

Democratizing scientific knowledge through building scientific institutions in nineteenth century India: the sociology of science perspective

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This note, from the sociology of science perspective, argues that during the colonial regime, the colonizers, on the one hand and the cultural elite in India on the other, introduced science education to the people of India. Whereas scientific knowledge was introduced in India in order to keep the vested interests of the colonial government alive, a section of the Indian intelligentsia, in contrast, tried to democratize scientific knowledge through building scientific institutions in nineteenth century India. The present study is a modest attempt to understand the dialectic between science-for-its-own-sake and the application of scientific knowledge in the society.

‘... To assume *one* basis for life and a *different* basis for science is *a priori* a falsehood. ... Natural science will in time incorporate into itself the science of man, just as the science of man will incorporate into itself natural science: there will be *one* science’¹.

The fundamental tension of science studies, as I see, is the dialectic between science-for-its-own-sake and the production of scientific knowledge that has an immediate utilitarian value affecting the world-views, meanings, values, interests, attitudes and the corresponding actions of the scientific community, which one can empirically observe. Sociology of science, as a specialty, has been concerned in exploring this dialectic. Sociology of science is a specialty that examines how and to what extent various socio-cultural factors, both internal and external, to the world of science influence the production of scientific knowledge and its application. The literature suggests that the earlier conception that science is autonomous having its own dynamics unconnected with the external forces, is no longer sustainable. Rather, science and technology have been influenced by various factors – social, economic, political, cultural, legal, ethical, institutional, ideological, and so on. The divide between the internal and external worlds of science is, therefore, not rigid but porous². As Bloor³ put it, ‘All knowledge, including scientific knowledge, is socially caused’. Restivo and Bauchspies⁴ pointed out, ‘The term “social” is not only in the “external” social and cultural milieu or context of science, but in the social organisation of science, indeed in scientists themselves. The ‘so-

cial’ in this sense is pervasive, and no more transparent than quantum or gravitational forces’. The social is historically and democratically constituted, and hence varies over time and across space.

The term, ‘democratization’ refers to the way democratic norms, institutions and practices evolve, and are disseminated both within and across national and cultural boundaries. Equality of opportunities to do science and the degree of access to do science, equality of opportunities to evaluate any knowledge form, the degree of access to scientific knowledge for application and the freedom to dissent constitute democratic norms, both external and internal. In this context, there has been a relationship between the ‘social responsibility in science’, on the one hand, and the mainstream of political and social debate and action, on the other. The concept, ‘social responsibility in science’ came into the literature on sociology of science in the context of the Second World War⁵. Historians and sociologists of science use this term both in the context of war and ethics. In particular, we must begin to see the central place of the institutional and ideological role of science in maintaining and/or transforming the most basic features of our democratic, non-democratic or anti-democratic society. However, democracy cannot be figured out simply on its own terms, in terms of either its argument or its vision, howsoever important these might be. Democracy seeks to connect the universe of values with the realm of power, and it is essential to see what is involved in this. It may also be useful to try to place this problem of connecting one with the other in its modern setting. Once we have begun to see,

all of us must decide what, if anything, s/he is going to do about maintaining, reforming or transforming the present order of society, starting with the institutional mechanisms in which s/he is most directly involved – laboratories, departments, colleges, communities, etc. The present note, from the sociology of science perspective, attempts to provoke a debate and action on these questions, keeping in mind the context of the building and growth of scientific institutions and universities in nineteenth century India.

There is a need to engage oneself with studies on historical contexts that shaped the building and growth of scientific institutions in India towards democratizing the production of scientific knowledge. As Mills⁶ put it, ‘Unless one assumes some trans-historical theory of the nature of history, or that man in society is a non-historical entity, no social science can be assumed to transcend history. All sociology worthy of the name is “historical sociology”’. Abrams⁷ stated, ‘In my understanding of history and sociology, there can be no relation between them because, in terms of their fundamental preoccupations, history and sociology are and always have been the same thing. Both seek to understand the puzzle of human agency and both seek to do so in terms of the process of social structuring. Both are impelled to conceive of that process chronologically; at the end of the debate the diachrony–synchrony distinction is absurd. Sociology must be concerned with eventuation, because that is how structuring happens. History must be theoretical, because that is how structuring is apprehended. Historical sociology is thus not some special kind of sociology; rather, it

is the essence of sociology'. Giddens⁸ wrote, 'What distinguishes social sciences from history? I think we have to reply as Durkheim did ... nothing—nothing, that is, which is conceptually coherent or intellectually defensible'. Thus, the present study employs a historical–sociological perspective. It is against this backdrop that the tension of science studies in the Indian context would be explored.

