Scientific Institutions as Sites for Dissemination and Contestation: Snippets from Colonial India

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Scientific institutions are modern icons. They arrived in India as part of the colonial baggage and soon became the carriers of new ideas, and in fact they came to symbolize modernity itself. Was this a smooth process? What debates did institutionalization spark? The quest for knowledge has never been alien to Indian society and there were knowledge institutions also in pre-colonial times. What changes came in the nineteenth century? Can they be explained in terms of metropolis-periphery relationship or impact/response studies? Did the process of institutionalization differ in colonial and non-colonial settings? The same questions could be made for the process of professionalization. How to 'straddle the spatial and epistemological divide' between metropolis and colony? [1] Was this a one-way transfer? And one can also add, was this a derivative form of knowledge? Could it produce autodidacts or intellectual-migrants who could hold on their own? Is indigenous knowledge 'original and unsullied' to be taken in opposition to modern/scientific knowledge? Could they interact; could they change? Was a synthesis or co-production possible? The present paper attempts to address these questions with the help of examples and illustrations from a colonial city, Calcutta.

Much before South Asia was properly colonized, numerous travelers and traders had delved into the characteristics and peculiarities of other peoples and societies. India was no tabula rasa. But as conquest began, new forts, ports, and cities were established. Thus came into being the new port cities of Calcutta, Bombay, Madras. These were to witness a distinct break with the past. In the new cities new institutions were established in contrast to the older cities of Delhi, Hyderabad or Lahore. Some of these institutions were to become the carriers of new knowledge. It is not easy to see them as sites for knowledge exchange as this would involve a two-way process which colonial conditions would seldom permit. They mostly functioned as sites for dissemination and also contestation. Nevertheless, the transfer of knowledge, though purported to be osmotic, was not really a one-way simple process; it sparked debates and produced cross–currents. This can be seen in full–flow in the history of Calcutta.

The emergence of Calcutta as a science city is synonymous with its growth as an imperial city or perhaps even with imperialism itself. Here, one may ask, can there be an imperialist side to natural knowledge? Many would argue that science is universal; and certainly one cannot call it colonial simply because of its association with colonial cities! Many authors believe socio-political circumstances do shape natural knowledge. More so in a colonial framework. The essence of colonialism is dependency, so is that of colonial science. The colonial scientists were offshoots of the metropolitan culture and drew sustenance from it. Roy MacLeod defines metropolitan science as not just the science of Edinburgh of London, Paris or Berlin; but as a way of doing science, based on learned societies, small group of cultivators, certain conventions and certain priorities. [2] The colonial scientists were also a small group of cultivators; they also established learned societies; but the priorities, realm and scope of investigations were not always determined by them. This made all the difference. It became mostly derivative, and was, in the eyes of the metropolis, some sort of a dependent, if not low science, identified usually with data gathering.

There is one more dimension. Natural knowledge serves to confer prestige on the metropolitan power and thereby legitimize imperial control over peripheral territory. But prestige alone could not have been the sheet anchor for the empire. So, the focus was directed towards the applied sciences- botany, meteorology, physiology, applied mechanics, etc. I am not arguing that all science at the periphery was applied science. An obvious counterexample would be astronomical observations. But colonial science was primarily science applied to production of systematic knowledge about the colony (its flora, fauna, minerals and topography) and the solution of certain practical problems of the day. Certain material benefits did accrue and some 'development' did take place. But here the key question, which has been the subject of several long debates, arises: whose development and for whom?

One thing is clear, colonial science does represent an advance over pre-colonial science. For example, pre-colonial India did not have any scientific society or any scientific journal. As a result, research remained esoteric and tended to get lost. Mostly it took the form of commentaries which continued with the older traditions albeit minor changes. An excellent example is Sawai Jai Singh (1688-1743) who tried to assimilate and synthesize the astronomical knowledge then available to him but who could not transcend the barriers of canonical (siddhantic) knowledge. [3] He had attracted several scholars to his court but he never thought of establishing an institution that would continue and improve on his work. It was a curious situation. On the one hand, one finds Mushibullah al-Bihari writing Risalab Juz 'la Yatajazza,

an Arabic treatise on the indivisible atom, and two other texts on motion and time (1700); on the other hand is Walih Musawi (1700-1770) writing Murgh-namah (on cock fighting) and Kabutar-namah (on pigeons). [4]

