Introduction

This thesis is an attempt to understand the shared, conflict-ridden history of western science and modern India. While western science played a crucial role in the constitution of the identity of 'modern India', it has been itself transmuted and redefined in the process. The area of this shared territory is thus vast. In temporal terms, it spans a period of at least two hundred years, from the late 18th century to the present times. My thesis attempts to cover a major part of this period. Thematically, this period involved issues like the discovery of India's natural world by a new system of knowledge, origins of the Gondwanaland theory, introduction of the telegraph and railway systems, the identification of science as the key factor in ushering a modern India, discoveries of Indian and alternative traditions of science as well as the declaration of the Indian Scientific Policy in 1958 as the mainstay of an independent India. Apart from these, there is the vast area where science manifested itself in more diffused modes of political and social hegemony. This thesis does not attempt to address all these issues.

What I attempt here is closely related to my understanding of the problem of modern western science. Science has articulated itself in the modern world in primarily two diverse yet complementary modes. One was the growing hegemony of science in the popular imagination. An unprecedented popular consciousness about and participation in the discourses of science marked the 19th and the 20th centuries. Science as a result was analysed, debated, re-analysed in astoundingly diverse ways. It was through this larger debate that science redefined, reformulated, and ultimately affirmed itself.

The other development was in the opposite direction. It was the increasing specialisation and professionalisation of science in which its cognitive language and symbols were getting refined and distinct. The growing institutionalisation and specialisation of science contributed to its esoteric and elitist status.

My work attempts, at a rudimentary level, to initiate a dialogue between the two. In doing so, it faces the danger of not belonging anywhere. Admittedly this is not a purely internalist critique of science where the focus is on its mode of cognition. Neither is it a study of the popular imagination of science. Instead, it attempts to locate the links between the social context of science and its cognitive
content. In other words, it tries to understand the simultaneous processes of social legitimisation and the elitist insulation of science. The simple question to ask is, how far was the cognitive content of science influenced or informed by the larger social history within which it was ultimately located?

The individuals that I study become crucial in the context of this enquiry. These scientists were those who possessed the expert knowledge of science and practised the scientific method in all their intellectual concerns. They held the unique position as social beings interacting with the various social and cultural symbols on the one hand, and on the other, they were also the select few endowed with the ability and the right to analyse science's cognitive areas in a modern world. An analysis of their careers and work would open the areas of possible interaction between the two worlds.

My focus on institutions is not for an externalist social, organisational assessment of science. The institutions become important as representations of certain orientations, shifting concerns, changing times and social pressures. My thesis is thus a study of the interaction between these individuals, the science they practised, and the institutions they formed or belonged to.

Coming to the specific context of modern India, two phases in the history of science can be identified. The initial years leading to the second half of the 19th century was marked by a predominance of Europeans in the research and debate on science. The subsequent decades were marked by a greater and ultimately a dominant presence of Indians. Although the two may not be chronologically distinct phases, one can distinguish the dominant discourses in these phases. In the European enterprise in India, science was marked by the zeal of exploration, to know the natural world within the colony, identify, and commercialise its resources for the colonial state and to usher in 'modernity' in a 'backward' country. For the Indians science allowed the adoption, propagation, contestation, and rejection of an alien system of knowledge as well as a search for an enlightened modern India. Yet, my project is to go beyond these distinctions. I wish to investigate the links, the dialogue between these two apparently distinct phases; for that seems to me an important way to conceptualise science in modern India. What I attempt to show is not a simple correspondence between the two, rather I seek to explore the deeper and inarticulate areas of shared passions, visions and orientations. I emphasise the need to appreciate the shared terrain as well as explore the contrasts and contestations between the two.
I thus discuss men like William Jones, Piddington, Tytler, Corbyn, Falconer, Sircar, P.C. Ray, J.C. Bose, M.N. Saha, P.N. Bose and their contributions. I discuss the institutions with which these men were involved, research organisations like the Asiatic Society, the Geological Survey of India, mineralogical and Geological Institute of India, Indian Association for the Advancement of Science, Bose Institute, Council for Scientific and Industrial Research.

The level of experience, my research on European scientists was quite distinct from that on the Indians. I had a feeling that I was ‘discovering’ these European men, most of who have been long lost in the annals of Indian history. In my attempt to unearth these men, and their passions, I hope I have not romanticised their experiences. The Indians I discuss here are of course, prominent individuals - even icons of modern India. Here my urge was to delineate their framing ideas, and the deeper implications, orientations, and tensions of their work and their times.

The study of colonial science involves an understanding of the problem of transmission of scientific knowledge in particular and of knowledge in general. I approach this analysis by discussing my problems with the Needhamian notion of modern science. To me, the Needhamian understanding of science as a universal, monumenal discipline formed by the various streams of ‘ethno-sciences’ hailing from China, Europe, India and the Islamic world through the transmission of knowledge from one spatial and temporal location to another, appears important but somewhat problematic. Recent studies suggest another possible way of viewing the question of ‘transmission’ of scientific knowledge. To illustrate my point I will briefly examine one important instance of such a ‘transmission’ of scientific knowledge, that from Arabia to Europe.

In the twelfth century, the transmission of scientific knowledge from the Islamic world and ancient Greece became crucial to Europe. It was a century when Florentine economy was thriving, the crusades were in full flow, and Europe’s contacts with the East were expanding. The Arabs in Spain were enchanting the western world with their scientific and philosophical discoveries. This was also the century in which Europe was trying to absorb these influences in the process of evolving a new culture. As Umberto Eco suggests, Europe was searching for a culture that would reflect a political and economic plurality. This plurality had to

revolve around a new sense of nature, of concrete reality and of human individuality and not only the church. This period was also marked by Europe’s renewal of interest in ‘its’ past — Greece.

Greek texts had been brought into Persia due to the persecutions of the Orthodox Byzantine Church from the fourth and fifth centuries. Schools were set up for teaching studying, translating and commenting upon Hellenistic knowledge. This trend continued into the seventh and early eighth centuries. From the eighth to the tenth centuries, a record number of translations occurred and this body of literature was gradually drawn into Muslim culture and society in the Arab world. These translations underwent a process of nativisation when they were reinterpreted in Islamic terms. The Arab-Islamic world divided Greek science according to its own needs into the “metaphysical and rational encyclopaedic schools”. What we understand as the Arab society, was itself a complex world whose science was already accepting contributions from Persia and India. Thus, a number of critical Islamic elements were moulded into the already complex nature of Greek, Indian and Persian astronomical learning and practise. Changes, such as a compromise between Aristotle’s concentric cosmology and Ptolemy’s theory of planetary motion based on epicycles, the use of instrumentation and the drawing of star maps were introduced. The result was that the Greek corpus was transformed; 250 years of possession and cultural incorporation had intervened. It was no longer the same ‘Greek’ knowledge.