The term 'social responsibility in science' has involved four sorts of issues: (a) the social, economic and political context of science; (b) the sources of scientific research and its funding; (c) the use and abuse of sciences in technology, war, social control and ethics, and (d) the social system of science itself. Those concerned with these issues have made studies, instituted reforms and involved themselves in various kinds of direct action and protest. In contrast, there has been relatively little activity in the science movement, which has addressed two central issues: (a) the role of science and the ideal of scientific rationality⁹ in maintaining the established order of society; and (b) the hierarchical and anti-democratic structure of the institutions in which scientists work. The first point raises the general issue of science versus democracy, and brings us into the mainstream of social and political debate. The second point brings the problem of social action directly into our immediate professional context and makes us face the challenge of creating direct democracy in the institutions in which we find ourselves now.

The process of democratization of scientific knowledge: the Indian context

As mentioned earlier, the term 'democratization' refers to the way democratic norms, institutions and practices evolve, and are disseminated both within and across national and cultural boundaries. This term is best understood as a long-term, dynamic and open-ended process extending over generations. Democratization of scientific knowledge involves an attempt to critically focus on who benefits and loses under specific regimes of knowledge production and consumption in specific social contexts and to provide normative frameworks for minimizing inequalities in the dissemination of scientific knowledge¹⁰. Equality of

opportunities to do science and the degree of access to do science, equality of opportunities to evaluate any knowledge form, the degree of access to scientific knowledge for application and the freedom to dissent constitute democratic norms. Democratic environment is both an antecedent to and consequence of the production of scientific knowledge and its application.

Rapid accumulation of knowledge, which has characterized the development of science since the seventeenth century, had never occurred before that time. The new kind of scientific activity emerged only in a few countries of Western Europe, and it was restricted to that small area for about two hundred years. Since the nineteenth century, scientific knowledge has been getting institutionalized by the rest of the world. And, India was no exception to this. It has occurred through the diffusion of the patterns of scientific activity and scientific roles from Western Europe to other parts of the world¹¹.

Institutionalization of modern science in colonial India

The institutionalization of modern or Western science in India began with the establishment of the Great Surveys – the Geological, the Botanical and the Trigonometric – under the inspired impetus of the Asiatic Society of Bengal¹², inaugurated in 1784. This was followed by the establishment of universities in the port towns of Bombay, Calcutta and Madras in 1857. This period saw the consolidation of British rule in India, especially with the failure of the First Indian War of Independence of 1857. The British rule in our country was primarily based on its improved mode of production – improved technology, organizational abilities, etc. It was important for the colonial government to maintain its superiority, if it were to continue its rule. Colonization is always inimical to any organized development of creativity amongst the colonized. As India was a large country to be governed, the British realized that it was important to have a cadre of well-trained Indians in all areas, including science and technology. Therefore, the British set up a small number of universities loosely based on the British pattern in the nineteenth century. In fact, till 1850, India had only one university, founded at Serampore near Calcutta in 1818 by a group called The

Danes; it was primarily a theological university. Between 1850 and 1900, five more universities were set up at Calcutta, Bombay, Madras, Allahabad and the erstwhile-undivided Punjab, intending to cover the entire country. The first two medical colleges were set up at Madras and Calcutta in 1835. The first scientific research organization set up by an Indian, Mahendra Lal Sircar, was the Indian Association for the Cultivation of Science (IACS) at Calcutta in 1876. At the end of the nineteenth century, India had a total of six science-related societies (including the Asiatic Society of Bombay, set up in 1804), out of which two were professional societies: the Agricultural and Horticultural Society of India (1820, Calcutta), and the Bombay Natural History Society (1883). However, we must remember that modern science was not introduced in a vacuum, that we had a rich tradition of knowledge systems, including positive sciences and that some of them like ayurveda and astronomy were more democratized than perhaps modern science, then or now.

The colonial government started building scientific organizations to use the knowledge generated by the institutions for gaining better understanding of the territory, climate, flora and fauna of the colony to administer the colony and perhaps exploit the resources in a more efficient manner. It is against this background that the first generation of nationalist scientists attempted to build scientific institutions and democratize science without taking any support from the colonial government. Enthusiasm was shown by a section of our elites to embrace modernity; modern science may also be construed as an attempt to get closer to the colonial rulers. On the contrary, those who were suspicious of things Western or modern, including modern science, cannot be viewed as being opposed to democratization of knowledge or of society, at large. Some of them at least did perceive modern science as a part of colonial dispensation and as an alien imposition. It was the policy of the colonial government that did not allow Indian scientists to occupy higher positions, though many of them were competent. It thus hindered the process of democratization of scientific knowledge in India. It is against this backdrop that the nationalist scientists attempted to build scientific institutions to democratize science.

