

Creative Dissent in India: Knowledge *Swaraj* and the People's Health Movement

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Abstract

There is an increasing interest among STS scholars to go beyond public understanding of science to look at the role of social movements in shaping alternate science and exploring the role of scientific dissent and the reconfiguration of the relations between scientists and citizens. The increasing popularity of citizen science that seeks to reengage the public in science needs to be situated within broader social movements that have argued for more conversations on science and democracy. This paper explores the idea of scientific dissent in India within a rich and vibrant tradition of People's Science Movement(s). We suggest that the dominance of the technoscientific elite has been countered in part through creative dissent by citizens and scientists working together in envisioning knowledge futures. Specifically, a citizen's manifesto—*Knowledge Swaraj*, is examined for its potential to present a frame for science in civil society rooted around the principles of plurality, sustainability, and justice that could reclaim the citizen's autonomy or 'self-rule'. Through the case study of the knowledge created by the People's Health Movement (PHM) in India from 1976–1990, we show how creative dissent has enabled multiple conversations about science, medicine, and democracy that both critique dominant state and market narratives and presents an alternative through dissenting scientists.

Keywords

creative dissent; people's health movements; science movements; knowledge swaraj; citizen science

Science Movements and Dissent in Science

From the radical science movement emerging in the late 1960s to more recent protests against technologies fraught with risk, STS studies have brought to the fore a better understanding of how individuals and groups engage with technoscience from multiple perspectives—ranging from critiques of dominant forms of knowledge and contestations of institutional knowledge to efforts to shape alternative practices of knowledge production ([Schiebinger 1999](#); [Werskey 2007](#); [Bhadra 2013](#); [Quet 2014](#); [Martin 2014](#); [Kimura and](#)

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[Kinchy 2016](#)). Within this tradition, work on scientific dissent has offered an improved understanding of how practices of dissent often help reframe scientific issues by inserting them in a broader political framework ([Martin 1993](#); [ibid., 2004](#)). This exploration of the relation between science and politics has (re)emerged in recent years through the study of disruptive science movements including the revival of the older (1960s) 'Science for the People's Movement as well as recent movements aiming to democratise science by drawing attention to the effects of neo-liberalism and the globalisation of science ([Moore 2008](#); [Moore et al. 2011](#)).

Citizen science is seen as one way of democratising science by making it more participatory through the involvement of people outside of formal scientific institutions. Going beyond traditional science communication or the mere production of scientific data, Citizen Science Movements (CSMs) are increasingly being seen in a diverse set of contexts and activities that include greater collaboration, civic engagement and efforts to reconnect professional scientists and the public in new ways. By involving the public in contributing to the production of knowledge, CSMs potentially open opportunities for more democratic debates on science and society ([Ottinger 2016](#); [Strasser & Haklay 2018a](#); [Strasser et al. 2018b](#); [Kimura 2021](#)). The histories of these movements are better known in STS work in the 'Global North' than in the 'Global South' ([Hess 2018](#); [Dumoulin et al. 2018](#)). In this paper, we seek to redress this gap by exploring the story of a notable CSM from India.

In recent years, 'manifesto movements' from Europe ([STEPS 2010](#)), Africa ([ATPS 2010](#)) and India ([KICS 2011](#)) have attempted to reconfigure the relationship between citizens and the scientific establishment. These can be seen as experiments to rethink the direction of science and technology futures through attempts by citizens collaborating to envision their own futures through written manifestos. These movements have tried to broaden public discourse to include important forms of knowledge beyond the scientific, raising normative concerns on science and development relating to poverty alleviation, environmental sustainability, and social justice. The Sussex Manifesto ([STEPS 2010](#)), for example, called for a new politics of innovation that addresses the question of who innovation is for, and about the need for pluralising progress by looking at the direction, distribution and diversity of science and innovation. Going beyond science and technology, those engaged with innovation should examine the related knowledge, institutions, practices, and social relations that shape the purposes, applications, and results of science and technology ([Bryden and Gezelius 2017](#); [Stirling 2009](#)).

This paper aims to examine the contribution of People's Science Movements (PSM) in India to STS discussions on scientific dissent. Specifically, we look at how PSMs have understood the relation between the expert and the citizen and attempt to exemplify science *by* and *with* people rather than science *for* people. We build on earlier work on 'creative dissent' in agriculture ([Quartz 2010](#); [Prasad 2014a](#)) to explore its manifestation in the People's Health Movement (PHM). Drawing from the Indian manifesto on science and technology, *Knowledge Swaraj* ([KICS 2011](#)), we examine the notion of expertise from a citizen's perspective by suggesting the importance of understanding dissent within scientific institutions and as part of a broader search for autonomy and self-rule (*Swaraj*) of the scientists who are engaged with societal concerns. The People's Health Movement (PHM), we suggest is an expression of such a science in civil society ([Prasad 2005](#)) and a quest for *Knowledge Swaraj*. Extending Gandhi's experiments in science the *Knowledge Swaraj* manifesto presents a framework of a scientific future based on principles of plurality (of knowledge and knowledge systems), sustainability (as an organising principle) and (cognitive) justice.

We begin by exploring the history of dissenting scientific imaginations in India as seen in radical critiques dating back to the 1960s as well as their origins in the writings and work of Mohandas K. Gandhi on science. We point out how scientific dissent in India is not only expressed through radical writings (such as *Hind Swaraj*) and protests (boycott of foreign cloth), but often through alternative practice. We follow this overview by exploring how creative dissent manifests in the case of the PHM that emerged in the late 1960s, involving grassroots actions through experiments that combined a critique of health policy, constructive engagement in community health projects and alternative hospitals, epidemiological studies, and advocacy for access to medicines. We then examine the nature of public action and advocacy of this group through a detailed study of its key journal—Medico Friends Circle Bulletin (MFCB), from 1976–1990. Most authors in the MFCB were practicing scientists and doctors who were uncomfortable with India's science and medicine policy.

We conclude the paper by suggesting that detailed studies of forms of creative dissent, such as that of the MFCB, not only provide insights on science and public participation in India, but also help us understand what citizen science might look like in an Indian context. We suggest that 'creative dissent' helps us mediate between otherwise rigid dichotomies of right-left, tradition-modernity, or civil society-state that have hitherto framed science movements in India. While science movements with different origins and disciplinary orientations (people's science and alternative science) have been seen as opposed even leading to 'science wars' ([Nanda 1998](#); [Varma 2001](#)). We suggest that there is indeed a case to explore common ground in the search for a more democratically rooted science, and the paper presents such possibility through the frame of creative dissent. Framing creative dissent is especially important for the articulation of a vision and a coping strategy for innovation at the 'margins', by people and groups beyond the formal scientific enterprise and represents a 'new contract of science and society' and society 'speaking back to science' ([Gibbons 1999](#); [Prasad 2014b](#)) that differs from STS examples commonly highlighted in global North settings.