As the British strengthened their grip by the end of the eighteenth century, and as interaction with the West grew, Indians did try to look out and look within. For example, in 1790 Mir Hussain Isfahani wrote Risalah-i-Hai'at-i-Angrezi, a Persian text on European astronomy. [5] Many commentaries were written during this period; although they did not entail a paradigmatic change, neither were they slavish. In fact, composing commentaries was considered a civilized form of making progress. [6] In several instances (especially in medicine) these commentaries explain scientific knowledge in terms of its own rationality and logic, but in the final analysis when the validity of certain knowledge was put to test, the sacred texts were always the standard measure. At the peak of Mughal glory, Abul Fazl had mourned "the blowing of the heavy wind of taqlid (tradition) and the dimming of the lamp of wisdom… The door of "how" and "why" has been closed; and questioning and enquiry have been deemed fruitless and tantamount to paganism". [7]

Against this background of intellectual torpor and the colonial onset, William Jones founded the Asiatic Society in 1784. This society soon became the focal point of all scientific activities in India. This was a unique experiment, probably the first such in Asia. The scope and objects of it enquiries were: 'Man and Nature; whatever is performed by the one, or produced by the other.' [8] What could be colonial in such magnificent objectives?! Nothing. The difference lay in practice. Though the criteria for its membership was nothing more than 'a love of knowledge and zeal for promotion of it', Indians were not taken as members until 1829, and no Indian made any scientific contribution to its journal till the 1880s.

The roots of professional and scientific colonial literature from the viewpoint of science can be traced back from the publication of the Asiatic Miscellany (1785). It soon flowered into Asiatick Researches (1788-1839) and the Journal of the Asiatic Society(JAS). Between 1784 and 1839, the Asiatic Society published 20 volumes. The demand for the publication was such that in 1798 a pirated edition was brought out in England. It is impossible to look at the JAS without considering the role played by Orientalism in its development. Orientalism led to the study of Eastern civilizations by scholarly Europeans. The literary researches of the `Orientalist' scholars complemented scientific investigations in colonial India. Orientalism had its most visible manifestation in the nineteenth century and is symbolized in India by the development of the Asiatic Society. It had its supporters and detractors. On the one hand, it can

be said that it rediscovered the history and culture of the subject people and cast it in a modern idiom and promoted global awareness of diverse civilizations. On the other hand, going by the critiques of Edward Said, orientalism was the vehicle by which Western civilization penetrated into the civilizational hearts of its subject and function as an inseparable handmade of imperialism. Both the defence and critiques of Orientalism would also apply to the mindset and the body of thought and action that gave rise to these journals. [9] There is equally an element of self interest as well as reform in their study of natural resources, topography, socio-cultural traits, diseases, etc. in the native milieu.

The Asiatic Society suffered and prospered simultaneously but remained a beacon of knowledge for long. It was the sole organ of research in Asia. Whatever was done in geology, meteorology, zoology and botany was done through the Society. Gradually all these branches developed lines of their own and blossomed into separate departments. The society multiplied by fission, like the 'philoprogenitive sponge' and gave birth at successive epochs to the Geological Survey, the Indian Museum, the Meteorological Dept., the Botanic Survey, and the Linguistic Survey. [10] As Nature noted in 1907,

Like all the scientific organizations in the East, it has suffered vicissitudes. The short and broken residences of Europeans in the country, pressure of official work, lack of native co-workers, want of libraries of reference, and last, not least, the indifference of the Indian Government, which prefers that its servants should devote their spare time to the judgements of the High Courts or the circulars of the Board of Revenue rather than to the science and literature of the country, have at times interrupted its progress. [11]

Another important scientific society was the Calcutta Medical and Physical Society, established in March 1823. The objectives of this Society were twofold—first to collect original papers relating to discoveries in medicine and surgery, and in the branches connected with them, as researches in anatomy, physiology, botany, chemistry for the advancement of professional knowledge, for the mutual benefit of the members, more particularly with reference to Indian diseases, and treatment—the papers would be presented, read and discussed at regular appointed meetings and afterwards published, and entitled Transactions of the Society. And the second objective was the formation of a select and extensive medical library for the use of its members. It broke the social and professional isolation of the doctors, and without any government aid, was able to publish its Monthly Circular and Selections regularly[12] . The Medical and Physical Society of Calcutta elected four Indians – Radhakant Deb, Ramcomul

Sen Madhusudan Gupta and Raja Kalikrishna Bahadur, as corresponding members in 1827 and they did produce few papers on indigenous drugs. [13]

These societies rendered invaluable services, particularly through their journals whose standards compared very favorably with that of European ones. It was no minor achievement that Calcutta, with a public of a little more than two thousand people, could produce and support scientific journals like the Gleanings in Science and Calcutta Journal of Natural History. The latter even attempted to establish in 1841 an Indian Association for the Advancement of Natural Science [14] based on the pattern of the British Association for the Advancement of Science.