Most of the research about perceptions on and reception of modern science in nineteenth century India focused on the Bengal province and North India. However, it does not imply that Indian intelligentsia did not respond to modern science in other regions. For example, the Madras Presidency had instruments, but no observatory. The East India Company had established an observatory at Madras in 1870. According to Kochhar¹³, 'It was the first modern public observatory outside Europe and to use today's term, the first modern research institute in India'. The Company had declared that the purpose of the Madras Observatory was to encourage the advancement of the knowledge of astronomy, geography and navigation in India. There were other more important things than doing science, such as increasing the Company's revenue by improving irrigation facilities. Several astronomical observations were carried out by John Goldingham and his deputy, Warren, both of whom were trained astronomers. While the British East India Company was reluctant to encourage observatories in India, the establishment of the Nizamia Observatory in 1908 in the Hyderabad State, shows that the Nizam's regime was receptive and favourable towards the establishment and continuation of the astronomical observatory. This was partly because Hyderabad State was never under any colonial regime (S. Mallick, M Phil dissertation, University of Hyderabad, 2004, unpublished). However, democratization of scientific and technological development remained a myth for the millions of the country. Only certain social groups of the society were able to receive and respond to the introduction of modern science and technology to the Indian soil.

Reception of modern science in colonial India

Now the question arises: 'Which social groups were the first who received and responded to the introduction of modern science in India?' Of course, not much work has been done on the transmission of scientific ideas between different cultures. An attempt has been made to understand as to how knowledge conceived of within the epistemological framework of one culture is received, adapted and absorbed by another culture¹⁴. In the first half of the nineteenth century, both Hin-

dus and Muslims had their own elites. However, paradoxically, it was only the Hindu elites drawn naturally from the upper castes, principally the Brahmins, the Baidyas and the Kayasths in the Bengal province, who made contact with the British and eagerly sought after modern science, which took roots in Europe as a legitimate knowledge.

Amongst the Bengali Muslims, there was a much larger socially and economically inferior stratum and a correspondingly smaller aristocracy than amongst the Hindus. This fact in itself does not explain the almost complete lack of response of Muslims to English education in nineteenth century Bengal¹⁵ nor were the explanations based on religious outlook¹⁶ for the Muslim response different elsewhere in the country¹⁵. For instance, between 1876-77 and 1885-86, 51 Muslims and 1338 Hindus took the BA degree at Calcutta. In 1870, only two Muslims, both of whom failed, wrote the BA examination, while in the same year, 151 Hindus sat for the examination of whom 56 received their degrees¹⁵. In the North-western Provinces, Bihar, Orissa and Oudh, although Muslims were in a minority, the community-wise education pattern was quite opposite to that in Bengal.

Modern scientific ideas and techniques came to India in the wake of the British conquest, but they faced three major limitations¹⁷. First, the scale of implantation and degree of utilization was limited to suit the policies of the rulers. Secondly, the teaching of science was introduced merely to provide training in various branches, rather than creating an appreciation of science as a tool of intellectual and social transformation. And, thirdly, science was introduced in English. Consequently, instead of playing the role modern science did in Europe, it became isolated. It did not interact with different strata of society, but leaned heavily for its growth on the government and became an intrinsic part of the policies of the rulers¹⁸. Yet, there was a section of the Indian intelligentsia that believed that the British civilization represented a new approach to life and nature and that therein laid the hope for the future emancipation of India.

One aspect of this intellectual realisation was the thirst for knowledge. This led to the formation of scientific societies and institutions by Indians to provide access to modern science. Most of the Indian intelligentsia or the cultural elite

felt the need of imparting science education to Indians for exploring the new horizons of knowledge about nature and life. In contrast, it must be noted that when the British introduced Western education, they did not introduce science and technology in the curriculum. Rather, they focused on literature, law, grammar, etc. In this context, it is worth mentioning that in 1875, Sir Richard Temple, the then Governor General of Bengal, wrote a letter to Sir John Laird Maire Lawrence, the then Viceroy, on the rising discontent in India. In this, Temple lamented,

'But this arises partly from our higher education being too much in the direction of law, public administration and prose literature, where they may possibly imagine, however erroneously, that they may approach to competition with us. ... But we shall do more and more to direct their thoughts towards practical science, where they must inevitably feel their utter inferiority to us¹⁹.'

