particularly horrendous. More than 90 per cent of adolescent girls in India are anaemic, and 40 per cent of Indian mothers are underweight (Harris 2015). Global public health presents the poor in India as one of the most abject populations in the world. Despite evidence that genetics play little role in much of this ill health (Harris 2015), the funding of a mega genomic project rather than one of public health infrastructure is striking.

In response to the ill health within India, we need to include the proven strategies and knowledge that science and technology has already produced. India needs more investment in meeting basic health and nutritional needs, and should address the disparities and inequities in health. A pharmacogenetic solution cannot be our only option. These shifts in biomedicine have lead to what Donna Dickenson calls 'Me Medicine,' a set of practices that aims to focus on an individual's needs and interests have resulted in mixed results. Her analysis shows that the scientific plausibility is not the key determining factor in availability of new treatments and options such as umbilical cord banks. Rather what has driven recent biomedicine is the development of new markets, products and services catering to individual needs, perceived threats and risks drive the diffusion and availability of products and services. Instead, she calls for a return to a 'We Medicine' approach that emphasises investment in public health infrastructure that has already extended our life spans radically. 'We Medicine,' that emphasises technology used for the common good coupled with better regulation of biotechnology industry, she argues should be our path forward to restoring the idea of the commons in modern biotechnology. It is important to critically examine what goes in the name of common good from gender perspective and who matters in the 'We Medicine' (Dickenson 2013).

The Possibilities of Postcolonial Biologies

What both case studies show, I hope, is the failure to consider women in our biotechnological imaginations. Biotechnology gets heralded as the economic engine of a nation, even while its imaginations continue to marginalise a large proportion of the population. What is often missing in the discussions is a contextual understanding of biotechnology, locating it within its economic, political, cultural, and national contexts. It is not that biotechnology cannot be used towards more liberatory goals, but rather that the dominant face of biotechnology are ones that moved us to more corporatised, commodified, and privatised ventures. By locating biotechnology within these larger forces, we can see the broad and myriad issues that shape the relationship of women and biotechnology.

How should we study the world? A specialised academia has vivisected an inextricably interconnected world into myopic disciplines that have divided the world into binary categories of nature/culture, and human/non-

human. One of the central methodological insights of the feminist studies of science and technology has been refuting the binary worlds of nature and culture. Defining the object of the biological sciences as non-human life creates the illusion of a human-free world, a world removed from ideology, politics, and culture. Conversely, human culture remains in the purview of the social sciences and humanities, a world removed from the natural. But what if we refuse this nature/culture binary? In coining the term *naturecultures,* Donna Haraway challenges us to reject the binaries of nature and culture and attend to the constant traffic of discourses, information, and theories between the worlds of natures and cultures (Haraway 1999). There is no nature or culture, only naturecultures. Similarly, many feminists who are critical of the impact of the sciences and technology on women's lives have refused to support an anti- science/technology/ globalisation, arguing instead that we need to reimagine science and technology and their relationship with society (Haraway 1997). In this paper, I have explored two very different case studies of biotechnology in India to show how our politics of gender - shapes and is shaped by biotechnology and through it, the lives of women. I use these two very different case studies because they work across different scales and levels, demonstrating how gender gets deployed in very similar ways across macro- and micro-scales of analysis. In each, we see how objective sciences and the knowledge they produce are deeply entangled in the politics of gender in a post-colonial nation. Post-colonial biologies thus get shaped by the gendered scripts of the colonial legacies that it inherited (Verrran 2002), and subsequently by the complex political shifts in independent India. Ultimately, biotechnology is an exciting site of innovation, and has the potential to enable democratic and progressive visions of society, but in practice has instead gotten imbricated in the old colonial and gendered scripts of the nation. But contestations over technology open up new spaces for innovation and the possibilities for developing a biotechnology as if women really mattered.

Endnotes

1 This is a very simple rendition of the history of sex and gender. Both terms are today seen as much more complex. See Fausto Sterling (2012).

2 Considerable work on intersex has shown that human bodies appear as a sexual continuum rather than in only two categories of male and female. See Dreger (1998).

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