enabling the community to take full advantage of the rainy season for productivity and recruitment of plants through germination, while maximising the period of food availability to pollinators, frugivores and seed predators in return for their pollen transfer and seed dispersal services. Factors that may cue phenology in a proximate sense could be water stress, humidity, temperature and timing of nutrient release[15].

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Science in British India. I. Colonial tool

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A major accomplishment of the Renaissance in Europe was the 1498 discovery of the direct sea route to India. The great commercial success of the Portuguese spurred the Dutch, the English, and then the French to venture out to the sea. The overseas trade was extremely profitable[1]. Cloves purchased for only £2048 in the Spice Islands sold in London in 1609 for £36,287. The first 12 voyages to East Indies from England yielded an average profit of 138%. By 1621, one man in 2000 in England was working for the East India Company[2]. The navigational needs of the traders acted as a great incentive for development of science in Europe. The best scientists of the time applied their minds to 'discover the longitude'. In the early seventeenth century, professors at Gresham College, London took up navigational problems in the national interest, e.g. Henry Briggs[4] (1560–1631) whose introduction of logarithm to the base 10 greatly simplified mathematical calculations.

English as well as French companies started compiling sea charts and keeping records of voyages. Observatories were opened at Paris (1667) and Greenwich (1675) to solve the problem of the longitude. The Astronomer Royal supplemented his meagre salary by giving tuition to young men seeking employment with the East India Company[4]. It paid to join the Company, and it paid to know astronomy.

The European climate was now extremely conducive to scientific innovation. The 1731 invention and use of a sea quadrant by a young American glazier Thomas Godfrey was a dead end because neither the inventor nor America at the time had any use for it. But the next year, when it was independently invented in England (by John Hadley), it was immediately accepted as a valuable navigational aid and developed further[5]. As early as 1736, Hadley's octant 'when it was definitely regarded as an English instrument', was used in India by a French navigator, Apres de Mannevillette [ref. 6a, p. 151 = 6a:151].

Maritime trade transformed not only European economy but also its state of mind. For the first time in history of mankind, production of wealth depended not upon the courtesy of God and the King, but on human endeavour. Merchants and artisans now became respectable and influential members of the society. And since the new rich class owed its wealth to science, it became patron of science.

The new experiences weakened the hold of the past authorities. Thus the French physician Julien La Mettrie wrote in 1747 in *The Man-Machine*: 'We are no more committing a crime when we obey our primitive instincts than the Nile is committing a crime with its floods, or the sea with its ravages'[7].

Modern science came to India in tow with the Europeans. The very act of reaching India from Europe showed a sense of adventure and competence. It was natural for these early visitors to try to acquaint themselves with their new environment, for survival as well as for profit. Early European scientific endeavours in India consisted of two disciplines, geography and botany. In the early days, the Europeans were confined to the coastal areas and had no reason to venture into the interior. Geographical exploration therefore fell to the Jesuit priests. The Society of Jesus was set up in 1540. The first Jesuits arrived in India in 1542 and remained active for more than 200 years. In 1759 the King of Portugal banished all Jesuits from his colonies, and in 1773 the Pope banished the order altogether. It was revived in 1814, with the first English Jesuits arriving in Calcutta in 1833. The Jesuits had the time, scientific training and the opportunity of criss-crossing the country. Thus in 1580 Father Monserrate (1536–1600) on a mission to Emperor Akbar took observations for latitude from Surat to Fatehpur Sikri [6a: 11]. The next year when Akbar marched to Kabul against his half-brother Mirza Hakim, he took Monserrate along as a tutor for his second son Murad, and for making observations on the way. The Jesuits sent their observations and diaries to Europe where they were faithfully preserved and ignored. Europe was not yet ready for India. It is only in the 18th century when knowing India became a paying proposition that Jesuit data were dug up and put to use. (Monserrate's observations were first noticed 200 years later, in 1784). The 34 volumes of Jesuit observations from all over the world published at Paris between 1702 and 1741 were avidly read by the colonialists, and a 26-volume edition appeared in 1780–83, of which six volumes were devoted to India [6a: 11].