These voluntary societies were important institutions in their own right. I shall not cover the official institutions like the Royal Botanic Garden, the Calcutta Mint, the Geological Survey, the Telegraph Department, etc. because these institutions worked along government lines and had little public contact. The voluntary societies definitely had more stimulating effect on the city life. But their works could have reached the mass of local people only through educational institutions to which we now turn.

Educational Experiments

One of the intentions mentioned in sec. 43 of the Charter of 1813 for the grant of one lakh rupees to be spent in education was the introduction and promotion of scientific knowledge among the inhabitants of British India. [15] But the Court of Directors gave no directive as to which system of science, indigenous or European, was to be preferred. The Court perhaps tried to avoid taking sides and took refuge in the neutrality of the engraftment principle, calling for the fusion of the scientific and medical techniques of both East and West. The result was that the whole issue got bogged down into what became known as the Anglicist-Orientalist controversy [16] which the former finally won. Macaulay's distaste for science, the mechanical arts, astronomy, and engineering, led to a curriculum which was purely literary. [17] The entry of science was thus delayed. In July 1835 the General Committee of Public Instruction recommended even the abolition of chemistry instruction. [18] An influential contemporary journal wrote: "More useful knowledge is to be gained from the study of one page of Bacon's prose, or of Shakespeare's poetry than from a hundred pages of Euclid." [19] Against this backdrop began the Victorian era.

Purely scientific education did not fit into the exigencies of the Company Raj. But the need was felt to have a class of apothecaries, hospital assistants, surveyors, and mechanics to serve the fast-growing medical, survey and public works departments. Training native youths was obviously much cheaper than getting technical personnel from abroad. So it was opened in 1935 the Calcutta Medical College [20] and in 1843 an engineering class started at the Hindu College. [21] In 1844 was revived the idea of having a Chair of Natural and Experimental Philosophy. But the controversy arose whether the emphasis was to be put on pure science or on applied science. [22] Around the same time Dr. F. J. Mouat, Secretary of the Council of education, floated the idea of establishing a university. [23] But it was only to be a mere examination body and thereby could not have produced a boost to science education as such.

The university system could not dispel the air of pessimism which hung round science education. Rather, it got accentuated in the name of liberal education. Physical sciences were removed from the list of necessary (viz, Languages, History, Mathematics and Mental & Moral Science) subjects for B. A. Examination. [24] W. S. Atkinson, the DPI of Bengal, wrote: 'Indeed if I am asked what steps should be taken by this Department in furtherance of original research, my answer must be none': and then added the same old ecclesiastical cliché, 'the causes which have produced the degradation of centuries of moral, social and political debasement'. [25]

The question was not that natives were not receptive enough. That the students reciprocated well can be asserted in what J. Prinsep wrote to O'Shaughnessy after examining the chemistry students of the Calcutta Medical College: 'All the essays are extremely creditable; indeed the extent and accuracy of the information has far surpassed my expectation and I do not think that in Europe any class of chemical pupils would be found capable of passing a better examination.' [26]

Vernacular periodicals like Samvad Prabhakar, Tattvabodhini Patrika, Somprakash etc. every now and then harped upon the importance of science education and research. Somprakash, for instance, observed that 'in a country like France even at the primary level or at the very ordinary school sufficient attention is given to science. In India the study of true science is negligible. It remains limited to the Roorkee Engineering or Medical Colleges. In 1869 the Asiatic Society proposed that science should be studied properly at the university level right from the Entrance. But the Govt. refused by saying that the time was not yet ripe. Is not the Education Department the cause of our scientific and technological backwardness?' [27]