Creative Dissent in Indian Science

Public engagement with science and technology in India has a rich tradition that dates to India's freedom movement against the colonial state. Indian critiques of science and technology cover a wide gamut of responses—traditionalists, neo-vitalists, organic technologists, Swadeshi nationalists, theosophists, Gandhians, Nehruvians, and Leninist technocrats ([Visvanathan 2006](#)). Following independence, the Nehruvian vision of statist science became the dominant force. Nehru had famously remarked in 1937 at the Indian Science Congress that—'The future belongs to science and those who make friends with science' ([Arnold 2013](#)). The goals of the scientific establishment as articulated in India's Science Policy in 1956 was to become a scientific and technical powerhouse that would impact Indian society through a cultivated scientific temper that would trickle down to India's poor. These assumptions remained largely unquestioned until the 1970s.

By the 1970s there was widespread disillusionment with the fact that the fruits of science and technology (S&T) were not reaching India's vast populace. An early critique by Sharma ([1976](#)) suggested that India's science policy had an urban bias aimed at revolutionary goals with evolutionary policies, and its new but increasingly powerful scientific establishment excluded scholars from humanities and social sciences in India. The late 1970s witnessed the emergence of science activism rooted in a concern for the public.

Voluntary groups were critical of science because it served the elite, and its benefits were not being directed adequately to India's poor ([Jain 2002](#), refers to these networks as elite and subaltern). By the late 1970s, there were a large number of voluntary (non-state) initiatives that were working on science-society interfaces organised under the broad rubric of a People's Science Movement (PSM) ([Jaffry et al. 1983](#)). These groups were engaged in scientific literacy actions, in counter-expertise and organisation of mass protests against technological and agro-industrial projects ([Sahoo and Pattnaik 2012](#)).

Beyond the critique of science and its impact on citizens was the emergence of a more radical critique of science and its relation to violence and hegemony ([Nandy 1988](#); [Shiva 1991](#); [Alvares 1992](#); [Visvanathan 1997](#)). These 'Alternative Science Movements' (ASM) evolved largely outside the perspective of modern S&T and had greater affinity with Gandhi's ideas and thoughts on the development of Indian society ([Guha 1988](#); [Visvanathan 2006](#)). Some of these social science critiques of the hegemony of Western science were complemented by the work of many scientists from India's elite Indian Institutes of Technology (IITs), who explored alternatives rooted in Indian traditions and ethos. Under the broad banner of the Patriotic and People Oriented Science and Technology (PPST) and through articles in the PPST bulletins of the 1980s and '90s, the claim of modern science as universal, value-free and the only source of legitimate knowledge and enlightenment was challenged. The bulletins also featured research on lost or aborted indigenous traditions of medicine, health, irrigation, building technologies, history, politics, social organisations, and the foundations of modern sciences in India ([Krishna 1997](#); [ibid., 2021](#)).

More recent work on public engagement of science has pointed to why it is necessary to take citizens' views seriously. Detailed studies have pointed to how recognising S&T and development policy realms as value-laden and normative could enable public engagement ([Raina 2015](#)), to how the discipline (of meteorology) serves state interests than opening itself to public assessment ([Dash 2020](#)), and the need to go beyond the 'social distribution of expertise' in non-western contexts ([Varughese 2020](#)). Rather than seeing these science movements as opposed to each other we suggest that they need to be seen as part of a search for alternate pathways for science in India. We suggest that the frame of creative dissent helps in articulating their common quest for alternatives, articulating the possibility for a 'science in civil society' ([Prasad 2005](#)). To better understand this potential, we look at Gandhi's conception of experiments and knowledge by and for the people, that we suggest was an inspiration for creative dissent on science in India.¹

The Gandhian Origins of the Indian Critique of Science

While Nehru's scientific views shaped India's scientific trajectory post-independence, the views of Gandhi as expressed in *Hind Swaraj* (Indian Self-Rule), has often been read and seen as conservative and anti-modern ([Nanda 2003](#)). However, a closer reading of Gandhi's views on science ([Prasad 2001](#); [ibid., 2002](#)) reveals that the Gandhian alternative included both a critique of western science and an engagement with alternative scientific futures through experiments. *Hind Swaraj*, written by Gandhi in 1909, deals with India's

¹The PPST movement organised the first ever 'Congress on Traditional Sciences and Technologies of India' (CTSTI) at the Indian Institute of Technology, Bombay in December 1993. For more details see the PPST's website and bulletin: <https://www.ppstindiagroup.in/> and <http://ppstbulletins.blogspot.com/>.

future based on a rejection of western civilisation and progress and a radical call for Indians to create a society based on self-rule and non-violence through soul-force. The document was Gandhi's fictitious conversation with Indian intellectuals who he felt were mimicking the methods and goals of Britain, and which were unlikely to lead to true freedom for India. Gandhi's often radical critique was also tempered by a deep appreciation of the spirit of experimentation that he believed Indians could learn from scientists from the West. Thus, while he was against vivisection and was a votary of the Indian system of medicine—*Ayurveda* (which some of his opponents have claimed make him entirely 'anti-modern' and 'anti-science')—he was also keen to bring back the agency of the scientist and urged Indian *ayurvedic* practitioners to learn from the spirit of sacrifice and experimentation of western scientists. His experiments on the self, have been chronicled in his autobiography, *My Experiments with Truth* (1925), that sought to minimise the self-other dichotomy.

Lesser known are the experiments with several others that he and his co-workers practiced at his Ashram. The Ashram itself was no traditional spiritual retreat but was seen by him more as a laboratory and as a 'scientific and prayerful experiment' (quoted in [Prasad 2001, 3729](#)). Society, he believed, had an important role in providing key axioms for scientific research and this was exemplified in the announcement of a prize for an improved spinning wheel, first in 1919 for Indians and in 1928 inviting people across the world to participate. His later discussions with manufacturers of the spinning wheel demonstrate an attempt to create an alternative space of science in civil society. This also found expression in experiments in rethinking institutions drawing on different foundations such as the 'All India Village Industries Association' that he established in 1934 that had prominent scientists such as Jagdish Bose and Sam Higginbottom on its Board ([ibid., 2001](#); [ibid., 2002](#)). The Gandhian experiment did not die after his assassination in 1948.