It was this ‘Arabised and Islamised’ Greek knowledge that entered Europe through Arab literature from the twelfth century. In Europe this was also a period of transformation from the ‘oral’ tradition to the ‘written’ text and of the ‘vernacular’ revolution. It was also a period of major social change. New technologies based on waterpower and urbanisation were becoming common. Artisans and craftsmen gained freedom with the growth of productivity, and were liberated from local feudal lords. Few in Europe knew Greek except for the Arabs. However, due to the

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5 Montgomery, op. cit., p. 85.
6 Ibid., p.87.
7 Ibid., p.94.
8 Ibid., pp. 93-94.
Crusades, the Christian attitude towards Islam was clearly hostile. It was difficult for Europe to depend on Arabic-Islamic sources for Greek learning. The compromise was that technical knowledge in Arabic was delinked from Muslim religion and culture. This resulted in the severing of Arabic learning from Islamic culture in Europe and was followed by the growth of the idea of a ‘lost’ knowledge about Greece. To be ‘found’, this knowledge had to be stripped of its history and its contents that made it the inalienable property of another people. From the thirteenth century, Greek sources were used instead of Arabic ones. In the fourteenth century, translation from Arabic had practically stopped when the Mongols overran Mesopotamia and Persia. Greek, by then, was ensconced in Europe as the language of the philosophy of science. From the late thirteenth century, universities in Europe collected Greek texts. Research on manuscripts in the West was matched by a continuing effort to acquire copies of Greek authors from the wreck of the Byzantine world. Greek culture had by now become the ‘heritage’ of Europe.

The other process was the Christianisation of Greek thought. The role of Thomas Aquinas was crucial in ‘christianising Aristotle’. He fused the Christian theological order with the materialism of Aristotle seeking to know why man knows things, why his body is made in a certain way, why he has to examine facts and opinions to make or decision, and resolve contradictions without concealing them. It was in the Christianisation project that science got entrenched in its peculiarly European problematic, which in turn relocated its thematic concerns. As French and Cunningham show, one of the important concerns of 13\textsuperscript{th} century European natural philosophy was from the heretical group of Cathars. Against their extreme form of dualism, the faith in two Gods – the spiritual benevolent one and the evil materialist one, the Catholic thinkers found the newly recovered theories of Aristotle particularly useful. In the process, there appeared a new concept of natural philosophy whereby the teleological notions of Aristotle confirmed God as the single creator.

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9 Ibid., p. 107.
10 Ibid.
11 Ibid., pp. 109-110.
13 See Eco. op. cit.
14 Ibid., pp. 265-266.
15 Roger French and Andrew Cunningham, Before Science: The Invention of the Friars’ Natural Philosophy, Aldershot and Brookfield, VT: Scolar Press and Ashgate, 1996, pp. 130-190.
So, by the early sixteenth century Europe had 'found' its Greece and had established the idea of a 'reawakening' of classical antiquity. It gave the very idea of 'Europe' (Europe- a sacred portion of Greece) its grounding and rationale. In absorbing and nativising the knowledge of another world, Europe chose to shed this knowledge of certain elements. It chose to gradually define this knowledge as its own by manufacturing a genealogy of heroic descent from Greece. This meant the stripping away the Islamic elements from it. Latin culture looked gradually inward even as it drew sustenance from outside. The new knowledge of Europe was thus its own, not Islamic, and not even Grecian. In choosing 'Greek' culture, Europe had really chosen a series of textual commentaries, long internalised by the Islamic world. The 'purity' of Greek civilisation was lost to the past. Europe created a 'new Greece' for itself. The roots of modern European science have to be located in this emerging idea of 'Europe' and the growing consciousness about its culture and lineage.

From now on Europe's intellectual history had a chequered career with many discontinuities, shifts, and reinterpretations. It was also endowed with a certain amount of self-consciousness and inwardness. This was manifested also in the Renaissance maps from the 15th century onwards, which depicted a certain triumphal celebration of its 'emancipation' and humanism. Europe was placed at the centre of the map of the world as the powerful, civilised, clothed and cultured, while others appeared subdued, exotic or savage. These visual images of Europe's identity had a strong impact on its intellectual traditions.

It was on the foundation of this 'Europeanised' Greek learning that the Copernican Revolution had taken place whereby heliocentric notions were gradually

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17 Ibid.
18 The process of identifying Greek thought as a solely European heritage and Greek science as the only one of its kind was so complete, that even critical philosophers of science like Kuhn and Ben-David seem to accept this without hesitation. Kuhn, while arguing that the bulk of the scientific revolution in Europe was a product of the past four centuries pointed out that Europe, as the only "descent from Hellenic Greece have possessed more than the mere rudimentary science". See his Structure of Scientific Revolution, New American Library, 1986 (1962), New York, p.137. Joseph Ben-David in a slightly different tone argued that only Greece could be the "legitimate ancestor" of modern European science, as only it had a logical structure. So, a scientific' Europe could only have a equally 'scientific' Greece as its ancestor. The Arab legacy was easily forgotten. See Ben David's, The Scientists' Role in Society: A Comparative Study The University of Chicago Press, Chicago and London, 1984 (1971), p. 33.
shed to shape a new world-view. It was a complex process, which started with Copernicus' attempt to solve the mystery of the calendar year.\textsuperscript{20} Subsequently, Francis Bacon attempted to develop a new methodology of logic. It was based on a rigorous process through which the human mind was tied down to a strict inductive methodology of collecting materials and arranging and deriving new knowledge which would ensure the unique truth and the realisation of the ideas of the Divine Mind. In doing so, he propagated a new way of apprehending nature, of its 'conquest' by human beings.\textsuperscript{21} Bacon was probably the earliest prophet of 'modern science'. The evolution of this science is a complex process. It marked a complete break from traditional scientific knowledge for it not only eclipsed the religious and traditional philosophical understanding of nature, but it also relegated it to the margin of intellectual activity and to the category of superstition. Modern science, therefore, is not simply the continuation of Islamic, Greek or Latin sciences. A major change of worldview or paradigms separates modern science from its medieval counterparts.\textsuperscript{22}