Although the Calcutta University was avowedly founded on the model of the London University, the Oxbridge tradition was apparent in the exclusion of science. [28] The education system led to the acquisition of literary, rather than of scientific tastes---- 'tastes which are best satisfied by the profession of the lawyer, teacher, or the government official.' [29] Bombay was the only University to confer a separate degree in science. The scientific course in Bombay, Lahore and Calcutta were almost similar, except that English, which formed a compulsory subject at Calcutta, was altogether excluded from the two former, and that Mathematics, optional in Bombay, was a compulsory subject at Calcutta and Lahore. [30] Quantitatively, the science course was less popular but it produced better results and was preferred by scholarship holders. In 1882 the DPI of Bengal reported that the percentage of success was 20 in literature course and 46 in the science course. [31] The science course continued to grow in popularity and in 1899 the Calcutta University decided to institute the degrees of B. Sc. and M.Sc. [32]

From Dependence to Independence

One of the first men to realize the necessity of re-articulating science in national terms was Mahendra Lal Sircar (1833-1904). In 1869 he wrote an article 'On the desirability of a national Institution for the cultivation of sciences by the natives of India'. This title is extremely significant. He argued against the prevailing contention that the Hindu mind was metaphysical, and called for the cultivation of the sciences by 'original' research. He wrote, 'we want an Institution which will combine the character, the scope and objects of the Royal Institution of London and of the British Association for the Advancement of Science'. And then he added, 'I want freedom for this Institution. I want it to be entirely under our own management and control. I want it to be solely native and purely national'. [33] In Apri11875, Bharatvarshiya Vigyan Sabha (an all-India Science Society) was formed. Its objects were: (1) to discuss science as a subject by instituting a Society at Calcutta, which would have branches in other parts of India; and (2) to educate the people of India in various scientific subjects and to publish all the ancient Indian tracts relating to science. [34] In 1876, after a great deal of effort and controversy, the Indian Association for Cultivation of Science was inaugurated in Calcutta. This event was no less important than the establishment, nine years later, of the Indian National Congress, a political forum that was to spearhead the national movement. The Association was a cultural challenge and symbolized the determination of a hurt psyche to assert and stand on its own in an area that formed the kernel of Western superiority.

The turn of the twentieth century saw intense debates on what the Indians had received at the end of a century and a half of British rule. A cursory look at the periodicals, pamphlets and publications of the time would show the high level of discontent with the situation. [35] Even the then Governor General agreed that a huge stratum of the society retained 'the primordial elements far away from the reach of progress.' [36] In the first decade of the twentieth century amelioration was sought through the slogans of Swadeshi (self-reliance) and Swaraj (self-rule). These were more than political slogans; they symbolized rather an intense yearning for change. [37] The 'new vision' of India that came to be debated so intensely in the years to follow, had its beginnings in the last two decades of the nineteenth century. The quest for 'techno-scientific knowledge' preceded and facilitated the emergence of such 'vision'.

Calcutta's Scientific Pioneers

A large number of Indian interlocutors, belonging to different disciplines and walks of life, contributed to the new quest for techno-scientific knowledge. Among those who were the first to take scientific research and teaching as their career were Pramathanath Bose (1855-1934), Ramendra Sundar Trivedi (1864-1919), Jagadish Chandra Bose (1858-1937), and Prafulla Chandra Ray (1861-1944).

P.N. Bose specialized in geology at the University of London and later joined the Geological Survey of India. In 1886 he wrote a pamphlet on 'Technical and Scientific Education in Bengal' and a decade later he published the three volumes of 'A History of Hindu Civilization'. Fierce nationalism transformed a geologist into a historian. From physical mapping he shifted to cultural contours. He held the Brahmanical system responsible for neglecting physical science 'to a most serious extent'. 'The Hindu civilization carried the germs of its decay within it', he argued. But he would never agree to his (geological) Chiefs perception of Indians as 'utterly incapable of any original work in natural science'. [38] He could see no reason why 'with an improved system of scientific education, and with just and sympathetic treatment of the young men trained in India, they will not be able to take a place in the modern scientific world.' The Japanese 'instead of being thwarted, discouraged, and set down as incapable, have been aided, encouraged and stimulated by their government to pursue science.' [39] Bose only forgot to mention that Japan was not a colony! But he did realize (at his own cost) that 'a just and sympathetic treatment' was not always possible in a colony. Every concession had to be literally wrung. It was a struggle in slow-motion but on a high pitch. In 1886 P.N.