Public participation in science was a feature of many of the experiments of the Khadi Gramodyog Prayog Samiti (KGPS), an arm that was to take further some of the ideas of science and innovation in khadi (hand-spun, hand-woven cloth). The KGPS ran a technical journal in Hindi from 1948–1964 and organised several *saranjam sammelans* (instrumentation conferences) that had wide participation from different parts of India. This was the same period when modern Indian scientific institutions were being established and these experiments thus could also be seen as the early stages of the citizen science movements in India. This view of science, independent of the State, in Gandhi's work opens possibilities for creative dissent.

Innovations and insights into complex problems such as addressing poverty, reducing farm distress, and health for all require openness to innovations and insights from outside formal research systems. Beyond the aspiration of the Indian elite to transform India into an innovation superpower there are additional challenges relating to inclusion and equity. An uncomfortably large number of vulnerable Indians—tribals, healers, peasants, artisans—arguably the largest numbers in the world, who practice, access and are serviced by indigenous knowledge systems are not part of the dominant innovation story. Unlike the global North that has little living memory of indigenous knowledge, in India practitioners of indigenous knowledge compete, negotiate, and innovate both against and with modern scientific knowledge. This is articulated by a traditional Ayurvedic doctor as follows:

We don't want degrees or money. We just want validation, respect for our traditional doctors. ([Upadhyaya 2014](#))

As pointed by Rajan (2005), Indian state bureaucracies internalise, propagate, and reproduce the myths of value-neutrality, objectivity, reason, discipline, uniformity, progress, democracy, and modernity. Within rigid and hierarchical systems, reflexive and socially conscious scientists have little space for dissent, and if one is poor or a tribal, dissent is simply read as a sign of backwardness by the technocratic elite (*ibid.*, 2005). The articulation of scientific dissent in India needs to thus go beyond open political dissent and ‘dissident science’ (Delborne 2008) to include pro-active agendas and participation in shaping alternative sciences and practices. Indian experiments in creative dissent point to a space beyond the state and the market, science by civil society, or science by people. Gandhi recognised the imbalance of power in all—not just political—institutions. Gandhi’s articulation, including his insistence on intellectuals being part of constructive work, seeks to conceive of dissent differently (Prasad 2014a).

This idea and method of creative dissent has been studied in sustainable agriculture in India (Quartz 2010). Agroecological practices as alternative pathways to a green revolution have re-emerged in twenty-first century India due to creative dissent by scientists who backed research *by* and *with* civil society organisations in Non Pesticidal Management (NPM) and Systems of Rice Intensification (SRI) (Prasad 2014a). Lone dissenters, especially within the scientific establishment (as the work on NPM and SRI have shown), often find their creative dissent expressed and bearing fruition in collaboration with civil society networks. The creative dissent concept need not be restricted to a particular sector, or even with a single influential thinker—in this case Gandhi—but as a method or heuristic to help rethink the embeddedness of science within society.

Furthering Creative Dissent in Science

The Indian citizen manifesto on S&T—*Knowledge Swaraj* (KICS 2011) has sought to present newer possibilities of science and democracy in India. It draws from the traditions of critique and creativity that have been common to science movements in India. The group involved in drafting the manifesto was a loose network called ‘Knowledge in Civil Society’ (KICS) that had started as a conversation between activists and practitioners who perceived that their critiques of science were being deemed anti-science, and scholars with the broad orientation of science, technology and society studies (STS) whose disciplinary orientation involved a critical engagement with science. The manifesto was developed over a period of two years (2009–11) and included a pilot in which the ideas of the manifesto were explored through case studies in water, health, sustainable habitats, agriculture, and climate change.²

The manifesto questioned the dominant narrative of Indian science that has led to a powerful, even undemocratic at times, science and technology establishment that has privileged the all-knowing scientific expert over the citizen.³ The *Knowledge Swaraj* manifesto draws inspiration from Gandhi’s *Hind Swaraj* without quoting it explicitly. It seeks to make a case for self-rule, or *swaraj*, of India’s science and

² Shambu Prasad was also involved in the KICS network and in drafting the manifesto in 2009 and revising the same following the pilots (from 2009–11) that resulted from the manifesto.

³ Sharma and Bhatia presents an account of the significant personal costs of dissenting with the scientific and nuclear establishment in India (1996).

technology. The manifesto argues against the tyranny of the expert in contemporary science policy in India and for a knowledge democracy that draws its agenda for research and technology on the needs of the Indian people and the richness of Indian culture. It is a pro-science manifesto that favors a new form of science. The manifesto begins with interrogating expertise by challenging the expert vs. lay person dichotomy. It argues that citizens have different kinds of expertise that the scientific establishment needs to dialogue and engage with. It makes a plea for reinvigorating the ideals of gift-giving and hospitality, and a newer socialisation of research and technology that seeks to translate a vision of a non-violent science built on ideas of science for sacrifice.

The manifesto questions the tenuous link between knowledge and democracy in India and presents a newer vision of science-society relations that goes beyond the idea of a contract that is rooted in *trusteeship*.

The vocabulary of contracts typically implies that the contract partners see themselves as opposing parties. . . . The manifesto invites the scientists to regard themselves as trustees for those on whom they depend for the making, the distribution and the use of knowledge ([KICS 2011, 17–18](#)).

A good example of this vision of trusteeship, as suggested in the Manifesto, is the civil society innovation, the System of Rice Intensification (SRI) that originated from Madagascar, shared widely by an American political scientist with Quaker roots, and that found wide acceptance in India in modified forms through several experiments by farmers, scientists and civil society organisations ([ibid., 16–18](#); [Prasad 2016](#)).

The manifesto foregrounds the values of sustainability, plurality and justice. The Manifesto's understanding of sustainability is long term, with emphasis on universal human rights with access to food, health and education, and a focus on reduction of vulnerability of the under-privileged. It argues that societies would be more vulnerable without a plurality of knowledge. Recognising plurality begins with the realisation that there are multiple knowledge systems that require skills and mind-sets for an engagement across differences. A recognition of different kinds of experts as opposed to the conventional division of experts and non-experts.

