



Reflections on Social Movements of Science in Contemporary India

Dhruv Raina and Omprasad

ABSTRACT: Social movements of science in India have had an important role to play in the democratisation of science for more than half a century. The participants in these movements have different understandings of the social relations of science, ideological agendas, and the social origins of the participants in these movements are quite diverse as are their educational backgrounds. The relationship of these movements with the state funded science and technology research system has been marked by ambivalence, now by antagonism and at other times as a resource to be cherished and defended. But the challenges facing them today are of a different order. The ascent of authoritarian regimes globally, as well as in the Indian political sphere pose a threat to the institutions of learning and knowledge production and dissemination. Beyond research institutes and universities facing up to the threat of political intervention and budgetary cuts, the academy that ensconces the three cultures of the sciences, social sciences and the humanities, is a divided house today. While there have been popular movements and democratic struggles led by students and farmers, in a post-truth world defence of the values and ethos of science and the world of knowledge as an open community of scholars oriented towards the production of robust knowledge needs to be defended again. This paper will address some issues presently faced by social movements of science encountering a populist and authoritarian regime. The paper argues why it is important to defend a socially robust theory of knowledge making and one of the arenas for disseminating this conception of knowledge relate to the specific struggles of the social movement of science today.

KEYWORDS: Social Movements, India, March for Science, post-truth, credibility of scientific knowledge, authoritarian governments, populism.

Introduction

The history of science movements in India for purposes of demarcation can be divided into two distinct phases. The first phase coincided with the first two decades of the achievement of Indian independence from British colonial rule

Raina, Dhruv and Omprasad. 2023. "Reflections on Social Movements of Science in Contemporary India." *Marxism & Sciences* 2(2): 29–42.
<https://doi.org/10.56063/MS.2310.02203>

- *Correspondence:* Dhruv Raina, Zakir Husain Centre for Educational Studies, School of Social Sciences, Jawaharlal Nehru University, New Delhi. (retired)
- e-mail: d_raina[at]yahoo.com
- ORCID: 0000-0002-3251-4191
- DOI: 10.56063/MS.2310.02203
- *Received:* 04.04.2023; *Revised:* 24.07.2023; *Accepted:* 27.07.2023
- *Available online:* 05.11.2023

in 1947. During this phase the most prominent science movement was the scientific workers movement inspired by the Bernalist ideas of the relationship between science and society as well as popular front movements of scientists from the inter war period (Petitjean 1997; 2008). This moment is a particularly important one since it sits at the conjuncture of the end of the Second World War, the beginnings of the Cold War and the phase of de-colonisation in the Third world. The 1950s is also the decade marking the phase of institutionalisation of Big Science in India with the imperatives of industrial research, space research and nuclear research dominating funding and attention of science policy makers (Raina and Jain 1997). The second phase of science movements was in the 1970s and after. This phase is characterised by a disenchantment with the top-down model of the expansion of the domain of science and technology championed by the regnant paradigm of modernisation of the previous decades. Thus, this period saw the rise of ecological and social movements raising concerns of livelihoods and ownership of resources, habitats, and energy resources. Science and technology remained a concern of these movements to the extent that its application in aiding the state's development policy affected livelihoods, especially the livelihoods of those sections of society living at the margins (Raina and Omprasad 2023). Amongst the spectrum of social movements of those early decades of decolonisation, the Kerala Sashtra Sahitya Parishat (KSSP), inaugurated in the southern Indian state of Kerala in 1962 probably was the first of its kind dedicated to the democratisation of the cultures of science (Varughese 2002). By 1988 other progressive science movements from different parts of the country coalesced together to form an all-India platform of science movements called the All-India Peoples Science Network (AIPSN), which continues to exist till date and has an annual convention of all its constituent bodies (Venkateswaran 2020).