Bose asked for a science course at the F.A. (intermediate) level to facilitate early specialization. It was not till 1906 that an intermediate science course was introduced. He also pointed out the defects in the B.Sc course which was itself divided into literary and scientific curriculum. The Presidency College had no chairs in botany, zoology, and geology. Officers of the Geological Survey were asked to teach geology on a purely temporary basis. One could imagine what progress would come from such 'intermittent lectures.' The case was similar to the one at the Bengal Engineering College in Shibpur where chemistry, physics, geology, and metallurgy would be taught by 'one and the same teacher.' [40] Bose wanted science subjects to be taught with an eye to their application to industry. But at the same time he warned against the dark sides of industrialism in Europe which was feeding 'the growing spirit of militarism and imperialism in the West.' [41] He would have preferred the cultivation of science and technology within 'the limits of intellectual culture.' Later the experience of the First World War made him revert to 'the propagation of ancient culture' (as represented by India) which would 'rescue the humanity from the morass of militarism, malevolence, destitution, disease' etc. [42] Thus P. N. Bose wanted change and progress but on his own cultural terms and without losing Indian values.

A sharper articulation of the cultural dimensions of techno-scientific education came from Ramendra Sundar Trivedi, a science teacher at Ripon College (later its principal) in Calcutta. He wrote a number of thematically-rich yet seemingly popular science articles in Bengali which were published in book form under the titles Prakriti (1896) and Jigyasa (1904). Thanks to the English education, one may have learnt a great deal. But 'have we acquired the ability to learn on our own?'

'Have we assimilated scientificity into our system? The very word science throws us into raptures, but what we ultimately imbibe is basically pseudo-science. Having heard that human hair is a non-conductor of electricity we immediately begin growing pigtails; and as soon as we learn that changes in lunar position cause tides we take our horoscopes to the astrologer. Can one think of a more piteous situation?' [43]

This comes from a person with a supposedly Brahmanical and revivalist bias. But such poignant questions would have occurred only to such persons who had a deep understanding of their traditions and who were able to relate the latter to the ideas and requirements of their own time and locale. Trivedi even tried to expand the realm and definition of science.

'Science! Science! We all aspire for scientific research. As if science is confined only to physics, chemistry and physiology. As if anthropology is beyond the scope of science – as if historical analysis is outside science's concern.' [44]

Such a holistic view may not be appreciated by today's scientists, but a century ago that was not the case. In fact, scientists like P.N. Bose and P.C. Ray turned into wonderful historians. Like them, Trivedi could see the distorting influence of the colonial system and its bureaucracy. The educational system had become 'mechanized', with the universities reduced to little more than degree-granting machines. Even private efforts had come to a naught. Trivedi criticised the content and quality of education in the tols and chatuspatis, but he thought that these had at least some 'genuine respect for knowledge'. Modern educational institutions, because they followed 'mechanized routine,' failed to inculcate such genuine respect. They became what P.C. Ray later called 'golam-khanas' (slave-factories), churning out munsifs, clerks, assistant surgeons and overseers, serving the requirements of the colonial job market. Trivedi realized that this' mechanization' could not altogether be avoided. It was part of the global change. That is why he did not become a Gandhi and attack the West with anything he could lay his hands on! Trivedi kept grappling with the two different texts. He would accept modernity but not westernization; modern university system of education but not its commercialization. Several Indian thinkers and reformers of his age like Vivekanand and Aurobindo held similar views. But Trivedi was slightly different in the sense that he was deeply aware of the philosophical issues concerning science and scientists. Nevertheless, he would deny modern science any epistemological superiority (unlike P .C. Ray). He would rather describe western scientists in Hindu terms; for example Copernicus as one with Dibyachakkhu (spiritual vision), Newton as a Rishi (sage), and Helmholtz as an Abatar (incarnation). [45]

In contrast, the two most creative scientists that late nineteenth century India produced, J.C. Hose and P.C. Ray, would fully accept the epistemological superiority of modern science, and both treated education as the most effective vehicle for assimilation and gradual diffusion of the new ideas. Both were well-steeped in Indian history and culture, and could discriminate between what was to be taken and what not. J.C. Bose was a bio-physicist who worked on the 'electrical impulse and response in the living and the non-living.' Borrowing from the technical language of his discipline, he described the role of education in the East-West encounter in the following terms:

An impulse from the outside reacts on impressionable bodies in two different ways, depending on whether the recipient is inert or fully alive. The inert is fashioned after the pattern

of the infinite repetition of one mechanical stamp. But when an organism is fully alive, the answering reaction is often of an altogether different character to the impinging stimulus. The outside shocks stir up the organism to answer feebly or to the utmost in ways as multitudinous and varied as life itself. So the first impetus of Western education impressed itself on some in a dead .monotony of imitation of things Western; while in others it awakened all that was greatest in the national memory. [46]