While geography was left to the missionaries, botany did interest the traders. This is not surprising. After all, it was the lure of the culinary plant that had brought Europeans to India in the first place. But plants had other uses also. They provided drugs in the treatment of diseases and had in addition exotic value. It was only natural that visiting seamen should take interest in plants for reasons of their own health, and for their medicinal, commercial and curiosity value back home. The first western botanist in India was the Portuguese Garcia D'Orta (1479–1572), a physician and professor at Lisbon, who came to India in 1534 and stayed till his death. D'Orta, said to be a converted Jew, moved in 1538 or 1541 to the island of Bombay which the Portuguese had acquired in 1528 and which they now leased to D'Orta in perpetuity at an annual rent of £85. Obviously d'Orta could not hold on to his estate, but in 1563 he wrote a book called *Dialogues on Samples and Drugs*[8].

The next dabblers in botany were the Dutch[9], who opened a factory (a fortified warehouse) at Cochin in 1663. The material collected from Malabar was published at Amsterdam as 12-volume *Hortus Malabaricus* and illustrated by 794 plates 'some of which are so good that there is no difficulty in identifying them with the species which they are intended to represent.' Such work had a curiosity value, but fulfilled no pressing need, as can be seen more clearly from the work of Rumphius whose manuscript on the flora of Spice Island of Amboina completed in 1690 was published years later between the years 1741 and 1755. Another work with delayed but influential response was by Paul Hermann who spent seven years (1670–77) exploring the fauna of Ceylon at the expense of the Dutch company. Since this 600-species collection was sent to Europe, it was used by that great systematist Linnaes in 1747 to publish his *Flora Zeylanica*.

We have seen that the early use of modern science in India was sporadic and desultory, and motivated by localized curiosity. Most of it had no contemporaneous significance and was incorporated into the main body of science much later. Additionally, it left the Indians themselves untouched. Of far greater significance was the medical expertise of the British doctors [10; 37]. This expertise was sought by the Indian rulers who paid for it in terms of goodwill and trading concessions. Thus Gabriel Boughton, a surgeon on the East India Company's ship Hopewell, was sent to Emperor Shahjahan's court at Agra in 1645. He served between 1645 and 1650 as a surgeon to Shah Shuja, Emperor's second son and Viceroy of Bengal, from whom he got a farman for free trade issued in favour of the Company. Then in 1716, when the Company sent an embassy under John Surman to the Mughal Emperor Farrukhsiyar, it included a surgeon William Hamilton, who came in handy in curing the Emperor of a painful disease, which had delayed his marriage [10: 110]. The surgeon's skills brought the English party into high favour not only with the Emperor but also with his powerful Vazir. The embassy returned with three farmans confirming the right to trade free of all duties. Ironically, this gave Company as well as the traders a big advantage over their native competitors. Surman's embassy has been hailed as 'a landmark in the history of the Company's settlements'[11].

With the post-Aurungzeb (1707) collapse of the Mughal Empire, India became available for grabs. The European vaishya outfits developed kshatriya ambitions. The 1757 battle of Plassey laid the foundation of the British colonial empire[12]. Earlier scientific activity by the Europeans in India had been motivated by commerce and curiosity. Now science was pressed into the cause of empire-building and institutionalized. (It is not without significance that Robert Clive, the founder of the British empire in India, was made Doctor of Laws in 1760 by the Oxford University, a full year before the King made him a baron[13].) We present here a model to act as a framework for discussing the advent and growth of modern science in India[14]. The model distinguishes between three nested stages of development.

The first stage, called 'the colonial-tool stage', consists of introduction and use of science, especially by the British, as an imperialist tool, with incidental benefits to science. The second stage, the 'peripheral-native stage', came into being when the British were well entrenched in India. In it, the Indians were assigned the peripheral role of providing cheap labour to the colonial science machinery. The third stage, 'the Indian-response stage', arose as a reaction to the second stage, and is characterized by scientific activity by Indians themselves and on their own initiative. We use the term native to refer to Indians in a subservient role, using Indian itself only when there is exercise of, or desire to exercise, free will. We shall now discuss each stage separately, drawing illustrations mostly from the Survey of India[6] which represented science in the most dedicated service of the state.

The colonial-tool stage

The gold coins minted by the Portuguese for use in India depict the armillary sphere, the pre-telescopic basic navigational instrument used for determining the latitude. This was Portugal's way of paying tribute to science to which it owed its power. The Portuguese arrived in India even before the Mughals did. Their love for Christianity and hatred for Muhammadans far exceeded their desire for Indian territory. Moreover, given their small population they did not quite know how to successfully deal with the scurvy deaths on the sea. The Portuguese introduced navy as a parameter in India's geo-political equations, placing the Indian rulers at a disadvantage. Even when its power was at its peak, the Mughal Empire had to seek the help of the religiously neutral British to thwart the Portuguese attempts at preventing Indian Muslims from sailing to Mecca. When the Portuguese first arrived in India, Copernican heliocentrism had not yet made its appearance. But by the time the Mughal Empire collapsed, Europe was already on the verge of industrial revolution, so that science and colonialism could feed each other.

Filling the political vacuum in India required as a first step knowledge about its geography. The French were more successful on the scientific front than on the colonial. The first worthwhile map of India was compiled in 1752 by the French geographer Jean-Baptiste Bourguignon D'Anville at the request of French East India Company, who based it on Jesuit data and on whatever geographical information he could lay his hands on. The value of D'Anville's *Carte de l'Inde* can be judged from the fact that it was reprinted in England in 1754 and then again in 1759, along with the annotated translation of his memoirs [6a:33].

Astronomy was the first modern science to be brought to India, as a geographical and navigational aid. Its early use was however sporadic and mostly out of personal curiosity. Systematic scientific effort became essential when the 1757 battle of Plassey transformed the British East India Company into a jagirdar. The Company Bahadur was fully conscious of its needs: survey of its present and future lands; safety of navigation; increased revenue; and proper administration. The first need was geographical knowledge. In 1757 itself when Clive was still at the Nawab's capital Murshidabad, he proposed that 'an exact and useful survey may be made which will enable us to settle beneficial boundaries'. Accordingly a 'Surveyor of the New Lands' was appointed in 1761, and in 1767, two years after the Company received divani rights over Bengal, Bihar and Orissa, Maj. James Rennell was made the 'Surveyor-General of Bengal'. Rennell's Bengal and Behar Atlas appeared in 1779–81, and the Map of Hindoostan in 1782–92 [6a:369; 15].

Surveys were continually required for military purposes. Geographical location of important places in the country was determined with alacrity by 'borrowing a sextant here, a watch there, and a quadrant in another quarter, from different officers at Calcutta who happened to possess them'. Surveyors were sent out with every army to prepare route maps. The importance of 'military geography' can be gauged from the fact that in 1790 when the Governor General took the command against Tipu, the Sultan of Mysore, he appointed the Surveyor-General to his personal staff. In 1793 the Company paid the fabulous amount of Rs 6000 to a surveyor, Lt Robert Hyde Colebrooke, for a map of Mysore accompanied by a memoir [15:57]. Colebrooke served as Surveyor-General of Bengal in 1794–1808 [6a:326].