The rejection of the medieval cosmology was a more general process in European intellectual history, which is particularly engendered in Renaissance humanism. A very significant aspect of it was the negation of the 'other worldness' of man in the medieval Christian theology as a half-angel, half-man. Man became terrestrial being firmly established in this newly discovered planet. Man was defined more in terms of his individuality, reason, and the use of senses. Henceforth, reason, which severed philosophy from revelation, came to be the sole criterion of verification of the knowledge along with man's sensory perceptions. Faith in God was still important, but it could not prevent the gradual desacrilisation of knowledge that characterised European intellectual history from the Renaissance onwards, particularly the knowledge seeking to understand nature.\textsuperscript{23} The eighteenth and the nineteenth centuries made further strides in the conquest of nature by defining new fields of visibility vis-à-vis the same. It developed a new gaze towards nature, particularly in disciplines like botany and in parts biology, "a series of systematically negative condition" and through a new medium, the microscope. By limiting and

\textsuperscript{23} \textit{Ibid}, pp. 169-176.
filtering the visible, nature could be better transcribed into a language and helped in the development of scientific taxonomy and classification. Nature was engraved into the material of language, transposed and re-constituted.24

Reviewed above was the particular orientation science had taken in Europe. European science was located in its temporal and spatial dimensions. The trajectories of Islamic science were quite different. As Nasr has shown, Islamic science has to be seen as a creative refusal, an affirmation of a different world, a refusal to profane nature. He asserts that in the Islamic world, India, and East Asia, nature was never shorn of a sacramental and spiritual character. Even the intellectual dimensions of these traditions were not so ‘enfeebled’, as to enable a purely secular science of nature to develop, outside the matrix of traditional intellectual orthodoxy. Even if the cosmic vision of Copernicus and Kepler or the Arabs were similar, the paths they took to truth were divergent.25 Sivin has argued that Chinese science has to be studied within the context of Chinese society. His contention is that while the modern-style mathematisation of astronomy was carried out by the seventeenth and eighteenth centuries Chinese astronomers, like its western counterpart, it did not lead to a scientific revolution.26 Nasr provides an important clue to the question of why modern science developed in Europe. The first factor was the weakening of the sapiential dimension in Europe, which aided the rise of rationalism. The eclipse and marginalisation of Christian philosophy during the late medieval period and the all-important rise of humanism in Renaissance created the space for the incubation and formation of modern science.27

With such a problematic picture of the question of ‘transmission’ of scientific thought, we now hope to analyse the nature and scope of another significant transmission of science in another time, that from Europe to non-Europe. In doing so, as discussed earlier, the focus would be on individuals and the institutions. The careers of the individuals reveal the interaction between this science and the colonial world. Let us now focus on the social, political and cultural space within which they functioned. It is through this discussion that the specific and

fundamental questions of this thesis would be approached. We begin with the Europeans.

III

The transmission of modern science to colonial India was initially through European initiative. The thin and sporadic trickle of European medical men, naturalists, Jesuit missionaries and adventurers with different degree of scientific backgrounds and scientific knowledge, which had begun a century earlier had developed by the end of the 18th century into a steady and regular stream of scientists. The thrust to this was provided by two related developments. The first was the emergence of science since the Renaissance as a feature of European intellectual life. This was followed by two major periods of scientific changes. First, the intellectual revolution of the 17th century in which the cognitive basis of modern rational science was established. Second, the emergence of science as a professional activity in the early nineteenth century when the social structures which provided the basis for the integration of science into the fabric of social life were established.

The period 1780-1850 witnessed a major transformation in which the image of the 'natural philosopher' as the investigator of nature was succeeded by the image of the 'scientists', the professional investigator of technical problems. The professionalisation of science was reinforced by changes in the cognitive content of scientific knowledge, in which the secularisation of scientific thought was accompanied by the merging and consolidation of newly defined and specialised scientific disciplines. 'Natural philosophy' and 'Natural history' branched off to the disciplines of 'Physics', 'Chemistry', 'Biology', and 'geology', each with its distinct boundaries, subject, conceptual structure, technique of investigation and trained, specialised practitioners. The specialisation of scientific activity was accompanied by increasing opportunities for the pursuit of a scientific career and the wider dissemination of scientific education in Europe. In the 18th century science had flourished in the universities initially as an appendage to medical education, and was firmly established only in a few universities such as those of Edinburgh and Leiden, which had important medical facilities. The 19th century saw the further specialisation of courses in French, German, and later at English universities, and science emerged as a socially organised intellectual enterprise. A plethora of

specialised societies devoted to geology; mineralogy, astronomy, zoology, and engineering proliferated. The new professional self-awareness led to the foundation of the British Association for the Advancement of Science in 1831, a body which sought to promote and patronise research by its meetings and research grants and by setting the agenda of scientific research in Britain and in other distant parts of the earth. Others like the Royal Agricultural Society (1838), the Royal Botanical Society of London (1839), the Geological Society of London (1807) and the Zoological Society of London (1876) had also been founded.

The introduction of western science took place in India during this period of professionalisation and specialisation of the discipline in Europe. Much like Europe, scientific societies were founded in colonial India from the late eighteenth century onwards. The Asiatic Society of Bengal (1784) was the first to be established, closely followed by the Botanical Garden at Calcutta in 1787 in the pattern of the Kew Garden of London. Next came the Bombay Literary Society (1804) which later became the Bombay Branch of the Royal Asiatic Society. Several other clubs and societies were established in Calcutta, Madras and Bombay. The Madras Literary Society was founded in 1818. Several surveys, for instance, the Trigonometric Surveys, were organised by the late 18th century as well.

The other development was the growing imperial assertion of Europe. The transmission of science into the colonies has to be seen within the larger process of colonialism whereby Europe was increasingly seeking to acquire, control, and 'understand' vast tracks of alien territories. This had resulted in the accumulation of an enormous source of information about the colonial world. This was a critical period in the history of British Empire — the 'second empire' extending from the American War of Independence to the era of 'high' imperialism from the 1840s. It was during this period that British settlers and officials came into close contact and conflict with the African, South Asian and Australian terrain, and their inhabitants. From the 1750s, the English East India Company entered into increasing conflicts in Bengal, North India, and Deccan. The result was accumulation of vast geographical, scientific and cultural information. One important project was the examination and graphic reproduction of the natural world of the colony. Various scientific surveys, including the Great Trigonometrical Survey were launched. The other was the Orientalist search for the 'exotic', the socially unfamiliar customs, rituals, and

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practices of the natives. They were subsequently codified in a particular language of power and legitimisation. The Orientalists bestowed the classical texts with absolute authority and authenticity as against the contemporary practices, which were considered 'impure' and thus invalid. Thus, a major process of discovery, translation and rewriting of ancient texts started particularly since the time of Hastings. The project was a joint one with the brahmin pundits, which saw the compilation of N.B. Halhead’s *The Code of Gentoo Laws*, William Jones’ *Al Sirajiyah: Or the Mohammedan Law of Inheritance* andColebrooke’s *The Digest of Hindu Law*. It was through these multifaceted surveying and encoding that the structure and character of modern India were inscribed within the colonial knowledge. If this was the larger context within which scientific knowledge was accumulated in the colony, how was it linked to Europe, the source of this quest? This has to be understood in terms of the relationship between the ‘Centre’ and the ‘Periphery’, which holds the key in understanding this transmission of scientific knowledge.

