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THE ERA OF SCIENCE ENTHUSIASTS IN BENGAL (1841-1891): AKSHAYAKUMAR, VIDYASAGAR AND RAJENDRALALA

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During the nineteenth century, the Indian sub-continent witnessed two distinct outbursts of scientific enthusiasm in Bengal: one led by Rammohun Roy and his compatriots (1820-1840) and the other piloted by Mahendralal Sircar and Eugene Lafont (1860-1910). The intermediate decades were pioneered by the triumvirate: Akshayakumar, Vidyasagar, Rajendralala and a few others. Several scientific journals such as *Tattvabodhinī Patrikā*, *Vividārtha Samgraha*, *Rahasya Sandarbha* etc dominated the intellectual environment in the country. Some outstanding scientific books were written in Bengali by the triumvirate.Vidyasagar reformed the science content in the educational curricula. Akshayakumar was a champion in the newly emerging philosophy of science in India. Rajendralala was a colossus in the Asiatic Society, master in geography, archaeology, antiquity studies, various technical sciences, and proposed a scheme for rendering European scientific terms into vernaculars of India. There was a separate Muslim community's approach to science in the 19th Century India.

Key words: Akshayakumar, Botanical Collection, Geography, Muslim Community approach to Science, Phrenology, Rajendralala, Science enthusiasts (1841-1891), Technical Sciences, Triumvirate, Positivism, Vidyasagar

Introduction

It can be proposed that the first science movement in India was chiefly concentrated in the city of Calcutta and spanned the period of approximately quarter of a century (1814-39) coinciding with the entry of

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Rammohun in the city and James Prinsep's departure from it. The second science movement (1860-1910) also originated in this city and was successfully led by Reverend Father Eugene Lafont (1837-1908) of the St. Xavier's College (founded 1860) and Dr. Mahendralal Sircar (1833-1904), the two co-founders of the Indian Association for the Cultivation of Science (IACS, founded in 1876). The Indian science was in a moribund state during the interim period of two decades, notwithstanding the establishment of several scientific and technical educational institutions: Medical College, Calcutta and Elphinstone College, Bombay (1835); Delhi College had been established in 1825 on the oriental pattern; Christian College, Madras (1837), Grant Medical College, Bombay (1845), Thomason College of Engineering, Roorkee (1847), Bengal College of Engineering (1856) and then Universities in Calcutta, Madras and Bombay (1857).

There was no science-teaching infrastructure at the graduate collegiate level during this period, not to speak of any research facility. The primary and secondary education in rural schools was in a miserable state. The steam boats, telegraphy and the railway network system helped the people a little, and the colonial power more, in ruthlessly exploiting the people, throttling their First War of Independence in 1857. The Indian intellectuals realised that the masses urgently needed education, intellectual emancipation and leadership. Socio-religious reforms and emancipation alone could lead the way for political freedom and prosperity. Calcutta produced three intellectual leaders at this stage in the sphere of reformist education: the more famous Iswarchandra Vidyasagar (1820-1891) Rajendralala Mitra (1822-1891) and the less well-known but better articulate intellectual, Akshaya Kumar Datta (1820-1886). We would start this chapter discussing the scientific and philosophical contributions of Akshayakumar.

After the demises of Rammohun, Derozio and Hare, there was a vacuum in the intellectual atmosphere of Calcutta which the Derozians tried to fill in to the best of their abilities. But they were a heterogeneous lot, and could not properly gel and coalesce amongst themselves. They were staunch reformist, more militant and less constructive. Their flair for ridiculing all aspects of Hinduism, even to the point of indulging in beef-eating, drinking and switch over to Christianity made them tactically unfit for engineering any worthwhile inner reform within the Hindu society. The Brāhmos led by

Devendranath Tagore (1817-1905) were sympathetic towards the spiritual aspects of the Hindu tradition particularly the Vedantic tenets and some rituals like the sacred thread ceremony; they protested against the proselytizing activities of the Christian priests. The Derozians alleged that the Brahmos were diluting the reformist spirit of Rammohun, and compromising on principles.

Vidyasagar, Akshayakumar, Rajendralal Mitra, and later Dr. Mahendralal Sircar preferred to avoid the theological disputes between the Hindu, Brahmo and the Christians (the Muslims as well), and pursued a secular approach towards education and scientific reform in the Indian society. They were specifically committed to modern science; so were Keshab Chandra Sen and Bankim Chandra Chattopadhyay, who however nurtured their own spiritual preferences.

Amongst these intellectuals, Akshaya Kumar was decidedly the most articulate, critical, resolute, and paradoxically the least remembered and emulated by the posterity! We cite several writings on his life and works (Roy 1885) including his own works which have been published so far[1].

Akshaya Kumar Datta: Early life

Akshaya Kumar Datta was born in Chupi, a village near Nabadwip in West Bengal on 1 Śrāvaṇa 1227 B.S. 1820 AD, the same year Vidyasagar was born. He had, even in his childhood, an insatiable spirit of curiosity and an indomitable thirst and hunger for education in the natural sciences. This was an inborn spirit which the Hindu/Buddhists call as *saṃskāra*. We wonder if Akshayakumar himself approved of this philosophical concept! When he realized that some of the Hindu Purāṇic notions on geography were inaccurate and even silly, and better accounts are available in the textbooks of Pearson etc., he firmly decided to have an education in English and not Persian. Again, when he was told that the Greeks had abandoned their ancient notions about many gods and goddesses, he immediately fell attracted to Rammohun's message of anti-idol monotheism.

During his youth Datta picked up adequate knowledge about English, Sanskrit, French and German as well as higher mathematics and natural sciences. The descendants of Radhakanta Deva of Sobhabazar (who had a fabulous library), such as Srinath Ghosh, Anandakrishna Basu who had been

students of the Hindu College, assisted the two youths Datta as well as Vidyasagar, in their self-propelled education. As a young man Datta attended lectures in the Calcutta Medical College, on chemistry in the first year and on botany in the second year curriculum.

In 1839 Datta and Vidyasagar, and several others such as Rajendralal Mitra, came in contact with Devendranath Tagore who had founded *Tattvabodhinī Sabhā* for discussions on several intellectual matters. Very soon *Tattvabodhinī Patrikā*, a periodical, was launched; Datta became its editor assisted by the illustrious members of the Editorial Board and launched upon writing a series of scientific articles in the vernacular language of Bengal. He wrote many other articles related to education, the plight of farmers, scientific philosophy, social science etc. also.

Some of His Scientific Writings

Bhattacharyya has discussed (Bhattacharyya 1980, pp. 69-94) some of the scientific writings of Akshyakumar whose contributions have been considered to be of landmark quality. As a matter of fact, Bhattacharyya has divided the entire tradition of scientific writing in Bengal, from Rammohun Roy to Ramendrasundar Trivedi, into two eras, one before and the other after Akshayakumar. We would paraphrase Bhattacharyya's presentation (Bhattacharyya 1980, pp. 69-94), stressing at the same time, as Muhammad Saiful Islam has noted[2], that the complete compilation of Akshyakumar's writings is yet to be done; Datta and his descendants could compile in book form only a part of his many articles scattered in different journals.

After his poetical work *Anangamohan* (1834), Datta's first scientific work was *Bhūgol* (1841) published by the *Tattvabodhinī* establishment. He attempted a comprehensive natural, commercial and political version of 'geography' based upon the extant works of Pearson, Clift, Hamilton and Mitchell. Datta edited the periodical *Vidyādarśan* established by Prasannakumar Ghosh of Ṭākiṭ for the six months of its existence since June 1842, and wrote several articles on zoology, geology, geography and chemistry.

Tattvabodhinī Patrikā was launched on 16 August 1843, and four months later on 21 December, 7 Pauṣa, twenty-two members of the movement including Devendranath and Akshayakumar, initiated themselves under written

pledge in anti-idol monotheistic Brāhma religion. Devendranath the leader wanted to spread the message of the Vedas and Vedanta through the *Patrikā* , but Akshyakumar the editor had other ideas!

There was no scientific article in the first 26 issues of the monthly *Patrikā*. Gradually a few short articles in zoology and on animals appeared, and we find superior full length articles on science only from the 47th issue Āṣāḍa, July 1847.

Datta went on writing extremely popular scientific articles on astronomy, mathematics, physics, geography, geology etc. in lucid Bengali, introducing many technical terms of *Paribhāṣā* such as chemistry as *rasāyana* (instead of *kimiyā*), physics as a defined subject *padārtha vidyā* etc. Many of these articles were later compiled in the three volumes of the monograph *Cārupāṭh* in 1853, 1854 and 1859. We list some of the articles as originally published in the *Patrikā*:

Sindhughotak appeared in Āśvina 1845, *Banmānus* in Māgha 1845, then after seven years the most exciting *Bībar* in Śrāvana 1852. Up to 1855 there had been many articles from his pen on life-sciences: *Vṛkṣalatādīr Utpattir Niyam* (Rules for the Origin of Trees and Creepers), Kārtika 1852, *Dīpa Makṣikā*, Caitra 1852, *Bālmik*, Pauṣ 1853, *Prabāl Kīṭ*, Jaiṣṭha 1854, *Kīṭāṇu*, Bhādra 1854, *Bihangama Deha*, Āśvina 1855 etc. In most articles, morphology of the living organisms were discussed lucidly.

Akshayakumar's first article on astronomy came out in Āṣāḍa 1847 in which he dealt with the solar system, the planets, their dimensions and distances and lastly mentioned the comets. In the footnote Akshyakumar dwelt on the ancient Indian glory in the subjects of mathematics and particularly algebra. Most probably he had read Colebrooke's treatise on the subject as well as the then stimulating work being done by Professor Ramchandra on Indian Algebra.

Datta's article on moon published in Māgha 1847 was 'euphoric, clouding his scientific judgement'; he praised the Divine Creator who might have created 'divine creatures on the moon – *candraloke divya purūṣ*'[3]. The article *Brahmāṇḍa Kī Prakāṇḍa Vyāpār* (What A Huge Creation is this Universe), published in Āṣāḍa 1854 was itself huge and ecstatic about the creation and its mechanism.

It has been alleged, quite unfairly, that Datta was interested more in the *brahmāṇḍa*, the scientifically engineered created universe, and less in the *Brahmā*, the Creator. The impression that we gather from his writings is that he was ever euphoric about God, the first cause for creation and never turned an atheist. We would endeavour to explain his philosophy a bit later.

Datta wrote a series of articles starting from Āṣāḍa 1851 on physics, and these were eventually collated in his 1856 monograph entitled *Padārtha Vidyā*. This was the first attempt in the 19th century Bengali literature to dwell on physics in the modern sense, isolated from the neighbouring scientific disciplines. Datta concentrated on matter and its properties, force, power, speed, velocity, centre of gravity, pendulum. He wrote a separate series of articles on *vārivijñān* (hydrostatics and hydrodynamics), starting from Bhādra 1854, which dwelt with not only the bodies of water but also on the properties of liquid and gaseous substances in general. The Baiśākha 1852 issue contained an article on 'Vesuvius, a Volcano' and Āṣāḍa 1852 issue discussed 'Waterfalls'. The Bhādra 1853 issue article dwelt on ebbs and tides.

In 1855 Datta started in the Baiśākh issue a separate column *Vijñānvārtā* on Scientific News compiled from the leading international journals such as *Literary Gazette*, *Chamber's Journal*, *American Journal of Science and Arts* etc. Around that time he felt seriously ill.

Resembling James Prinsep, Datta a work-maniac, overtaxed himself and succumbed to a strange brain fever accompanied by serious pain with the slightest stress of sound or thought. He suffered till his death in 1886 and never recovered. During this period Datta's books came out, the *Patrikā* survived till 1884 under changed editorship with much of subscribership and popularity eroded.

Referring to his era of editorship (1843-1855) Datta's huge number of admirers were most ecstatic. Satyandranath Tagore described him as the 'sentinel of new knowledge'. Rameshchandra Datta wrote about Akshyakumar's era:

> "People all over Bengal awaited every issue of that paper with eagerness, and the silent, sick but indefatigable worker at the desk swayed for a number of years the thoughts and opinions of the thinking portion of the people of Bengal"
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> (*The Literature of Bengal*, 1877, pp. 163-64).

The Ideological Conflict

During the twelve years of his editorship (1843-55), the Brāhmo community including Devendranath Tagore was proud of Datta's intellectual prowess and introduction of European wisdom and science in the rejuvenated Bengali language, and yet very apprehensive and uneasy about the editor's ideological stance. Datta would not write on the 'infallibility' of the Vedic and Vedāntic tenets which he considered to be man-conceived and not the divine revelations. He argued endlessly and ultimately persuaded the Brahmo leaders not to accept the Vedas or even the Vedānta or for that matter any scripture as the sole basis of their religion.