The destruction of Tipu in 1799 extended the Company's territories from the east coast to the west. Just as Plassey had produced its Rennell, Seringapatam produced its Lambton, only more quickly. Unlike Rennell's survey which was run in traditional, route survey style, Maj. William Lambton (1753/6–1823) modelled his on the lines of the recently started surveys in France and England. The Trigonometrical Survey of Peninsular India was started in 1800 with second-hand instruments bought within the country. Expectedly, its history is also the history of the entrenchment of the British in India. In 1817 the Mahrattas were finally crushed. On 1 January 1818 the survey was renamed the Great Trigonometrical Survey of India (GTS) and extended to cover the whole country. It even surreptitiously covered trans-Himalayan region. The GTS came to its own in 1830 under Lt. Col. Sir George Everest (1790–1866) who was also appointed the Surveyor-General. The GTS fixed with great accuracy the longitude and latitude of a large number of places. The details were then filled in by the Topographical and Revenue Surveys. In 1878 the three were merged under the name Survey of India. (The name GTS is often retroactively applied to include Lambton's survey, and the Survey of India to its predecessor constituents.) Uniformly accurate data from such a huge landmass as India led to the important geodesical theory of isostasy by Archdeacon John Henry Pratt (1808/9–71) and to a mathematical model of the earth, known as Everest geoid[6,15].

As early as 1787, General William Roy, the founder of the British survey, wrote how desirable it was to determine the length of a degree of latitude on the Coromandel coast and in Bengal. It was too early for the Company to bother about the shape of the earth when its ships were getting wrecked. Rennell and Alexander Dalrymple, the Company's hydrographer at London, made a joint reply: 'Whatever advantage to science may be derived from the exact determination of the figure of the Earth, we conceive no other benefit can possibly attend the Admeasurement in Bengal; but that proposed on the Coast of Coromandel will contribute towards the construction of an exact chart of the Coast' [6a:164].

The Coromandel coast is rocky and full of shoals and without a natural port and was a graveyard for the Company's ships. A survey of the coast was thus literally a matter of life and death, and eventually in 1785 a professionally trained surveyor-astronomer Michael Topping (1747–96) was brought from England, on free passage and equipped with his instruments [6a:389]. Since his work required a reference meridian, an Astronomical Observatory was set up at Madras in 1790. It was the first modern public observatory outside Europe. While pleading for it, Topping reminded the Company Directors that they now had a chance of 'affording their support to a science to which they are indebted for the sovereignty of a rich and extensive empire'. Although the Company had grandiosely declared that the purpose of the Observatory was to 'promote the knowledge of astronomy, geography, and navigation in India', it was clear that the main aim was to promote the Company's profitability[16]. Science was only a part of the duties of the Company's officers. The value of various services can be gauged by the price placed on them. Topping's monthly salary as the 'Company's Astronomer and Geographical Marine Surveyor' was 192 pagodas (1 pagoda = Rs 3½; £1 = Rs 8). He got double this amount (400 pagodas) as the 'Superintendent of Tank Repairs and Water Courses'. An additional 100 pagodas came from the superintendence of the Surveying School. In the early years, the Observatory was no more than a surveying outfit. This role ended with the 1830 reorganization of the GTS, but navigational need was still outstanding. Increased sea-trade activities of the British required familiarity with the southern skies. In 1844 after 14 years of labour, Thomas Glanville Taylor (1804–48) produced the celebrated Madras catalogue giving positions of about 11,000 southern stars. It was hailed by the Astronomer Royal as 'the greatest catalogue of modern times' and revised in 1893 with funds from the India Office and the Royal Society[16].

The Observatory was now redundant. Even the British astronomers who had now observatories in South Africa and Australia lost interest. The Astronomer Royal wanted it abolished but could not succeed against the assertion of the local British pride, succinctly expressed in the letter written by the Madras Director of Public Instruction to his Chief Secretary (16 January 1867)[17]:

> 'Here I beg to call special attention to the fact that the views of Mr Airy [Astronomer Royal] are based simply upon the question as to what work is absolutely required to support the work done at Greenwich and other first class Observatories. I earnestly hope that the Rulers of India will take a higher and most extended view of the matter, and consider what is due to this country.'

The rhetoric saved the Observatory, but no new equipment was sanctioned. Fortunately, there were workshops of the Public Works Department that could maintain the ageing instruments. India's astronomical fortunes revived with the advent of the new field of solar physics. India was ideal for extensive photography of the sun, which was not possible in cloudy Britain. Also, it was then believed that a study of the sun will help predict the failure of the monsoons. In 1878 solar photography was started at Survey of India, Dehra Dun, and photographs were sent to England for analysis. A solar observatory was established by the Imperial Government at Kodaikanal in 1899 (which still exists)[16].

Once the Trigonometrical Survey was begun, the Government lost interest in Madras Observatory. In 1801 Madras Astronomer was getting a monthly salary of Rs 672, whereas the Superintendent of the Trigonometrical Survey was slightly better placed at Rs 980. Seven decades later, in 1877, while the Astronomer's salary had crawled up to Rs 800, the Survey Chief's had jumped to a substantial Rs 2565. Fifteen surveyors were getting more than the Astronomer, three of them being Fellows of the Royal Society. All surveys were manned by military officers. Whereas meteorological and magnetic observations were considered legitimate military duty, pure astronomy was not.

The last word on where pure science stood up *vis-à-vis* the applied belongs to the irrepressible Everest. In 1834, on orders from the Government, astronomical instruments from the Survey were issued to enable the former Bombay Astronomer to observe the phenomenon of the opposition of Mars. This happened when Everest was out on field tour. On his return Everest made a strong protest against the loan, saying:'... The discoveries which the late Astronomer of Bombay is likely to make in science would hardly repay the inconvenience occasioned by retarding the operations of the Great Trigonometrical Survey...' [6d:137]. It should however be noted that John Curnin, the first Director of the Colaba Observatory, was dismissed from service in 1828.

From geography to geology was but a natural step. The survey of the Himalayan region naturally brought forth interest in its legendary mineral wealth. The Governor-General wrote (1817): 'We have been duly sensible of the want of professional enquiry into the mineral produce of the hill country lately acquired by us. The remedy now offers itself'. The remedy consisted in the person of Mr Alexander Laidlaw 'Mineralogist and Investigator of Natural history' though 'lacking in liberal education'. He was sent out by the Court of Directors His pay was consistent with the wealth he was to explore: 'a salary of Rs 600 plus Rs 200 for hill carriage, and free issue of instruments and stores, to say nothing of an advance of Rs 2500 in cash'. He was attached to the survey of Kumaun. The Governor-General wanted him to look for metals but added, 'To copper or iron I would not point Mr Laidlaw's attention, as I think the working either might injuriously affect important articles of British export'. Mr Laidlaw did not pay attention to anything, and was dismissed after two years [6b.266].

In 1818 Dr Henry Voysey a surgeon who doubled as a geologist was attached to the GTS so that he could draw 'attention to anything that might influence geometrical and astronomical observations'. Voysey's reports included one on the stone used in building the Taj at Agra. He also reported on diamond mines of South India. Industrial revolution meant the realization that coal was more important than diamond. As the steamer ships were pressed into use, the Government became interested in coal fields. This led to the appointment of a Geological Surveyor to the Company, and in 1851 to the Geological Survey of India. (The Survey of India, the Geological Survey, and the Medical Service, were the only science services in the pre-1857 British India.) Geological evidence in support of the continental-drift hypothesis came from India; this fact is commemorated in the name 'Gondwana' for the ancient southern super-continent. The name, Gondwana System, was introduced in 1872 by Henry Benedict Medlicott (1829–1905), from 1854 professor of geology at Roorkee and later superintendent of the Geological Survey of India[18].

Systematic study of botany[9] in India was pioneered by John Gerald Koenig, a native of the Baltic province of Courland, who came to the Danish settlement at Tranquebar (150 miles south of Madras). Koenig was a pupil of the celebrated Linnaes and at once initiated many enthusiasts into botanical studies. The workers included Sir William Jones, the well-known oriental scholar, who in 1784 established Asiatic Society of Calcutta. Most workers were however content with collecting the samples and sending them to Europe. Rottler, a missionary, was the only member of the band who himself published in Europe descriptions of any of the new species of his own collecting; they appeared in *Nova Acta Acad. Nat. Curiosorum* at Berlin. All these efforts were individual.

A recognized centre for botanical activity was provided by the East India Company in July 1787 with the establishment of a 300-acre botanical garden at Sibpur on the bank of Hooghly, near Calcutta. The reasons for the Company's initiative were described at the 69th Meeting of the British Association for the Advancement of Science by Sir

George King, president of the section of botany, and director of the garden during 1871–97:

The East India Company was still in 1787 a trading company, and a large part of their most profitable business was derived from the nutmegs and other spices exported from their settlements in Penang, Malacca, Amboina, Sumatra, and other Islands of the Malayan Archipelago. The Company was also in those days the owner of a fine fleet of sailing vessels, and the teak of which these ships were built had to be obtained from sources outside the Company's possessions. The proposal to found a Botanic Garden near Calcutta was thus recommended to the Governor of the Company's settlements in Bengal on the ground that, by its means, the cultivation of the teak and of the Malayan spices might be introduced into a province near one of the Company's chief Indian centres[19].

(Years later decline in availability of timber for ship building in the Malabar coast made the Government wise to the destruction of forests and led to appointment of Dr Alexander Gibson (1800–67) as Conservator of Forests for Bombay Presidency during 1847–60.)

At the fall of Mysore, the botanical garden at Bangalore (the Lal Bagh) was appropriated by the Company 'as a depository for useful plants sent from different parts of the country'. The Company's botanist at Madras (Dr Benjamin Heyne) was ordered by the Governor-General to accompany the Surveyor, with the following instructions:

A decided superiority must be given to useful plants over those which are merely recommended by their rarity or their beauty,... to collect with care all that is connected with the arts and manufacturers of this country, or that promises to be useful in our own; to give due attention to the timber employed in the various provinces of his route,... and to collect with particular diligence the valuable plants connected with his own immediate profession [i.e. medicine] [6a:113].

An important task assigned to the colonial botanical gardens was dealing with malaria, the scourge of the tropics and the biggest obstacle to colonial expansion[19]. The bark of the cinchona tree as a cure for malaria was introduced in Europe from South America in 1640 by a Spanish lady Countess del Cinchon [20.28]. In 1820, two French chemists Pierre Joseph Pelletier and Joseph Bienaime Conventou succeeded in extracting the alkaloid of quinine from cinchona bark, and commercial production of quinine began in 1827. Until the 1850s all the world's cinchona bark came from the forests of Peru, Bolivia, Ecuador, and Colombia, where the trees grew wild. The British and the Dutch interests then decided to grow the trees in Asia[19]. In 1858–60, Clements Robert Markham (1830–1916) assistant secretary at the India Office aided by a gardner at the Royal Botanic Gardens at Kew secretly travelled to Bolivia and Peru and brought back seeds of the *Cinchona calisaya* tree; while English botanist Richard Spruce brought seeds and young plants of *C. succirubra* from Ecuador. (Curiously, Markham's[15] own 1878 *A Memoir of Indian Surveys* makes no mention of cinchona.) Intense experimentation at the Indian botanical gardens made India self-sufficient in quinine. Dr Thomas Anderson (1831–70), superintendent of the Calcutta Garden since 1860, died at Edinburgh of 'disease of the liver, contracted during his labours to establish the cultivation of the quinine-yielding species of cinchona'[9]. Almora-born British physician Ronald Ross (1857–1932) discovered in 1897 that the germ of malaria is carried by Anopheles mosquito, and received the 1911 Nobel prize. Not unexpectedly, he could carry out his research only intermittently 'during his spare time when he was not on duty as regimental doctor' and entirely at his own expense, which included payment of an anna per mosquito given to the patient (Husein Khan) who permitted Ross's 10 mosquitoes to have a good meal from his malaria-infected blood [20:40]. Later, in 1904 Ross served as a consultant at Panama where the long-needed canal could finally be built only when malaria was eradicated.

The botanical gardens carried out 'systematic, geographical and economic studies' of Indian flora, and finally in 1891 Botanical Survey of India was constituted[9]. The Company did not mind enrichment of science as long as it took place in the normal course of its own activities. But the moment it was asked to extend patronage to science for the sake of science, it baulked. In 1851, not withstanding a memorandum from the British Association, the Company refused to promote a project on *Flora Indica* by Dr (later Sir) Joseph Dalton Hooker of Kew and his collaborator Dr Thomas Thomson (1817–78), later the superintendent of Calcutta Garden 1854–61. Hooker's monumental seven-volume *Flora of British India* (1875–97) had to wait for orders from the Secretary of State.

The British desire for exploration and increased revenue led to the epoch-making discovery of fossil fauna in the Shivalik hills. The story deserves to be told in some detail, because it brightens a particularly dark period at Delhi [6b:67; 6c:23; 15:210]. As early as AD 1357, Ferozeshah Tughlaq cut through a hill with the help of 50,000 men to dig a west Yamuna canal. East Yamuna, or doab canal, was dug up later, during the Mughal period. Both these canals had ceased to flow by the middle of the eighteenth century. The British government took up the question of restoring these two old canals. After preliminary survey in 1810–11, work on the Ferozeshah canal was begun in 1817, and on the doab canal in 1822. The head of the two canals, Saharanpur, was also the seat of a public garden that was established in 1779 by the Rohilla Fauzdar, Zabita Khan, who appropriated the revenue of seven villages for its maintenance. His son Ghulam Qadir, who pitilessly blinded the hapless Mughal emperor Shah Alam in 1788, continued the arrangement, and so did the Mahrattas after him. In 1823 Marquis of Hastings converted it into a 400-acre botanical garden, to which was later added a nursery of trees for canal banks.

Dr Hugh Falconer (1808–65) of the Bengal Medical Service, who in 1832 became the director of the Saharanpur garden, was aware of a report by Ferozeshah's historian Farishta where he described unearthing of three yard long bones of giants while digging the east canal. In 1831, Falconer along with Sir Proby Thomas Cautley (1802–71), in charge of the doab canal, discovered fossil bones. On 16 November 1834 Lt (later Sir) William Erskine Baker (1808–81) superintending engineer, received a present of a fossil of an elephant's tooth from the Raja of Nahan. He sent a sketch to the secretary of the Asiatic Society Calcutta. On hearing this Dr Falconer made enquiries, and had a fragment of a similar tooth presented to him also. 'I got a hint where they (the teeth) came from and on going to the spot I reaped a rich harvest' collecting more than 600 specimen of bones within six hours[21]. These discoveries proved that in the remote past a sea occupied the valleys of the Indus and Ganga. The well-known pattern of the Company's attitude towards science is repeated here. Dr Falconer wanted to devote his full time to his great work *Fauna Antiqua Sivalensis*, but as a 1878 Memoir[15] puts it he 'was not spared to complete it'. This work was edited and published after his death.

Steam navigation, telegraph, and railways helped tighten British grip over India. The practice of government-sponsored science to serve the practical need of the administration continued throughout the British rule. Thus there came about India Meteorological Department (1875); Imperial Bacteorological Laboratory (1890) at Poona, later shifted to Mukteswar; Imperial Agricultural Research Institute (1903) at Pusa in Bihar, later shifted to Delhi; and Zoological Survey of India (1916). The last scientific act of the British Indian government was dictated by the second world war which in turn brought about its exit from India. In 1942 Council (then called Board) for Scientific and Industrial Research was set up for providing scientific support for the war effect. Note that the actual number of scientific officers was very small. In 1920 the biggest of the scientific services, Survey of India, had a total of 46 imperial grade officers, while the Botanical Survey had only two[22].

We have seen that the British rulers were not interested in science as such, but in using science to further their interests. Whenever their practical needs pointed a finger towards a particular branch of science, attention was paid to that science. Harnessing science enriches it also. Thus in the process of empire building, India was added as a laboratory to the edifice of modern science. Introduction of Indians to science came about when they were assigned the role of laboratory assistants. They soon graduated to respond to science on their own initiative. In the second part of this article, we shall discuss the Indian response.

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