If Europe with London and Paris was the Centre of the growing influence and knowledge of European science, colonial India represented the periphery of such activities. George Basalla’s three-phase model refers to a ‘spread’ of western science from centre to the periphery.\(^3^0\) He proposes a universal pattern of diffusion of western science cutting across geographical, cultural and other differences of the non-European societies. This included stages of exploration, dependency and independence of colonial science. Roy MacLeod assigns more complexities to the relationship than the steady one-way flow of information which Basalla’s model assumes.\(^3^1\) He argues that Bassalla’s scheme tends to generalise all societies regardless of cultural context. It also does not explain the political and economic dynamics within a colony, which may have influenced the shift. MacLeod argues that science has to be understood as a convenient metaphor of empire itself. Imperial statesmen used science’s ethos, methods and organisational strategies. At the same time MacLeod stresses how metropolitan scientific communities were dependent on the discoveries made in the colonies. It is from this point of view that he develops his concept of a ‘moving metropolis’, a dynamic concept of imperial science. This is linked with MacLeod’s dynamic concept of imperialism, which stresses its pervasive yet, unobtrusive character, the ability to recognise the vitality of the colony and yet maintain its leadership over the same.


This thesis appreciates MacLeod's notion of the imperial science, but attempts to understand the links between Centre and periphery in slightly different terms. It attempts to analyse it in terms of the ways in which information and knowledge was collected in the periphery itself, which MacLeod's big picture of transmission through institutional and economic frameworks is not essentially concerned with. This thesis focuses on how such a journey from the centre to the periphery influenced the constitution of the science, what new meanings the science of the centre may have had in the periphery. How did the periphery view the Centre? Did it submit entirely to its terms or did it attempt to subvert and resist it? How do we conceptualise these subversions in terms of growth of scientific knowledge? Such an approach is important and relevant not only to understand science in the colonies, but also to enrich our changing understanding of the construction of scientific knowledge as such.

One major development in the post war writing of the history of science has been the challenging of the 19th century assumptions of science as a continuous unfolding of objective thought. Science is being understood as a social epistemology, socially and culturally conditioned like all other forms of human endeavour. At the same time the Euro-centric prejudices of scientific visions are becoming apparent, particularly in its geographical reconstruction of the earth. While these arguments have been contested they have nevertheless provided fresh ways of looking at the question of the constitution of scientific knowledge and the formulation of new frameworks within which scientific knowledge can be located.

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33 Derek Gregory and David Livingstone have argued that the visual representation of the world in the forms of maps can be a powerful and insidious way of conveying cultural prejudices. Derek Gregory, Geographical Imagination, OUP, 1994; David N. Livingstone, "Lost in Space", The Times Higher Education Supplement, 11 March, 1994, p.15. Nicolas A. Rupke in an interesting article has shown how the Continental Drift theory incorporated the prejudices of 'continentalism' i.e., the belief in the geographical superiority of one continent over another. Nicolas A. Rupke, 'Eurocentric Ideology of Continental Drift', in History of Science, XXXIV, 1996
Similarly in recent researches, the formation of scientific knowledge in the periphery has been seen to be an extremely complicated issue. Important studies of science in England now seek to locate developments in terms of the relationship of the centre and the province. Arnold Thackray's work on the Manchester Literary and Philosophical Society looks at the character of science in the province in an urban-local context. He argues that the pursuit of science in the province can be seen as a means of the social legitimisation of marginalised men, as a mode of cultural self-expression and as an instrument patterning generational intellectual life. The 'progressivist rationalist' image of science served the need of this group to justify themselves in a changing society in which they were 'unwillingly cast in leading roles'. Ian Inkster, sharing Thackray's concerns, stressed the need to understand the motives and characteristics of social groups in their acquaintance with science. He understands the dynamism, tension and ambitions of the provincial societies in terms of the local political structure: the contradictions with the local elite on the one hand, and their relation and self-perception vis-à-vis the metropolitan societies on the others. Such dynamics also led to the growth of centres like that at Edinburgh as a 'provincial metropolis' which was essentially in competitive terms with the metropolitan societies. This thesis is informed by these various formulations on the nature of science and its evolutionary contexts.

However, the marginality of scientific research in colonial India had one crucial component distinct from both Thackray's and Inkster's concepts of provinciality - its colonial reality in both its economic and cultural terms. It is that colonial world, which provides the arena for science in this work.

Science and imperialism, two of 19th century Europe's most thriving enterprises were linked at least to the extent that Europeans usually took their science along with them on their forays overseas. But how was science implicated in the imperialist project? Was it a component only in the panoply of economic imperialism? Or do we need to explore other links between science and imperialism as well? Contemporary historiography tends to suggest that western science in the colonies had largely commercial implications. It demonstrates how the apparently scholarly researches on Indian topography, geology, botany were guided mostly by

commercial and administrative factors.\textsuperscript{36} Deepak Kumar through his detailed research has established the links between science and the colonial exploitation of resources, administrative requirements as well as the racial bias of the colonial state. He has analysed different aspects of scientific and technical education, research facilities in scientific pursuits in colonial India and considered the imperatives of the colonial administration which actually shaped the growth of scientific institutions as well as response and resistance of the educated Indians to these developments. Deepak Kumar's work should be also seen as an important critique of Lewis Pyensen's work, which while stressing the ingenuity of colonial research, presumes its complete autonomy from the economic compulsions of the colony.\textsuperscript{37}

However, such an approach tends to reduce scientific research to an extension of the state machinery. The individuals working in different parts of the country in such a scheme appear as actors in that great project. It leads to a preconception that a career made in the colonies was ultimately confined to serving the economic priorities of the colony. The economic setting was certainly crucial but imperialism itself, as recent researches emphasise, needs to be understood in terms of cultural and political control as well. Here even the economic question, as I argue later, could be understood differently.