The native intellectuals were quick to take note of this fact, and of which they were aware throughout the nineteenth century and even the beginnings of the twentieth century. They had two options before them: the first option was to convince themselves that the best products of modern science were already anticipated by what they considered to be the national philosophy of India, namely the *Vedanta*. Such an effort aimed at internalizing an alien system of knowledge on the one hand, and exhibiting rational and empirical significance of the Vedantic thought which was treated at best as ethno-philosophical by the Western philosophical world, on the other. It is this concern which has been expressed in the works of Vivekananda, Aurobindo and many others. The second option was to build an indigenous tradition of modern science by establishing scientific institutions for pedagogy and research. The second option is sociologically significant, and deserves to be discussed in detail.

In this context, scientific institutions like Hindu College (1816), Delhi College (1825), the Aligarh Scientific Society (1864), the Bihar Scientific Society (1868), and the IACS figure the most. These institutions were initiated mostly in the second half of the nineteenth century as a part of the process of not merely popularizing but also democratizing scientific knowledge in India by creating opportu-

nities for Indians to pursue science education.

Building scientific institutions in nineteenth century India

The Hindu College

To start with, the only people committed to introducing Western education into India were the missionaries, particularly the evangelicals, who wanted to use Western arts, Western philosophy and Western religion to rid the Hindus of the moral depravity that, according to them, was the cause of their degeneracy. These attempts did not receive the expected enthusiasm from the 'Hindu subjects of Great Britain'. In addition, there was not a way of going about imparting new ideas to the latter. The Hindu upper castes could not be convinced of almost any of their shortcomings, but they could not be called morally depraved. Attempts by both Orientalists and missionaries received no measure of official approval. Consequently, these attempts made little headway.

In sharp contrast, however, a native gentlemen community rose to the occasion. These gentlemen were better known as the *Bhadralok*. They had an inclination towards the acquisition of Western ideas and Western science through English language education. Indeed, education itself became the hallmark of *Bhadralok* status. The Simon Commission Report observed, 'The school is the one gate to the society of the *Bhadralok*'²⁰.

Within the colonial framework, the conflict among the different systems of knowledge was also a conflict among the value systems. However, for those sections of the Indian society that first seriously took up science as a profession (for example, the Bengali *Bhadralok*), the process of cultural redefinition automatically began. Cultural redefinition implies a prerequisite for the legitimation of the new knowledge system²¹.

In continuation of the reaction to the attempts of both Orientalists and missionaries, the *Bhadralok* had established the *Mahabidyalaya* (better known as the Hindu College) in Calcutta in 1816. The purpose was to cultivate 'European literature and European science' without any assistance from the government. The original curriculum comprised not only reading, but also instruction in history,

geography, chronology, astronomy, chemistry and other sciences. The college was managed exclusively by the Calcutta *Bhadralok*. It was open only to sons of Hindu families. There lies a sense of caste discrimination and gender bias. Despite this, its enrolment figures had touched 400 by 1828. And, within two decades of the opening of the Hindu College, the demand for English education had led to the creation of a respectable number of English schools 'originating with the natives and deriving resources exclusively from them'²².

Thus, the Hindu College was set up and run by the *Bhadralok* as a scientific institution that would not only introduce the application of modern science and technology to the Indians, but also show them new horizons of life as a whole, thus extending the opportunities to pursue science education and a career in science.

But, the British were not interested to introduce science education into the Indian soil as a part of democratization. They opened a Sanskrit College in Calcutta in 1824 to teach Sanskrit, rhetoric, sacred literature, law and grammar to Bengali children. However, this was not what encouraged the new elite. In this regard, the name of Raja Rammohun Roy figures first. It is clear that the colonial government was not inclined to introduce science education and inculcate a scientific temper among the natives, whereas attempts on the part of the native intelligentsia were to promote precisely the activities which the colonial government was not interested in.