Unlike P.N. Bose and P.C. Ray, J.C. Bose did not undertake any investigation into the 'national memory' (i.e. history). But he did try to identify his works with what he considered to be 'greatest' in his cultural inheritance. His propositions that life emerges out of non-life and that there exists an underlying unity between the living and the non-living, were taken as scientific manifestation of the Sarnkhya philosophy. J.C. Bose used to quote from the Vedas and had a poetic flavor; he even gave Sanskrit names to his instruments and did not see any conflict between science and religion. The contemporary opinion did not consider him mystical or oriental; rather he was hailed as a synthetic mind. [47] His works were the first authentic rebuttal of the colonial view that Indians were incapable of original scientific investigations. But his was not an ivory tower projection of education and research. He was convinced of the utilitarian value of science and wanted its wide-spread diffusion through proper science education. It had to be not only for the sake of scientific knowledge but 'also to harness the economic resources of the country and to show how to discriminate between industries which can and which cannot be profitably carried on under the climatic and other conditions prevailing in India.' [48] To achieve this one needed a 'satisfactory' science course, good laboratories and scholarships'. Bose was particularly perturbed over the science curriculum in Indian universities. At the graduate level in Calcutta University, for example, the vast area of acoustics, heat, light, electricity and magnetism formed only half a paper! To add to the woes of the students too many textbooks were prescribed. The result was they looked for help books. Second hand knowledge thus took the place of 'living science.' Even this could not be put to any use because, in the absence of any post-degree scholarship or employment, they would shift to a career in law or administration. Like his compatriots, Bose excelled in diagnosis but his solutions were limited and heavily dependent on government. All through he remained a devoted researcher, not an activist.

P.C. Ray, on the other hand, showed a higher degree of social commitment. He was an educationist, a scientist, an entrepreneur, a Gandhian activist -all rolled into one. He spoke and wrote extensively on educational matters with rare passion, sincerity, and clarity. Himself a working scientist and deeply conscious of its industrial applications, he was one of the earliest to

see science in its social context, to talk of its social relevance and accountability. He did some original research in India's scientific heritage and attempted a social explanation of what went wrong when and how. Unlike Trivedi and others, he held the Indian social and caste structure responsible for the cleavage between mental and manual work and the resultant stagnation. [49] He wanted modern education to bridge this gulf. In his view education has to be quality oriented; not for degree but for generation of employment and wealth. The average graduate was found to be 'a licensed ignoramus', and the degree itself served as 'a cloak to hide the degree-holders ignorance'. Higher education should be limited to only those who feel 'an instinctive call in that direction.' [50] The other great defect in his opinion was the undue stress on a literary curriculum. A Calcutta University student for M.A. degree in 1930 had to attend 230 classes in English, and only 65 in mathematics. He was equally unhappy about the intellectual narrowness of the specialist in science. He envisioned a broad 'mental culture' in which science, literature, history, and philosophy were to be given almost equal attention. Legal studies which thrived on the colonial requirements had no place in this scheme. Gandhi had severely criticized the legal profession. Similarly Ray would exclaim, 'if I am made the dictator of the university for one day, I would shut down the Law Department for at least three years!' Apart from the defective curriculum what hurt Ray most was the medium of instruction. He was convinced that learning through a foreign medium killed originality.

Imagine for a moment what would happen if the English lad were compelled first of all to learn Persian or Chinese or say German or Russian and then had to read through the medium of such a tongue.... in India we have adopted the most unnatural system and have to pay a heavy penalty for it. [51]

Ray realized that his own forefathers had gone 'mad' over English education but he appreciated their dilemma. In the first half of the nineteenth century English education was necessary to acquire new knowledge. Rammohum and Vidyasagar who asked for it, had also written extensively in Bengali. Later the whole process degenerated into a 'service-seeking mania.' This Ray resented. He was not against English. He only asked for its late introduction, after the mother tongue had laid the base. J.C. Bose held similar views and recalled with pride how his father had sent him to a' vernacular' school. This did help him relate to his surroundings. But higher education and publication of research had to be in English, the language of the scientific world. [52] They had no doubt about it. Then the existing institutions of science education and research had to be strengthened through fellowships, laboratories and private donations. When J.N. Tata (a leading Bombay merchant) floated the idea of an Indian