When we understand multiple and often oppositional realities—of rural and urban, of agricultural and industrial, of traditional and modern. . . . we can re-examine the linear notion of time and recognize the parallel realities that this manifesto wants to celebrate ([KICS 2011, 20](#)).

Democracy as a theory gives voice and as a practice it allows for participation; but it is still incomplete if it does not allow for or enable alternatives that challenge the status quo, and celebrate the innovation at the margins.

The KICS movement's call to take knowledge democracy seriously implies a new form of justice—*cognitive justice*. Cognitive justice recognises the right of different forms of knowledge to co-exist ([Visvanathan 2006](#)). It goes beyond tolerance of liberalism to an active recognition of the need for diversity. It demands recognition of knowledge: not just as method, but also as a culture and a way of life. Cognitive justice recognises the diversity of time beyond the instant time of global financial markets and industrial manufacturing plants. It makes a plea to understand other varieties of time such as tribal time, body time, and festival time and seeks to include these in planning futures. The manifesto presents the case of newer democratic experiments that reflect the values mentioned above and urges policymakers to be more open to experiments on S&T from civil society for ideas for the future. The experiences of SRI and NPM in agriculture

and PHM discussed here are examples of these possibilities. Given the complex and uncertain world environment the manifesto does not seek to be a final document, but an offering to think, revise and co-create ([KICS 2011](#)). As a twenty-first century document, the manifesto opens up newer thinking on science and democracy for citizens and peoples movements. Creative dissent is one such frame that could help better understand science movements in India.

Tracking creative dissent enables counter-narratives to the larger, mainstream, nation-state centered narrative on innovation. New insights on research pathways on sustainable development, rural livelihoods, and 'health for all' are likely to emerge from a closer study of dissenting scientists and their practice ([Seshadri and Visvanathan 2002](#); [Chikkatur 2010](#)). A few Indian scientists including Amulya Reddy often pursued an alternative scientific paradigm within the establishment by responding to societal concerns outside their laboratories. The PSMs, we suggest, foster such creative dissent, and help shape and create new knowledge. In the following section we revisit the work of the Medico Friends Circle and show how this occurred in health movements in India.

Creative Dissent through People's Health Movement in India (1970–1990)

The People's Health Movement (PHM) in India, an extension of PSM, was formed in the mid-1970s from the combined action of several activist groups demanding not just more availability of healthcare but also a transformation in the context and nature of healthcare services (see [Shukla and Phadke 1999](#)). It took form through three broad approaches to community health and related initiatives: projects based on alternative appropriate technologies; coordinated networks of organisations such as the Voluntary Health Association of India (VHAI), and a third that went beyond providing healthcare, and consisted of organisations that were involved in pro-active lobbying and advocacy. These approaches were not strictly convergent and were promoted by distinct groups including (although not limited to) groups such as the Medico Friends Circle (MFC), the All India People's Science Network (AIPSN), All India Drug Action Network (AIDAN) and the *Lok Swasthya Parampara Samvardhan Samiti* (LSPSS) that focused on indigenous medicinal traditions ([Sharma & Bhatia 1996](#)). These groups supported different approaches to healthcare but shared many interests and objectives in terms of reshaping the relations between practitioners, patients and institutions. The movement gathered many medical professionals who were actively engaged with societal concerns and their work involved critiques of medical practice and lobbying for alternative healthcare. Anant Phadke, a medical doctor and one of the founders of the Medico Friends Circle, saw PHM including a focused position on health but also health as the means for a larger discussion from environmentalism to socio-economic activism ([Shukla and Phadke 1999](#)). The journey of the PHM is an opportunity to document creative dissent in health and to go beyond the direct influence of Gandhi.

Transforming Care and Expressing Dissent

The PHM was an ensemble of institutions and services engaged in the improvement and the transformation of healthcare. The movement was quite diverse, and some strands relate to grassroots movements from the late 1960s and early 1970s ([Basu 1987](#)). Indeed, the Indian movement takes place in the broader context of the reformulation of the agenda of international public health, initiated through the movement of barefoot doctors in socialist China as early as the 1960s, and propagated by the World Health Organization (WHO) in the late 1970s ([Chorev 2012](#); [Williams 2019](#)). The conference put forward the fact that healthcare tended to

be considered and encouraged solely through the prism of technological innovation, which inevitably put the wealthiest countries far beyond the others. On the contrary, it was high time to pay more attention to primary healthcare and to develop inexpensive methods for treating illness in developing countries. Within India the PHM was based on a critique of the prevalent health model of the Indian State that was too focused on the hospital and that neglected rural areas. One response to the lack of access of health services for the majority of Indian rural population was the barefoot doctors movement where young medical students who were convinced that hospitals and health had to go to the people would thus situate themselves in remote rural areas. Influences in the 1970s included a mix of Marxist, Maoist, Gandhian and feminist movements, and a tradition from Christian medical colleges as well. The PHM responded constantly to, and was shaped by, external events such as the Bhopal Gas tragedy of 1984, as we shall see later.

Within the PHM the Medico Friend Circle (MFC) and its Bulletin played an important part by providing a platform for a critique of public health in India. Many health activists from the 1970s to the 1990s were either involved in or closely followed the discussions of the MFC Bulletin. The exchange of mails between two young barefoot doctors, coping with the difficulties of providing rural healthcare is often credited with the formation of MFC. The first meetings of MFC in the early 1970s was a discussion group of ten-to-twenty persons who were keen to discuss and debate rural work and health services rather than to institutionalise their work into more formal organisations. The group refused any external funding.

To better understand the content and context of the discussions, critiques and alternatives to healthcare we present a thematic content analysis from their journal, the MFC Bulletin (MFCB), published between 1976 and 1990. MFCB started as a monthly and in later years was a bi-yearly magazine. Of the total 380 articles from 1976 to February 2019, the focus of this paper is on the 168 issues published between 1976 and 1990. These correspond to the initial years of existence of the movement, and to the context of 'pre-liberal reform' India (a periodisation which appeared relevant since the last decade of the century) entailed important changes in the management of public health. For instance, the multiplication of private clinics and the weakening control on health products prices, which are typical of the neoliberal views adopted during this reform period. The forms of publication were diverse, but the predominant form was the article (319), letters (163), reports (107) and editorials (60). MFCB has a few full-length articles but many short papers and opinion pieces that were written individually and collectively. The editorials and opinion pieces were based on the experience of the doctor-activists and covered a wide range of topics, from the Bhopal gas tragedy to family planning policies, working conditions of healthcare workers and the merits of traditional medicine. They often emphasised the insertion of health concerns within a broader political context, highlighting the social inequalities of access to health or the colonial roots of a given issue. Our analysis follows a thematic classification based on the 'subject' categorisation proposed on MFC bulletin's website. This is summarised in [figure 1](#). This has been followed by a qualitative content analyses upon selected categories such as health services, drugs, specific diseases, activist projects, mass disasters, etc.