No account of India's development to modern times would be complete without a mention of Raja Rammohun Roy, an aristocrat from Bengal, whose social reforms in the eighteenth and nineteenth centuries contributed towards narrowing the gap in attitude towards science and technology among the Indians. A term that is used these days but which was not used during Rammohun's era, though he advocated it in many of his speeches and works, is 'scientific temper'. This teaches us to sift the available evidence objectively and base our actions on a rational approach²³. Rammohun was a rationalist in his advocacy of reason and freedom of thought. His criticism of the existing religion and its rigid practices and caste barriers was inspired by his desire to make religion consistent with the changing world of his times. That attitude is even more relevant today, as the influence of

science and technology on our lives is increasing rapidly.

When the British went on opening Sanskrit Colleges, Rammohun, in his all-too-famous address of the 11 December 1823, pleaded for the instruction of European sciences. He penned:

'... as the improvement of the native population is the object of the Government, it will consequently promote a more liberal and enlightened system of instruction, embracing mathematics, natural philosophy, chemistry and anatomy, with other useful sciences which may be accomplished with the sum proposed by employing a few gentlemen of talents and learning educated in Europe, and providing a college furnished with the necessary books, instruments and other apparatus'²⁴.

And, in 1827, the Hindu College introduced into its curriculum mechanics, hydrostatics, optics, astronomy, mathematics, anatomy and medicine, all in English. Then almost half of its 91 students opted to study these, though they were not compulsory subjects. In addition, on the whole, Hindu students trained in the traditional manner did not have any difficulty in responding to the Western course work²⁵.

And, indeed, the curriculum seems to correspond closely to the *Bhadralok* ideal of education. It refers to a fusion of the traditional Sanskritic studies of rhetoric, sacred literature, law and grammar with those of Western literature and science. However, knowledge of Sanskrit was essential to their being.

The Northern Province: The Delhi College

In this section, I look at the pioneering efforts made by the Delhi College in the early nineteenth century. This college played a significant role in the dissemination of modern science. Delhi College, originally established as *Madrassa-i-Ghaziuddin* by Nawab Ghaziuddin Firoz Jung in 1772, was rechristened Delhi College in 1825. The college was set up to translate scientific books into local languages in general, and Urdu, in particular.

The Oriental Department of the College carried out studies in modern education through the medium of Urdu. In 1835, when the new British policy veered away

from the concept of modern education through Indian languages, Delhi College took a bold stride in the reverse direction. The Educational Committee was created to translate into Urdu, scientific books then taught in European schools. The English faculty of the College launched 'The Society for the Promotion of Knowledge in India through the medium of Vernaculars', which subsequently came to be known as the Delhi College Vernacular Translation Society. It translated as many as 125 books. These included chiefly Greek classics, Persian works and scientific treatises into Urdu. All these were translated in the space of about twenty years. The Society fostered a rich and multifaceted education and transformed Urdu from a language of poetry to the transmitter of Western scientific ideas¹⁷.

The new emphasis on Western science attracted several young minds and in a short span, Delhi College had produced a few geniuses like Master Ram Chandra. His work on differential calculus was published and noticed in Europe. Master Ram Chandra was not only an erudite scholar of Delhi college, but also became a prolific teacher at the college. He started a paper in Urdu called the *Fawa'id-ul-Nazarin*, which played an important role in the dissemination of modern science in India. He also edited two more of Delhi's earliest Urdu newspapers, viz. the *Mohabbat-Hind* and the *Kiran-us-Sadain*. The former aimed at a wide readership, whereas the latter published various articles on scientific subjects.

Delhi College had a well-defined school curriculum, which included a local language. On to this were grafted European philosophy and science. Students at Delhi College showed clear-cut inclination towards a scientific rather than literary education. In Bengal, a sudden literary enthusiasm for the newly discovered English novelists and poets swept everything else before it.

For translations into local languages, some European teachers like Boutros, a Frenchman, and Sprenger, a German, will be remembered for their sense of involvement. Probably, this was the reason why learning in English was not, as in Bengal, regarded as vitally important. In fact, Delhi College made a laudable and pioneering effort in the dissemination of modern science through the medium of local language. This had immediate effect of increasing the accessibility to modern

science to those who did not have exposure to the English language. We may compare the situation to sixteenth century Italy, where several academies were established as alternatives to the existing universities to replace Latin by the vernacular language¹¹. This was made possible in an atmosphere where people were not prepared to readily accept the principles of modern science. Master Ram Chandra has referred to the first open conflicts of the new learning with the old. He wrote:

'We commenced a monthly magazine at the cheap rate of four pence a month in which notices of English science were given. Not only were the dogmas of ancient philosophy exposed, but many of the Hindu superstitions were openly attacked. The result of this was, that many of our countrymen condemned us as infidels and irreligious²⁶.'