In 1847 the word *Brāhmodharma* replaced *Vedānta Pratipādya Satyadharma*, thus knocking off the Vedāntic mooring of the religion. Devendranath wrote his 1849 book *Brāhmodharma* commanded by his own heart and conscience: *ātmapratyaya siddha jñānojjval viśuddha hṛdayer dvārā ādiṣṭa*. Even this could not heal the rift between the devotees and the intellectuals led by Akshayakumar, Rakhaldas Halder (later Keshab Chandra Sen also pursued this staunch reformist stand) etc. who demanded more reforms such as abandonment of the rituals of initiation, worship, use of Sanskrit language instead of Bengali for prayer, rejection of casteist Brahminic rituals and so on. Rakhaldas eventually left the movement.

Akshayakumar's famous philosophical equation, cited by so many scholars, took the Bengali and even the Indian intellectual world by storm:

Labour = Crop

Prayer + Labour = Crop

Hence, Prayer = 0

Many average Brahmo members accepted the common sense argument that when simple remedies are available, there is no necessity for the ritual of praying to God for such matters. This argument had been mooted earlier by Rammohun himself. But an embittered opponent, Rajnarayan Bose (1826 – 1899, grandfather of Sri Aurobindo) insinuated that Akshayakumar was contemptuous of the tradition of prayer itself. In Māgha January 1850 Rajnarayan made his veiled, barbed remark:

> "O intellectual, God becomes more angry with the intellectual sinners. You may be able to mesmerize the public with your knowledge in various

> scriptures. But until such time as you rectify your character (*caritra śodhan nā karo*), you remain a mere quadruped bearing loads of books (*granthabā hak catuspad tulya*)".

Years later, Rajnarayan remarked that Akshayakumar had long ago abjured his belief in Brāhmoism and turned an agnostic; had drifted from deism to atheism. Devendranath also wailed that the Brāhmo movement could not prosper 'unless the atheists are removed'. Whereas he (Devendranath) was investigating his relationship with God (Brahma), others (like Akshayakumar) were concerned with their relationship with the external objects (*bāhyavastu, brahmāṇḍa*)!

The departure of Akshayakumar from the *Tattvabodhinī* community during the summer of 1855 paradoxically distressed as well as provided relief to his friends who did not loose time to start a new series of scientific articles in the *Patrikā* starting in the month of *Kārtika* with the caption *Iśvarer Mahimā* 'The Glory and Majesty of God' probably to indicate the change of guard and the banishment of atheism.

The Philosophical views of Akshayakumar

First and foremost, Akshayakumar Datta was a patriot who loved his country, his language and culture and looked for a comprehensive programme to raise them to the modern European standard. But he would do that through his own language and not the English. In this endeavour he resembled William Carey, Adam and the Srirampur Missionaries and not the Derozians. Datta created a sensation in 1845 by delivering his memorial lecture on David Hare in Bengali. Referring to Datta's scientific articles in Bengali, Reverend John Anderson of the General Assembly praised: "Akshayakumar is Indianising European Science".

Datta's article on the supreme role of vernacular languages published in *Tattvabodhinī Patrikā*, Śrāvana 1848, no. 60, pp. 64-72, recently reprinted (Islam 2006, pp. 364-363), was a masterpiece. Datta questioned what had been achieved during the previous 25 years of English education in India except to produce many snobs who scoffed at their own culture, Hinduism, Sanskrit literature, hardly interested in the accounts of their own glorious antiquity published in the Asiatic Society Journal. William Jones had written that 'Sanskrit is more perfect than the Greek, more copious than the Latin,

and more exquisitely refined than either', and yet the English-knowing snobs would prefer Shakespeare to Kalidasa, Newton to Aryabhata. 'The mother tongue is the most nourishing like mother's milk. Persia/Iran toiled in vain with the Arabic language till the nation produced its own Firdausi, Saadi and Hafez'.

Datta preferred translation of Bacon and Locke, Newton and Laplace into the Indian languages, and hence insisted on the continuance of English education – *Ingrājir anuśilan rahit karā kadāpi mat nahe* – and recommended cultivation of other languages as well, such as French, German, Sanskrit, Arabic, Persian etc. Thus Datta ended up as a syncretist and not a narrow chauvinist or Hindu revivalist. His syncretism became manifest in many other areas of intellectual endeavour. Following two German educationists, J.F. Oberlin (1740-1826) and Friedrich Froeble (1782-1852), Datta submitted a comprehensive scheme of education, free and compulsory for the age group 2-14, and higher education including technical education in agriculture and industry for the age group 15-21.

Datta did not accept or encourage the British presence in India and what is more, wrote candidly against it and the colonial oppression in India. He described the tyranny of the indigo planters over the defenceless farmers in *Tattvabodhinī Patrikā*, Agrahāyana 1850, a decade before Dinabandhu Mitra and Reverend James Long, when the indigo agitation picked up in the country, the Sepoy Mutiny had been quelled and Datta incapacitated by incurable cerebral ailment. Datta was more of an intellectual rather than an activist like Vidyasagar in the area of social reform. As soon as Vidyasagar wrote his first article on widow-remarriage in the *Tattvabodhinī*, Datta penned a rejoinder strongly endorsing it. He wrote several articles against polygamy, early marriage of the adolescent youth etc.

The most noteworthy aspect about Akshayakumar's personality was his scientifico-philosophical view which was original and developed over many years. Although he was influenced by several earlier thinkers he did not totally follow any one of them.

There had been a long tradition of Naturalism in the West starting from Democritus, Lucretius up to Spinoza, who believed that the entire created universe was guided by a set of material or 'natural' laws which had nothing to do with supernaturalism or occultism. On the issue of God, the

naturalists were either atheists or agnostics. Thomas Henry Huxley (1825-1895) declared himself as an 'agnostic' sometime in 1869. Much earlier, Akshayakumar used the term *aparigñeya* and *abigñeya* echoing the age-old agnostic tradition that Brahman cannot be firmly comprehended. Even Sri Ramakrishna told Vidyasagar that Brahman or the Absolute has never been '*ucchiṣṭa*', i.e . 'adequately articulated in tongue', and this remark gladdened the heart of the philanthropist who was also a kind of agnostic. In his *The Age of Reason*, Thomas Payne defined God as the first cause to be discovered by reason alone. Ramakrishna differed.

The proponent of 'Positivism', Auguste Comte articulated:

> "The study of the positive doctrine leads to the conclusion that man's true unity consists in living for others. The positive worship has for its main object the development of the feelings conducive to such a life "(The Catechism of Positivism).

Mill, Bentham, Akshayakumar, Bankimchandra in his early career, Dwarkanath Mitra etc subscribed to positivism. Keshabchandra declared:

> "The politics of the (his) age is Benthamism, its ethics Utilitarianism, its religion Rationalism, its philosophy Positivism".

The famous phrenologist from Scotland, George Combe wrote his monograph *The Constitution of Man Considered in Relation to External objects* in 1828, the sixth edition of which came out in 1855. Deeply influenced by Combe's views, Akshayakumar wrote his original *Bāhyavastur Sahit Mānab Prakritir Sambandha Vicār*, two volumes of which were published in 1851 and 1853.

Combe was a Deist who restricted God's role in merely creating this universe and establishing a set of operating principles in the physical, biological and mental planes. These principles are inter-connected according to the deistic view, so that the entire world of inanimate and animate objects moves on like a mechanical clock. If there is any mechanical problem, then (and only then) the clock-maker namely God may intervene and set it right. Otherwise, God's role is minimal and Man's duty is to discover the natural laws and subscribe to them, non-compliance leading to distress and death. Rectification of misery lies in compliance to the natural laws and not in prayer without effort, not in astrology or occultism or miracles. Mere prayer would not help, since 'God would not violate His laws'.

Such a paradigm of inviolable scientific laws had been evolved earlier in the Islamic world by Ibn Sina for which he was vilified by the Muslim clergymen. The 18th and 19th century rationalists and deists like Combe and Akshayakumar were also derided as atheists, since they restricted God's freedom to bend His own laws if necessary.

Akshayakumar articulated his ideas in *Bāhyavastur…* on the basis of a large number of scientific books which discussed laws for inanimate objects:

Anot's *Physics*, Newton *Introduction to the Library of Useful Knowledge*, *Principia* etc.; for life sciences: Rowler's *Physiology*, *Lawrence Lectures in Comparative Anatomy,* Leibig *Organic Chemistry*, John Smith *Proper Food for Men*, Sylvester Graham *Science of Human Life;* for mental and social sciences: Abercrombie's *Intellectual Philosophy*, George Combe's *Constitution of Man, A system of Phrenology, Moral Philosophy*, many other books on social sciences.

Akshayakumar made huge scholastic efforts to evolve his world-view in consonance with Combe's prescription. "This world is a Divine institution, and it is our duty and interest to try to discover its plans and to conform to its plans". Combe further stated: "I recognise the activity of Veneration, Hope and wonder, when addressed to the Divine Being, and excited by His word or His works as constituting" (Charles Gibbon, *The Life of George Combe*, 1878). We are not certain whether Akshayakumar followed the spirit of Combe during the end of his life, and paid adequate attention to the aspects of 'veneration, hope (prayer to?) and wonder addressed to the Divine Being.' It is reported (Biswas 1887) that when he fell sick, he went on a long tour (1853-56) upstream on the Ganges, and on his return route, visited his ancestral house at Chupi and saluted the idol of Narayana. This is a tragic story which we tend to believe. It could represent a moment of weakness exhibited by an extremely sick man.

Akshayakumar's *Bhāratvarṣīya Upāsak Sampradāya* (two volumes in 1870 and 1883) was modelled after Horace Hayman Wilson's classic study *Sketch on Religious Sects of the Hindus.* For this Bengali masterpiece, Datta undertook extremely stressful research under painful health condition. He discovered plenty of agnosticism and atheism in the ancient Indian traditions of philosophy, and equated *Vaiśeṣika* Kaṇāda's theory of *paramāṇu* with the modern atomic theory of Dalton. But, did he accept the

inert atom as the'first cause' venerated in his legal will as *Viśvabīja?* We doubt.

Ramakrishna Bhattacharyya has quoted Datta to show that in compiling *Bhāratvarṣīya Upāsak* he looked for mental aberrations in some religious communities *janasmāj biśeser mānasik roga.*[4] Yes, but there was no wholesale denunciation; Datta did not equate spirituality as a whole with a mental disease (Bhattacharyya has used the caption, *Dharma : Mānasik Roga*!) Akshayakumar's outstanding oration, just before he fell sick, was delivered at Bhowanipur, Calcutta on 19 Caitra and printed in the *Tattvabodhinī Patrikā* Baiśākha 1855 issue. It has been entirely reproduced and reprinted (Bhattacharyya 1980, pp. 343-353). We provide below a selected extract in free translation to stress the following : (a) Datta was not an atheist, venerated the supreme Creator; (b) he felt that *Dharma* needs continuous evolutionary improvement and it cannot be treated as a 'mental disease'; (c) he mentioned several religious leaders like Saadi, Hafez, Kabir, Chaitanya, Tulsidas with deep respect, presumably because they were not mental patients, and lastly (d) he hoped that the *Brāhmo Dharma* to which he had subscribed in 1843 would improve and develop as a perfect *dharma*, wedded with logic, reason and genuine *vidyā* other forms of knowledge: secular, scientific and even technical. The new age demands synthesis and syncretism. Now let us quote him even though partially:

> "…….No established religion is faultless. What is the future of religion? We should consider whether we should abandon religion altogether or improve it in the light of modern enlightenment. True knowledge *(pṛākṛta vidyā)* is related to the functioning of the universe, the nature and the will of the Creator; true religion must be wedded to true knowledge. Just like other knowledge systems, the religious systems also need rectification of defects and continuous improvements (*bhrama nivāran o śrīvṛddhi sādhan*) ….
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> "…. The gems of knowledge (*jñāna ratna*) which the earlier exponents of religion have gathered and collated in their scriptures should permanently remain as ornaments in the neck of the body of religion (*dharmavigraha*, an iconic concept). The Veda and the Qurān superbly proclaim the *Advaita*, the monotheistic principle. How sweet are some of the messages of Bible, Mahābhārata, Socrates, Confucius, Saadi, Hafez, Tulsi and Kabir; these should decorate the great stage (*mahāmancca)* of religion, illumined by the modern solar rays of science (*idānintan vijñānarup bibhākarer prabhāy pradīpta*)…..

> "…Recently there have been phenomenal improvements in science and technology, in the spheres of agriculture, industry, navigation, compass, printing press, steam boats, steam locomotive, microscopes and telescopes etc which were scarcely under human imagination in the ages of Zarathustra, Confucius, Muhammad, Vyasa and Shankara. Can the traditional religions survive, if their ideas are not consistent with the modern knowledge and emancipation?....
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> "……. Many are showing disrespect to the traditional religions. But one should not renounce religion, since true religion would live forever (*pṛā kṛta dharma abaśyai sthāyī haibe)*. Resembling true knowledge, true religion would also be wedded to logic and reason. Our *Brāhmodharma* is that true religion.
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> "The Creator, sustainer and destroyer, the infinite, all-powerful, inscrutable (*aparijñeya*) Absolute (*Parameśvara*) is the object of devotion (*bhakti-bhajan*) and worship (*ārādhya*) for the entire mankind (*mānavjāti*). We are the children of that Absolute. To worship Him with the sacred flower of love and devotion (*prīti-puṣpa dvārā arcanā*) is the only religion of the Brāhmos. To perform the tasks dear to Him is the only duty for the Brahmos, who should discover and conform to the Divine Laws in the natural, material, biological, mental and other (social) planes…..
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> "……. *Brāhmodharma* is related not only to the sacred principles (*tattva*) already ascertained, but also to the new principles to be ascertained in future…… The entire universe is our religious scripture (*akhil saṃsār-i āmāder dharmaśāstra*). Pure knowledge is our teacher. The discoveries made by Bhāskara, Āryabhaṭa, Newton and Laplace are included in our scriptures which also encompass the principles articulated by Gautam, Kaṇāda, Bacon and Comte. Musa, Muhammad, Jesus and Chaitanya have evolved some spiritual principles and these are included in our *Brāhmodharma*. Our religion would evolve, prosper and assume resplendent beauty (Bhattacharyya 1980, pp. 343-353)."

The cited philosophical testament delivered and published by Akshayakumar just before he fell sick, was never disowned or retracted by him during the subsequent three decades of his mortal sick life. In this testament his syncretism shines, *bibhākarer prabhāy pradīpta*. Rajnarayan Bose, Devendranath Tagore as well as Ramakrishna Bhattacharyya and Asish Lahiri have considered Akshayakumar as an atheist; while the first two have viewed atheism as a vice, the last two treated this as a virtue, prerequisite for developing scientific objectivity . We would rather agree with Amal Kumar Mukhopadhyay's estimate:

> "As a social scientist, Akshayakumar's purpose was to evolve a syncretic approach. He searched for a real harmony in society and visualised an organic unity between science, society and religion (Mukhopadhayay 1979)".

Datta spent his last few years in Bali on the Ganges, where his house and garden were a veritable museum, library and laboratory combined, reflecting his strong scientific temperament. This garden called *Śobhānodyān* (Vidyasagar called it *Cārupāṭh* Part 1V) was full of plants and creepers, rare botanical specimens such as *Bugainvalla spectabilis*, cardamom, clove, white and red sandalwood with characteristic smells; the huge collection reminded one of similar collections in Srirampur (William Carey) and Sibpur Botanical Gardens . His 'Orchid House' was full of orchids, fern, moss etc. Within his residence, he maintained a big collection of coral, conchshell, snail, human skeleton, skeletons of land and marine animals, bones, fossils, geological specimens and minerals. Some geological specimens reached his address from England shortly after his death.

Akshayakumar's house was decorated with portraits of Rammohun Roy, Isaac Newton, Charles Darwin, Thomas Henry Huxley, John Stuart Mill, illustrations of stellar clusters, animal and plant families etc. There were microscopes, thermometers facilities for chemical testing, fossils, many metals and alloys, metallic ores, coins of different countries and eras. His library possessed encyclopedia, many books on mathematics, calculus, botany, zoology, geology, archaeology, biology, anatomy, linguistics, almost a complete set of the Asiatic Society journals. Justice Saradacharan Mitra maintained his library for 20 years and checked his notings on the collected books. It was evident that he collected books in so many disciplines not for show and glamour; he actually read most of them despite the severe cerebral pain, that he suffered incessantly.

Akshayakumar Datta expired on 15 Jaiṣṭha 1293 BS that is 28 May 1886. One year earlier, Mitra had helped him in preparing his 'Will'. Datta enquired whether it was essential to write on the top of the testament any name of God. Mitra answered in the negative, and then Datta preferred to use the word *Viśvabīj*, the first cause. Did he mean Daltonian atom, or the primordial fire-ball before the 'Big Bang', or the original speck of consciousness, the Creator? We do not know the answer and the riddle survives! Another riddle is why Akshayakumar Datta's legacy in the Bengal

Renaissance has not enjoyed the same stature as those of Iswarchandra Vidyasagar and Bankimchandra Chattopadhyaya etc [5].

Out of his saving of approximately forty thousand rupees, Akshayakumar apportioned three–seventh for scientific discussions, encouragement of learning, alleviation of poverty and nourishment of children; one fourteenth was allocated to *The Indian Association for the Cultivation of Science* (IACS)[6]. Burdened with poverty, Datta could donate only Rs 50 on 5 May 1881. After his death, the IACS received Rs 3000 from the executors to the estate of the late Babu; this was indeed a touching tribute from the stalwart to the cause of India's nationalist science movement (Biswas 2000, pp. 112-113).

Vidyasagar: An Associate of Akshayakumar

Iswar Chandra Vidyasagar (1820-91), the great neo-humanist of Bengal, was a towering, venerated personality of Bengal Renaissance, next to Raja Rammohun Roy. His charisma in the annal of history has been much more than that of Akshayakumar Datta. In this limited presentation, we portray Vidyasagar as an 'associate' of Datta, who has been almost forgotten, by referring to his splendid defence of scientific thinking which has not been well documented or remembered either. The reason has a commonality which has not been deeply probed even by several reputed scholars (Bondyopadhayay 1929).

The young Brāhmin boy was educated in the Sanskrit College from 1829 to 1841, the premises of which were adjacent to those of the Hindu College. His idealism was derived more from the latter rather than the former. Thoroughly versed in the different branches of Sanskrit literature, he became painfully aware like Rammohun, about their limitations and heroically supplemented his own deficiency in knowledge, like Akshayakumar, through self- studies in English, mathematics, astronomy and other scientific subjects.

The idea of modernising the Sanskrit College through the arrangements of scientific lectures (in mathematics, physics, Astronomy) in the neighbouring Hindu College and also in Sanskrit College (medicine, āyurveda) belonged to Horace Hayman Wilson. Vidyasagar might have met Wilson, Rammohun and Derozio, or at least saw them with reverence from a distance. He must have seen and talked to David Hare during his twelve years of studentship.

No memoir has been left for us but it has been reported that young Vidyasagar used to attend the annual memorial meetings (01 June every year) arranged in honour of David Hare who has been aptly described as 'one of those persons disabled by temperament from accepting the dogma of religion but compelled by his heart to lead an essentially spiritual life'. We have replaced the word 'Christian' by 'spiritual' and consider that this description is applicable to Vidyasagar as well. Sri Ramakrishna would have concurred.

Vidyasagar took lessons on *Nyāya* philosophy from Jayanarayan Tarkapanchanan who edited some books on behalf of the Asiatic Society and consulted several texts of Western philosophers while writing his monograph *Padārthatattva* . Once he commented during his lecture on *Nyāya* in the Sanskrit College that according to their philosophy 'air has no weight' . Some students objected and explained the experimental evidence of weight, pressure etc of air and different gases as obtained by Galileo etc. Tarkapanchanan readily accepted the facts and wondered at the superiority of the Western science in such matters (Bhaduri 1998, pp. 17-22).

Vidyasagar also witnessed how Madhusudan Gupta conducted his Āyurveda classes using Hooper's book on Anatomy, how Gupta visited the neighbouring hospital and pioneered the practice of dissection of dead human bodies and thereby ' cleared a space in the jungle of prejudice'. Gupta had assured David Hare that he had collected evidences to show that the Hindu *Śāstra* of Āyurveda never objected to surgery; such evidences were submitted for a public debate, and thus the 'jungle of prejudice' was destroyed. Vidyasagar emulated Rammohun and Madhusudan in citing scriptural passages in favour of liberal reforms such as widow-remarriage. While Akshayakumar took a more militant approach against the old religious scriptures, Rammohun and Vidyasagar emphasized on the liberal aspects of the ancient religion which were not incompatible with the tenets of modern scientific thinking. All of them were resolute in their struggle for modern science in India.

After the completion of his education (1829-41), Vidyasagar started his career as a lecturer in the Fort William College and a decade later, was appointed a Professor and the Principal in his alma mater, the Sanskrit College. The 1840's and 1850's were very productive for the Bengal Renaissance, when Akshayakumar and Vidyasagar joined their hands in the

Tattvabodhinī movement for scientific literature and awareness in the country. Vidyasagar wrote several books in Bengali with strong messages in modernity and scientific knowledge: *Bānglār Itihās* (‘1848), *Jivancarit* (1849), *Bodhodaya* (1851) etc.

In *Bānglār Itihās*, the last nine chapters of Marshman’s English treatise were utilized and the coverage was from the ascendancy of throne by the evil character (*ati durācāra*) Siraj-ud-daula till the memorable era of (*cirasmaraṇīya*) Lord Bentinck. Major G.T. Marshal translated Vidyasagar’s Bengali text into English: *A Guide to Bengal* (1850). Before his death Vidyasagar compiled materials for writing a history of India, but his project was not completed.

In September 1849 came out the Bengali *Jeebuncharita* a free translation of the lives of Copernicus, Galileo, Newton, William Herschel, Grotius (Hugo Groot), Carolus Linnaeus, B. J. Duval, William Jones and Thomas Jenkins in “Chamber’s Exemplary Biography” . It is remarkable that Vidyasagar did not choose the names of Indian mystics such as Chaitanya or Ramprasad Sen. He wanted children to emulate the founders of modern science, the astronomers /mathematicians. Copernicus had axed the roots of human faith in ancient and false astronomy (*eirup viśvāser mūle kuṭhārā ghāt*). Galileo’s observation and experiments ‘sounded the death knell of the old system of philosophy’. Isaac Newton solved in his *Principia* the problems of physics in the light of mathematics (*gaṇit śāstrānusāre padārthavidyār mīmānsā*). Vidyasagar also eulogized Newton’s modesty and quoted him: “I am merely collecting pebbles on the shore of the ocean of knowledge” .

William Herschel (1738-1822) the great astronomer who discovered the planet Uranus (1781) and its two moons (1787) was still alive when Vidyasagar was born, and his wife Caroline, also a competent astronomer (1750-1848), was alive when Vidyasagar penned his *Jeebuncharita* .

Carolus Linnaeus (1707-78) founder of biological taxonomy was (and still is) a legendary figure having proposed in his *Systema Naturae* (1735) the binary Linnean nomenclature for classification of animals and plants. Linnaeus knew and gave scientific names to 4200 species of animals and 7700 plants; ‘to-day the system has been gradually expanded to include 350,000 plants and more than a million animals’ (Roy 2000, pp. 82-90).

Vidyasagar was criticized by some reviewers including his mentor Anandakrishna Bose for mentioning the names of the foreigners only in his book. But Bose and others missed the point that all the nine greats mentioned by Vidyasagar were scientists also; which Indian could match them in the arena of modern science. To the botanists like William Carey, Roxburgh, our Akshayakumar etc. Carolus Linnaeus was a hero, a legend, a Newton in botany. We have discussed the contributions of William Jones; who could match his pioneering studies in the area of Orientalism, Man and Nature. We are proud that one Calcuttan has been included amongst the nine greats in the list prepared by another great Calcuttan. Vidyasagar adored not only William Jones but also another stalwart of the Asiatic society, the founder of the Sanskrit College, also a competent chemist, metallurgist and later a Professor in Sanskrit in England, Horace Hayman Wilson, whose portrait was displayed with respect in Vidyasagar's house. We are aware that some modern scholars have viewed the orientalists in the Asiatic Society as the stooges of the East India Company; they might have not forgiven Vidyasagar for labelling Siraj-ud-daula as *ati durācāra* and Lord Bentinck (who abolished the practice of *satīdāha* immolation of widows) as *cirasmaranīya*!

For his *Jīvancarita*, Vidyasagar coined, for the first time, the Bengali/ Indian equivalents of 74 technical terms, many of which survive even to-day:

āviskṛiyā (discovery), *udvidvidyā* (botany), *kusamskār* (prejudice), *kendra* (centre), *gaveṣaṇā* (research), *grahanihārikā* (planetary nebulae), *chhāyāpath* (milky way), *jyotirvidyā* (astronomy), *dūrabikṣan* (telescope), *dhātuvidyā* (mineralogy, metallurgy), *viṣubarekhā* (equator), *padārthavidyā* (natural philosophy, physics), *pariprekṣita* (perspective), *viśvavidyālaya* (university), *śatābdi* (century) etc.

Between Akshayakumar and Vidyasagar many of the extant scientific terms in Sanskritic languages such as Bengali were coined and used. In terms of literary lucidity and articulation, Akshayakumar was the pioneer later followed by Bankimchandra, Rabindranath Ramendrasundar etc.

Bodhodaya (1851) was compiled on the basis of information in several English books such as *Rudiments of Knowledge* by Chambers; this included various topics in physics, biology, geography etc. Under physics or material science, the compiler referred to dimensions, their measurements, non-metallic

and metallic substances, eight types of metals including zinc (now accepted as 'pride of India') and alloys such as bronze and brass, glass and diamond. Vidyasagar commented on the recently obtained knowledge:

> "It is a matter of great surprise (*atyanta āścaryer viṣaya*) that the precious stone diamond and black coal have the same elemental composition".

Only a decade earlier, the French chemist J.R. Breant had discovered (1821) that the Indian steel wootz was an alloy of iron and carbon, the same element which constitutes diamond and coal!

Under the animate objects, the compiler discussed varieties of animals, plants and their economic importances. Vidyasagar touched upon not only medicinal plants as in Āyurveda but also economic zoology, wax, honey, silk, lac, pearl etc. Agricultural and mining products such as coal and kerosene were discussed. Under geography came the topics of day and night, lunar month and solar year, rivers, oceans, ebbs and tides etc. The first edition of *Bodhodaya* did not contain any statement on God. Some brief positive comments in the second edition show that the author was not an atheist.

Vidyasagar edited many publications of the *Tattvadodhinī Sabhā* such as the first part second edition of *Paśvābali* on animals, Akshayakumar's scientific articles and the serials of '*Bāhyavastur Sahit* …' etc. He encouraged and assisted publications of many books on *Pāṭigaṇita* (arithmetic) and *Bījagaṇita* (algebra) composed by his colleague Prasannakumar Sarbadhikary, also by Bhubanmohan Chattopadhyaya (1879), Kaliprasanna Gangopadhyaya (1886) etc.

Comments in Reports and Recommendations

Between 1850 and 1858, Vidyasagar made several recommendations on educational matters in his official capacities:

(a) as Professor of *Sāhitya* in Sanskrit College (16.12.1850) a Report to F.J Mouat, Secretary to the Council of Education

(b) as Principal, Notes on the Sanskrit College (12.04.1852) to F.J Halliday submitted to the Council (30.06.1852)

(c) comments (07.09.1853) on the Report dated 29 .08. 1853 submitted by the Visitor Dr J.R. Ballantyne, Principal of Sanskrit College, Varanasi

(d) Notes on Vernacular Education dated 07.02.1854 sent to Hodgson Pratt, Under – Secretary to the Govt. of Bengal

(e) as the Assistant Inspector of Schools, South Bengal, a Report dated 08.10.1855 to W. Gordon Young, Director of Public Instruction

(f) a Report on the 'Model School' for 1856-57 ending January 1857

(g) in the introduction of Madhavācaryya's *Sarvadarśanasaṃgraha* edited by him and published by The Asiatic society dated 20.01.1858

Indra Mitra has carefully compiled the above documents from the official files and published them (Mitra Indra 2001, pp. 641-684); We selectively quote Vidyasagar's opinion on scientific matters which according to him, should be included in educational curricula :

Regarding *Jyotiṣa* or Mathematical Class

"Great changes are required in the branch of study. Complete treatises on Arithmetic, Algebra and Geometry should be compiled from the best English works. The higher branches of Mathematics should be translated and adapted as class books. A popular treatise on Astronomy, such as Herschel's, be compiled in Bengali, and be read in the mathematical class. These works may also be studied in English.

"After studying these, the students will be able to read *Līlāvatī* and *Vījaganita* of Bhāskarachārya with great facility. Both of these works are very meagre. They are in a great measure without any method, and do not contain all that is contained in similar English books.

"Besides the *Sāhitya* and *Alaṅkāra* students, the students of the *Smṛti* and *Nyāya* classes should attend the lectures of the Professor of Mathematics.

"For the First Grammar Class – Miscellaneous subjects (should be taught) such as Art of Printing, Loadstone, Navigation, Earthquake, Pyramids, ChineseWall, Honey Bee etc. Elements of Natural Philosophy for the *Alaṅkāra* class. Of the books recommended some are already published, some are in the press" (Mitra Indra 2001, pp. 645-646).

Regarding *Nyāya* / *Darśana*

"The *Nyāya* or Logic class should be called *Darśana* or Philosophy class. There are six prominent schools in Hindu Philosophy (Vidyasagar himself authored the text in 1858, vide 'g' above). The *Nyāya* ystem of Philosophy principally treats of Logic and Metaphysics and occasionally touches upon subjects of Chemistry, Optics, Mechanics etc.

> "True it is that the most part of the Hindu systems of Philosophy do not tally with the advanced ideas of modern times (we have discussed earlier that *Nyāya* Philosophy propounded : 'air has no weight' which modern science has contradicted !). The acquirements in English will enable the students to study the modern Philosophy of Europe (thus the centuries of xenophobia would be overcome – the present author).
>
> "One of the principal reasons why I have ventured to suggest the study of all the prevalent systems of Philosophy in India, is that the student will clearly see that the propounders of different systems have attacked each other (the *Vedānta* disagreeing with the *Nyāya* on atoms) and have pointed out each others' errors and fallacies. Thus he will be able to judge for himself. His knowledge of European Philosophy shall be to him an invaluable guide to understanding of the merits of the different systems".[7]
>
> "Under the present state of things, the study of Mill's work in the Sanskrit college is, I am of opinion, indispensable ….. For certain reasons, which it is needless to state here, we are obliged to continue the teaching of the *Vedānta* and *Sānkhya* in the Sanscrit college. That the Vedānta and *Sānkhya* are false systems of philosophy is no more a matter of dispute (very strong words indeed). These systems, false as they are, command unbound reverence from the Hindus. Whilst teaching these in the Sanskrit course, we should oppose them by sound philosophy in the English course to counteract their influence."[8]

As we have stated (a to g), Vidyasagar tried his best during 1850-57 to inject scientific principles in Indian vernacular education, to be wedded with modern European traditions. However, there were several impediments. His colleague Akshayakumar had become medically unfit. He himself became much too engrossed in social activism and philanthropic activities, in the widow-remarriage movement, a great and successful social science experiment, in female education and so on. Then in 1857 came the Sepoy Mutiny agitation, better called the First War of Indian Independence, and the foundation of three major universities in India: in Calcutta, Bombay and Madras. The British administration had enough excuses to set aside Vidyasagar's proposals, to defer the implementation of scientific education in India .

The science movement in Calcutta /India could be restarted only a decade later with the arrival of new leadership : Indian Association for the Cultivation of Science (IACS) was conceived in 1869 by Dr Mahendralal Sircar and his colleague Reverend Father Eugene Lafont. Like Akshayakumar,

Vidyasagar also made handsome financial contributions to the cause of the IACS. Vidyasagar also inspired Mahendralal in the science of homeopathy and advised him regarding arsenic-related and other medicine formulations and clinical trials.[9]

The Renaissance scholars have not missed the greatness of Vidyasagar's character, what constituted his greatness. In the words of the famous poet Michael Madhusudan Datta, he was 'not only *Vidyāsāgara* but *Karunāsāgara* also', not only an ocean of knowledge but also an ocean of compassion. This compassion was directed universally to all down-trodden people, to the destitute, to the lower caste people, to the suffering millions of women in India. His compassion was not effeminate but manly, based upon robust and resolute character and the Vedantic principle of *sāmya*, the glorious science of socialism and spirituality[10]. Yet, many scholars have missed the scientist in Vidyasagar, just as they have ignored the scientist-philosopher Akshayakumar, the *sabyasācī* Rajendralala Mitra, and strangely took little notice of the architects of the science movements in India such as James Prinsep, Mahendralal Sircar and Eugene Lafont . Perhaps they have forgotten to consider that Calcuttan science itself has been an integral part of Bengal Renaissance and Indian Awakening!

RAJENDRALALA

The inadequacy and the incompleteness of the analyses rendered by the renaissance scholars should be brought to the fore. Most of them have preferred to deal with humanism, literature and religion in preference to science. Regarding religion, they have harped on Hindu revivalism and remained silent on Muslim revivalism and dogma; in this regard Kaji Abdul Wadud is of course a glorious exception (Wadud 1956, pp. 62-70, 73, 85). Both Wadud and Sarkar (1985 pp. 34-36) have ignored the science movements in the Bengal Renaissance, the architects such as Rajendralala Mitra, Mahendralal Sircar, Eugene Lafont. Sircar and Lafont are receiving some attention recently after the present author unearthed and focussed on many valuable source materials. Rajendralal had been hailed much earlier by the poet Rabindranath Tagore (only) as a *sabyasācī*, many–sided personality, 'an institution by himself'; we would pay our reverential estimates of him in this section, based upon some earlier literatures (Mitra 1969, Dutta 1991, Ghosh 1994).

There is a controversy about Rajendralal's date of birth: 16 February 1822 or 15 February 1824. Vrindavanchandra his grandfather was a close friend of Rammohun and a close associate of *Ātmiya Sabhā*. His father, 1796 born Janmejay was the first Bengali to read Western post-Lavoisier chemistry under the guidance of Schoulbraid. Rajendralal himself learnt chemistry in the Medical college under Dr W. B O'Shaughnessy[11] who later became famous establishing the telegraphy network in India. Rajendralal studied in the Medical college for several years but could not complete his education there on account of an incident of student unrest . In 1846 we find him taking up a job in the Asiatic Society, and following in the footsteps of Kishorychand Mitra and Ramkamal Sen, learning in the intricacies of Indological and antiquarian studies. During 1848 –50, he assisted Akshayakumar and others in the *Tattvabodhinī Sabhā* and *Patrikā*. Eventually he took independent charge of two pictorial scientific journals : *Vividārtha Saṃgraha* (1851-59) and *Rahasya Sandarbha* (1863-68) instituted by Vernacular Literature Committee of the *School Book Society*. Some of the popular scientific articles that he wrote are titled:

In Vividārtha Saṃgraha (V.S.), Classification of Animals; Walrus; Zebr; Byson; Cat group of animals, articles on Geology and Chemistry; Gold Mines in India (Kartick, 1854); Mercury, Iron, Preparation of Saltpetre (1854); Coal (1858), articles on Botany; Consciousness in Plants (1854) On Comet (1857), articles on Technology; tunnel beneath the River Thames, Light House, Irrigation, Electric Telegraph and Railways

The article on Electric Telegraph was published in the *Bhādra* issue of 1854 (1776 Śakābda) only a few years after the technology was inaugurated between Diamond Harbour (Shibchunder Nandy) and Calcutta (O'Shaughnessy himself). The chief architect was Rajendralal's mentor not only in the Medical College but also in the Asiatic Society (successor of James Prinsep). The article on electric telegraph suggested a method of sending Bengali messages by adapting the single needle recording instrument then in use for communication in English.

The articles under miscellaneous topics included Dacca Muslin; Library (a rural library movement was launched); Old Pali Script; Natural Classification of Human Beings; Volcano; Origin of the Ganges; The Cave of Ellora; Indian Census of Population; The Egyptian Pyramid; On the City of Śrikshetra (Puri); On the Tartars; Japan and the Japanese etc.

In *Rahasya Sandarbha* (*R.S.*)

On Greenland; The Customs of the Persian Women; Linguistics; The Brain; Diamond, Attar and the Roses; The Chinese Silk; Geology; The Degraded State of the Hindu Women.

Articles related to physics; On Echo; Electricity; Energy: Gravitational, Chemical, Electrical, Magnetic (a series of articles)

Articles related to Chemistry and Metallurgy; On Sulphur; Platinum: Extraction and Properties etc.

Amitabha Ghosh made a special note[11] about young Satyendranath Tagore's article, sub-titled in English as 'Baconian system of Philosophy' published in *Vividārtha Saṃgraha* Volume 4, 47th issue during 1854-55: Whereas Bacon stood for science as power through experimental investigation, the idea of science as pure thought had been propounded by Socrates, Aristotle and Plato. Satyendranath did not attempt a direct comparison between Plato's teachings and the Vedantic *māyāvāda* (which was a hot topic of contention in the *Tattvabodhini Sabhā* at that time!), but this point came out later in *R.S.* Volume 5, 53rd issue :

> "Plato propagated the doctrines of Socrates and those doctrines were analogous with the Vedantic ones in our country. That is to say, Plato was the Sankaracharya of Greece".

Rajendralal published many articles in several volumes of *Vividārtha Saṃgraha* (*V.S.*) and *Rahasya Sandarbha* (*R.S.*) ridiculing social prejudices and belief in the occult:

Somnabulism or Dream walking : On Spirit Rapping or Dealing in Ghosts (*V.S.* 4) On Superstitions and Traditions; The Haunted House (*R.S.* 1); The Séance (*R.S.* 2); Necromancy or Communication with the Dead for Forecasting (*R.S.* 4); The Divining Rod for Prediction of Underground Resources (*R.S.* 5) etc. In the article on *Superstitions and Traditions* (*R.S.* 1.) the author wrote:

> "Born out of the wedlock of Dread, the groom, and Ignorance, the bride, Superstition had her birth shortly after the world was created. Wed to local customs, she in turn gave birth to Myth, her son".

In like manner there were several articles in these two magazines which criticized *kaulinya prathā* and polygamy, child marriage, *gangā*

jātrā, *antarjali*, abandonment of the dying patient on the Ganges etc. Ghosh points out that Rajendralal was no fire–brand social reformer; as a matter of fact he could not altogether abandon his Hindu conservatism on certain issues. Did the Muslims of his era succeed?

On Geography and Technical Sciences

Bireswar Banerjee has written an excellent article on Rajendralal's contribution to geography and technical sciences (Banerjee 1978, pp. 24-33). The excellence of Rajendralal's genius pervaded through the various fields of arts, science, history, geography, archaeology, other fields of technical sciences, sociology, religion etc. He was the first to feel the importance of geography in the study of history, and vice versa. The methodological problems of geography and history are very close, 'the former dealing with chorology and the latter in chronology'. Rajendralal's concern was four-fold (a) to write systematic text –books (b) prepare atlas maps in various regional languages (c) standardise geographical place names and scientific terminologies and (d) infuse historical elements in geographical research and vice versa.

Rajendralal made a three–fold classification of geography, viz. (i) regional / applied / cultural geography (ii) mathematical or quantative geography dealing with latitude, longitude, all measurable parameters, drawing of maps etc; and (iii) physical geography discussing all physical aspects of the earth.

Prākṛta Bhūgol by Rajendralal was the first book in Bengali on physical geography. Published in 1854, running into nine editions by 1886, different chapters of this book had been originally published in different volumes of *Vividārtha Saṃgraha* . He was the first to prepare a Bengali map in 1850 and to make the first globe with Bengali characters in 1857 . Rajendralal launched a gigantic project in cartography.

At the request of the Governor of North-west Frontier Provinces, he prepared an 'Atlas of NWFP' in Hindi and Persian scripts during 1853-55. During the same period he also prepared maps of India and Asia in Hindi, Oriya, Bengali and Persian languages. His *Atlas of Bengal Presidency* was published in 1871; it contained a series of 21 maps of various districts of Bengal based upon Revenue Survey maps and various Government records. He was the pioneer in the subject of thematic mapping in India.

Rajendralal's contribution towards popularisation of science and technology was immense. We have already mentioned about his articles on zoology, botany, geology, chemistry and metallurgy in *R.S*. Eighteen articles written by him on manufacturing or processing common articles of industrial nature, scattered over different journals, ranging from candle, camphor to coal tar aromatics, essences, were collected and published as a book titled *Śilpik Darśan* in 1860. There were articles in this book on the manufactures of salt, sugar, soap, paper, saltpetre and also on the techniques of weaving handloom fabrics, dyeing textile materials, cleaning and tanning leather. On the last item he wrote :

> "Nowadays all the Hindus look down on leather as an unholy substance, but in *Ṛg Veda* there are references to skins of cattles, water bags made of leather, wines being stored in leather containers"
>
> (*R.S.* Volume 6, issue 66).

To buttress the point even further, he wrote another article 'Beef in ancient India' (*Indian Antiquary,* Vol:1, 1872, p.424); he was prompted by the senseless bloody riots centred around the question of cow- slaughter.

Technique to Technical Education

One of the attractive features of the journal *Vividārtha Saṃgraha* (1851-59) was the striking visual arts, the illustrations. Photography had been discovered in 1839, and its commercial use took firm root during the Great Exhibition of Arts and Industry held in London during 1851. Almost simultaneously, Rajendralal 'took photography beyond the studio'(Karlekar 2007) by using lithography (first employed by Herbert Ingram in 1842) for illustrating his journal.

In April 1854 Rajendralal founded in collaboration with Colonel H. Goodwyn, a British military engineer, who drafted the first prospectus for Bengal Engineering College the same year, *The Society for the Promotion of Industrial Arts* and then *The School of Industrial Arts (SIA)*. On 11 October 1855, the SIA sought Governmental aid 'to arrange instructions on the arts of engraving, modelling, printing, architectural design, ornamental pottery and porcelain manufacture etc., so as to open new branches of employment for middle and educated classes'. The School was established initially to provide instruction in drawing, wood-engraving, modelling and later in

photography and lithography. In due course the school was re-named as the Government College of Art and Craft associated with E.B. Havell, Abanidranath Tagore and Annadaprasad Bagchi, the last-named accompanying and assisting Rajendralal in his antiquarian studies at Orissa and Gaya.

When the Photographic Society of Bengal (PSB) was established in 1856, Rajendralal was a founding member and the treasurer amongst the predominantly European membership. Ever since his student days he was associated with political activism and struggle in favour of the demand that the errant Europeans should be tried even by Indian Judges. This infuriated the Europeans who were against the proposed 'Black Act'. Now in 1857, the agitation against the indigo planters was brewing. On the 6th April 1857 Rajendralal delivered a lecture at the Town Hall naming the indigo planters as 'adventurers, interlopers, Anglo-Saxon Planters determined to live above the law'. In an act of reprisal, the while majority of the PSB threw him out of the Society on false charges from which he was later exonerated.

A Colossus in the Asiatic Society

Rajendralal joined the Asiatic Society dominated by European membership in 1846 as the Assistant Secretary and Librarian, and as his career progressed for nearly half a century, 'he strode over the Society like a colossus'. The congenial environment of the Society 'helped his genius to sprout forth'. The fruits of his intellectual labour started pouring out 'not in trickles, but in torrents'. Within a span of little over forty years he published:

A. Ten bibliographical works, the first in 1849, one on nine volumes (1870-88), the 10th *Sanskrit-Buddhist Literature of Nepal* (in collaboration with the famous Brian Houghton Hodgson) in 1882.

B. Fourteen old texts, *Kāmanḍakīya Nitisāra* in 1849, *Lalita Vistāra* in 1877, the fourteenth a posthumous work (1892) *Bṛhaddevatā* of Śaunka.

C. Six English works including Antiquities of Orissa, Vol. I 1875, Vol. II 1880 and Buddha Gaya, *the Hermitage of Śākyamuni* 1878 and also his Speeches (posthumous, 1892)

D. Eight Bengali works including *Prākṛta Bhūgol*, 1854 and *Śilpik Darśan*, 1860

E. Three Atlases (1850-58)

F. 117 articles published in the Journal and Proceedings of the Asiatic Society.

Sisir Kumar Mitra has provided a complete list of the above-mentioned (A-F) Publications (Mitra 1969).

Rajendralal also performed editorial works for *Tattvabodhinī Patrikā* (1848-50), *Vividārtha Saṃgraha* (1851-60), *Rahasya Sandarbha* (1862-67) and *Hindoo Patriot* (1884-91). In 1877 he published a pamphlet entitled *A Scheme for the Rendering of European Scientific Terms into Vernaculars of India* and worked on the same project for *Sāraswat Samāj* during the 1880's assisting Jyotirindranath and Rabindranath Tagore.

His antiquarian studies led Rajendralal towards archaeology, which was yet to emerge as a scientific discipline. His work was 'not that of a dillettante glossing over an antiquity in a nostalgic and chauvinistic spirit or rejecting it altogether (Sarswati 1969 pp. 34-47). He equipped himself in such branches of learning as epigraphy, palaeography, numismatics, art history, iconography Rajendralal was a firm advocate of the view of an indigenous evolution of Indian architecture against James Fergusson's of Greek origin (Fergusson 1974). He provided his convincing rebuttal: "Fergusson seems to overlook, if not ignore or repudiate historical evidence, and to confine himself exclusively to the interpretation of lithic remains".

In a book published in 1868, Friedrich Max Müller wrote of Rajendralal:

> "He is a scholar and critic in our sense of the word… thoroughly imbued with those principles of criticism which men like Colebrooke, Lassen and Burnouf have followed in their researches into the literary treasures of his country… Our scholars in Europe will have to pull hard, if, with such men as Babu Rajendralal in the field, they are not to be distanced in the race of scholarship. He has proved himself completely above the prejudices of his class".

Rajendralal could be thorough because he was never alone in his research in the Asiatic Society. For example during his time, the *Bibliotheca Series* took up 266 Sanskrit fasciculi of which 85 were edited by five internationally reputed foreign scholars and the rest 181 by five Indian scholars including himself; he edited 83, and 19 were edited by Vidyasagar's teacher Jayanarayana Tarkapanchanan.

As regards his objectivity, his own statement made in a meeting (dated 02 July 1870) in the Town Hall of Calcutta should suffice: "If patriotism means an insensate love of everything that is ours, good or bad, away with such patriotism. The less we have of it the better". S.K. Saraswati wrote:

> "He was the first Indian to challenge the sanctity of tradition, break away from its entangling meshes and establish the need for scientific objectivity in Indian historical thinking"
>
> (Sarswati 1969, pp. 34-47).

With his impeccable scientific objectivity, why did Rajendralal not attempt to collate a comprehensive history of India? Sisirkumar Mitra has raised this question[12] and answered it himself, Because he was objective: much more data had to be collected. William Jones's project of 'Discovery of India' was only a century old and the historical cobwebs of several millennia were yet to be cleared!

Was Rajendralal a nationalist? It is difficult to answer this question without defining what did he mean by 'nation' which was still 'in making'. Like Rammohun he believed that some good would come out of the British rule. Yet he was sufficiently critical of the establishment, of the preferential treatment meted out to the white residents, the indigo planters.

The British Indian Association was founded by Rajendralal and others on 29 October 1851 to protect the rights of the upper class Indians. Two decades later Rajendralal reviewed the services rendered by the Association:

> "For 21 years they have acted in Bengal which the 'Opposition' does in the House of Parliament in England, criticizing almost every (wrong) measure of Government and watching the interest of their nation with more than partisan zeal".

That was in 1872. The class of Rajendralal had not supported the Sepoy Mutiny but launched the pro-people Indigo Movement resisting the planters and supported the liberal 'Black Act' also known as Ilbert Bill.

When Surendranath Banerjee formed the *Indian Association* in 1876 and then the *Indian National Congress* in 1885, Rajendralal and many others moved from the concept of a 'Hindu Nation' to an 'Indian Nation', to the view that the Hindus and Muslims formed one Nation. A common slogan raised at that time was: "The Hindus and Muslims have coalesced into an

Indian people". The cited statement was made by the national leader Lajpat Rai (Majumdar 1978, pp. 1-23). Why is it that the process of 'national coalescence' took nearly one millennium to start? The Renaissance scholars have attributed this and many other ills exclusively to Hindu Revivalism!

Rajendralal defended the Indian languages as well as the use of English. Amitabha Ghosh wrote that on this point Rajendralal 'could be accused of preaching double standards'.[13] Rajendralal had written and Ghosh quoted him: "I have the profoundest conviction that if the European Science are to be thoroughly studied, it should be through the medium of English, and for centuries to come, no vernacular substitute will supply its place"[14]. Then Ghosh commented that this statement 'has turned out to be prophetic but was still paradoxical'.

'Prophetic'–yes; 'paradoxical, double standard'–categorical no. Ghosh failed to understand that Rajendralal was prophetic in recommending multilingualism in a multilingual country which has adopted the famous 'three languages (English being one of them) formula' after our independence.

On 27 February 1868 Rajendralal delivered a speech in favour of English education throughout India and dissuaded a brother Association at Aligarh to pursue the idea of a Vernacular University: "I call on our friends of Allyghar to pause and consider before they renounce the study of English and thereby compromise the best interests of their community".

The mother tongues, the Indian link language (such as Hindi) and the international link language, the best with regard to the frontier sciences (English at present since the 19th century) have their well-demarcated domains of utility which need not be violated. In 1876 the Indian Association for the Cultivation of Science (IACS) was founded by Dr. Mahendralal Sircar, Reverend Father Eugene Lafont and all the proponents of nationalist indigenous science in the sub-continent. Rajendralal came forward in support of this movement, and delivered an impassioned speech in favour of the basic sciences and their cultivation (as distinguished from the technical arts which he had experimented with two decades earlier). We would discuss the IACS Movement in detail later. English was chosen as the official medium for the IACS which also arranged popular lectures on science delivered in vernacular languages.

Nine years later, the Indian National Congress (INC) was founded in 1885 and again Rajendralal welcomed the leadership of Surendranath Banerjee, the author of *A Nation in Making.* Rajendralal evolved his concept of a 'Hindu Nation' to an 'Indian Nation' in which the Hindus, Muslims and the rest could happily 'coalesce'. Emulating the poet Rabindranath Tagore we salute the *Sabyasāci*, the multi-dimensional Renaissance personality who was 'an institution by himself'.

Apart from the triumvirate in the Akshaykumar era, there were other personalities who contributed to the science popularisation and consciousness in the country.

Krishnamohan Bandyopadhyay (1813-85) was a direct student of Derozio and himself an erudite scholar. His forte were geometry and geography. A 13-volume encyclopaedic work *Vidyākalpaḍruma* was conceived in February 1846 and completed during 1846-51. The object was 'to present the history and science of Europe in an attractive fashion to the Bengali Hindu mind'. Bapudeva, the Principal of the Sanskrit college at Varanasi assisted him to choose the Sanskrit equivalents of the technical terms in algebra, geometry, conics etc.

The section on Natural Geography was written on the basis of Murray's *Encyclopedia of Geography* and Malte Brun's *Geography*. Bandyopadhyay published scientific articles in his journal *Samvād Sudhānśu*. He was one of the founders of the *Society for the Acquisition of General Knowledge* and in 1875 became the President of the *Indian League* espousing the cause of technical education in the country.

Bhudev Mukhopadhyay (1827-94) was the Head Master in Hooghly Normal School till 1856 teaching the students various scientific subjects such as zoology, optics, algebra, geometry, trigonometry etc. A voracious reader in scientific subjects, he converted his class-notes in two-volume *Prākṛtik Vijnān* published 1859-66. His *Kṣetratattva* covering Euclid's Geometry was published by the School Book Society in 1862. *Prākṛtik Vijnān* included discussions on steam boat, mechanics and physics with mathematical treatments.

The famous literateur of *Ānandamath Vande Mātaram* fame, Bankimchandra Chattopadhyay (1838-94) wrote superb scientific articles in

his journal *Baṅgadarśan* during 1872-76, some of which were compiled in his book *Vijnān Rahasya*. The English equivalents of the titles of his Bengali articles are provided below:

Great Solar Eruption; Multitudes of Stars; Dust; Aerostation; The Universe in Motion; Antiquity of Man; Protoplasm; Curiosities of Quantity and Measure; The Moon.

All these articles displayed superb language and scientific content. In the article entitled *Jaivanic* (Protoplasm), Bankimchandra explained that the Aristotelian / Puranic concept of five *bhūtas* had been replaced by the modern discovery of 'chemical elements' which constitute the protoplasm.

Bankimchandra had written many other articles and published them in *Baṅgadarśan*, e.g. on Heredity, Darwin and Spencer; Solar System; Comets; Water; Fractions- Definite and Indeterminate; Craters under the Sea etc. A special and very important article on Mahendralal Sircar's IACS *Bhāratvarṣīya Vijnān Sabhā* was printed in the Bhādra 1279 B.S. (August-September 1872) issue of *Baṅgadarśan* which we would partially translate and quote later.

> Bankimchandra's *Sāmya* 'Egalitarianism' was based on the thoughts of Voltaire, Rousseau and John Stuart Mill and published in 1879. This was not reprinted since he claimed that his views had changed. In his early career he was influenced by the Utilitarianism *Hitavāda* of Jeremy Bentham (1748-1832) the proponent of the principle of 'greatest good of the greatest number'. Gradually he moved on to 'Positive Philosophy' or *Dhṛuvavāda* of Auguste Comte (1798-1857) who conceived the entire Human Society as the 'Goddess of Humanity'. The goal should be the prosperity of all, and not merely of 'the greatest number'. Finally, the novelist reached the grandest ideal of *Bhakti* or devotion to God as enuciated in the *Bhāgavad Gitā* and *Śrimad Bhāgavat*. He quoted Comte's statement from Catechism of Positive Religion: "The General Law of Man's Progress, whatever the point of view chosen, consists in this that Man becomes more and more religious". He himself propounded in his Bengali essay *Cittaśuddhi* (Fālgun, 1292 B.S., Feb- March 1886) that spiritual 'purification of the mind' and consciousness 'is the essence of Hinduism, of all religions, of even Positivism, the atheist variety of Comte's proposition (*niriśvar Comte dharmer-o sār*).

Many Indian followers of Comte felt that the syncretist novelist had betrayed Positivism, and some religious fanatics might have felt that he was

not sufficiently committed to spirituality![15] Bankim went on to explain that total knowledge has three objects to investigate: (a) material universe or *bhūta* (b) the self *āmi* and (c) God or *Iśvara.* The first one is to be studied through 'Comte's first four tools viz, Mathematics, Astronomy, Physics and Chemistry aided by the Western teachers'; the second one 'needed Comte's last two, namely Biology and Sociology, again to be learnt through the Western teachers'; the third kind of knowledge could be reached 'through the religious scriptures of Hinduism specially the *Gitā*' (*Dharmatattva*, 15th Section entitled *Bhakti*. Reference No. 15, pages xiv and 630).

Some Renaissance scholars have labelled Bankimchandra as a Hindu revivalist, but we are satisfied with the syncretistic evolution in his philosophical thoughts and his firm commitment to the cause of Science and scientific consciousness in India.

Reverting back to the other scientific writings in Bengali during this period we may refer to some articles in *Āryadarśan* the journal first published in 1874. Noteworthy were the articles on lightning, electricity, optical instruments in astronomy, philosophical views of Huxley and Darwin, on the utility of Chemical Science (Kanailal Dey, an architect of the IACS, wrote this serial starting in Jaistha 1875), on 'Science and God' (Kārtika 1878) etc.

Devendranath Tagore (1817-1905) was doubtlessly more interested in spirituality but his interest in scientific subjects particularly astronomy was genuine. He gave free hand to the editors publishing scientific articles as long as God's greatness remained unquestioned. Even after the departure of Akshyakumar, *Tattvabodhinī Patrikā* continued to publish many brilliant scientific articles. Devendranath's sons and daughters wrote on different scientific subjects. His eldest son Dwinjendranath had strong interest in mathematics, and he started a new journal titled *Bhārati* in Śrāvaṇa 1877.

Kalibar Vedantabagis wrote in *Bhāratī* on the History of Mathematics and Astronomy (Āśvina, 1878), on the Time Measuring Techniques in the Ancient India (Kārtika 1877, Agrahayana 1878). Swarnakumari Devi wrote on Comets (1882), on whether life may exist on other planets (1884-85), on the fourth state of matter (1884). We find in *Bhāratī* other interesting articles such as on Evolution of the Animal World; Charles Darwin and the 19th Century; The Gangetic Delta and the Geology of Calcutta (Caitra, 1880) etc.

Much of the information provided in earlier have been collated from the excellent Bengali text of Buddhadev Bhattacharyya (1980, pp. 95-129), and we are very much indebted to him. Excellence in the scientific writings in Bengali continued through the pens of Rabindranath Tagore, the first few professional scientists such Jagadischandra Bose, Ramendrasundar Trivedi etc., but these are outside the scope of our work ending with the Akshayakumar era. With the establishment of the IACS in 1876, the Science Movement acquired for the first time an all India national character; English was not the national language but at that point of time, it was definitely the best link language in India, better than Hindi or Urdu.

Before we embark upon the IACS Movement, we may touch upon some developments outside Calcutta related to the science movement during the Akshayakumar era, particularly up to 1857, the year of India's so-called First War of Independence.

Calcuttan Science could not be, and was not, unrelated to what was happening in the rest of the sub-continent. We would enter into sector-wise reviews based upon some valuable data and information compiled by Samarendra Nath Sen (1988) Rajesh K. Kochhar (1999), a special issue of *IJHS*[16], Satpal Sangwan (1998, 1991), Dhruv Raina and S. Irfan Habib (1989, 2004) etc. Interpretations and views are strictly ours.

Calcutta was chosen as the political capital of the newly established colonial establishment, but that did not ensure that the city would necessarily evolve as a cultural capital and usher in Bengal or Indian Renaissance. Such a phenomenon did not blossom in Delhi after it was chosen as the new capital in 1911. London could never compete with Oxford and Cambridge regarding prestige on science traditions.

Amongst the European scientists who worked in the sub-continent during the 18th and 19th centuries, as many as 34 persons were honoured by their election to the Fellowship of the prestigious Royal Society of London[17]. Much of their work served the causes of international science and long-term interest of the Indian people (as distinguished from the colonial interests of the East India Company which were also attended to); these torch-bearers and many selfless science-educators worked all over India, not exclusively in Calcutta.

The common issue all over India was the question of language(s) of communication or educational instruction. Should it be English or a classical language such as Sanskrit, Arabic or Persian (the favourite choice of the Orientalists and the dogmatic revivalists in India) or the vernacular language(s), if so, which one amongst the so many. Paradoxically, but quite understandably, the early European educators' choice was an Indian language and the Indians' choice was English, the language of the new ruler who would give them jobs!

The common problem all over India had been to obtain sufficient number of competent teachers, competent in the medium of instruction as well as mathematics and science subjects. In his 1837 Minutes, Macaulay confessed that the Administration 'was forced to put up with the leavings of every other trade and profession, could hardly venture to reject any man who can read, write and work a sum'. Four decades earlier the situation was far worse and only an astute astrologer could venture to foretell whether the Indian Renaissance would start in Madras, Bombay, Delhi or Calcutta. We start with Madras and in that order!

(a) In Madras nothing much appears to have been done for the promotion of English education before Bentinck's resolution of 1835. Negapatam in Madras state had two missionary colleges, namely the Christian College founded in 1837 and St.Joseph's College functioning from 1844. The nucleus of the Madras University was in the Collegiate Department started in 1853 where courses in plane and spherical trigonometry, astronomy, algebra etc were introduced.

Late introduction of English education did not inhibit research on Tamilian science. In 1794 Michael Topping had started a Surveying School at Guindy where several Indians were trained. One Mohsin Hussain of Arcot specialized in mechanical repairs and was later appointed by Everest as the mathematical instrument maker at Calcutta. John Warren (1769-1830) took up in 1811 'a monumental project on South Indian system of time-keeping'. Kochhar records the instance of Chintamani Ragoontha Charry (1828-80) who was trained in the Madras Observatory and discovered in 1867 a variable star R. Reticuli. This was the 'first recorded discovery by an Indian' which earned him the fellowship of the Royal Astronomical Society. Charry went on to compile a work in Tamil entitled *Jyotiṣa Cintāmani*, deliver public

lectures on astronomy and bring out a book on the 1874 transit of Venus, monitored by Father Lafont of Calcutta. Kochhar also mentioned in this connection (Kochhar 1999, pp. 334-335), the example of Samanta Chandrasekhar (1835 -1904) of Orissa who studied pre-telescopic Astronomy, compiled a Sanskrit book *Siddhānta Darpaṇa* (1865) and was honoured by the Viceroy in 1893.

(b) The development of educational infra-structure in the Bombay Presidency followed a pattern very similar to that in Calcutta. The Pune Sanskrit College was established in 1821 by utilizing a part of the fund of Peshwas and later expanded in 1837 for including 'the useful parts of Hindu learning' as well as 'such branches of European knowledge as they may be able and willing to receive'.

Mountstuart Elphinstone (b. 1779) came to Calcutta in 1796 and after acquaintance with the Orientalists such as Samul Davis and H.T. Colebrooke and subsequent participation in Second Maratha War became the Governor of Bombay during 1819-27. He was a great champion of education and stressed upon vernacular education apart from English in the schools and colleges. Missionaries played a strong role in this area. Elphinstone (Native Education) Institution established in August 1820 was 'modelled upon the recently established Hindu College of Calcutta'. Between 1835 and 1856 many institutions were opened in the Presidency, both in English as well as Marathi. Out of 19 most were English, only two in Marathi and one in Hindustani. At the end of 1855 -56, 65 p.c. of the 1312 students were Hindu, 6 p.c. Muslim and the rest mostly Parsis constituted 29 p.c.

There was a craze for English education from the very beginning despite Elphinstone championing the cause of Marathi. Trevelyan's 1833 Minute shows that the medical institution using Marathi language as the medium and opened by Elphinstone had to be closed 'after barely six years', when 'not a single person could graduate with qualifications to practice medicine.'[18]

In 1822-23, the first ever manufactured steamboat in India came out of Messrs Kyd & Co. of the Kidderpore dockyard in Calcutta, and very soon the Parsee shipbuilders assisted the Bombay Dockyard to produce its first steam vessel in 1829. In 1838 Jamsetji Bomanji sent his son and nephew to

England for the purpose of receiving instruction in naval architecture.[19] In Calcutta Dwarkanath Tagore, an entrepreneur in coal mining and other industries could play a similar pioneering role. However his descendants preferred the spirituality part of their mentor Raja Rammohun Roy.

Ardaseer Cursetjee (1808-77), a young member of the Parsi family of Wadia shipbuilders was recruited and trained by East India Company in the subject of steam machinery and naval architecture. He received further training in England during 1839-40 and in 1841 became not only the Chief Engineer in the Company, supervising the steam factory and foundry at Bombay, but also honoured as an elected Fellow of the Royal Society. He retired in 1857 and died 1877 in England where he had settled. His was a strictly private honour. Kochhar writes that his honour 'did not make any impact on his countrymen'[20]. Cursetjee was requisitioned by Elphinstone Institution to teach practical sciences.

S.N. Sen has provided (Sen 1988, pp. 176-178) a beautiful description of science teaching at the Elphinstone Institution during 1854 -55. R.S. Sinclair used to teach geography, commercial geography and philosophy of science propounded by Bacon, Descartes, Mill, Whewell, Herschell and others. The students were conducted to visit the collections of the Royal Asiatic Society in the city. Herberwt Giraud was the Professor of Chemistry, Botany and Geology.

The famous patriot Dadabhai Naoroji was there as the Professor of Mathematics and Natural Philosophy covering mechanics, hydrostatics, hydraulics, astronomy and surveying as well. In surveying the students learnt the use of theodolite and other equipment. Spherical trigonometry was taught in connection with astronomy. 'Sometimes classes were held in the open air after dark to enable the students to acquire a knowledge of the stellar vault and of the manner in which the positions of heavenly bodies were determined'.

Naoroji also taught the subject of steam engine. The students had difficulty in understanding Reynold's diagrams. 'Better results followed from educational visits to the Dockyard Factory and the Boree Bunder Railway Station where the students had the opportunity of seeing steam engines in connection with steamers and locomotives' (Sen 1988, pp.176-178). Around that time a young Parsee Jamsetji Nusserwanji Tata (b. 1839) was dreaming how to enrich the motherland through applied science and technology.

(c) An oriental college of some importance had been functioning in Delhi as early as 1792. J.H. Tayler opened a new college in 1825 with emphasis on modern teaching through Persian and Arabic. In 1828 English classes were introduced. Nothing worked and the student population dwindled. The situation in other parts of North Western Provinces, Oudh, Agra was the same. The students felt that the knowledge of Arabic and Persian was no longer useful in getting jobs. A knowledge of English was not useful as in Calcutta, Bombay or Madras. A contemporary remark may be quoted:

> "There are here very few residents. There is no wealthy body of merchants transacting their business in the English language and according to the English method. There is no supreme court here where justice is administered in English; no English bar or attorneys, no European sea-borne commerce. There is much less encouragement here for the study of English than in the case of the Lower Provinces and in the Presidencies of Madras and Bombay"[21]

Gradually the popularity of the English College went up in the North Western Provinces but not as fast as in Calcutta or Bombay. Yet, as Kochhar has aptly remarked: "The very first case of Indian response came not from intellectually active Calcutta but from still Mughal Delhi" (Kochhar1999, pp. 317-346). The Government decided in 1843 to introduce education through the medium of the vernacular language Urdu, and almost immediately reaped the benefit in securing the services of a genius Yesudas Ramchandra (1821-80) who taught European Science particularly Mathematics in the Delhi College (now Zakir Hussain College) through Urdu. Dhruv Raina and S. Irfan Habib have written extensively on the life and works of Ramachandra (Raina & Habib 1989, 2004).

At the same time the Government was contemplating to start a few Engineering Colleges in the sub-continent so as to promote their 'colonial interests' to have roads, buildings, bridges, irrigation canals, railways, other recent technologies such as telegraphy. They could not achieve their targets without aiding the subject people and embarrassing the future paradigm-makers who would not give the devil even his due! Opening a network of irrigation canals from the Ganges and Yamuna was a priority matter, and James Thomason of the North –Western Provinces suggested in 1845 that an Engineering College at Roorkee would aid in engineering constructions, employment of the advanced students in the Delhi and Agra Colleges

(eventually many students like Nilmoni Mitra came from Calcutta) and bolder scientific training in the country. His proposal was readily accepted and the institution started in 1848.

In the meantime Yesudas Ramchandra was steadily moving towards national fame. At first he joined his College Principal Mr. Boutros in the project of translating European scientific works into Urdu. *The Vernacular Translation Society* was set up in 1843 and under its aegis an Urdu newspaper *Favā'id'n-Nāẓrīn* and then a weekly *Qirānu's-Sa'dain* (1846) were started. Ramchandra eventually wrote many scientific articles in Urdu during 1848-52: 32 in the first and 4 in the second periodical. He also wrote 15 books in Urdu during 1844-80, two of them critical of Islam and its Prophet. His best and more well-read books are however in English!

Ramchandra wrote his famous book on mathematics *A Treatise on the Problems of Maxima and Minima* in 1850. The work was original in that it sought to obtain the maxima and minima of a function from algebra and without using differential calculus. The method developed by Ramchandra could be used for functions involving quadratics or higher order expressions, as well as for expressions involving two or more variables.

The Calcutta Review (Volume 14, No.27, July- December 1850, p.38) made some critical remarks and yet acknowledged the genius of the author: "The mind which gave birth to this mathematical idea is actually capable of producing something much better". The more damaging criticism came from his NWP friends, the protagonists of Urdu: how could he show his temerity in publishing a book in English!

Undeterred by such criticism, E. Drinkwater Bethune, Member of the Supreme Council and Chairman of the Education Commission, Calcutta forwarded the book to Augustus De Morgan, an outstanding mathematician in the Trinity College, London, who praised the book and had it re-published in 1859 by the London publisher W.M.H. Allen. All discerning critics admitted that Ramchandra's work epitomized the ancient Hindu genius in solving the mathematical problems algebraically, as opposed to the ancient Greek preference for geometrical methods. Ramchandra published another book (again in English, and this one from Calcutta) *A Specimen of a New Method of Differential Calculus called the Method of Constant Ratios* (publisher: Chakravarty and Chatterji, published 1863).

A bit of Ramchandra's personal life is significant. In 1852 he and his friend Chiman Lal were converted to Christianity in Delhi; as a consequence Chiman Lal was murdered during the 1857 revolt and Ramchandra narrowly escaped, eventually accepting a teaching position in the Thomason Civil Engineering College, Roorkee.

Ramchandra was closely associated with the Delhi Society founded in 1865 whose members included Mirza Ghalib, Syed Ahmad Khan and others. Ramchandra and Mirza Ghalib visited Calcutta and Syed Ahmad Khan met Dr. Mahendralal Sircar in Varanasi to discuss matters of scientific interest. Delhi Society proposed the institution of a University using not English but a vernacular language Urdu. Maulana Imdad Ali founded the Bihar Scientific Society in 1868 for the purpose of spreading modern scientific knowledge through Indian languages. His Society published translations of many scientific books into Urdu.

Ramchandra, one of our national heroes, died on 11 August 1880. Eight years before his death, another national hero, the great Calcuttan literateur Bankim Chandra Chattopadhyay of '*Vande Mataram*' fame paid his tribute to Ramchandra (*Baṅgadarśan*, Bhādra, Aug-Sept 1872, Reference No. 15 p. 1026):

> "We have lot of expectations from the famous professor of Delhi College Ramchandra whose excellent '*Treatise on Maxima and Minima*' has evoked astonishment and elicited unstinted praise from the scientists of England such as De Morgan. We feel optimistic when we find such a banyan tree amidst what appears as a desert, and hope that irrigation and tilling would make the land of India full of wish-fulfilling trees (*kalpataru*)". (Bengali text translated).

Kochhar (1999) could have observed that the 'intellectually active Calcutta' appreciated the genius from the 'still Mughal Delhi'. Whereas Delhi objected to its hero writing in English, embracing Christianity and the city almost killing him on that count, Calcutta did not mind the switch-over!

(d) Completing our journey through the three other metropolis cities and coming back to Calcutta, we find the educational scenarios having lot of commonalities, and yet Calcutta somewhat ahead both in the terms of the English education and Vernacular culture, paradoxically one boosting the other. The leadership of Rammohun and Vidyasagar was successful in

convincing the people that the best thing to do in a multi-lingual situation is to cultivate multi-lingualism.

There had been some resistance in the Calcutta Sanskrit College when the students were required to study some arithmetic and science in English, but gradually they complied under the influence of the Hindu College in proximity. Later Ballantyne of the Benares Sanskrit College observed that Bengalis in Calcutta were more 'pliant' and receptive to English education.

In the Calcutta Madrassa the problem was more severe. When the practice of translating a large number of modern text books in English into Arabic was found to be impracticable and abandoned, a large number of students protested in writing, alleging that this was an attempt to stifle Arabic science and medicine! The issue at stake was not science but the Islamic culture.

Macaulay himself reported the difficulty of getting sufficient number of teachers in India who could competently explain modern subjects in English. In 1839 Lord Auckland was inclined to fall back on to the vernacular languages for which he received warm support from his advisers in Delhi and Bombay. Scientific education depended upon demonstration through modern equipment. Edward Ryan, the President of the General Committee went to England in 1842, purchased a large number of instruments related to mechanics, hydrostatics, hydraulics, pneumatics, optics, heat, electricity, voltaic electricity, electro-magnetism, magneticals and distributed them in five Colleges: Hindu, Hooghly, Dacca, Agra and Delhi. The details have been compiled and presented by S.N. Sen (1988, pp. 186-194).

John Elliot Drinkwater Bethune, the President of the Council of Education in Bengal, was a pioneer in female education in Bengal. Through the College in his name established in collaboration with Vidyasagar and other intellectuals, he has remained as famous as David Hare. Bethune had been educated in scientific subjects in Cambridge and emphasized, like Whewell, another Cambridge man, on the application of mathematics in all science subjects. In a lecture he illustrated the triumph of mathematical application in astronomy through the recent discovery of the planet Neptune. Bethune assisted Ramchandra in attaining international reputation and influenced the Bengali public and intellectuals like Vidyasagar very deeply (Sen 1988, 202-206).

Between 1847-1857 there was the wave of application of science and engineering in the country. Thomason College of Engineering at Roorkee opened the avenues for the youth digging canals, building bridges and roads, assisting the construction of railways etc. Hindu College was converted to Presidency College and Bengal Engineering College was instituted. Three major Universities in Calcutta, Bombay and Madras were planned to be established in 1857 on the model of the University of London. Of the four faculties in the Calcutta University viz., Law, Medicine, Arts, Science and Civil Engineering, the Science faculty remained non-existent or dysfunctional for quite some time.

John Herry Pratt, Archdeacon of Calcutta developed in 1854 his famous *Theory of Isostasy*, the principle of Isostatic Compensation according to which the Earth is in isostatic equilibrium beginning from a certain depth in the earth's interior, the crust with different densities in different segments of blocks floating on an effectively liquid substratum (*IJHS* 1994, pp. 23-30). This well-known theory did not receive adequate publicity at that time.

Similarly it is not well-known that Shiv Chunder Nundy (b. 1824) was the first Indian to send a telegraphic message from Diamond Harbour in 1851 which was received at Calcutta, in the presence of Lord Dalhousie, by Nundy's mentor the famous scientist William O'Shaughnessy who eventually erected 11000 miles of telegraph lines in the country (*IJHS* 1994, pp.9-22, 65-66). The same year in 1851, Nilmony Mitra (1825-94) with 'extraordinary attainment in mathematics' entered the Thomason Civil Engineering College at Roorkee as a student and later became one of the best architects in the country. The list of his creations includes the buildings of Metropolitan Institution established by Vidyasagar, the first Cultivation of Science Building at Bowbazar Street, the famous 'Emerald Bower' palace of Jatindramohan Tagore and many more palatial buildings. In his Memorial Meeting held in 1895, Alfred Croft, the Vice-Chancellor of Calcutta University said: "If you seek his monument, look around you" (*IJHS* 1994, pp. 72-73).

Satpal Sangwan has documented in detail that during the 1850's there was spontaneous demand from the Indian public for more developments in technology, more steam navigation, railways and even telegraphy for common man's use (Sangwan 1988, pp.220-223, 231-232). All these facilities helped the British in defeating our First War of Independence in 1857 but the public demand for more of them did not wane a bit after the Mutiny.

Lahore Literary and Scientific Institution founded in 1854 and the *Lahore Chronicle* pleaded for 'more electricity, electric telegraph, steam engine, geology' *The Hindu Patriot* wrote on 6 April 1854: "The resources of the country will never be developed unless the children of the soil learn the way to develop them". We have earlier mentioned that Rajendralal Mitra was a prominent leader of the movement for applied science and technology. He described in *The Morning Chronicle* 22 April 1854 how 'the ancient system of confining the cultivation of industrial art to particular classes, and those the least educated in the community, constituted the barriers to progress', and categorically stated:

> "To enable natives of India to be themselves instrumental in the development of her material welfare, the instruction of the majority must be practical as well as theoretical"[22].

We recorded earlier, how Rajendralal proceeded to organise *The School of Industrial Art* and its various practical courses in engraving, printing, architectural design, photography, lithography etc. when side by side Bengal Engineering College was being established (1856) to take care of the practical and theoretical aspects of civil engineering.

Quoting the above, Kochhar made some comments:

> "Here was thus an attempt to create an Indian infrastructure of science parallel to that of British India. Such attempts were few, half-hearted, and ineffectual.
>
> "The Bengalis believed that since they knew Shakespeare as well as, if not better than, the British themselves, their edifice of science should be an extension of and supported by, the British effort. 'Science application' was to be left to the Government; it was 'science speculation' that needed cultivation. The leadership came from Dr. Mahendralal Sircar".[23]

The comment regarding the so-called Bengali psyche is a slur, malicious and objectionable. Rajendralal and Mahendralal worked together for the whole of India and not Bengal alone. In a following paragraph we would discuss the IACS National Movement for cultivating basic sciences in India led by Mahendralal, Rajendralal and Lafont, and supported by almost all the intellectuals and patrons in the sub-continent. They thought that there should be separate associations and institutions to promote studies in engineering and applied/technical sciences. These objectives of national importance were not to be left for the discretion of Shakespeare-knowing British!

The Muslim Approach to Science in India (1780-1857)

The Hindu approach and the Muslim approach to European science were remarkably similar particularly during the first four decades since 1780. Calcutta Madrassa and Banaras Sanskrit College were instituted to aid the British judges in the matter of Muslim Law and Hindu Law respectively. Some traditionalists were not happy with the British intrusion in their affairs.

Ramananda Pathaka one of the first few professors in the Banaras Sanskrit College (founded in 1791) had been trained in ancient astronomy and mathematics by his father Śivalal (b. 1734) who refused to be dependent upon his son's 'earnings in English money'! In Calcutta Madrassa, Maulavee Abdoor Ruheem translated several English science books into Arabic and Persian. Thomason and Mill felt, like Rammohun, that the students would master European science better through English rather then the translations. When in 1835 the medical classes at Sanskrit College and the Madrassa were abolished alongwith the *Native Doctors' Medical Institution* itself, a petition signed by 8,312 Muslims of Calcutta accused the government of 'causing the science of Arabia to cease'. The students of Sanskrit College also reacted the same way pleading for the Indian or Hindu science of Āyurveda. None had any reservation against science per se; their contentions were related to the kind of science, its cultural (European or Hindu / Indian or Arabic) context and the language of instruction. The sane advice of William Carey, Rammohun, David Hare, H.H. Wilson, Vidyasagar etc prevailed over the Bengali Hindu mind but not the Muslim psyche. Yet, gradually a substantial number of Muslim students all over the country did take advantage of English education. A census data of 1842-43 show the number of Muslim students and the total student population in several colleges providing English education:

Hindu College (0/518); Muhammadan College (282/282); Hooghly College (373/947); Dacca College (30/364); Benares Engineering College (4/170); Agra College (100/495); Delhi College (128/286).

It is clear from the data that what divided the two communities was prejudice and not British interference. There was neither prejudice nor interference in the Hooghly College for example (Sen 1988, pp.79, 107-111, 173-174).

Satpal Sangwan has argued at length that the Indian response to the Western S & T was reasonably positive during 1757-1857 and much better than what it was during the earlier Mughal era (Sangwan 1988, pp. 219, 227-231). He has furthermore challenged the notion that compared to the Hindus, the Muslims were more antagonistic to the European science, by providing several examples. Mirza Abu Talib (1752-1806) of Oudh was the first educated Muslim to visit England and be impressed with the Western science and 'love for machines'. Shams-ul-Umarah (1783-1863) of Hyderabad propagated scientific learning in Urdu, translated a few French works on geometry into Urdu, and established a *Translation Bureau* and a printing press. Abdur Rahim Dahri (1785-1850) of Gorakhpur learnt English, taught at the Fort William College, and wrote books on the laws and principles of modern mechanics, and on the need to acquire the knowledge of modern science. Latfulla (1802-54) visited England in 1844 and observed the building of railways and bridges with great admiration. Mirza Ghalib, Altaf Husain Hali and several other Urdu poets praised the achievements of Western civilization which had developed steam and coal as a source of heat and power. Sangwan concluded that:

> "Whatever resistance (to modern science) came, it came from those traditional classes who had long been the sole representatives of a particular profession, be they Hindus or Muslims"
>
> (Sangwan, 1988, pp.219, 227-231)

Sangwan did not dig into the problem of traditional conservatism any deeper, how it had rendered the Indian society irrational and unscientific for centuries and was continuing to damage even in the 19th, the heroic struggle of Rammohun against it, not only at Calcutta (Hindus) but also at Rangpur (Muslims). Clearly, personalities like William Carey, Rammohun, David Hare, H.H.Wilson, Vidyasagar, Akshayakumar, Rajendralal etc. (Bankim Chandra, Sri Ramakrishna, Keshab Chandra, Mahendralal, Father Lafont came later) made the difference, and had such visionaries worked at Delhi and the NWP area, the phenomenon of Indian Awakening would have started there. This phenomenon was much more profound than Bengali or Hindu Renaissance.

Instead of appreciating the broad perspective as outlined in the previous paragraph, Kochhar indulged in blame game and wrote:

> "European interest in India's antiquity had far-reaching influence on the Hindus. The discovery of their past glory, as certified by the Europeans

> themselves, restored the sense of self-esteem of the Hindus and gave them the courage to look the Empire right into the eye. It also made Hindus revivalist and increased their distance from the Muslims" (Kochhar 1999, pp.336-370)[25].

That the so-called Hindu revivalism was responsible for Muslim backwardness and even the 1947 political partition of the sub-continent, has been an oft-repeated slander, tantamount to a cliché, perpetrated by pseudo-secular scholars, who would not bother to study the Muslim psyche and their response to the Indian Awakening.

References and Notes

1. Akshayakumar Datta: His principal works: *Anangamohan Kāvya*, 1834; *Bhūgol*, 1841; Eulogy on David Hare, third death anniversary, in Bengali, 1845; *Bāhyavastur Sahit Mānav Pṛākṛtir Sambandha Vicār*, Vol. I 1851 Vol.II 1853; *Cārupāṭh* Vol. I 1853 II 1854 III 1859; *Vāspīya Rathārohider Prati Upadeś*, 1855; *Dharmonnati Sanśodhan Viṣayak Prastāv*, 1855; *Dharmonnati*; 1856; *Padārtha Vidyā* 1856; *Bhāratvarṣīya Upāsak Sampradāya* Vol. I 1870 II 1883; *Prācin Hindudiger Samudrayātrā O Vāṇijya Vistār* (posthumous, 1901); *Vividha Pāṭh* (1948)

2. Muhammad Saiful Islam edited, *Vijnān Buddhi Carcār Agrapathik Akshaya Kumar Datta O Bāngāli Samāj*, Renaissance Publishers Private Ltd., Kolkata, first published January 2006. This is 'gold mine' of a collection of articles or extracts from books penned by 29 celebrated authors. Akshayakumar's two compositions dated 1848 and 1855 are appended. The spectrum of Akshayakumar's scientific intellectualism presented in this book is excellent. Equally admirable is the introduction by Sibnarayan Roy.

3. Bhattacharyya, p. 85.

4. Islam, p. 284

5. Vide Reference No. 2 where Sibnarayan Roy (in his Introduction pp. 9-11) and Muhammad Saiful Islam (in his lengthy editorial pp. 13-43) have discussed this riddle and have offered various explanations:

   Akshayakumar could not articulate his intellectual vision more clearly on account of his prolonged sickness and suffering. His colleagues in the Brahmo Samaj did not appreciate his vision. All his writings were in Bengali. The Bengali community had preferences, still has preferences, for literature, music, drama, ritualistic religion rather than rigorous philosophical thoughts and intellectualism.

   The present author would like to add one more vital point. Akshaya Kumar contemplated a science movement in Bengali, and some 13 years later, Dr. Mahendralal Sircar piloted the nationalist science movement throughout India and through the

medium of English. But the country was not ready and the countrymen were apathetic. Both suffered from the apathy of history and historians of national awakening. In pp. 22-23 M.S. Islam has pointedly shown how apathetic the Renaissance historians have been. They faithfully followed the great historian Arnold Toynbee who did not bother to mention in his vast treatise the name of Isaac Newton!!

6. Islam, p. 200, 258 etc.

7. Mitra, p. 647

8. Mitra, p. 659. This was in response to Dr. Ballantyne's (c) comments. Rammohun had accepted Vedanta's *Advaita* monistic principle since it was grand in philosophy, consistent with monotheism, contradicted idolatry, polytheism, casteism and held out some promise in favor of India's spiritual and political unity. Vidyasagar's submission was that the great Śankara supported casteism and otherworldliness, *māyā*: "*Jagat Mithyā*", "this world is false"! Swami Vivekananda has suggested neo-Vedanta accepting the grand principles approved by Rammohun and rejecting the negative aspects of Śankara's philosophy, disapproved by Vidyasagar also.

   Dr. James R. Ballantyne, Principal of Sanskrit College, Varanasi had come to Calcutta on an officially sponsored visit to the Sanskrit College, Calcutta, headed by Vidyasagar. He observed that the Calcutta College was doing well with its Sanskrit and English programmes running conjointly, but this experiment need not be copied in the Upper Provinces. There was 'the danger that the two courses may end up in persuading the learner that truth is double', the possibility that the students may not 'grasp the identity of the two, the European logic and the Hindu logic', and may not realize 'that the advancing European science recognizes all those elementary truths that had been reached by Hindu speculation'. Ballantyne believed in unity of the Eastern and Western Philosophies. Vidyasagar did not, and refused to accept Bishop Berkeley's Inquiry, 'no more considered in Europe as a sound system of philosophy', yet in agreement with *Vedānta* and *Sānkhya*.

   Vidyasagar wrote that 'to believe that truth is double, is but the effect of an imperfect perception of the truth itself', If there is real identity, the single truth would be perceived by an intelligent student. According to him the 'danger' lies elsewhere. The goal should be not to concoct artificial concordance but to evaluate critically the rival claims of 'truths'. The students of the Calcutta Sanskrit College were studying Sanskrit literature and English science to ascertain the objective truth and 'extend the benefit of education to the mass of people in vernacular schools'. Vidyasagar articulated his apprehension that it would not be an easy matter to reconcile the conservative Hindus to critically accept the new scientific truths:

   "It is not possible in all cases, I fear, that we shall be able to show real agreement between European Science and Hindu *Śāstras*. Even if we take it for granted that we shall be able to point out agreement between the two, it appears to me to be a hopeless task to conciliate the learned of India to the acceptance of the advancing science of Europe. They are a body of men whose longstanding prejudices are unshakeable. Any

idea when brought to their notice either in the form of a new truth or in the form of the expansion of truths, the germs of which their *Śāstras* contain, they will not accept. It is but natural they would obstinately adhere to their old prejudices. To characterize them as a class, I can do no better than quote the words of Omar.

When Amru, the Arab General, the Conqueror of Alexandria wrote to Omar about the disposal of the Alexandrian Library, the Caliph replied, "The contents of those books are in conformity with Koran or they are not. If they are, the Koran is sufficient without them; if they are not, they are pernicious. Let them therefore be destroyed."

The bigotry of the learned of India, I am ashamed to state, is not in the least inferior to that of the Arab. They believe that their *Śāstras* have all emanated from Omniscient Rishis and therefore, they cannot but be infallible. When in the way of discussion or in the course of conversation any new truth advanced by European Science is presented before them, they laugh and ridicule. Lately a feeling is manifesting among the learned of this part of India, specially in Calcutta and its neighbourhood, that when they hear of a Scientific truth, the germs of which may be traced out in their *Śāstras*, instead of showing any regard for that truth, they triumph and the superstitious regard for their own *Śāstras* is redoubled. From these considerations, I regret to say that I cannot persuade myself to believe that there is any hope of reconciling the learned of India to the reception of new scientific truths. Dr. Ballantyne's views may be successfully carried out in the North West Provinces where his experience has made him arrive at his conclusion with regard to the learned of India" (Mitra 2001, p. 660).

9. Biswas, 2000, pp. 55, 69, 76-77, 80-82, 102 and 283.

10. The monistic, egalitarian, unifying version of Vedanta, accepted and adored by Rammohun and Vivekananda is quite different from the *māyāvāda*, other-worldly, casteist version of Vedanta propounded by Śankara and detested by Vidyasagar. Vidyasagar had to take his lessons on Vedanta from Śambhuchandra Vachaspati, a very old and infirm person who married a child and made her a widow within a few years. It is understandable that Vidyasagar developed his resoluteness against Vedanta and in favor of widow-remarriage!

11. The full text of an introductory lecture in Chemistry delivered by O' Shaughnessy in April 1836 was printed in *The India Journal of Medical and Physical Science*, May 1836, and reprinted by Dr. Mahendralal Sircar in his *Calcutta Journal of Medicine*, Vol. 4, Nos. 2 to 6, February to June 1871, pp. 170-180. O'Shaughnessy mentioned that only 54 'elements' were known at that time. He was analysing specimens from the 'mine in Kemaon' rich in copper. The students 'should study the chemistry of Turkey red dye, Peruvian bark quinine, medical formulations etc'. Rajendralal was asked to compile the list of indigenous medicines which were being used by Indian women.

12. Mitra, 1969, p.20

13. Ghosh, 1994, p.85.

14. Mitra, 1877, p.16
15. Bankim *Racanāvalī* (Collected Works), Volume II, Collection of his non-novel writings, Sahitya Samsad, Calcutta, 1361 B.S. pp. xi-xv deal with Bankim's philosophy. The article on *Cittaśuddhi* in pp. 259-262; on *Dharmatattva* chapter 15 *Bhakti-Bhāgavad Gitā Jnāna* pp. 629-631; on *Bhāratvarṣ̣īya Vijnān Sabhā*, pp. 1024-1028.
16. A special Issue, a Collection of Papers, presented at a Seminar on 'Calcutta and Science' in the Tercentenary Celebration on Calcutta in December 1989, *IJHS*, 29.1 (1994)1-119 also S-1 to S-46.
17. Sen, 1988, p. 75
18. Sangwan,1988, p. 218 foot note
19. *Ibid*, p. 222
20. Kochhar, 1999, p. 333
21. Sen, 1988, p. 169
22. Sangwan, 1988, p. 219 and the footnote in this page
23. Kochhar, 1999, p. 338
24. Sen, 1988, p. 79, *IJHS* (29.1), p. 5
25. Kochhar, 1992, p. 2609

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