On the other hand, this essay maybe seen as the first in a preliminary effort on a subject that was researched *de rigueur* in India during the 1980s, when civil society was an important arena of science activism (Issac 1997; Krishna 1997; Raina 1997), as it was for those opposing the developmental agenda of the post-colonial state from a neo-Gandhian standpoint (Guha 1988). As pointed out above, in the 1970s and 80s these movements were arguing for the democratisation of science and the struggle for its democratisation in the interests of wider social change and social revolution. The last two decades of the twentieth century were emblematic of the high tide of the progressive science movements in the country, while the first two decades of the present millennium appear—as a “business as usual” intermezzo, rather than a phase of permanent or continuing revolutionary struggle. It could be argued, contestably though, that the momentum of the 1980s and 1990s created the space for the stabilization of the programmes and efforts of what these movements

were seeking to achieve and the apparatus of the state proceeded to institutionalize some of these programmes, particularly those with some innovative promise (Delhi Science Forum 1989).¹

At this juncture, one could ask whether the movements of the 1970s to the 1990s informed the practice of the sciences? And the answer would be that they did so in two ways. The science movements of progressive or the neo-Gandhian orientations played a significant role in placing new priorities for the scientific establishment, and over a period the scientific establishment had to incorporate these priorities into their institutional and funding priorities, although in monetary terms it did lay claim to a very small portion of that funding. But at another level, leading scientific institutions created, such as the Indian Institute of Science at Bangalore, the Indian Institute of Technology at Mumbai and gradually many others, Centres for research into problems of the rural areas and that over the decades grew into centres for the study of sustainable development and futures. But despite significant interest that these centres generated they remained at the margins of the national science and technology research system both in terms of the funding they received and the ability to attract researchers.

This process of institutionalization in the late 1990s meant that the campaigns and objectives of social movements were translated by a neo-liberal state into the language of projects and achievable targets and goals, be it in the area of drinking water or health or non-conventional energy resources or low-cost housing. We could then be led to ask if this transition occurred at the expense of the agitprop mode that characterised the earlier decades of these movements. In fact, several of these movements from the 1990s onwards formed coalitions and alliances with international movements such as the World Social Forum, which provided the banner for both joint and distinct local campaigns in their attempt to give concrete expression to an alternate vision of globalization, distinct from neo-liberal market driven globalization. Some of these programmes undertaken across national contexts were in the areas of health, reaching out to the global dimensions of health care while responding sensitively to specific regional contexts. (Purkayastha et al. 2021; Green 2019).

The Crisis of Scientific Legitimacy

However, over the last decade, following the resurgence of neo-fascist movements and authoritarian regimes, another space has opened for these movements and these have to do with the struggles of farmers and issues of public

1. This was the subject of discussion in a special issue of *Social Scientist* Vol. 17, 1989 to mark 50 years of the publication of J.D.Bernal's *The Social Function of Science*.

health. In these cases, the science movements joined hands with political movements agitating for farmers demands as well as those demanding more equitable health care schemes.² These struggles erupted at the national level. But a global movement that appears to have had a world-wide response, involving communities of scientists from across the globe as well as science movements was the “March for Science.” This was purportedly a reaction and response to the use authoritarian regimes were making of post-truth rhetoric to delegitimize scientific expertise when the scientific communities’ advice ran counter to the interests of the electoral constituencies supporting authoritarian regimes or those of the military-industrial complex.

These developments have been accompanied by structural transformations afoot over the last three decades within the world of science and impacting at the level of the institutional practices of science, that have altered the epistemic norms of science and asymmetrically skewed the internal mechanisms of prioritizing what is considered important in science and steers the efforts of scientists (Gibbons et al. 1995). John Ziman for one has elaborated upon the problems of post-academic science and the shift from CUDOS to PLACE as the new social norms of science (Ziman 2000). On the other hand, those speaking of the new production of scientific knowledge have announced the emergence of mode-2 knowledge production which brings with it a more robust social accountability and prompts the gradual shift from the overall scientisation of society—something that has unpacked over the last hundred years—to the gradual socialisation of science (Nowtony et al. 2001). Even if one were to accept the latter argument, it still needs to be asked which forces and interests steer this socialization. That scientists do feel constrained by the new social contract, that the worlds of the sciences have evolved in different national contexts is reflected in one of the slogans at the march for science campaigns in Europe: “laisse moi-penser.”