The Aligarh Scientific Society

An attempt in the direction of democratizing modern science was made by Sir Syed Ahmed Khan. The attempt was in the form of establishment of the Aligarh Scientific Society in 1864. It was not only an attempt in imparting scientific knowledge, but also an effort in the direction of socio-cultural change in India.

Sir Syed started his career as a clerk with the East India Company in 1838. He qualified three years later as a sub-judge and served in the judicial department at various places. Sir Syed had a versatile personality, and his position in the judicial department left him time to be active in many fields. His career as an author (in Urdu) started at the age of 23, with religious tracts. In 1847, he brought out a noteworthy book, *Athar Assanadid* ('Monuments of the Great'), on the antiquities of Delhi. Even more important was his pamphlet, *The Causes of the Indian Revolt*. In this booklet, he ably and fearlessly laid bare the weaknesses and errors of the British administration that had led to dissatisfaction and a countrywide explosion. Widely read by British officials, it had considerable influence on British policy.

The supreme interest of Sir Syed's life was education, in its widest sense. He began by establishing schools at Muradabad (1858) and Ghazipur (1863). A more ambitious undertaking was the foundation of the Aligarh Scientific Society, which published translations of many educa-

tional texts and issued a bilingual journal in Urdu and English.

The Aligarh Scientific Society was set up in 1864, within a certain context. During the nineteenth century, the government's education policy had a predominantly literary bias. In schools and colleges, the teaching of sciences and of technical and vocational subjects was almost neglected. The emphasis was merely on the study of literature and logic, politics and philosophy. There was a deliberate attempt to keep the Indians bound to traditions and superstitions. Fruits of technological development were a myth for the Indians. Sir Syed Ahmed Khan was acutely conscious of this move of the British. He wrote:

'Up to the present time the indigenous education of the country has been (like that of Europe at no very distant period) confined to the study of language and metaphysics, which though it undoubtedly serves to increase the mental acuteness of the learner, gives rise to none of those practical results which have been the fruits of the study of positive science amongst European nations²⁷.'

Besides this, the people in general, and Muslims in particular, were averse towards English education and modern European sciences. This was particularly true in the case of the Northwest-Province, the home province of Sir Syed Ahmed Khan. In his own words, 'This Presidency is hitherto much behind in the race of diffusing the light of knowledge among the people occupying it, when compared to the other more enlightened and prosperous presidencies of Bengal, Bombay and Madras'²⁸. Sir Syed was convinced that 'It requires to make strenuous efforts and throw strong inducements in the way of the people to regenerate them, by repelling and overcoming the many difficulties that defend the present gross ignorance of the people from the useful sciences and arts, and that retard the progress of their mental and social improvement²⁹'. The declared aim of the Society was 'causing the blessed morning of civilisation to dawn on the night of ignorance and darkness which for ages has retarded the advance of this country³⁰'. The objects of the Society were:

(a) To translate into such languages as may be in common among the people,

those works on arts and sciences which being in English or other European languages are not intelligible to the natives;

(b) To search for and publish rare and valuable Oriental works. No religious work will come under the notice of the Society. Subsequently, in 1867, two more clauses were added to this section;

(c) To publish, whenever the Society thinks it desirable, any newspaper, gazette, journal, periodical or magazine which may be calculated to improve the native mind;

(d) To have delivered in their meetings from time to time, lectures on scientific or other useful subjects, illustrated when possible by scientific instruments³¹.

From these objectives, it is clear that the Society was highly secular in outlook. It completely eliminated religion from its purview, which was something rare during the nineteenth century. The Society also had certain political objectives. It sought to foster and encourage the growth of an enlightened public spirit. The Society also wanted to introduce improved methods of agriculture in India, so that the economic conditions of the people might improve. The activities of the Society may be classified into four parts, viz.

(a) Translation of Western literature into the local Indian languages;

(b) Practical attempts to popularize and democratize mechanized farming;

(c) Delivering lectures on topics of common interest;

(d) Highlighting the socio-political problems of the country¹⁷.

The main thrust of the Society's activities was towards the translation of various European works – relating to basic and applied sciences – into local languages and importing into them the concepts of Western learning.

The Society translated around forty European books dealing with history, political science, geography, meteorology, electricity, algebra, geometry, calculus, hydrology and agriculture. It selected only those books which would be beneficial for the people in developing a sense of historical perspective, interest in science and technology, and make them capable of managing their affairs and enable them to evolve a form of government best suited to themselves. In this regard, Sir Syed wrote: 'If the creation of a good

vernacular literature and the introduction of European science through the medium of the vernacular are impossible, then the Society may as well cease to exist. It has *no raison d'être*³².'