Institute of Research, Ray was reticent. He would have preferred private munificence to encourage the existing institutions in different parts of the country rather than create one single island of excellence. He argued 'India is not a compact, homogenous country, like Japan; a central Research Institute with an "Imperial University" like that of Tokyo, does not seem to commend itself.' [53] Later in 1931 when the eminent engineer M. Visweswaraya pleaded for a Technological University, Ray called it a delusion. 'In every country industrial progress has preceded progress in science and technology'. [54] In this industrial progress he envisaged a greater role for the businessmen and workers than the graduates in science and arts. The key to prosperity allegedly relied on the spirit of entrepreneurship and not on mere technical expertise.

Ray did not advocate higher education for everyone but primary education was a different matter. As late as 1934 the Bengal Government was spending only 27 lakhs on primary education while it raised 32 crores of rupees as revenue from the province. It was a mere 0.9% of its earning while Japan and Denmark spent about 20% of their gross revenue on primary education. Ray cited from the Famine Commission of 1880, the Agricultural Conference of 1888, etc. on how beneficial primary education would be for the peasants. Millions perished in epidemics, and the ignorant masses, steeped in superstition, looked to goddess Sitala. It was useless 'to din Pasteur's researches into their ear.' Ray would argue, 'an ignorant people and a costly machinery of scientific experts go ill together.' He shared the belief that 'it is education, and nothing but education, that can remove social evils, sanitary troubles and economic distress from the country, and can awaken political consciousness and create social solidarity in the people. Self-government without literacy would be nothing but a farce, and might possibly be a tragedy.' [55]

CONCLUSIONS

The above details show that the voluntary associations and individuals played perhaps a more important role in the gradual emergence of Calcutta as a science city than direct government efforts. But government patronage was important. The establishment of scientific institutions and journals was dictated not so much by the diffusion of scientific knowledge per se as by the local management of the complex resources of the colony. The government, that too of a trading company, would naturally be guided by economic considerations. But there was no guarantee that scientific excellence would bring economic benefits. Science came to be valued more as a cultural activity. The government asked its officials to undertake such pursuits only in

'leisure' time. Researches thus were individualistic and esoteric, the only binding cord being the scientific 'clubs'.

Another important aspect is that the practice of science remained largely alienated from its social context. In fact, one may ask, was it culturally divisive? Some found cultural dependence quite unavoidable, while others rejected colonialism entirely and searched for identity in indigenous traditions. The spread of modern science required the penetration of indigenous science and culture by western science. Many Calcuttans responded enthusiastically. Was it because the bhadralok wanted to legitimize their newly-won status or was it a true craving for knowledge and improvement? The truth perhaps lies somewhere between the two.

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[9] Savitri Das Sinha, Academic and Professional Journals, TS.

[10] H.H.Risley, "Presidential Address", Proc.of the Asiatic Society of Bengal, Jan.6,1904, p.26.

[11] Nature, vol. LXXV, March 28, 1907, p. 511.

[12] Medical Selections, I, Calcutta, 1833, pp.III-IV

[13] Transactions of the Medical and Physical Society of Calcutta, III-V, 1827-1831.

[14] The prospectus of this Association was published in the Calcutta Journal of Natural History, 1841, pp. 8-14

[15] Howell, Arthur, Education in British India, Calcutta, 1872, p-5.

[16] For Miraculous details see, Griffin, H.M., T.B. Macaulay and the Anglicist- Orientalist Controversy in Indian Education, (unpublished Ph.D. thesis, Pennsylvania University, 1972), 11.

[17] Ibid, 488.

[18] Home, Public, July 8, 1835, no.4 (all archival references unless otherwise indicated are from the National Archives of India).

[19] The Hurkaru, April 28, 1838, also quoted in The Calcutta Monthly Journal, XLVII, Oct. 1838, p. 206.

[20] The Centenary Volume of the Medical College of Bengal, Calcutta , 1938, p.12

[21] 125th Anniversary Souvenir of the Bengal Engineering College, Shibpu, 1981, p. 1

[22] Home, Public, Sept. 13, 1845, nos. 19-30

[23] Mouat, F.J., Proposed Plan of the University of Calcutta (Calcutta, 1845), 57-62.

[24] Selections from the Records of Govt. of India no. LIV (Calcutta, 1867), 11.