I attempt to approach such an empire first through a key institution, the Asiatic Society. The Society was a colonial institution and yet its coloniality cannot perhaps be grasped within a purely economic framework. To begin with, it was not established by the colonial state, and it always sought to develop its independent resource base. Most important perhaps was its intellectual inclination, its quest for uncompromising truth, its amateurish, puritanical search for knowledge, and its subsequent urge for autonomy and insulation from the colonial state. Linked to it was its urge to become an original Centre of learning, situated in its unique site in


\textsuperscript{37} Lewis Pyensen., Empire of Reason: Exact Sciences in Indonesia, 1840-1940, New York, 1989.
the Orient. Yet, it was a colonial institution situated in a distant colony, intellectually and institutionally subordinated to the Centre, and located within the grand European project of accumulation and codification of knowledge on a global scale. The focus of this research would be on the several individuals working under the Asiatic Society, who were responsible for carrying forward this agenda through their diverse research projects. Science was a matter of passion for these men, which reflected the growing fascination for science in Europe. Although often Company officials, they practised science mostly outside the official duties inspired by their own amateurish interest. Scattered in different parts of the country they studied the soil, the plants, and the animals in their neighbourhood and wrote to the journals of the Society. One of my aims in this paper is to situate these men as important actors in the history of science in India and through them retrieve an important period of the Indian scientific experience. An analysis of their work would reveal the implications of the geographical and cultural location of India as a colony away from Europe for the constitution and transformation of the scientific knowledge at the Centre. It would also explain the wider motives for pursuing science in the colonies as well as the myriad circumstances of its pursuits, and thereby attempt at an evaluation of the determinants of the science. The questions raised would be as follows: what were the intellectual concerns with which scientific researches were carried out here? What were the experiences of a European discipline when applied to a land so far away from Europe? What were the experiences of these men who pioneered the process? What were their attitudes towards the ‘centre’ - Europe and their more ‘privileged brethren’ the ones working in Europe? What were their motivations for conducting such researches in India? These questions would be raised in the context of the dominant position of the Centre in the world of science and the aspirations of the Society for an alternative centre, a confluence of the knowledge of the entire Oriental world.

IV

My focus on the Asiatic Society raises another problem, how do we understand the role of science in the formation of ‘colonial knowledge’? History writing on colonial India has never been the same ever since Edward Said’s classic Orientalism was published.\footnote{Edward W. Said, Orientalism, Rutledge and Keagan Paul, London and Henely, 1978.} The book not only questioned the various assumptions
regarding politics and society of the 'Orient' but had also opened the scope for various fields of study in the East ranging from anthropology to literature.

Said argued that the knowledge about the Orient since the colonial period has been a systematic discourse by which Europe has been able to control and even reconstruct the 'Orient' politically, sociologically, militarily, ideologically, scientifically and imaginatively. According to Said, European and American views of the Orient formed a condition in which the Orient was forced to live. In defining the Occident's distinction from the Orient, the European had actually legitimised the former's power over the latter. Although Said's work dealt primarily with West Asia, it has encouraged a number of researches on similar lines on South Asia particularly India. However, there have been few attempts to link the cultural and social aspects of science with this question of Orientalist knowledge particularly in the late 18th and early 19th centuries. How did Orientalism shape scientific research in the colony? Were the two identical processes of codifying the Oriental world or were there areas of tension? It is important to seek answers to these questions because it was around the same period, under the same institution (Asiatic Society) and often by same individuals that researches on India's nature and culture were carried out. Moreover, both these forms of knowledge had strong implications for the exercise of imperial 'power'.

The first two chapters will be a study of the discourse of science as it developed in and around the Asiatic Society in the late 18th and early 19th century India. The attempt is to understand how a metropolitan knowledge sought to articulate itself in a colonial world and the various tensions and contradictions such an enterprise involved. These chapters would thus discuss how the centre-periphery relationship, the nature of the colonial state, and the structure of Orientalist discourse influenced early scientific researches in colonial India. I argue that all these forces informed the conduct of scientific researches in colonial India. There was an element of tragedy in the way the efforts of these scientists went unrecognised and that is

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40 David Ludden "Oriental Empiricism: transformation of Colonial Knowledge", in Brekenridge et al. Edited, *op. cit.*, has talked about Rennell's Maps but not really approached the question of science.
probably why the later historians too have often forgotten to write about them. The first chapter would discuss the 'quest' and the second would attempt to narrate the tragedy of such an endeavour.

And yet, the economic realities of the colony were crucial to how science was shaped there. At a time when the economic virtues of science were becoming increasingly apparent in Europe, its implications for the colonies were appreciated. Science had to not only analyse its natural world but also enhance their commercial exploitation. In India such a process had grown particularly in the second half of the 19th century when faced with international competition, England was seeking to expand its commercial potentials overseas. This, coupled with the changing perceptions about the commercial role of science, led to the establishment of various scientific departments under the colonial government. This also meant a break from the Asiatic Society's orientations of science, and an encounter with romantic Orientalist perceptions. The changing scenario led to new negotiations in the practice of science in colonial India. I see the economic use of science as another instance of the transmission of science in colonial India. In the third chapter I study the role of the Geological Survey of India, and the various scientists working under it like T. H. Holland, Fermor, Fox in bringing about a re-orientation of science in the colony. Once again the emerging concerns of the Centre got reflected in these activities. How can we conceptualise this movement? Was Holland's utilitarian science a simple extension of the European project? Or, did it also articulate a contestation, an attempt to break away from the centre – periphery hierarchy? How did the colonial world shape such a project?

With the entry of the Indians in scientific research and debates we can see the history the history of transmission from another perspective. The first effort towards institutionalising Indian interest in western science was Mahendra Lal Sircar's Indian Association for the Cultivation of Science (IACS, 1876). The basic aim of the Institute was to encourage Indians in scientific research and to popularise the same. Within a few years of its establishment, seven sections were set up: physics, chemistry, astronomy, mathematics, systematic botany and geology. Other efforts in this direction were also made. In 1902, Satishchandra Mukherjee launched the Dawn Society to promote the idea of national education. The society's journal, The Dawn provided an important forum for Indian scientists to promote and
popularise science. The Indian Institute of Science and the Bose Research Institute came up gradually. With the formation of the Indian Science Congress Association in 1914, Indian scientists gained a broad platform on which to exchange ideas.

