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HISTEM and the Making of Modern India — Some Questions and Explanations*

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Abstract

This paper discusses the concept and relevance of a discipline HISTEM for historical understanding of science, technology, environment and medicine. The assessment is made here in the context of both colonialism and modernity. For a long time, scholars have written about it and a good deal of research papers and books have come out but unfortunately this theme is yet to enter the curricula of our university system. Numerous works have been written on different aspects and facets of both colonialism and modernity as it evolved in South Asia. This paper argues that studies in HISTEM may help us get a better understanding of the colonial modernity. It raises certain questions and offers some explanations.

Key words: Colonialism, Education, Hegemony, India, Medicine, Modernity, Power, Science, Society, Technology

1. Introduction

Fascinated by the intricacies of the man-nature relationship, William Jones the founder of the Asiatic Society in 1784, had set as its goal to study 'Man and Nature; whatever is performed by the one, or produced by the other'. He could not have been more apt and precise. Taken together, man and nature form the basis for the history of science, technology, environment and medicine (HISTEM) or STEM in history. The discursive terrain of HISTEM was never flat. It had its ups and downs, ruptures and dichotomies. The ancient Greeks had talked of the 'desire to know', later it gave way to 'desire for power'. Ancient Indians had hailed knowledge as 'a liberating force' (*sā vidyā yā vimuktaye*), Bacon later popularized it as 'power to control'. For long scholars debated the distinctions between *theoria* and *praxis,* between *episteme* and *techne*. Historians of science have wrangled over internalism and externalism.

Many have played 'historiograpaher royal' to science, transforming an individual genius into an icon. In this sense history of science helped an *ex post facto* legitimation and pandered to the scientists' amour proper. 'We are liable to optical illusions if we only have eyes for the mountain-peaks', warns a renowned historian (Butterfield, 1959, pp.329-47). On another occasion he wrote, 'Sir Issac Newton is the starting-point of a new age not merely for us but also for the Indians and the Chinese'. However, in recent years there has been an almost universal realization to view HISTEM within 'the wider spheres of thought, culture and society' (Porter, 1988, pp.69-71). Men of sciences are no longer the sole 'creators and

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consumers' of this new discipline. It now has a wider appeal. And in this sense history of science belongs to the mainstream of social and cultural debates in history.

Another sub-theme of this paper is the making of modern India. Sociologists have debated for long what constitutes modernity (Singh, 1973; Chatterjee, 1986; Raghuramraju, 2011). But there is a near unanimity on how it reached India riding the colonial wave. Like colonialism, modernity is also janus-faced; it kills and nourishes almost simultaneously. Both succeeded to a large extent and dominated but not without resistance. These were powerful historical forces but no monoliths. There were punctures and disjunctions all around. The result is, in India, as in many other Afro-Asian societies, pre-modern ideas and institutions continue and co-exist with the modern. This complex yet dynamic relationship has been explored extensively in political, cultural, sociological, and even economic, terms. Can studies in HISTEM help us get a better understandingof colonial modernity? I believe it does.

History is always a contested intellectual territory; and no historiography can ever be a neutral enterprise. Every society, indeed every individual, has a right to reflect upon it. They need not come to a single or consolidated conclusion, rather more the merrier. Then there is no guarantee that the 'new' will work better than the earlier one. What appears as a new explanation may actually be an old wine in new bottle. Nevertheless the variations in arguments or thrust deserve no less appreciation. Certain portrayals or arguments, based on a little imaginative use of sources, may have a longer validity or wider acceptance. But this does not mean that those which go against the grain be consigned to dustbin. New evidence or a fresh look may induce a rethinking. And the cycle goes on. In the process theories often melt and very often historians appear better than their theories (Gillespie, 1995).

Another issue that calls for attention is the concept of 'mainstream' history. What constitutes the 'mainstream'? Does it really exist? What is the status of the 'tributaries'? When do they become 'main stream'? Agreed, that a study of material culture is mainstream history. But what this study would be without history of tools and techniques? Again, what history of ideas would be without a study of scientific ideas? Some scholars, perhaps due to a misplaced academic ego, think that what they do is mainstream history. So, in the context of modern Indian History, the scholars writing on national movement, partition, etc., tend to treat their themes as 'mainstream' research. Changes, however, did occur from political accounts to social explanations, peasant studies, then 'subaltern', post-modern, and now probably history of science, technology, environment and medicine (HISTEM). Some scholars, working in hitherto unexplored areas, are sometimes themselves keen on 'mainstreaming' their themes. A relevant work on history of medicine, for example, claims, 'Mainstreaming takes a historical subspecialty, like the history of medicine, lifts it out of the confining limits of a disciplinary channel, and refloats it in broader historical currents' (Lindemann, 1999, p.1).