[25] West Bengal Archive, General, Education, Aug. 1860, no.90.

[26] Calcutta Monthly Journal, Voll. III, 1837, p. 826.

[27] Ghosh, Benoy,Samayikapatre Benglar Samajchitra, Vol. IV (Calcutta, 1966), 530, and the Athenaeum, no. 2168, May 15, 1869, p.672

[28] Nature, Vol. V. April 25, 1872, p.510. Most of the professors were Oxford or Cambridge graduates, who sought to impart to the Indians such an education as they had themselves received, Murdoch, J. Educational Reform, (Madras, 1893), 2.

[29] Note by E, C. dt. 10th Jan. 1886, Home, Educations, Oct, 1897, Nos. 14-88, Pt. B.

[30] Croft, A., Review of Education in India, (Calcutta, 1888), 147

[31] DPI Report, Bengal, 1891-92, (Calcutta, 1892), 5.

[32] Minutes of the Calcutta University, 1898-99, para 331, Members of the Science Degree Committee were J. C. Bose, E. Lafont, Mahendra Lal Sarkar, A. Pedler and P.C. Ray.

[33] Quoted in, A Century: Indian Association for the Cultivation in Science (Calcutta, 1976), 5 (emphasis added).

[34] Bhattacharya, B. Banga Sahitye Vigyan, (in Bengali) (Calcutta,1960), 144-5.

[35] 'The Danger of the New Century', The Pioneer, Jan. 28, 1901~ 'Good Bye 1800- 1900, The Statesman, Jan. 4, 1900; K.Zulaskar, 'India entering upon a new era of enlightenment', Modern Review, 21, V, 1913, pp.535-38.

[36] 'Lord Curzon 'on Higher Education', The Dawn, 25 Dec., 1900.

[37] As a recent work argues, 'it would be erroneous to conceive Swadeshi's nativism as an atavistic upsurge of a reified tradition in the face of modernization. Rather , nationalism's nativist particularism must be situated within a broad understanding of the perceived decentering dynamic of capitalist expansion. ' Manu Goswami, 'From Swadeshi to Swaraj: Nation, Economy, Territory in Colonial South Asia, 1870- 1907', Comparative Studies in Society and History, 40, no. 4, (1998): 609-637.

[38] Note by H.B.Medlicott, Director, GSI; National Archive of India, Revenue- Agriculture, Surveys, proc. no.25, Sept. 1880.

[39] P.N.Bose, A History of Hindu Civilization, vol. III (Calcutta, 1896), II-V and 98.

[40] P.N.Bose, Essays and Lectures on the Industrial Development of India (Calcutta, 1906), 65-85.

[41] Prophetically be wrote, 'the great wars of the future will be fought not for interests in Europe, but for interests outside Europe'. Ibid, 241-258.

[42] P.N.Bose, Swaraj, Cultural and Political (Calcutta: 1929), 275-76.

[43] R.N. Trivedi quoted in, Santanu Chacraverti, Ramendra Sundar Trivedi and Bengal's Response to Modern Science (unpublished Ph.D. thesis, Jadavpur University, 1996), 42 and 80.

[44] Ibid, 85.

[45] Ibid, 183.

[46] Modern Review, Feb. 1917, reprinted in D.Sen and A.K.Chakraborty (eds), J.C.Bose Speaks (Calcutta, 1986), 31-32.

[47] The Dacca Review, vol. VI, Dec. 1916, in J.C. Bose Trust Press File no.2, 247.

[48] The Englishman, May 22, 1897, in J.C. Bose Trust Press File no.1, 58.

[49] P.C.Ray, History of Hindu Chemistry, 11, (Calcutta, 1909), 195.

[50] P.C.Ray, Life and Experiences of a Bengali Chemist (Calcutta, 1932), 261-299.

[51] Ibid. 289.

[52] Those who were not too happy with J.C.Bose (probably Sir Asutosh Mukherjee) would make fun of his professed love for the mother tongue: 'Why does not Sir Jagadish publish his original articles in Bengali? Who knows, there may flock in Bengal, thousands of devotees from the remotest corner of the earth to learn the Bengali language. The Century Review, Jan. 1918 in J.C.Bose Trust Press File No.F/94.

[53] P.C.Ray, 'The Problem of Scientific Education in India'. Calcutta Review, CVIII, (1899): 347-395.

[54] P.C.Ray, Life and Experiences, 321.

[55] Ibid., vol.II, 82-100.