We do not attempt to paint the 1970s and 80s as a golden age of the science movements in India, though they were animated decades, but there are very important differences between the context of the 1990s and the last decade. In India at least, the 1980s saw the emergence of movements for the democratisation of the sciences, which was part of a much larger process of striving for political and intellectual decentralization, striving for financial and programmatic planning and decision making at the state rather than the federal level (Parameswaran 2013). It was argued that this would facilitate imple-

2. The All India Peoples Science Network (AIPSN) which is a national level platform of different constituent science movements was consistent in its support of the farmers protests against farm laws brought in by the Federal government that took place in India in 2021–22. Their solidarity and support is well documented in the AIPSN website <https://aipsn.net/>. For the causes leading to the farmers movement and protest see Jodhka (2021).

mentation of plans at the state level and would add up to national development at the federal level. In today's changed world of science there is a patent disregard for the findings of science and the process that leads to the acceptance of well corroborated scientific theories. As McIntyre puts it a "hyperpoliticized do your own research on Google" has eroded trust in science. McIntyre suggests a shift from a preoccupation with scientific method to disseminating the "scientific attitude" that entails in the first instance a respect for and concern with evidence, and the ability to revise our beliefs in the light of evidence. Fundamental to the practice of science is the collective practice of testing and checking one another's findings (McIntyre 2019). In other words, there is the need to reaffirm the idea that the practices of science encode the ethics of science as well (McMullin 1982).

The Fractured Academy

At the turn of the millennium, with the wider distribution and accessibility to technoscientific systems and the ever-expanding applications of information and computer technologies—the digital revolution—the sorts of problems encountered at the societal level were variations of problems encountered across other national contexts.³ In other words, trouble shooting in the United States could be sorted out sitting in Bengaluru. Nevertheless, the problems that afflicted rural India persisted and many of the problems addressed by the science movements were to be addressed in new formats. The mobilization of technoscience as a transformative practice and knowledge form to the still neglected realms of agriculture, rural livelihoods, energy, health and habitat were important priorities of civil society organization in the 1980s (Raina and Chowdhury 1997). The dimensions of the problems grew manifold over the decades, the research required to cope with these problems has also been institutionalised within the scientific academy as mentioned above. In the 1980s, the scientific infrastructure for "small science"⁴ had to be created within "institutions of "big science" and the pressure from the science movements and civil society organizations helped steer this process of institutionalization and conferring on it a legitimacy (Raina 1993). But the more significant change that has taken place is that in the 1980s, a kind of weak technological determinism provided a scaffolding for the movements taking science to the people, as well as the efforts of scientists to develop new technologies (Winner 2001). However, the lessons that have been learned is

3. For a history of India's Information Technology sector see Sharma (2015)

4. We deliberately employ the term small science here as distinct from De Solla Price's "little science." In fact, what we refer to as small science here for convenience, has a great deal in common with Ravetz and Funtowicz's post-normal science (Funtowicz and Ravetz 1993).

that solutions to these problems cannot be technological fixes for the socio-cultural embedding of technology plays an equally important role in the reception and optimal uptake of a travelling idea or system. Perhaps it is still too early to say but the expansion of AI may reverse some of these changes in perspectives and framings and movements may need to revise their imaginaries once again.⁵

But one says that with a great deal of caution. At another level a divide in the academy has divided movements; and this divide has to do with the cultures of the sciences and social sciences. If the tension between the sciences and the social sciences and humanities manifested itself in the Anglophone world in the debate over two cultures—there were pre-figurations of it in the Popper-Adorno debate. The debate raged over the methodology appropriate for social science research (Raina 2019). Steve Fuller reckons that this was a wasted opportunity for developing a more substantive engagement between the sciences and social sciences. The long-term outcome was that within the academy it dissipated the energy necessary for critique especially during a decade when neo-liberal educational policies began to transform the world of higher education on a global scale. In the process the cultural resources needed for defending the university as a site for autonomous inquiry were also absent (Fuller 2002, 365–80). Three decades later the culture wars were re-enacted, prompted by similar concerns but triggered off by scientists responding to the de-privileging of the epistemic authority of science, by science studies scholars (Gross and Lewis 1997). The science wars were not merely a defensive response from the scientific community but was symptomatic of its unhappiness with the cultural relativism that had received a new legitimacy with the rise of postmodernist thought (Baldwin 2008). We could say that we are now at a third moment in the science wars, which going by Latour's clarification is not so much a moment of rapprochement as one of turning science studies to critically look at science's critics (Latour 2004). In fact, this is a moment when the battle lines are not drawn between the sciences and the social sciences, but where the sciences and social sciences must defend their methods and domain specific expertise from the onslaught of populism (Ruane 2018). The urgency of this change in perspective reflects the exigency of a new concern with what has been termed as 'cosmopolitics' (Stengers 2010; Raina 2019).⁶

Speaking from within the sciences, enhanced computational abilities created a space for addressing increasingly complex problems in ways that

5. There has been an interesting discussion on AI and Society in the Boston Review. See for example (Acemoglu 2021)

6. The paper by (Raina 2019) engages in some detail with how the sciences and social sciences need to be brought into conversation with each other.

criss-crossed disciplinary boundaries. This enhanced capability has encouraged the conversation between disciplines, and to a large extent a conversation between the sciences and social sciences (Chakraborti et al. 2016). However, what may be required is a more substantial conversation between these distinct domains than the extension of big data analytics to the study of social systems. The same can be said about the digital humanities, for the hard task of analysis, explanation and interpretation must proceed nevertheless. The problem is that there are serious concerns about democratic citizenship, since it is creating a system of steering human behaviour, of developing a system of digital surveillance far more efficient and thereby pernicious than the Benthamite panopticon. Byung-Chul Han argues that dataism sets the stage for a second enlightenment that demands that everything becomes data and information, for they afford a 'reliable and transparent lens.' But the soil of the second Enlightenment is data totalitarianism, or data fetishism.' The dream is propagated under the banner of ideological neutrality but is in fact an ideology that reaffirms data totalitarianism. Through a quantification of the self, the new digital psychopolitics, that differs from the biopolitics driving statistics, intervenes deep into psychic processes (Han 2017, 55–70). The challenge then for the humanities, sciences and social sciences is not just to resist dataism, but to reveal the core premises of its agenda and to ensure the robustness of the concepts and methods of the emerging interdisciplinary fields that bypass this digital totalitarianism by counter posing memory, reflection, and democracy as the foci for defining a new academic culture (Raina 2019).

The last few years have been crucial and difficult for the science movements in India and require a different strategy of coping with issues of public health related crises—the pandemic, the development of vaccines and the controversies surrounding them, the environmental disasters in the form of flash floods, forest fires, drought etc. precipitated by the impact of anthropogenic activity on the climate have indeed been telling. On the Indian sub-continent, we do not witness any widespread mobilization or movements around these concerns, as we see in Europe. e.g., those led by Greta Thunberg. In other words, we do not have a counterpart of the new social movements that emerged in the 1970s in India around Silent valley, the protests around the establishment of the nuclear facility at Kaiga, or wider social movements such as the anti-big dam movement—the Narmada Bachao Andolan was possibly one of the biggest and long-lasting social movements in independent India. In all these cases, the resources of science, whether it related to seismic activity, hydrology, species extinction, forest management practices, were interlinked with the ideology and framework of development, that was constantly challenged and redefined (Raina et al. 1997). The main issue

related to the paradox that developmentalism as understood in the 1960s and early 1970s had contributed to unequal development, not to mention the ecological and environmental destruction it left in behind its wake (Gadgil and Guha 1994; Escobar 2011). The trail of unequal development was manifest in the disruption of rural life and loss of rural livelihoods as agriculture itself was threatened as forms of life and the numbers of the impoverished climbed as populations migrated to the city.⁷