The Aligarh Scientific Society had a library and a reading room of its own. The books were mainly donated to the Society by different Indian as well as foreign gentlemen. Sir Syed himself donated a large number of books to the library. The Society subscribed to forty-four journals and magazines in 1866. Of those, 18 were in English and the rest in Urdu, Persian, Arabic and Sanskrit. It exchanged its publication with similar societies like the Society for the Diffusion of Useful Knowledge founded by Pandit Harsokh Rai at Lahore and the Mohammedan Library Society founded by Moulvi Abdul Lateef Khan at Calcutta. It also exchanged its journal with the publications of the Bengal Asiatic Society, Calcutta³³.

The Bihar Scientific Society

Similar efforts were made by Imdad Ali to democratize European science in India. He had a firm faith in the efficiency of local languages and believed:

'England, France and Germany would never have attained that exalted degree of civilisation, which they now enjoy if the works of science originally imported from Rome and Greece in Latin and Greek, were not disseminated among the people by means of their own vernacular³⁴.'

Imdad was not opposed to English education, but he emphasized that the Society should not bring in religion into the scope of its inquiry. He was a Deputy Collector. He had started publishing pamphlets and then a regular journal attacking *Tahzib-ul-Akhlaq* and calling on Muslims to boycott Syed Ahmed's reform movement. Imdad was of the opinion that Indian students did not acquire properly the knowledge of Western science and technology, when it was taught through the medium of foreign language. Consequently, they failed to transmit adequately their newly acquired scientific knowledge to their countrymen for lack of suitable expressions in the Indian languages.

For the purpose of spreading European scientific knowledge through the Indian

languages, Imdad Ali founded an association in 1868 at Muzaffarpur called the British Indian Association. Later the name was changed to the Bihar Scientific Society. The principal aim of the Society was diffusion of all kinds of knowledge throughout India. The emphasis was on bringing Western arts and sciences within the reach of even the lowest denominations of the society through translations in the local medium of Urdu, thus creating equality of opportunities to learn science in a stratified society. The Society also started a fortnightly Urdu newspaper called *Akhbar-ul-Akhyar*, which dealt with the educational subjects and aimed at improving 'the moral, intellectual and social condition of the people'³⁵. As such, the Society entrusted the translation of many books on sciences to Maulvi Zakauddin and M. A. Rahim. The subjects in which books were translated included trigonometry, materia medica, optics, animal physiology, chemistry, dyeing, geography, botany, mechanics, algebra, agriculture, zoology, arithmetic, law, hospitals, mineralogy and masonry. The Bihar Scientific Society also established five schools at different places, in which Western sciences were taught through the medium of Urdu. The schools were opened at Saran, Narban, Jaitpur, Hari and Sitamarhi in the vicinity of Muzaffarpur.

Apart from this, the Society suggested to the Senate of the Calcutta University that 'the standard prescribed for the University examination be adopted for the Vernacular examination and science be taught in Urdu or Hindee'³⁴. Thus, the Society made a meaningful contribution in the diffusion of modern scientific ideas, despite the step-motherly treatment of the Education department, which unjustly rejected the Society's publications to make room for their own book³⁶.

In the nineteenth century, it was really a Herculean task to advocate the cause of education based on reason and scientific vision. In addition, such scientific institutions as the Delhi College, the Aligarh Scientific Society and the Bihar Scientific Society were not established merely to impart modern scientific education, but to emphasize the need for a socio-cultural change in contemporary Indian society. For this, men like Sir Syed Ahmed Khan, Hali, Master Ram Chandra, Imdad Ali and others had to face virulent criticism and opposition from the more orthodox, who included the leading 'ulemas' and 'moulvis' of the country.

The Indian Association for the Cultivation of Science

In Victorian England, the Royal Institution of London served as a scientific home for a host of scientists like Davy, Faraday, John Tyndall, and Huxley and, after Faraday's death, James Dewar. It was also a place for visiting scholars who spent short periods as workers in its laboratory. The Royal Institution of London was one of the important components of the institutional infrastructure for science in Victorian England. On the other hand, Calcutta had no such institution during the nineteenth century. Thus, even while science evoked interest in the capital of British India, there was not yet an institutional ambience that would induce Indians to practice science.