Such developments are commonly referred to as the growth of ‘nationalist’ science. The relationship of scientists and ‘science enthusiasts’ with nationalism has been well documented.\(^{41}\) One of the main issues of this nationalist scientific endeavour was the need to locate European science within its own cultural context. The task was complicated because the knowledge that came to India was accompanied by a cultural redefinition, by an essentialism, which proclaimed its own universality and validity. It was a part of a discourse of power in an imperialist context. Rationality assumed a very definite form in the post-Enlightenment view of the world. Natural sciences became the paradigm of all rational knowledge. This science was characterised by the idea of man’s control over nature, a progressive and ceaseless process of appropriation of nature to serve human ‘interest’. As Partha Chatterjee argues, rationality was seen as incorporating a certain way of looking at the properties of nature, of ordering the knowledge of those properties in a certain consistent and coherent way and of using this knowledge of adaptive advantage vis-à-vis nature.\(^{42}\) What accompanied this development was the ‘essentialism’ of the rationalist ethic. This particular form of rationality, located in the historical specification of Europe, was seen as a characteristic of ‘scientifically’ oriented cultures. Other cultures were viewed as ‘unscientific’ societies, which in the cultural values of post-Enlightenment thought were seen as ‘backward’ and ‘uncivilised’. The universality of such scientific knowledge reflected Europe’s self-consciousness, inwardness, and an obsession with its ‘origins’ located in Greece and a continuous flow of enlightenment, which transcended all boundaries. It also reflected in another sense the homogenising, imperialist and elitist tendencies of this knowledge.

A few years ago, Jerome K. Ravetz argued that the main problem of nineteenth century science was ‘epistemological’ (as opposed to the ‘social’ which developed after World War II). He suggested that in the nineteenth century contest

\(^{41}\) I am referring here to the writings of Dhruv Raina, S. Irfan Habib, Deepak Kumar, Ashis Nandy, and Shiv Viswanathan, discussed in this thesis.

\(^{42}\) Partha Chatterjee, *Nationalist Thought and the Colonial World: A Derivative Discourse?*, OUP, Delhi, 1986 p. 16.
for cultural authority, naturalistically inclined scientists had to show how and why their knowledge was the most reliable and powerful.41

So the story of transmission discussed here witnessed both the effects of hegemonisation by western science as well as the process of contestation between various frameworks. This process in colonial India is even more interesting because of its association with nationalism. Nationalist thought itself, in nineteenth century India, was a contested domain. As Partha Chatterjee comments, the problem of nationalist thought was a "particular manifestation of the bourgeois-rationalist conception of knowledge, established in the post-Enlightenment period of European intellectual history, as the moral and epistemic foundation of a supposedly universal framework of thought which perpetuates in a colonial domination"44. Ashis Nandy has shown how the very process of Indian nationalism manifested a 'colonisation of the mind' through its internalisation of various Christian and Victorian values of religion, masculinity and gender.45 At the same time, these scholars have argued for dissent and cultural creativity within this process.46 Consequently, the study of Indian nationalism is thoroughly absorbing. The study of nationalist science has to relate to these broad strains of Indian nationalist thought.

VI

The world of the Indian intelligentsia in the early nineteenth century was expanding through contact with an alien culture. This both delighted and troubled them in turns. The western humanities and sciences pleased the learned, educated class. They were fascinated by Shakespeare, Charles Darwin, Auguste Comte, by the

44 Chatterjee, op. cit. p. 11.
45 Nandy, The Intimate Enemy; Loss and Recovery of Self Under Colonialism, OUP New Delhi, 1983.
46 For Nandy's study of creativity among Indian scientists, such as J. C. Bose and Ramanujan, see A. Nandy, Alternative Sciences: Creativity and Authenticity in Two Indian Scientists, Allied, New Delhi, 1980. Chatterjee, acknowledges the creative aspects of nationalist discourse much more in his later book. There he argues that nationalism created its own domains of sovereignty within colonial society by creating a divide between the material and the spiritual spheres. The colonial state was only permitted in to the material sphere while the spiritual domain remained nationalism's sovereign domain. It is from here that Chatterjee believes that most creative and powerful nationalist imaginations drew their sustenance. Nationalism thus cannot be merely seen as a political movement as we have hitherto assumed so, 'too literally and too much seriously'. See his, The Nation and its Fragments; Colonial and Post-Colonial Histories, OUP, Delhi, 1994,pp.5-7.
French Revolution, the American War of Independence. Moreover, new learning opened new means of livelihood for the urban elite.

Trouble arose with the realisation that there was a great gulf that existed between their civilisation and the West. In the face of racial discrimination and Christian missionary criticism there was self-assertion, a search for cultural and civilisational inheritance as well as self-criticisms. The result was a growth of a particular nationalist ideology through which Indians sought to ‘educate’, unite and assert themselves vis-à-vis the West. This search for cultural roots of the modern Indian nation took place through Rammohan Roy’s Brahma Samaj movement, Bankim Chandra Chattopadhyay’s cultural nationalism or Vivekananda and Dayanand Saraswati’s redefinition of Hinduism. They often argued in favour of a valiant Indian nation, combining the best of the East and the West, a nation incorporating the aggressiveness of the West, while its spirituality could provide the perfect alternative to material culture of the west.47

Nationalism subsumed various issues such as religion, materialism, progress, and political strategy. I hope to narrow my study down to a focus on western science. Nationalism was the product of an interaction with foreign knowledge systems. Science, as the great denominator of nineteenth century European knowledge posed as the most important component of that interaction. The transfer of knowledge to India sometimes involved a passive process of diffusion of scientific knowledge, while the ideology of science was actively redefined in the milieu of the recipient culture.

One of the reactions to this development was the initiation of a culture of self-critique and the introduction of scientific knowledge to redefine the ‘obsolete’ traditional thought. Ram Mohan wrote to Lord Amherst, urging him to introduce Bacon’s method of new learning as opposed to Sanskritic studies in India. Sanskrit studies, he was afraid, would only lead the minds of Indian youth to grammatical niceties and metaphysical distinction. What was needed was the ‘enlightened’ knowledge of natural philosophy and science to develop truly rational Indian mind.48 Gosto Behari Mallick, the Secretary of the Burra Bazar Literary Club, saw western scientific education as the only way for India to be saved from the “depths of

47 See, Nandy, *Intimate Enemy* and Chatterjee, *Nationalist Thought*.
ignorance and superstition." Even a Maulavi Ubaidullah commented that European critical rational, reformist attitudes could help Muslims in their "rapid progress" towards an "actual civilisation."