But returning to the Covid pandemic, it appears that there was no significant resistance to the government of India's campaigns to get the population vaccinated, at least not of the order of resistance in Europe and the United States of America. The bottleneck in India was the timely availability of the vaccines. Nevertheless, there were several misplaced beliefs about the pandemic and during the early phases in certain regions doctors were attacked and the state had to respond by elevating them to the status of national heroes in order to protect them and ensure that the hospitals continued to function. In this case, the media informed by the medical profession and the state machinery played a role in dispelling these myths. There were nevertheless moments that had fateful consequences, when the state keeping its interests in mind, acted contrary to the advice of scientists.⁸ But there was never really the necessity to take on the anti-vaxxers since that kind of resistance was miniscule.⁹ But it is interesting to note that groups that were propagating anti-vaxxer ideas in the wake of the covid vaccination program across the world were relying on digital communication platforms like WhatsApp and Telegram for their propaganda.

While scientists and members of civil society belonging to various peoples' science movements were consulted on international climate change summits as experts, there was no movement for 'Climate Change.' Several university teachers, researchers and ecological activists have organised themselves into a platform called Teachers Against the Climate Crisis.¹⁰ The activities of the coalition are oriented to sharing and disseminating research and initiating discussion around the most significant concerns relating to the Climate crisis. An important objective is to understand the phenomenon and its impact on regions, areas, and nations.

Perhaps one of the biggest challenges posed for science and the integrity of scientific knowledge has been encouraged by the accessibility to digital

7. See the essays titled "House of Bamboo" and "Reinventing Gandhi" in (Visvanathan 1997).

8. Scientists had warned the Indian Govt of a possible surge of covid cases due to the delta variant. The Govt ignored such warnings. <https://www.reuters.com/world/asia-pacific/exclusive-scientists-say-india-government-ignored-warnings-amid-coronavirus-2021-05-01/>.

9. India, traditionally hasn't had a strong anti-vaxxer movement. This is partly due to the very successful publicly funded mass vaccination program for diseases like polio and small pox.

10. <https://teachersagainstclimatecrisis.wordpress.com/>

technologies and the social media and their amplification by political constituencies. This has to do with the increasing circulation of fake news that derives its justification from an epistemology of the post-truth regime. Fake news and disinformation campaigns have played an important role in the global de-legitimation of scientific expertise, that have received a great deal of support in nations with authoritarian regimes in power. Towards his last years the sociologist of science Bruno Latour pointed out that perhaps he had overdone his criticism of science and scientists, and the need of the hour was to defend science from the conservatism of the climate change sceptics (Poulson 2018). The Gifford Lectures that he delivered now published as *Facing Gaia: Eight Lectures on the New Climate Change Regime* is reflective of this turn. There is thus a need to reflect upon more than half a century of scholarship in the sociology of knowledge and the sociology of scientific knowledge and that influenced movements and through movements the wider social imaginaries of science more generally (Jasanoff et al. 1993).

The International of Science and Local Contexts

The de-privileging of validated knowledge claims considered by the scientific community to be robust has triggered off a reflective and assertive movement among scientists that was manifest in cities across the world and several cities of India in the “March for Science.” This has since become an annual affair. The long and short of these marches was to foreground the slashing of public funding for research, reaffirm the significance of science in contemporary society and recover the authority conceded to the epistemology of fake news. Clearly, this time around the old positivist defence of science would not have worked and the community would have to take course to its varied resources. McIntyre’s argument cited above has its sources in the recognition of these dimensions. In India, the movement was inaugurated by a group of scientists at the Indian Institute of Science Education and Research, Kolkata forming a coalition with colleagues in other colleges and research institutes throughout the country as well as the science movements affiliated, however loosely with the AIPSN. This came to be referred to as the ‘Breakthrough Science Movement.’¹¹ Over the years it has operated as a coalition of diverse institutes and science movements and what really binds them together is a progressive conception of the role of science in society and a commitment to science as a body of valid knowledge. But beyond this it is very likely that these different strands have very different conceptions of the nature of science. The glue binding them to-

11. <https://breakthroughindia.org/>

gether is as pointed out, the need to defend science as a way of life and scientific knowledge and scientific understanding of the world around us as reliable, valid and robust.

The aftermath of the March for Science in India that first registered its presence in 2017, triggered a discussion in the country whose participants included philosophers and sociologists of science, social scientists and scientists (Sarukkai 2017; Pathak 2017; Siddharthan 2017; Thomas 2017; Surendran 2017). While the debate had echoes of the Science Wars of the previous century, much of it was not alive to the changed place of science in our society and did not engage with the organised efforts that are underway by various political groups to de-privilege knowledge produced on the back of robust empirical investigation. The concerns of those who perceived the demand of the March for Science for 'more science' in our society appeared to be out of place in a political climate which is hostile to the practice of open enquiry, the sharing of divergent opinions and has scant regard for democratic principles. Put in a different way, a critique of science and its relationship with power which was articulated in the 1980s does not have the same kind of purchase in today's context, where the authority of scientific knowledge as well as that of the social sciences stands challenged. A more fruitful engagement with this kind of political action by scientists would have been to examine the changing relationship of science and scientists with politics and the corresponding response of the science movements.¹² In this context, it does make sense to ask some "now and then questions."

The movements of scientists date back to the beginnings of the era of scientific internationalism after the first World War, transitions through the Nazi era with the formation of popular fronts of scientists, the World Federation of Scientific Workers during the Cold War, the movement for nuclear disarmament and non-proliferation, and witnesses some kind of revival in the March for Science (Someson 2008). But between the 1980s and the end of the millennium the world Federation of Scientific Workers appeared to have gone into decline. Thus, between the 1920s and the 1990s the weakening of the internationalism of science, with may be a brief interlude in the 1970's had to do with the retreat of the horizon of these activities from global and transnational engagement towards regional and country-based ones, although the concerns of sustainability and non-conventional energy sources continued to have an international or global dimension.

By the 1980s, the institutionalisation of science and technology even in the developing world was wider than during the decade of decolonisation, as a result of which the dependence on the developed world, at least in India had

12. A good example of this kind of engagement are the articles published in the journal *Sociological Forum* in the wake of the March for Science marches in the United States of America.

declined. In other words, local problems and local level implementation did not require the support of the developed world in every instance. The transition from the global to the local, not undermining the place that international collaborations continued to have, the deepening of the processes of professionalization and institutionalization in the developing world and the role of transnational organizations such as UNESCO, UNEP, UNDP, OECD etc inadvertently played a role in sustaining the autotelic organized international of science (Salomon 1971; Elzinga 1996). The momentum of these developments impacted upon the science movements at the national level as well.

Nevertheless, in the 1970s the coalitions of civil society organizations that included scientists amongst its members, as well those located at institutes of science teaching and research committed themselves to the problems considered relevant to the developmental needs of different regions of India. The research required to address these issues required contributions from interdisciplinary domains of research that had still to be institutionalised and acquire stability. This required at the time little steering from the outside. Once these interdisciplinary fields acquired institutional stability, they became amenable to the forces of internationalisation in any case. One cannot preclude the possibility that these techno-sciences had themselves entered a phase of finalization or the phase of post-normal science.

This does not mean that movements have run out of issues and concerns - far from it. But what movements have begun to take on as matters of concern has changed. The concern today in India, is that waves of identitarian politics have challenged the ideal of the unity of knowledge. This throws open the concern as to what needs to be popularised, defended and criticized in the sciences and from which vantage point. After one has factored in the voices from the margins and peripheries, the reliability, coherence and robustness of knowledge is still ensured without conceding to relativism. But science still needs greater engagement with inequality, poverty and an understanding of their connections with dimensions of nature in the Anthropocene.

REFERENCES

- Acemoglu, Daron. 2021. "AI's future doesn't have to be dystopian." *Boston Review*.
<https://www.bostonreview.net/forum/ais-future-doesnt-have-to-be-dystopian/>
- Ashman, Keith M. and Philip S. Baringer. 2001. *After the Science Wars*, edited by Philip S. Baringer. Psychology Press
- Baldwin, John D. 2015. *Ending the Science Wars*. London: Routledge
- Chakraborti, Anirban, Dhruv Raina, and Kiran Sharma. 2016. "Can an interdisciplinary field contribute to one of the parent disciplines from which it emerged?" *The European Physical Journal Special Topics* 225: 3127-35.
- Delhi Science Forum. 1989. "The Notion of Science According to Bernal." *Social Scientist* 17(3/4): 3-12.