The reputation and character of the Royal Institution of London had, however, secured the imagination of at least Dr Mahendra Lal Sircar. Sircar was born in the same year (1835) in which Rammohun died. He was patently a legatee of the new learning. He studied at Hindu College. Later, he entered Calcutta Medical College in 1855, which had established a formidable course of studies in the sciences. Sircar truly became the torch-bearer of the spread of scientific education after the demise of Rammohun.

Sircar was, thus, a product of the College that had borne witness to the event of learning science education. He obtained, first, a licentiate in medicine and surgery in 1860 and then, in 1863, the degree of doctor of medicine, a rare achievement for an Indian at the time³⁷. In 1869, Sircar began broaching the project of a national science association to the public through pamphlets, letters to the editor of the *Hindu Patriot* and public addresses. In 1876, he founded the IACS. Being Sircar's brainchild, the IACS enjoyed the State patronage, private donations and his own life's savings. It was financed from public subscriptions, and had the support of Sir Richard Temple, the Lieutenant-Governor of Bengal. The IACS had an eventful life as well. During that period, the Indian League had already been founded. It opposed its preference for general science and advocated applied science for the economic development of the country and job generation. But, the IACS survived despite such hostilities of the Indian League. In the August 1869 issue of the *Calcutta Journal of Medicine*, Sircar wrote an article entitled, 'On the desir-

ability of a national institution for the cultivation of science by the natives of India'. He wrote:

'We want an institution, which will combine the character, the scope and objects of the Royal Institute of London and of the British Association for the Advancement of Science. We want an institution, which shall be for the instruction of the masses ... And we wish that the institution be entirely under native management and control³⁸.'

Sircar felt that the underdevelopment of India was due to its backwardness in science. India had the potential to master modern science. The Indians had shown themselves to master science in the past. This could be achieved through self-help. He desired that Indians should cultivate science not only for economic betterment but also for their regeneration. Of course, after persistent efforts, he succeeded in establishing the IACS in 1876. Later, the IACS evolved into a world-famous research institute. It had a lecture hall by 1884 and a laboratory was constituted in 1891 with donations from the Maharaja of Vizianagaram. It organized a series of lectures by Prafulla Chandra Ray, Jagadis Chandra Bose, Asutosh Mookerjee, Pramatha Nath Bose, Father Lafont and many other distinguished scientists. It is best known for its sponsorship of the work of C. V. Raman, a physicist, who was later awarded the Nobel Prize for the discovery named after him, the Raman effect.

A critical overview of the activities of all these scientific institutions shows that both the Aligarh Scientific Society and the Bihar Scientific Society were short-lived. Only Sircar's IACS could manage to survive. This shows how a man of unusual drive and determination Sircar was! The IACS grew from strength to strength, and celebrated its centenary in 1976. As the national institute of science, it remains a monument to the memory of Sircar, who died in 1904. The Association, as visualized by him, was an institution for the masses with full audience participation, where any lover of science could come and work the way it was felt necessary by the scientist. Being a national association created entirely by private donation, the IACS had no government control. But, it met with some resistance. The Hindu orthodoxy thought that the IACS was attacking the traditional Hindu

teachings. A large section of the public also felt that this kind of pursuit of abstract science had no meaning for a poor country like India. The cry of the day was utilitarian science, but Sircar's answer was: without scientists how can one have science³⁹?

Concluding remarks

As I see it, the historical survey indicates that democratization of scientific knowledge in terms of access to modern scientific knowledge, creation of equal opportunities to do science, etc. in the colonial period began to occur not because of the colonial government but in spite of the colonial government. Intelligentsia drawn from different religious groups realized the significance of modern science for material and cultural transformation of India, and attempted to democratize science in their own way by establishing scientific institutions and using the local or vernacular language as the medium of democratization.

Here, I would like to see the building of such scientific institutions by the cultural elite during the colonial period as a part of the process of democratizing scientific knowledge, rather than popularizing science. In post-colonial India, the whole responsibility of democratizing science was, by default, taken over by the State. It is due to the fact that the scientific institutions and societies have partly relegated this inescapable task, which they had carried out with enthusiasm and pride during the colonial period as a part of the nationalist struggle against imperialism. Democratization of science in India is an unfinished task even now. As such, modern science is being critiqued from the point of view of environment (genetic engineering research) and human rights. The process of democratization ought to address these questions. Democratization may be institutionalized in the process of science policy making that should be a broad-based, democratic, transparent and participatory process, as there is a Chinese saying: 'Tell me and I'll forget; show me and I may remember; involve me and I'll understand'.

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