The two main themes that emerge during this period are the dysfunctionality of health services and the need for rational drug policies to address pharmaceutical malpractices (see [figure 1](#)). The Bulletin also frequently covered alternative community projects and issues of nutrition and water supply, and critiqued state and for-profit institutions.

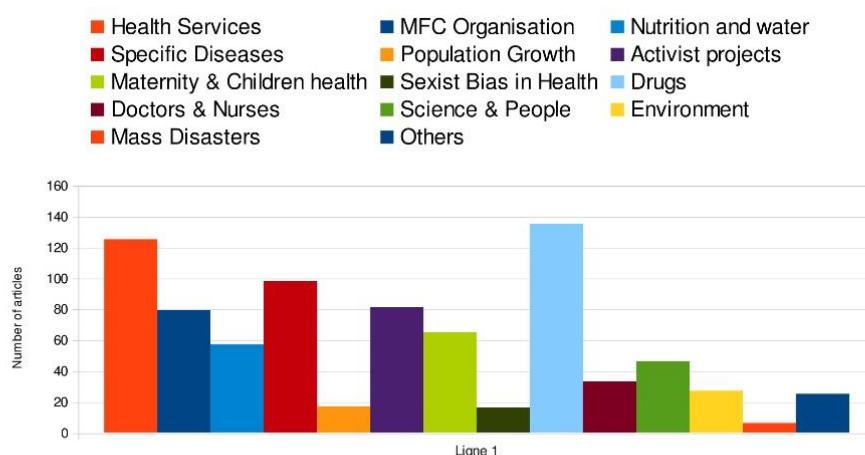


Figure 1. Thematic Content Analysis of MFC Bulletin (1976–1990)—a summary of major themes (Compiled by Mathieu Quet).

The activism of the MFC was not only discursive and policy based. Beyond its critique of health policies, the MFC, and the broader set of groups belonging to PHM, also produced new health knowledge through studies and actions. One such case is the lathyrism campaign in 1978. Neurolathyrism is a neurological disease provoked by the consumption of a pea, called khesari in Hindi, and also known as grass pea. Activists who responded to a call in the MFCB initiated a study to investigate the uses of khesari, the reasons for its consumption by villagers, and the possibilities for replacing it by other cereals. This study played an important role in fostering the engagement of MFC members. Similar actions would follow, the most prominent following the industrial disaster of 1984—the Bhopal gas tragedy. MFC stepped in following the dogged reluctance of the state to share publicly the scientific details of the effects of the tragedy. MFC members stepped in by initiating epidemiological studies in 1985 to analyse the consequences of the accident. Bhopal featured prominently in many MFCB issues from 1985–87 and became a rallying point for doctors and citizen scientists to step in by providing vital information and insights on the after-effects of the disaster. Few government agencies were willing to investigate this event. The state and the market colluded and blocked information on people's health.

The studies of Bang and Sadgopal (1990) and Sathyamala (1991) published in the MFCB was a strong indictment of the Indian Council of Medical Research (ICMR) for its failure to study a large number of victims who were not hospitalised, that also indicated a research bias excluding women in the ICMR studies (Fortun 2001). The ICMR raised 'the bogey of objectivity' in denying the validity of the MFC studies. The work by MFC was an expression of creative dissent not different from similar responses to science from civil society in sustainable agriculture (Quartz 2010; Prasad 2014a). MFC was not just a critique of state failure, however; as a form of creative dissent, their work also provided significant new knowledge in domains such as reproductive health after disasters. The discussions of alternatives and lobbying for a people-friendly healthcare policy and constructive work went hand-in-hand.

In addition to publishing the journal and carrying out studies, activists in the movement helped to create alternative hospitals whose particularity was to be co-managed by several stakeholders. These health centres could for instance be run by unions, workers, and civil society groups, the most famous being the Shaheed Hospital, built in 1983 in Madhya Pradesh, with the support of Dr Binayak Sen.⁴ In doing so they chose to bridge the cultural and epistemic boundaries between the expert doctor and the impoverished patient: all of them had to be involved on an equal footing in the construction and organization of work in health centers. The work by PHMs in India resonates with the role of HIV patient groups and health movements ([Epstein 1998](#)).

The Critique of Science and Medicine in the PHM

The journal carried debates about traditional, indigenous and ‘modern’ or ‘western’ medicine in the 1970s. Young modern medical doctors were also influenced by Western critics of science, like Ivan Illich, who argued against a new and powerful ‘medical technocracy’. Some of the techniques, institutions and health practices of modern medicine came in for criticism by practitioners and promoters of Indian medical traditions, such as Ayurveda, Siddha, Unani. The group attempted to redefine the relations between modern and traditional medicine. Amit Sengupta, a frequent contributor to the MFCB⁵ for instance, remarked during an interview that the gap between modern medicine and traditional knowledge is not as vast as it is perceived and that they hoped for an integrated alternative.⁶ Concerns about bio-piracy and excessive use of medicinal plants by industrial pharmaceutical companies and the use by local or traditional practitioners were also discussed. Writers in the journal often insisted that traditional and local practices (indigenous practices) were better adapted to local situations, as compared to other forms of knowledge. On those grounds they developed and preferred the use of ‘indigenous’ rather than ‘traditional’ knowledge highlighting its cultural rootedness in practice.

Debates in MFCB ranged from the pragmatic, such as suggesting a blending of methods of traditional and the modern, to the ideological, such as the suggestion that the paradigms of the indigenous and the modern were incommensurate. The PHM opposed institutional rules but rarely denounced modern medicine as a whole. On the contrary, they reflect on ‘best’ ways to cure people, whether they were biomedical innovations or traditional practices. They advocated an experimental way of engaging with patients and local needs to cure using innovative means.

Although discussions were multiple and disagreement was the rule, there was, however, greater agreement on some issues. Contributors to the MFCB shared a critique of Big Science, that they characterised

⁴ Dr Sen saw ‘health for all’ as linked to human rights. His activism and dissenting view led to his imprisonment by the Chhattisgarh government in 2010 and widespread protest globally ([Chatterjee 2011](#)). In the early 2000s, people from the MFC also took part in the health camps set up after the Gujarat riots ([MFC 2002](#)).

⁵ Amit Sengupta has been involved in PSM and PHM very actively since the late 1970s. He supervised the activity of multiple groups, and most notably of the Delhi Science Forum and the global People’s Health Movement. He was one of the main organisers of the People’s Health Assembly which took place in Dhaka in November 2018. He sadly passed away a few days after this event.

⁶ Amit Sengupta, interview in New Delhi, 9 August 2010 (with Mathieu Quet).

as a system obsessed with hospitals, privileging urban centers, and neglecting the majority of India, which is mainly rural. There was also greater consensus on the need to challenge the growing power of big pharmaceutical companies and the drug policies prevalent at that time. Dr. Abhay Bang, famous for his involvement in community health, connected the need for indigenous medicines and drug policy thus:

The indigenous medicines are important not just because they are 'indigenous' but because they have the potentialities to help to liberate the masses from the economic exploitation by the drug industry and the cultural slavery of medical professionals ([Bang 1978, 3](#)).

In MHC's critique, there is a Maoist inspiration with its focus on liberating professionals as well as a Gandhian critique of expertise and challenging the asymmetry between doctors and patients.

'Health by the People' was a motto of the bulletin. Bang and Sen's rural medical institutions demonstrated creative dissent that mixed different elements of Gandhi and Mao. The latter's medical principles—serving the people, prevention rather than cure, unifying traditional and modern medicine, and unifying medicine and proletariat—were regularly recollected in the pages of the MFC Bulletin. In a paper from 1977 commenting the organisation of community health in China, Vithal Rajan formulated as the most crucial question:

... should the country give importance to the role of the elite, the doctors, the scientists, the planners, the social workers, in the campaign for improving the people's health, or should they primarily rely on the people, and activate them? ([Rajan 1977, 1](#)).

The critique of medicine advocated by the Indian PHM is thus polymorphous and converges on a larger critique of the industrialisation of medicine. There is greater agreement among authors in the MFCB about a system which is far too 'hospital-centered', in favor of cities and neglecting the rural realities of India. There is also support for barefoot medical practice: sometimes non-specialist doctors, who mobilise their knowledge facing concrete specific situations and adjust their practice to local constraints. Such doctors resort without hesitation to traditional methods to cure diseases for which industrial medicines are inaccessible or too expensive. The attention of authors shifts from the mid-1970s and especially during the 1980s to a critique of the industrialisation of medicine that focuses on the pharmaceutical market. This includes the malpractices of multinational pharmaceutical companies and the irrationality of pharmaceutical policies. The creative dissent of PHM also included radical strands that challenged older distinctions between 'modernity' and 'tradition', 'developed', and 'underdeveloped' countries.

The PHM has continued its advocacy and formulation of alternative health policies under the broad Alma Ata declaration of 'health for all'. Some of its offshoots, such as the All India Drug Action Network (AIDAN), and the work of the People's Health Assembly (PHA) merit a separate discussion and is not attempted here. As shown in the case of the PHM, alternative imaginations of science and medicine are linked to current social movements. The PHM case also shows that there are diverse views of the public good and how to achieve it; such views are competing even within these movements. This diversity of alternatives needs to be acknowledged at the core of people's science and people's health movements.

The larger contribution of the PSMs is in their articulation of creative dissent, a dissent rooted and embedded in practice. In setting different axioms for research, such as 'health for all' PHM members shaped

alternative practice through designing their own tools of knowledge (social activism and epidemiology), technologies (herbal medicines), and processes (barefoot practice and social activism).

Conclusion

If science is to remain a moral enterprise, the scientific enterprise is in need of political correction. Technoscience, according to physicist John Ziman, has made data technicians of many scientists and mute spectators to the knowledge drama rather than being knowledge producers in the world. Ziman argues for a greater role of civil society as these ‘non-experts’ not only can unravel or articulate the partisan interests motivating the research, but also give the research processes meaning in life-world terms ([Ziman 2007](#)). This call for including citizens in the production, not just dissemination, of scientific knowledge resonates with studies on how patients’ movements have led to important transformations in clinical practice, integrating political and ethical aspects ([Epstein 1998](#)) and the People’s Health Movement (PHMs) in India.

The paper attempts to revisit a people’s science movement, the PHMs in India, through the lens of creative dissent. PHMs endeavoured to remind the technoscientific elite of the context of many vulnerable Indians by bringing meaning to slogans like ‘health for all’. The operations and processes of the were aimed at people’s Swaraj—self-rule, shaped through engagements *with*, and at times *against* the scientific establishment. Rigid institutional hierarchies in Indian science have meant that creative dissent has greater potential for being effective than dissent solely based on protests. Leading these movements were many creative dissenting scientists. The concerns of dissenting scientific imaginations in the global South, and in India in particular, open up possibilities beyond disrupting science to a more pro-active engagement with alternatives and autonomy of their scientists. Swaraj or self-rule opens up possibilities for scientists in India and elsewhere to explore their relationship with society and people not necessarily mediated through the scientific establishment.

Through creative dissent it is possible to extend the Citizen Science Movement’s (CSMs) search for a newer relation of science and society that celebrates diversity and citizens/people’s knowledge with the potential for engaged scientists to create newer knowledge *with* people. Creative dissent, we have shown, helps us reframe some of the contributions of the PSM and the PHM as having more in common with the Gandhian tradition of critical engagement with science and democracy than hitherto acknowledged. Science movements in India continue to articulate and create a space for ‘science in civil society’. This space goes beyond taking science *to* people, and sees citizens actively engaged *in* collective experimentation ([Prasad 2016](#)). Following Gandhi’s understanding, experimentation must be integral to individual and collective lives. It is for this reason that these Indian science movements are important in discussions on science and dissent. Creative dissent encompasses the critique of the dominant narratives on science and technology. It makes a call for deeply socialised experiments of transforming society and social relations with the moral imagination and political will needed for building a just and sustainable society, a potential ‘science in civil society’ ([ibid., 2005](#)) and incubators of new knowledges and technologies ([Hess 2007](#)). This idea has been relatively unexplored in the STS literature and could be a theme that could reengage scholars in the global North and South.