- <https://doi.org/10.2307/3517356>
- Elzinga, Aant and Catharina Landström. 1996. *Internationalism and Science*. London: Taylor Graham.
- Escobar, Arturo. 2011. "Development and the anthropology of modernity." In *The Postcolonial Science and Technology Reader*, edited by Sandra Harding. Durham: Duke University Press. 269-289.
- Fuller, Steve. 2002. *The Kuhn-Popper Debate: The Struggle for the Soul of Science*. Icon Books.
- Funtowicz, Silvio O., and Jerome R. Ravetz. 1993. "Science for the post-normal age." *Futures* 25(7): 739-55.
- Gadgil, Madhav and Ramchandra Guha. 1994. "Ecological Conflicts and the Environmental Movement in India." *Development and Change* 25(1):101-136.
<https://doi.org/10.1111/j.14677660.1994.tb00511.x>
- Gibbons, Michael, Camille Limoges, Helga Nowotny, Simon Schwartzman, Peter Scott, and Martin Trow. 1994. *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Sage
- Green, Andrew. 2019. "Amit Sengupta." *The Lancet* 393(10166): 24.
- Gross, Levitt, and Martin W. Lewis. 1997. *The Flight from Science and Reason*. New York: New York Academy of Science.
- Guha, Ram. 1988. "The Alternative Science Movement: An Interim Assessment." *Lokayan Bulletin* 6(3): 7-25.
- Han, Byung-Chul. 2017. *Psycho-politics: Neo-liberalism and the New Technologies of Power*. London: Verso Books
- Isaac, T. M. Thomas., Richard W. Franke, and M. P. Parameswaran. 1997. "From anti-feudalism to sustainable development: The Kerala Peoples Science Movement." *Bulletin of Concerned Asian Scholars* 29(3): 34-44.
<https://doi.org/10.1080/14672715.1997.10413092>
- Janoff, Sheila, Gerald E. Markle, James C. Petersen, and Trevor Pinch. 1993. *Handbook of Science and Technology Studies*. New York: Sage Publication.
- Jodhka, Surinder S. 2021. "Why are the farmers of Punjab protesting?" *The Journal of Peasant Studies* (48)7: 1356-70.
<https://doi.org/10.1080/03066150.2021.1990047>
- Krishna, V.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 et al. 375-411. Netherlands: Springer.
- Latour, B. 2004. "Why Has Critique Run Out of Steam? From Matters of Fact to Matters of Concern." *Critical Inquiry* 30: 225-248.
- McIntyre, Lee. 2019. *The Scientific Attitude: Defending Science from Denial, Fraud and Pseudoscience*. Boston: MIT Press
- McMullin, Ernan. 1982. "Values in Science." *Proceedings of the Biennial Meeting of the Philosophy of Science Association*, 3-28.
- Nowotny, Helga and Scott, Peter and Gibbons, Michael. 2001. *Rethinking Science: Knowledge and the Public in the Age of Uncertainty*. London: Polity Press.
- Parameswaran, M.P. 2013. *Science for Social Revolution: A Reader*. Thrissur: Kerala Sasthra Sahitya Parishath
- Pathak, Avijit. 2017. "Hubris of Science." *Indian Express*. August 12, 2017.
<https://indianexpress.com/article/opinion/columns/hubris-of-science-scientist-march-religious-intolerance-4792700/>
- Petitjean, Patrick. 1999. "Needham, Anglo-French Civilities and Ecumenical Science." In *Situating the History of Science: Dialogues with Joseph Needham*, edited by S. Irfan Habib and Dhruv Raina. Oxford University Press: Delhi.

- Petitjean, Patrick. 2008. "The Joint Establishment of The World Federation of Scientific Workers and of UNESCO after World War II." *Minerva* 46 (2): 247–70.
- Poulson, Steve. 2018. "The Critical Zone of Science and Politics: Interview with Bruno Latour." *Los Angeles Review of Books*, February 23, 2018.
<https://lareviewofbooks.org/article/the-critical-zone-of-science-and-politics-an-interview-with-bruno-latour/#/>
- Purkayastha, Prabir, Indranil, Richa Chintan. 2021. *Political Journey in Health: Essay by and for Amit Sengupta*. New Delhi: Leftword Books.
- Raina, Dhruv. 1993. "Technological determinism embodied in an appro-tech programme: Small science in a high-tech environment." *Journal of Scientific and Industrial Research* 52: 471–82.
- Raina, Dhruv and Ashok Jain. 1997. "Big science and the university in India." In *Science in the Twentieth Century*, edited by John Krige and Dominique Pestre. Amsterdam: Harwood Academic Publishers
- Raina, Dhruv. 1997. "Evolving perspectives on science and history: A chronicle of modern India's scientific enchantment and disenchantment (1850–1980)." *Social Epistemology* 11(1): 3–24.
- Raina, Dhruv. 2019. "After the Two Cultures Divide: Transdisciplinarity and the Shape of Things to Come." In *Questioning Paradigms, Constructing Histories*, edited by Kumkum Roy and Naina Dayal. New Delhi: Aleph Books. 365–380.
- Raina, Dhruv and Omprasad. 2023. "Small Movements, Big Problems: At the Margins of History of Science and Technology." Paper Presented at the *Workshop on "Civil Society, State and Science: Transformative Initiatives in/for Rural India 1980-2020*, January 22–23, New Delhi
- Raina, Vinod, Aditi Chowdhury, and Sumit Chowdhury. 1997. *The Dispossessed: Victims of Development in Asia*. New Delhi: Manohar
- Ruane, J.M. 2018. "Should sociologists stand up for science? Absolutely!" *Sociological Forum* 33(1): 239–41.
- Salomon, Jean Jacques. 1971. "The internationale of science." *Science Studies* 1(1): 23–42.
- Sarukkai, Sundar. 2017. "A March from Yesterday." *The Hindu*. August 10, 2017.
<https://www.thehindu.com/opinion/op-ed/the-march-from-yesterday/article19459043.ece>
- Sharma, D.C. 2015. *The Outsourcer: The Story of India's IT Revolution*. Boston: MIT Press.
- Siddharthan, Rahul. 2017. "Sundar Sarukkai's Claim That the 'March for Science' Was Unscientific Is Farcical." *The Wire*. August 11, 2017.
<https://thewire.in/science/sundar-sarukkai-march-for-science-scientific-temper-fundamentalism>
- Somsen, Geert J. 2008. "A History of Universalism: Conceptions of the Internationality of Science from the Enlightenment to the Cold War." *Minerva* 46(3): 361–79.
- Stengers, Isabelle. 2010. *Cosmopolitics I*. Translated by Robert Bononno. Minneapolis: University of Minnesota Press.
- Surendran, Aardra. 2017. "Why the 'March for Science' Was About the Social Sciences as Well." *The Wire*. August 20, 2017.
<https://thewire.in/science/march-for-science-scientific-method-sociology>
- Thomas, Renny. 2017. "Can Science and Social Science Really March Together?" *The Wire*. August 22, 2017.
<https://thewire.in/science/march-for-science-superstitions-latour-sal>
- Varughese, Shiju Sam. 2002. *People's Science Movements: A Study on the Ideological Orientations of Kerala Sastra Sahitya Parishad*. MPhil Diss: Jawaharlal Nehru University
- Venkateswaran, T V. 2020. "'Science for social revolution': People's Science Movements and democratizing science in India." *Journal of Science Communication* 19(6): C08.

- Visvanathan, Shiv. 1997. *A Carnival for Science: Essays on Science, Technology and Development*. New Delhi: Oxford University Press.
- Winner, Langdon. 2001. "Where Technological Determinism Went." In *Visions of STS: Counterpoints in Science, Technology, and Society Studies*, edited by Stephen H. Cutcliffe and Carl Mitcham. 11-19. SUNY Press.
- Ziman, John. 2000. *Real Science: What It Is and What It Means*. Cambridge: Cambridge University Press.