The other reaction was towards a redefinition of this scientific knowledge. In nineteenth century Bengal Positivism had appeared as a new religion of humanity, as the right path towards moral and material progress of all human beings. However, J.C. Ghosh, one of its most prominent followers, realising that a regeneration of Indian society could not possibly ignore Hinduism, sought the roots of rationalism, materialism, and atheism within Hinduism. He also developed a theory of social change in India from Vedic times to the present. He argued that Hindu thought had elements of positivism embedded within it. This redefinition of ideas reached a more mature stage under Bhudev Mukherjee and Satish who tried to locate the fundamentals of rationalist thought in Hinduism. N. K. Ramaswami Aiya blended positivism, classical Hindu texts, and modern science to authenticate a monotheistic Hinduism. Master Ramchandra tried to recover Indian algebra so as to resuscitate "the native disposition".

Such negotiations with foreign ideas were particularly prominent in the experiments of the Dawn Society during Swadeshi in the first few decades of the twentieth century. It attempted to combine the roles the traditional and modern technicians to make them the primary agents of social transformation. Indian artisans were seen as central to the industrial transformation of India. But, it was felt that they required better tools and implements, pecuniary support, and knowledge of market trends and fashions. This would necessitate training in modern science, with the state providing the infrastructure through technical schools and financial support.
In sharp contrast were the instances of rejection of or resistance to the alien. This was particularly noticeable in the field of medicine. Ajmal Khan, a Yunani expert, and P. S. Varier reacted to the onslaught of new discoveries by synthesising traditional medicines and as organising its commercial distribution. 57

In this very brief sketch, some broad trends are noticeable in the nineteenth century Indian involvement with science. One identified the East as essentially spiritual and passive and the West as a material and superior civilisation. The other was the attempt to locate modern western thought within Indian tradition in order to establish the legitimacy of the latter. A third was a slow and cautious fusion between traditional art and modern western thought and the rejuvenation of native society. The fourth was to reorganise traditional practice to counter the assault of an alien and hegemonic colonial system.

Along with such involvement with science there were efforts at increasing professionalisation and cultivation of science by the Indians. Famous scientists like J.C. Bose, P.C. Ray, and C. V. Raman were all products of this time. These developments have been well documented. The earliest writings on science were generally of two types. One involved a general sketch of scientific thought in nineteenth century India and its provinces, discussing the broad trends within contemporary scientific thought. 58 The second included biographies of important personalities who figured as heroes of the nationalist movement. 59 They generally followed the Whiggish-nationalist patterns of history writing. They accepted science and nationalism as naturally progressive and enlightening and the story of the nineteenth and early twentieth centuries was one of a gradual, progressive articulation of these ideas. Such a stand precluded the possibilities of a more critical understanding of the contradictions, predicaments and crises such a process entailed.

Ashis Nandy, in his analysis of the careers of Jagadish Chandra Bose and Ramanujan, tried to overcome this limitation. His is a complex understanding of the psychological tensions and disturbances that these individuals, who accepted

58 A typical example of books in such a genre is B. Bhattacharya’s Banga Sahitye Vijnan (Bengali), Calcutta, 1950; Nenai Sadan Bose, The Indian Awakening and Bengal, Calcutta 1969; Anil Chandra Gosh, Vigyante Bangali (Bengali), Calcutta.
Western science while wanting to remain ‘Indian’, had to undergo. A more recent trend has been generally to locate the redefinition of western scientific thought within the cultural matrix of Indian nationalism. Deepak Kumar shows how science formed a point of contest, of assertion of nationalism against the colonial regime. In the process, he argues, science itself was redefined and relocated. Dhruv Raina and Irfan Habib in a series of articles stressed the cultural transformation that science was undergoing in India in this period. Through an analysis of individuals such as, Ramachandra and P. C. Ray and associations such as The Dawn, they have tried to show how the Orientalist notions of science was challenged, how the ‘cultural redefinition’ of science took place, and how the changing images of science occurred. In this context, Gyan Prakash has sought to explore the process of ‘alienation’, ‘displacement’, and ‘cultural transformation’ of this dominant discourse in colonial India. Prakash, however, focuses on the general questions of modernity and rationality, not the actual shifts within scientific endeavours.

To my mind, a focus solely on the question of ‘cultural transformation’ is problematic. Knowledge systems of one particular cultural and social matrix are bound to undergo transformations through a range of creative interventions in another context. Such was the case with western notions of nationalism in colonial India. Moreover, the early history of the Asiatic Society shows that the cultural displacement of Western science in colonial India had already begun under the European scientists.

My questions would be regarding the nature and limits of that redefinition and its implications for the transmission. What were the frameworks within which this transformation was taking place? Nineteenth century science was an Eurocentric, centripetal, and hegemonic discipline. A neglect of this fact might tend to glorify the levels of transformation. We may be inclined to show clear breaks within the scientific thoughts of the Orientalist and the nationalist period. An analysis of the

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60 Nandy, Alternatives Sciences: Creativity and Authenticity in two Indian Scientists, Allied, New Delhi, 1989
62 Some important papers jointly written by them include “Bhadralok Perception of Science, Technology and Cultural Nationalism”, IESHR, XXXII (1), pp. 95-117; “Copernicus, Columbus, and Colonialism and the Role of Science in Nineteenth Century India”, Social Scientist, 17 (3-4), pp. 51-66; Also see Dhruv Raina, “Evolving Perspectives on Science and History: A Chronicle of Modern India’s Scientific Enchantment and Disenchantment”, Social Epistemology, II (1), pp 3-4.
63 Gyan Prakash, “Science between the lines”, in Shahid Amin and Dipesh Chakraborty (eds.), Subaltern Studies; Writings on South Asian History and Society, vol. IX, OUP, Delhi, 1996.
problem of redefinition during the nationalist era will provide new insights into this question. To this end, it is important to ask some basic questions sometimes ignored by the existing historiography. One interesting way to locate the limits of these transformations would be to link the two processes that I discussed in the beginning. How did the ‘cultural transformation’ and ‘displacement’ of nationalist science influence the cultivation and research of the same? Did it give rise to a new science and a different way of looking at the nature and the Universe? In other words, did the intellectual exercise, known as ‘nationalist science’ give rise to different attitudes towards nature and the Universe in contrast to western science, questioning the Euro-centric notions of truth, knowledge and control of nature and society? What were the frameworks of thought from and within which their ideas developed and were located? What was the content of their critique? I seek to answer these questions by studying three instances of attempts to define an ‘Indian science’. The fourth chapter focuses on the prominent doctor M. L. Sircar’s search for a spiritual science. It seeks to locate the particular orientation of Sircar’s involvement with science and nationalism as well as the ideas of others like father Lafont that defined Sircar’s pursuit. To that extent it analyses the role of the Indian Association for the Cultivation of Science, founded by Sircar. It was through this institute that Sircar sought to set the agenda for the ‘cultivation’ of western science by the Indians and thus the emergence of an Indian science.