I consider this a meaningless exercise. There is no mainstream, instead there are numerous streams that collectively produce the ocean that history is. This approach not only admits both macro and micro studies as equally relevant but also allows other disciplines a significant role in the production of historical knowledge.

The most significant feature of HISTEM lies in its necessarily interdisciplinary nature. It borrows and benefits from different disciplines. Philosophy, parts of physical and biological science, and social sciences like sociology, anthropology, political economy, etc. provide valuable insights. But any dependence on or overuse of any one may interfere with the

simplicity of a historical narrative and may even make a fine historical construction jargon-ridden. Conceptual analyses need not always result in epithets, labels or jargons. Concepts and empirical study should and do often mesh together and HISTEM provides ample opportunities for this interplay. This agenda must necessarily be not only interdisciplinary, but also be comparative in both content and analysis. Comparisons are relatively easier in terms of centre and periphery relationship but these are not sufficient. Here a major question is, can a periphery alter the terms of the centre (Chakrabarti, 2004, pp. 1-26)? The traffic is complex and we need to undertake comparative studies, for example, in regard to different colonial experiences in different parts of the globe. As Michel Paty cautions, only by 'differential' studies, whose subject is restricted but which are accurate and varied concerning different but in some respects comparable situations, can legitimate comparative statements be made (Paty, 1999, pp.171-204). The incorporation of these comparative facts and data may provide a correction to 'mainstream' histories of sciences. I am consciously using the term 'histories', there need not be one history, there can be many. Technology, for example, can be seen from the perspectives of social history, economic history, even cultural history. So is the case with medical history. HISTEM, like any other historical project, thus involves a study of several cross-sections representing events and ideas which are inter-connected and which exemplify the cause and effect relationship.

2. Science, Colonialism and Modernity

In recent years a good deal of attention has been paid to determine the place and role of techno-scientific changes and developments in the colonial process. New questions have been asked and certain explanations attempted. For example, what shape does 'modern' and 'universal' science take in a colony? To what extent were scientific discourses used to achieve political or economic goals? How the indigenous scientific traditions were perceived and how did the indigenous people react or respond to the introduction of 'new' science? Exact sciences like physics or astronomy may appear cognitively 'insular' in a colony, but several other branches of scientific knowledge were not. How 'colonial' do they become in a colonial setting (Kumar, 1980, pp.105-13) ? These questions lead to a new research agenda which includes the generation of national currents and traditions in science (without being revivalists!), the interactions between 'traditional' sciences and modern sciences and the diffusion, confrontation and integration of sciences.

Numerous such questions have engaged the attention of scholars for a long time and several plausible explanations have been offered. The colonizer and the colonized cannot be seen only in terms of binaries. How to characterize this delicate and dialectic relationship – in terms of core-periphery, network, web, circuits, persuasion – coercion, 'gentlemanly', 'traditional' imperial history or 'new' imperial history? Historical facts, dug honestly from different sites, do not seem to support deterministic or essentializing understandings. The very nature of historical construction invites one to look at cross-currents and fluidity. Colonialism as a process is no exception to this. Similarly scientific knowledge, like colonialism itself, is no monolith; both needed and aided each other. The present volume talks of 'trans-cultural cooperation and empire-building'. Cooperation, even collaboration, was definitely there. Such a massive and stable empire could not have been built and sustained without the support, silent or explicit, from a large section of the colonized. The colonial hegemony was based not only on physical or epistemic violence but also on consent. Some scholars, however, deny the idea of cooperation; they argue things were imposed from above. Many others try to soften the sting that imperialism was, and try to project it in terms

of collaboration. This paper would try to address these questions with the help of some relevant examples of techno-scientific education in Victorian India. Education as a whole has been researched well but its techno-scientific part remains relatively less explored. This part is significant as an agent of socio-economic transformation and modernization itself depended upon it.

Discussions on colonialism are probably as old as the colonial process itself. Shakespeare had reflected upon it in the early 17th century. His *Tempest* has all the ingredients of the real drama that colonisation played in different parts of the world. It has voyage, discovery, oppression, collaboration, intrigues, and above all, the magic of knowledge. Till the end of the 18th century, the travellers, the traders, the officials, the military and the missionaries remained busy in building up the colonial project, and they emerge as the major, if not, the sole informants on what was happening. Later the recipients also became very curious of what was happening around them. They were no longer passive and at least in some areas colonialism became a joint project. Out of this encounter, the seeds of decolonisation sprouted and this was followed by long years of contestations, struggle, and finally, independence for the colonized. In the postcolonial decades, the scholarly attention has naturally reverted to the fascinating and penetrative game- changer that colonialism was. Its myriad shades have now been dissected in terms of power, culture, imposition, contestation, metropolis, periphery, and what not. The diffusionist perspective and the centre-periphery model had held sway for a long time. It had its own advantages and did succeed in explaining the phenomenon to a large extent. The relationship between the metropolis and the colony was not merely geographical or political; these were also socially constituted, and as such 'represented the combined effects of social, political, and economic relations among different cultures and peoples' (MacLeod, 2000, p.5). So to discard the core-periphery explanation would be like throwing the baby with the bathwater! But the new post-colonial scholarship rightly points out the disjunctions, the ruptures, and the ambivalences that the earlier explanations had left out or ignored. Can both be taken together?

In undertaking such researches, the first port of call was obviously the archive pertaining to the trading companies who had initiated the colonial process in early modern times. These form an almost inexhaustible source of historical reconstruction. Next are the travellers and missionary accounts. And then of course are the numerous tracts, pamphlets, journals and reports written in both colonial and indigenous languages. Later researches, probably under the influence of postcolonial essayists, tend to undermine the significance of the so-called official sources even though they came from the horse's mouth. It may be more rewarding to go through numerous, often contradictory, notes written by lower-rung officials filed between dusty covers. They give an idea of how a decision was arrived at, the tensions involved and the perceived threats. The files preserved in the colonial archives lay bare the inner thoughts of the official mind and show what went into the making of a particular decision. It may be erroneous to believe that the official sources give only a particular picture. Through them it is possible to know about the 'other' side as well. This, however, is not to underestimate the importance of 'local' sources, especially those written in their indigenous languages. In them one gets sharp critique of the official policies and actions. Similarly, in private papers, several official participants appeared critical, outspoken and forthright. The letters written by the colonial scientists to their peers in London and the replies they received make exceptionally interesting reading and reveal what is not normally available in official documents or contemporary publications. They often contradict what one finds in official records and give new insights.

This brief discussion on sources is important because they provide the foundation for a valid discursive terrain. Literary people and even anthropologists may have the liberty to 'imagine', but poor historians cannot afford such luxuries. So all our talks on, 'web', 'network', 'circulation', 'calculation', etc. need to be based on solid primary evidence. We would also be ill-advised to make generalizations on the basis of one or two solitary manuscript or source. On the basis of the available sources and the works published so far, one can reasonably assume that scientific and technological knowledge was closely woven into the whole fabric of colonialism. The colonial state claimed superiority in terms of structure, power, race, etc. while modern science claimed superiority in terms of new knowledge. Both needed each other and moved hand-in-hand. Thanks to this relationship the concept of a 'state scientist' emerged under which its practitioner would have the dual mandate to serve both the state and science simultaneously. The Jesuit missionaries also did the same. In China, they skillfully served the interests of both Rome and the Forbidden City. As a critique points out, 'in both the linguistic and Latouriansense, Jesuits were masters of translation' (Harris, 2005, pp. 71-79). In India, they moved with the Bible on one hand and an improvised telescope or microscope on the other. Both could be used convincingly to shatter or change the world views and cosmologies of the indigenous. Major exploratory works were done by the medical men who travelled on every boat as 'surgeon-naturalists'. In the initial years of colonisation, the colonial scientist was, to a large extent, the master of his agenda; and a whole new world of flora, fauna and minerals was open to him. This was a period when it was possible to forge a network or a web connecting them despite the tyranny of distance and initiate a far more liberal though limited circulation of ideas and materials. These 'web-masters' understood the significance of the local knowledge. Bontius (the Dutch botanical explorer in Java), for example, considered the knowledge of the Javanese superior to that of Greek and Roman authorities. He objected to the epithet 'barbarians' given to the locals in Batavia and argued that their knowledge of herbs 'leaves our own far behind' (Schiebinger and Swan, 2005, p.12). Similarly, many influential Europeans in India felt that the local knowledge and its techniques could be put to constructive use. Except for a few, like Lord Macaulay who introduced English as the medium of instruction in 1835, there were many British officers who sought help from the old intellectual elite in their own work. J. Wilkinson in the Court of Rewa and J. Ballantyne of the Banaras Sanskrit College are illustrious examples. They were so respectful that they refused to sweep away the old hierarchies, but they did honestly try to replace them with new, syncretic Anglo Indian precepts (Bayly, 1999, p. 260).

But in many cases, the dismissal of the local was quick and sharp. The colonizers were genuinely convinced of their epistemological superiority. In such a scenario, Lewis Pyenson claims a 'distinct', 'special' and 'insular' status for the exact sciences like physics and astronomy (Pyenson, 1989). Scientific works in the colonial outpost no doubt 'lit the wilderness for metropolitan travellers' but whether they 'illuminated local residents with the light of superior learning', as claimed by Pyenson, is doubtful. Scholars have talked about the different ways of the transmission and reception of scientific ideas which were not always consumed 'neat' by the recipients. Tomes have been written on the encounter, struggle, and so forth. But struggle against whom? Can the different parties of an encounter or struggle be studied separately? The imperial and subaltern materials are not like grain and chaff to be winnowed. A comprehensive trajectory should include, highlight and analyse both (Kumar, 2006, p. 17).

3. Technology, Economy and History

It is universally agreed that techniques are part of, rather they form the basis of what Braudel calls material civilization. Any account of the *homo faber* would be a history of technology. A social history of technology, to quote Cowan, 'assumes a mutual relationship between society and technology; it also assumes that changes in one can, and have, induced changes in the other' (Cowan, 1997, p.3). In many ways technology is central to human history; everywhere it shapes and is shaped by political, cultural, social and economic changes (Allen and Hecht, 2001, p.3). Such being the case, can history of technology be segregated from the rest of history?

Technology was earlier defined a technical artefact and science as knowledge. Is technology science's other? Probably not. Both are historical variables. Science in part is knowledge about technology and technology can be embodied knowledge. So why distinguish the two? They are two sides of the same coin, enmeshed in a 'symbiotic relationship'. Techno-scientific developments can be presented as a non-determined, multidirectional flux that involves constant negotiation and renegotiation among the groups and between the forces shaping history. This approach is flexible and eclectic, and wards off the fears of technological determinism (Kranzberg, 1986, pp.544-60). To some scholars, however, technology forms an entirely separate area with its own internal evolution and dynamics. Others would make a sharp distinction between pure and applied sciences. This author believes goes against the spirit of inter-disciplinarity which constitutes the core of HISTEM.

During the last two decades, works on social construction of technology have virtually revolutionized our understanding of the technology-history relationship (Bijker, Hughes, and Pinch, 1987; Bergger and Luckman, 1966). This is fundamentally a sociological approach to technology that analyses artifacts in the context of society. It focuses on social groups that play a role in the development of a technological artifact. Based on the notion of 'interpretive flexibility', it argues that radically different meanings of an artifact can be identified for different social groups (Pinch, 1996, pp.17-36). This has interesting ramifications for gender studies as well. Women, for example, pump water and occasionally operate field machinery but man fix a leaky pump, and oil, grease or even redesign a machine. Technical competence thus helps to define them as masculine (in opposition to a non-technically competent feminity) and thereby reinforce the patriarchal system (Bray, 2012, pp. 37-60).

During the eighteenth century technology was understood in terms of 'knowledge of the arts'. It was knowledge produced and transmitted by craftsmen. In the next century it came to be described as 'the application of the sciences to the useful arts'. Now it involved knowledge and machines. This was an era of romanticism as well. The romantics were worried on what technology was doing to skill and craftsmanship. There appeared a reasoned critique of machines and industrialisation. Romantics like Thoreau believed that machines were destroying not only nature but also human artistry, creativity and sensitivity. Later the Luddities were to sharpen these arguments. Yet there were many who fancied the new Juggernaut. The great nineteenth century poet Mirza Ghalib, after a visit to Calcutta, sang hosannas in praise of the power of steam, the new tools and the new knowledge the British had brought. In 1855 when Syed Ahmed, a Muslim educationist and reformer, requested Ghalib to write a foreword for his edition of *Ā'in-i-Akbarī,* the poet admonished him in verse:

> For such a task, of which this book is the basis
> Only an hypocrite can offer praise…
>
> Look at the Sahibs of England. Look at the style and practice of these,
>
> See what Laws and Rules they have made for all to see What none ever saw, they have produced…

> What spell have they struck on water That a vapour drives the boat in water!
>
> Sometimes the vapour takes the boat down the sea Sometimes the vapour brings down the sky to the plains.
>
> Vapour makes the sky-wheel go round and round Vapour is now like bullocks, or horses.
>
> Vapour makes the ship speed Making wind and wave redundant.
>
> Their instruments make music without the bow They make words fly high like birds:
>
> Oh don't you see that these wise people Get news from thousands of miles in a couple of breaths?

It is generally agreed that technology- whether as tool or form of knowledge- is not value free; it always manifests socio-political qualities and drives the economy. In industrialized high-energy societies, it may become 'messy' and 'complex', but in colonial conditions it naturally acquired the contours of the colonial power, both commercial and administrative. What impact did colonisation have upon the technological systems and capabilities of the colonizers on the one hand and the colonized on the other? How did colonialism determine the transfer mechanisms? Did it mean geographical relocation of technologies or could it encourage its cultural acculturation as well? Did British colonization accelerate India's 'fall'? Or did the British presence, however, inadvertently and lacking in foresight, prepare what became in Indian hands a vital basis for later economic, scientific, and technological 'take off? Technologies are significant not only as 'tools' but also as forms of knowledge (sometimes referred to loosely as 'technical education' in colonial records). How was this knowledge generated, used and transferred, and to whom? The 'token' industrialization that did take place in certain sectors (e.g. textiles and later in steel) had no 'multiplier effect' on the industrialization of the colonial economy as a whole. Morris D. Morris has argued that the total structure of poverty and generally high factor input costs (but low raw labour costs) combined to discourage investments in new technology and thus prevented rapid economic growth (Morris, 1985, pp.125-29). But this does not explain what went into the making of that 'structure of poverty' and what sustained it. Was that structure a continuation or legacy of pre-colonial times? Was it the result of some cultural proclivity to remain poor? Was it an inevitable consequence of the imperial system? Or was it a combination of all these and much more? Aware of the darker side of Western industrialism, many in India wished to gain its benefits without losing India's indigenous culture. How to have the best of both worlds? The dilemma continues even at the turn of the new millennia.

In the Indian context it may be useful to recall the views of Mahatma Gandhi. Amidst the growing demands for self-rule, democracy, industrialization, and development, Gandhi had emerged as an extraordinary dissenter. He condemned the West for precisely those virtues in which it took pride: modernization and industrialization. Gandhi seldom used the terms "science" or "technology". His concern was with civilization and mechanization, and on these topics he talked and wrote profusely. He considered machinery "the chief symbol of modern civilization". "It represents a great sin." He wrote. "It is machinery (and Manchester) that has impoverished India…I cannot recall a single good point in connection with machinery. Books can be written to demonstrate its evils" (Parel, 1997, pp.109-110). Yet many times Gandhi (*Young India*, 1924) would say he was not opposed to machinery per se:

> How can I be when I know that even this body is a most delicate piece of machinery? The spinning wheel itself is a machine. What I object to is the craze for machinery…today machinery helps a few to ride on the backs of millions. The impetus behind it all is not philanthropy to save labors but greed. It is against this constitution of things that I am fighting with all my might.

Gandhi, with all good intentions, probably wanted to force the Ganges back to Gangotri. This was simply impossible. The sharpest criticism of Gandhian views came from Meghnad Saha (1893-1955), a pioneer astrophysicist. Saha wanted India to choose "the cold logic of technology" over the vague utopia of Gandhian economics. While he appreciated Gandhi's "genuine sympathy with the victims of an aggressive and selfish industrialism." Saha firmly refuted the claim that better and happier conditions of life could be created by "discarding modern scientific technic and reverting back to the spinning wheel, the loin cloth and bullock cart" (Saha, 1935).

At a global level, the two world wars not only rescued the *Prometheus* but established it as the presiding deity of modern times. Leading intellectuals from different disciplinary backgrounds like Karl Popper (philosopher), C.P. Snow (novelist), David Landes (historian), and W.W. Rostow (economist) saw a connection between the rationality of science, technology, and indsutrialisation, on the one hand, and the values of democracy on the other (Allen and Hecht, 2001). Relevant and reasoned criticisms from critics like Lewis Mumford, Jean Meynaud and in recent years Asis Nandy have no doubt illuminated the debate but these in no way have discounted the significance of historical investigations in this area.

4. Colonial Medicine

The history of medicine is no less significant a field than history of science and technology. Medicine for long has been considered both a science and an art. It has enormous social implications and probably equally important political and cultural dimensions as well. Earlier we had some studies on the Indian medical tradition as part of philosophical and cultural enquiries (Sharma, 1992; Valiathan, 2002). Now even scholars of modern Indian history have taken to it in a big way. Several works have appeared on medicine in politics and the politics of medicine (Bala, 1991; Arnold, 1993; Harrison, 1994; Kumar, 1998; Pati and Harrison, 2001; Kumar, 2002; Kumar and Basu, 2013). At a micro-level, anthropologists and sociologists have contributed a great deal. Comparative or prospographical studies of medical men can be equally instructive (Latour, 1988; Kumar, 1999, pp. 239-71).

Apart from the above-mentioned concerns of a general and societal nature, one may also ask certain specific questions, as Roy Porter does in the context of late medieval England (Porter, 1993, p.2). How was healing practiced and who practiced it? How was disease perceived? Medical anthropologists have looked into magico-religious rites, rituals and shamans. Can these be contextualized historically? Who were the grass root healers? How did professionalism emerge? What were the contours of medical pluralism? How can one chart the interaction between the great and little traditions in terms of folk medicine and ethno-history (Hart, n.d.)? Disease histories are many but we may need to look at them from the patients' eyes (Rothman, 1994). How did the sick evaluate doctors? How did the many distinct and competing practitioners relate to each other? This question was put in sharp focus when modern medicine entered new lands riding the colonial wave. Colonialism required bodies to travel from one place to another and this influenced the relations between the bodies and the pathogens. Moreover, the colonizing bodies were naturally anxious about their fragility either in the face of larger natural and social environments or in relation to other bodies (indigenous or foreign) that constituted an implicit threat (Bewell, 1999, p. 24). What were the epidemiological consequences? What were the concerns for sanitation and the public health? Then, how 'public' was public health (Hamlin, 1998, pp. 1-14). Colonial expansion strengthened the alliance between science and the state and the concept of state science/medicine emerged. How did it

function; what was its impact? Is there anything specifically colonial about colonial medicine?

Like technology, western medical discourse functioned in several ways: as an instrument of control which would swing between coercion and persuasion as the exigencies demanded, and as a site for interaction and often resistance. This discourse was medicated not only by consideration of political economy but also by several other factors. Polity, biology, ecology, the circumstances of material life and new knowledge interacted and produced this discourse. The emergence of tropical medicine at the turn of the last century may need to be seen in this light. It may be argued that tropical medicine itself was a cultural construct, 'the scientific step child of colonial domination and control' (Manderson, 1996, pp. 10-14). In now burgeoning literature, terms like tropical medicine, imperial medicine and colonial medicine have often been used interchangeably. But they have specific connotations. Tropical medicine and imperial medicine emphasize the tropics and the empire as units of analysis while colonial medicine stresses the colony. Each may attract different sets of questions. In tropical medicine what ought to be the determining factor – climate, race, geography or all taken together? What was carried over from the old medicine of tropical civilizations into the new tropical medicine? What attempts were made outside Europe to reconcile the older discourse of body humors and environmental miasmas with the new language of microbes and germs? Interestingly enough, a medical historian described colonialism as 'literally a health hazard' (Denoon, 1989, p.52). But to dismiss the colonial doctors reductively as the handmaidens of colonialism or capitalism would also be to ignore a more complex, and more interesting, reality (Bell, 1999, pp. 10-52). The doctors had to assume multiple roles. They had little choice. Still one can ask, what role did the 'peripherals' play? Could a synergetic relationship between the core and the periphery develop? These questions assume special significance when viewed against the four centuries of European's struggles in the 'torrid zones' and their transition from early explores, travelers, and traders to conquerors and ultimate arbiters of the trampled tropics. Earlier the 'tropical discourse' was viewed through its pioneers; now issues and dichotomies have been given primacy. However, these still abound in metropolitan theorizations and do not include the study of indigenous (non-settler) societies through their own literature and practitioners.

Certain specific diseases have received special attention. Some are explained in terms of topography, some on grounds of race, and others in terms of microbes. In the classic colonies, all these explanations had almost the same result – let the 'native' fend for themselves. These provide a theoretical justification for opposition of consistent sanitary works or to fundamental medical research. Successive sanitary commissioners were to rely 'more on statistics than research'. They definitely lacked the will, if not the resources to take effective action. Research, however, was not totally ignored. The works of Koch, Ross, Donovan, and Haffkine in India show the importance of field-work. Here the location was India but the agenda came from Europe. Compare it with nineteenth-century Brazil, an independent settler colony (Peard, 1996, pp. 108-132). The works of Bahian Tropicalista School of Medicine during 1860-90 were not imitative but innovative. It made full use of western clinical methods, tools, and statistics but framed its own agenda and worked without official funding. For the first time in Brazil, Otto Wucherer isolated hookworm parasites in 1865 and later also isolated the embryonic filarial. Pereira worked on beri-beri, while Silva Lima started a medical journal. All of them worked to inculcate autonomy and self-esteem in their profession. Living in a tropical climate, they argued, made them merely 'different' from the Europeans but not better or worse. Could

their contemporaries in India make such claims? Though to consider their works 'national' or 'Brazilianized medicine' may be a little overenthusiastic, the Tropicalistas definitely deserve notice and recognition.

Nevertheless medicine did emerge as a nationalist issue in India. Even at the height of colonial power, voices against the dominant medical discourse were heard. The indigenous practitioners vehemently denied that their system was unscientific or irrational, yet they did not see anything wrong in learning and benefiting from the new knowledge. Their emphasis was on reforming the system by adopting 'scientific' method and not on changing the fundamentals of the system. A critical anti-colonial spirit permeated the indigenous response. To quote a verse from a Hakeem in 1910 (Qaiser, 2000, pp. 29-42):

kuch-ilaj ayana kuch charagiri ayee:

tibb-e-unan ke munh doctory ayee:

band sheeshe mein vilayat se pari ayee:

lal-peeli hui, gussemein bhari ayee:

chaman-e-tibb se guldasta uda kar layee:

nayee tarkeeb se bandish saja kar layee.

Knows no method of treatment, but Doctory dared to challenge Unani. In a closed bottle a fairy has come full of anger from foreign lands. The bouquet stolen from the garden of Unani Tibb has been rearranged in a new fashion.

There were several areas in which the Western and indigenous systems could collaborate but did not. The former put emphasis on the cause of the disease, the latter on *nidāna (treatment)*. Microbes and microscopes constituted the new medical spectacle (Anderson, 1992, pp. 506-29). But the *vaidyas put* emphasis on the power of resistance in the human body. The Westerners were forced to take cognizance of indigenous drugs and the *vaidyas* took to anatomy, ready delivery of medicine, quick relief, and so forth (as in case with P.S. Varier and Hakim Ajmal Khan). But the comparison ends there. As a recent critique argues, 'they were inclined to borrow but could not create a dialogue between the two epistemics (Panikar, 1992, pp.283-307). Borrowed knowledge seldom develops into organic knowledge.

5. Environmental Perspectives

In recent years environmental history has required a new thrust and relevance (Sangwan, 2001). The pioneers are Ramchandra Guha, Richard Grove, Madhav Godgil and Mahesh Rangrajan. There is a need to integrate environmental perspectives with the existing discourses on history of science, technology and medicine. Both stand to gain in this mutual give and take. Can nature as an area of scientific research help historians understand the dynamics of past? If so, how? The sciences of nature have given us oodles of data on all possible dimensions of our material existence. They have given models and new paradigms. What place should these have in historical thinking and historiography? How do the environmental ideas emerge? Are they socially constructed or they emerge from the top as instruments of authority and explanation? Contest and defiance have played on less significant a role. The Chipko and Narmada movements are recent examples.

Environmental ideas have undergone numerous changes. It was never linear. Its beauty lies is its truly 'world history' perspective. But it can also 'zoom in' when needed to explain certain special circumstances. One such special circumstance which comes easily to mind is the history of imperial expansion, arguably the most potent historical force in modern times. What impact this expansion had on knowledge and use of natural sciences? How did the latter shape the 'pattern' of imperial expansion? One need not be obsessed with Europe while looking into these questions. A Eurocentric account is probably at its best while dealing with the Enlightenment project and the subsequent imperial 'burden'. The empire brought to Europe the shock of world's

'diversity', more so in terms of flora and natural resources. It held immense possibilities for commerce and power. One can easily justify the empire as an instrument of development. But here the key question is 'whose development'. Was it a largely one-way traffic? The evidences of commercial consideration are so abundant that no imageries or search for Eden hypothesis can give an alternative explanation or 'turn the history upside down' (Mukhopadhyay, 1996, p.350). As for the communities and environments destroyed in the midst of European expansion, a Cambridge scholar asks, 'should we care? Were the pyramids and so much human grandeur not built on slavery and despotism?' (Drayton, 2000, p. 272). He is not alone; some are convinced of 'constructive imperialism. However, many more recognize that there did exist a dark side of both topicality and hegemonism and its history is 'almost as long and as complex as the Edenic.' The debate continues (Arnold, 1996, p. 140).

Nevertheless we need to move away from state centric approaches and look to more complex engagements, which could be grouped under broad themes such as 'nature', 'culture', and 'science' (D'Souza, 2003, pp.46-48). Another significant point that make the environmental perspective extremely relevant is that human response to nature must necessarily be collective (to quote Professor Radhakamal Mukherjee, 'synecological'). It cannot be individual-oriented 'autoecology'. In any case, while political economy creates and revels in barriers, environmental concerns unite us. This is a silver lining and adds to the relevance of HISTEM.

6. Postscript

Notwithstanding the argument about 'ruptures', 'ambivalence', etc. one cannot lose sight of the fact that colonialism, on the one hand, and modern thought, science and technology on the other, form two aspects of one phenomenon – two branches stemmed from one root, two sides of the same coin, or two inseparable characteristics of western bourgeois civilization (Hairi, 2002). This may be criticized as too nationalistic. Yet within this critique of colonial power relations, it is possible to locate instances of 'colonial nomadism' or 'intellectual migrancy' which Warwick Anderson so passionately pleads for (Anderson, 1998, pp. 522-30). Recently he has alluded to new configurations under the rubric 'postcolonial technoscience (Anderson, 2002). Sites of hegemony are also sites of refutation, negotiation, and even exchange. Multi-sited, interdisciplinary studies would definitely be more illuminating. Social constructions, historical anthropology and cultural insights can bring forth new dimensions of HISTEM and enrich our understanding as nothing else has done so far (Fox, 1996; Turner, 1987; Rosenberg and Golden, 1992). Help from scientists should be equally welcome. How can historians tap the scientific literature without becoming scientists themselves? They can by consulting their colleagues in sciences. The study of human welfare (be it in terms of technology or health) requires a joint effort on the part of scientists and historians; neither side has an advantage in method or truth over the other (Fetter, 2002, pp.423-42). In fact both stand to gain. As an incisive work enquires, what did the Indian scientists and science historians inherit from the occidental discourse about the orient and where did they depart from the former? (Raina, 2003. p.2) Another significant aspect is that STM has always been much more *plural* than most people appreciate; there have always been lots of different ways of knowing and of making (Pickstone, 2000, p.125). But this pluralism has to be both critical and contextual. HISTEM recognizes this and testifies the complementary co-existence of the natural and social sciences. Apart from its research significance, it can be a useful teaching-aid. It deserves a place in our curriculam, long ago in 1918 an official report asked for it (Sharp, 1918) and the need is still there.

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