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References

- Alvares, Claude Alphonso. 1992. *Science, Development and Violence: The Revolt Against Modernity*. Oxford: Oxford University Press.
- Arnold, Dinesh. 2013. "Nehruvian Science and Postcolonial India." *Isis* 104(2): 360–370. <https://doi.org/10.1086/670954>.
- ATPS. 2010. *The African Manifesto for Science, Technology and Innovation, Nairobi: African Technology Policy Studies Network*.
- Bang, Abhay. 1978. "Editorial." *Medico Friend Circle Bulletin* 33. September 1978. <http://www.mfcindia.org/mfcpdfs/MFC033.pdf>.
- Bang, Rani, and Mira Sadgopal. 1990. "Effect of Bhopal Disaster on Women's Health: An Epidemic of Gynecological Diseases. Distorted Lives: Women's Reproductive Health and Bhopal Disaster." *Part I. Medico Friend Circle*. Pune, Medico Friend Circle.
- Basu, Amrita. 1987. "Grassroots Movements and the State: Reflections on Radical Change in India." *Theory and Society* 16(5): 647–674. <https://www.jstor.org/stable/657678>.
- Bhadra, Monamie. 2013. "Fighting Nuclear Energy, Fighting for India's Democracy." *Science as Culture* 22(2): 238–246. <https://doi.org/10.1080/09505431.2013.786986>.
- Bryden, John, and Stig S. Gezelius. 2017. "Innovation as if people mattered: the ethics of innovation for sustainable development." *Innovation and Development* 7(1): 101–118. <https://doi.org/10.1080/2157930X.2017.1281208>.
- Chikkatur, Ananth. 2010. "On Being a Technology Policy Analyst." *Economic and Political Weekly* 45(16): 33–35.
- Chatterjee, Patralekha. 2011. "Seeing Healthcare as a Human Right in India." *The Lancet* 377(9761): 195–196. [https://doi.org/10.1016/S0140-6736\(11\)60031-7](https://doi.org/10.1016/S0140-6736(11)60031-7).
- Chorev, Nitsan. 2012. *The World Health Organization Between North and South*. Cornell University Press.
- Dash, Biswanath. 2020. "Science, State and Meteorology in India." *Dialogue—Science, Scientists, and Society* 3(1). <https://doi.org/10.29195/DSSS.03.01.0026>.
- Delborne, Jason. 2008. "Transgenes and Transgressions: Scientific Dissent as Heterogeneous Practice." *Social Studies of Science* 38(4): 509–541. <https://doi.org/10.1177/0306312708089716>.

- Dumoulin, Kervran D., Mina Kleiche-Dray, and Mathieu Quet. 2018. "Going South. How STS Could Think Science in and with the South?" *Tapuya, Latin American Science, Technology and Society* 1(1): 280–305.
<https://doi.org/10.1080/25729861.2018.1550186>.
- Epstein, Steven. 1998. *Impure Science. AIDS, Activism, and the Politics of Knowledge*. University of California Press.
- Fortun, Kim. 2001. *Advocacy After Bhopal. Environmentalism, Disaster, New Global Orders*. Chicago: University of Chicago Press.
- Gibbons, Michael. 1999. "Science's New Social Contract with Society." *Nature* 402, C81–C84.
<https://doi.org/10.1038/35011576>.
- Guha, Ram. 1988. "The Alternative Science Movement: An Interim Assessment." *Lokayan Bulletin* 6(3): 7–25.
- Hess, David J. 2018. "The Anti-Dam Movement in Brazil: Expertise and Design Conflicts in an Industrial Transition Movement." *Tapuya: Latin American Science, Technology and Society* 1(1): 256–279.
- . 2007. *Alternative Pathways in Science and Industry: Activism, Innovation, and the Environment in an Era of Globalization*. Cambridge MA: MIT Press.
- Jaffry, Anwar, Mahesh Rangarajan, B. Ekbal, and K. P. Kannan, 1983. "Towards a People's Science Movement." *Economic and Political Weekly* 372–376.
- Jain, Ashok. 2002. "Networks of Science and Technology in India: The Elite and the Subaltern Streams." *AI and Society* 16: 4–20.
<https://doi.org/10.1007/PL00022694>.
- KICS. 2011. "Knowledge Swaraj: An Indian Manifesto on Science and Technology." *Knowledge in Civil Society (KICS)*. Hyderabad, India.
<http://kicsforum.in/kics/kicsmatters/Knowledge-swaraj-an-Indian-S&T-manifesto.pdf>.
- Kimura, Aya H. 2021. "Citizen Science and Social Movements: A Case of Participatory Monitoring of Genetically Modified Crops in Japan." *The Sociological Review* 69(3): 580–602.
- , and Kinchy, Abby. 2016. "Citizen Science: Probing the Virtues and Contexts of Participatory Research." *Engaging Science, Technology, and Society* 2: 331–361.
<https://doi.org/10.17351/ests2016.99>.
- Krishna, Venni V. 1997. "Science, Technology and Counter Hegemony—Some Reflections on the Contemporary Science Movements in India." In *Science and Technology in a Developing World*, edited by Terry Shinn, Jack Spaapen, Venni Krishna. 375–411. Dordrecht: Springer Netherlands.
- . 2021. "India @ 75: Science, Technology and Innovation Policies for Development." *Science, Technology and Society* 27(1): 113–146.
<https://doi.org/10.1177/09717218211047029>.
- Martin, Brian. 1993. "The Critique of Science Becomes Academic." *Science, Technology, & Human Values* 18(2): 247–259.
<https://doi.org/10.1177/016224399301800208>.
- . 2004. "Dissent and Heresy in Medicine: Models, Methods, and Strategies." *Social Science & Medicine* 58(4): 713–725.
[https://doi.org/10.1016/S0277-9536\(03\)00223-5](https://doi.org/10.1016/S0277-9536(03)00223-5).

- . 2014. *Controversy Manual*. Irene Publishing, Sweden.
- Medico Friend Circle. 1985. "Aftermath of Bhopal Disaster: An Epidemiological and Socio-Medical Survey." *Economic and Political Weekly* 20(48): 2109–2112.
- Medico Friend Circle. 2002. "Gujarat Carnage and the Health Services: A Public Health Disaster." *Report of an Investigation* May 2002.
<https://www.onlinevolunteers.org/gujarat/reports/mfc-report.htm>.
- Moore, Kelly. 2008. *Disrupting Science: Social Movements, American Scientists, and the Politics of the Military, 1945–1975*. Princeton: Princeton University Press.
- , Daniel Lee Kleinman, David Hess, and Scott Frickel. 2011. "Science and Neoliberal Globalization: A Political Sociological Approach." *Theory and Society* 40(5): 505–532.
<https://doi.org/10.1007/s11186-011-9147-3>.
- Nanda, Meera. 1998. *Reclaiming Modern Science for Third World Progressive Social Movements*, *Economic and Political Weekly*. April 18: 915–922.
- . 2003. *Prophets Facing Backward. Postmodern Critiques of Science and Hindu Nationalism in India*. New Brunswick & London: Rutgers University Press.
- Nandy, Ashis, ed. 1988. *Science, Hegemony and Violence*. Delhi: Oxford University Press
- Ottinger, Gwen. 2016. "Social Movement-Based Citizen Science." In *The Rightful Place of Science: Citizen Science*, edited by Darlene Cavalier and Eric Kennedy. Tempe: Arizona State University Consortium for Science, Policy, and Outcomes. 89–103.
- Prasad, Shambu C. 2001. "Towards an Understanding of Gandhi's Views on Science." *Economic and Political Weekly*. 36(39): 3721–3732.
- . 2002. "Exploring Gandhian Science: A Case Study of the Khadi Movement." *Doctoral Dissertation*. Indian Institute of Technology, New Delhi, India.
- . 2005. "Science and Technology in Civil Society: The Innovation Trajectory of Spirulina Algal Technology." *Economic and Political Weekly* 40: 4363–4372.
- . 2014a. "Creative Dissent: Linking Vulnerability and Knowledge in India." In *Vulnerability in Technological Cultures: New Directions in Research and Governance*, edited by Anique Hommels, Jess Mesman and Wiebe Bijker. Boston: MIT Press. 135–154.
- . 2014b. "Revisiting Science's Social Contract." *Seminar* 654: 55–61.
- . 2016. "Innovating at the Margins: The System of Rice Intensification in India and Transformative Social Innovation." *Ecology and Society* 21(4):7.
<http://dx.doi.org/10.5751/ES-08718-210407>
- Quartz, Julia. 2010. "Creative Dissent with Technoscience in India: The Case of Non-Pesticidal Management (NPM) in Andhra Pradesh." *International Journal of Technology and Development Studies* 1(1): 55–92.
- Quet, Mathieu. 2014. "Science to the People! (and Experimental Politics): Searching for the Roots of Participatory Discourse in Science and Technology in the 1970s in France." *Public Understanding of Science* 23(6):628–645.
- Raina, Rajeswari, ed. 2015. *Science, Technology and Development in India: Encountering Values*. Hyderabad: Orient Blackswan.
- Rajan, Ravi S. 2005. "Science, State and Violence: An Indian Critique Reconsidered." *Science as Culture* 14(3):265–281.

- Rajan, Vithal. 1977. "Community Health in China." *MFC Bulletin* 22: 1.
- Sahoo, S., and B. K. Pattnaik. 2012. "Understanding People's Science Movement in India: From the Vantage of Social Movement Perspective." *Sociology of Science and Technology* 3(4):8–72.
- Sathyamala, C. 1996. "Reproductive Health Consequences of Bhopal Gas Leak: Fertility and Gynaecological Disorders." *Economic and Political Weekly* 31(1): 43–57.
- Schiebinger, Londa. 1999. "Gender Studies of STS: A Look Toward the Future." *Science, Technology and Society* 4(1): 95–106.
- Seshadri, C. V., and Shiv Visvanathan. 2002. "'The Laboratory and the World': Conversations with C. V. Seshadri." *Economic and Political Weekly* 37(22): 2163–2170.
- Sharma, Dharendra. 1976. "Growth and Failures of India's Science Policy." *Economic and Political Weekly* 11(51): 1969–71.
<https://doi.org/10.1177/097172189900400107>.
- Sharma, Manoj, and Gayatri Bhatia. 1996. "The Voluntary Community Health Movement in India: A Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis." *Journal of Community Health* 21(6): 453–464.
- STEPS. 2010. *Innovation, Sustainability, Development: A New Manifesto* Brighton: STEPS–Centre.
- Stirling, Andy. 2009. "Direction, Distribution and Diversity! Pluralising Progress in Innovation, Sustainability and Development." *STEPS Working Paper* 32. Brighton: STEPS Centre.
- Strasser, Bruno, and Muki Haklay. 2018a. "Citizen Science: Expertise, Democracy and Public Participation." Report for Swiss Science Council.
https://www.swir.ch/images/stories/pdf/en/SWR_PolicyAnalysis_CitizenScience_INHALT_EN_excerpt.pdf.
- , Jérôme Baudry, Dana Mahr, Gabriela Sanchez, and Elise Tancoigne. 2018b. "Citizen Science"? Rethinking Science and Public Participation. *Science & Technology Studies* 32: 52–76.
<https://doi.org/10.23987/sts.60425>.
- Shiva, Vandana. 1991. *The Violence of the Green Revolution: Third World Agriculture, Ecology, and Politics* (Penang, Malaysia: Third World Network).
- Shukla, Abhay, and Anant A. Phadke. 1999. "Health Movements in India." *Health Action* 12(12): 6–9.
- Upadhyaya, Venus. 2014. *Traditional Indian Doctors Seek Government Recognition for their Practices*.
https://www.theepochtimes.com/traditional-indian-doctors-seek-govt-recognition-for-their-practices_1104788.html.
- Varma, Roli. 2001. "People's Science Movements and Science Wars?" *Economic and Political Weekly* 36(52): 4796–4802.
- Varughese, Shiju S. 2020. "Expertise at the 'Deliberative Turn': Multiple Publics and the Social Distribution of Technoscientific Expertise." *Dialogue—Science, Scientists, and Society* 3(1).
- Visvanathan, Shiv. 1997. *A Carnival for Science: Essays on Science, Technology, and Development*. Oxford: Oxford University Press.
- . 2006. "Alternative Science." *Theory, Culture & Society* 23(2–3): 164–169.
- Werskey, Gary. 2007. "The Marxist Critique of Capitalist Science: A History in Three Movements?" *Science as Culture* 16(4): 397–461.

- Williams, Logan. D. A. [2019](#). *Eradicating Blindness. Global Health Innovation from South Asia*. Singapore: Palgrave Macmillan.
- Ziman, John. 2007. "Science in Civil Society." Exeter: Imprint Academic.