The fifth chapter takes up the researches of J. C. Bose as the second instance of a redefinition of western science. It analyses how the physicist Bose, acclaimed for his discoveries in the field of electromagnetic waves, began to work on the question of the living and non-living, which ultimately urged him to link Vedic monism with modern science. My attempt is to locate this journey, which was essentially a multifaceted search for the indigenous, non-western ‘other’, within a complex interaction of the scientific, nationalist, and Orientalist discourses that seem to have shaped Bose’s concerns and motivations. The sixth chapter studies a very different search, that of ancient Indian science by P. C. Ray. Unlike Sircar and Bose, Ray’s quest was for an Indian materialism, which he sought to locate in tantric alchemy and thereby write a new history of Indian chemistry. Here Ray’s contestation was with scholars like Berthelot who had assumed the originality of Greek alchemy. But did Ray’s work produce a challenge to Greek Enlightenment or a celebration of it? Where do we locate Hindu Chemistry’s break from the Orientalist writings of the Indian past? What were Ray’s assumptions about science, universality, and Tantricism?
In the backdrop of these discussions, I seek to develop my final concern: how did science shape the visions of a future, modern, Indian nation? In the final stage of the transmission science assumed a central location in the Indian search for modernity and nationhood. At one level it attempts to illustrate how this engendered the various discourses around science, that of industrialism, Orientalism, romanticism, the projects of Sircar, Bose, and Ray, etc. At another level it seeks to understand the reductionism with which this assimilation was accomplished. How were the various contradictions of the geologist P. N. Bose’s anti-industrialism, the ascetic Gandhian Ray’s zeal for chemical industries and the leftist M. N. Saha’s fascination for the capitalist Carnegie sorted out? A final query, does this monolith somewhere lead us to the essential character of this transmission of knowledge from Europe to India?

VII

‘Nationalist science’ suggests a link between the nation and science. The scientists sought to address a wider political arena where their science would have a broader articulation and meaning. At the same time they sought to approach their laboratories with new insights and perspectives gathered from this political and social space. This link between the popular nationalist discourse and the practice of science holds a key in understanding the nature of this transmission of science. This issue can be looked at through the framework of the ‘popular’ and the ‘elite’.

Science appears elitist both for its hegemonic character and its association with the state. The popular here can constitute of, what Barry Barnes calls, ‘lay expertise’ which is derived from immediate and extensive involvement with the states of affairs wherein problems were arising. This can be the larger nationalist politics and its various popular manifestations. The popular in such a situation may also include the ‘traditional’ systems that the specialised, dominant one seeks to replace. The story thus becomes an interesting combination of clashes and compromise, trust and scepticism.

A large number of writings on colonial India and science have suggested a complex interaction between the two domains. The stress has been to show how the disruption and transformation of one led to similar changes in the other as well.

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Several important questions need to be raised: How in the process of acquiring hegemonic practises, the subaltern groups or popular culture in turn influenced the former? How did the same dominant knowledge allow areas of resistance, which ultimately challenged its hegemony?

Gyan Prakash, defining the popular and the elite in terms of distinct discursive fields, has shown how science was appropriated and redefined radically within the popular discourse, quite independent of its esoteric, elitist character. Thus science "lost itself" in the 'otherness' that it sought to dominate. This is how science and modernity asserted itself within the popular culture.65

The instances of resistance and negotiation between the two domains have been analysed in writings on medicinal practises in colonial India. Deepak Kumar’s study of Ajmal Khan and P.S. Varier’s synthesising and commercialising of traditional medicine and its distribution reflected such a resistance.66 Such instances often manifested themselves in a revitalisation of popular medicine, as studied by K.N. Panikkar. He shows how the popular movement, while opposed to colonial medicine, also incorporated elements of modern medicine, leading to the emergence of a new vigorous traditional medical practise, textualised and modernized.67

Dhruv Raina and S. Irfan Habib analyse another aspect of this negotiation. For them the issue is not tradition and modern science, but science and the popular national movement. They analyse the areas of contact that existed between the two, how science informed the popular arena, which in turn influenced science, particular its 'moral vision towards nature'.68 'Thus the process suggested here is one of mutual transformation. To that extent they propose certain coherence between the two levels rather than conflict.

For David Arnold, the problematic is different, as his 'popular domain' comprises of the 'colonised people', which included both the traditional practitioners, 'subaltern classes' like the peasants and labourers as well as the nationalist medical practitioners and scientists. The key to Arnold's analysis is his identification of colonial medicine and colonialism as hegemonic discourses, a

65 Gyan Prakash, "Science between the lines", op. cit.
68 Raina and Habib, “Bhadralok Perception of Science” op. cit.
vehicle “not just for the transmission of Western ideas and practices to India but also for the generation and propagation of Western ideas about India and, ultimately, of Indians’ ideas about themselves.”

His work narrates a complicated story of resistance, negotiation, compromise and accommodation that developed between colonialism and the colonised.

The focus of this research is slightly different, although it appreciates Arnold’s identification of colonialism as a hegemonic entity. It does not attempt to write a history of the perception or impact of science in the wide spectrum of the popular arena. Neither does it seek to understand the mutual transformations of science and nationalism. Its engagement is essentially with the elitist arena; the practice of science in a colonial world. From here it attempts to analyse how the engagement with science involved an appropriation of the popular domain, since the interaction between the two levels meant a process of selection, sifting, negation, and glorification of certain elements of one by the other. The concern is to see whether and how this redefined the elite domain of science.

Thus the attempt would be to understand the transmission of science in a colonial world. The 'colonial world' here implies a subordinate, dependent status. I would use two parallel and often interchangeable categories to express such a status - the centre- periphery for the earlier period under the European scientists and the West- East for the nationalist period. The separate categories are more for the sake of familiarity as the existing literature on these two phases have generally identified the two eras with these distinct categories. To this present research, however, they have similar implications. The categories are used here to essentially imply power in an imperialist world in cultural, epistemological, and political terms. The study would be an attempt to analyse this equation of power, the conditions of subordination in a colonial world and how scientific research confronted and negotiated it.

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David Arnold, *Touching the Body: State Medicine and Epidemic Disease in Nineteenth-Century India*, Oxford University Press, Delhi, 1993, p.291: