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Colonial Encounter on Indian Snakes and their Venoms: The Transmission and Transformation of Western Ophiological Knowledge in British India, 1780s-1910s

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Abstract

This paper demonstrates how the diffused western medical-zoological knowledge about snakes and their venoms was transformed, modified and improved during the British colonial encounter with the snake-ridden Indian landscape from the 1780s to the 1910s. It focuses on a particular colonial condition, engendered by the presence of a huge number of venomous snakes and their victims, within which meticulous toxicological research gradually made the colonial physician-naturalists able to differentiate between the effects of the toxin of *elapine* snakes and that of the *viperine* species. That venoms of different noxious categories have different biochemical characteristics and act diversely was an important finding which, ultimately became instrumental in rectifying many misconceptions in western ophiological knowledge, questioning the efficaciousness of a 'universal' panacea for snake poisonings derived in and imported from France, and finally inventing category-wise effective antidotes in British India.

Key words: Anti-Venom Serum, British India, Ophiological/Toxicological Knowledge, Snake, Venom.

1. Introduction

The present paper provides a case study of colonial medicine in India, focusing in particular on the British medical-zoological engagement with the snake-infested landscape from the 1780s to the 1910s. It begins by providing an overview of the colonial condition, engendered by the presence of a huge number of venomous snakes and their victims, the latter including both Britons and their subjects. It demonstrates how this specific life-threatening health problem that faced the colonisers as they sought to subjugate and control the snake-ridden terrain that was India compelled them to arduously study both snakes and their venoms. Starting with an individual European's efforts in relation to the natural history of snakes and leading on to the development of laboratory-based toxicological research in British India, this paper continues by focusing on a theory that gradually developed during the course of colonial medical experimentation with snake venoms, one which conclusively proved that snake venoms are not all universally similar. This theory ultimately became crucial when questioning the efficacy of a 'universal' western remedy for all snake envenomations, as widely advocated by a French physician, and finally in the invention of two category-wise effective antidotes—anti-*Naja* serum in 1904 and anti-*Daboia* serum in 1905—by a European medical practitioner in British India. While recognising the importance of the colonial tradition of toxicological research, which ultimately led to the successful invention of two different antivenins, it is not the intention of this paper to probe further. The snake venom research that followed during the first half of the twentieth

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century entered a new era, one that was conspicuously characterised by the intervention of western educated Indians in the field of venom related research. The distinctive nature of the research during this period was marked by the incorporation of Ayurvedic knowledge in the research process by a number of Indian physicians, which allowed the epistemology pursued by European practitioners to become wider and more complicated. It goes without saying that this new trend in research was linked to the growing consciousness of Indian national identity and thus falls outside the purview of the central question addressed in this paper.

2. Early British Engagement with Indian Snakes

By the late eighteenth century, the English East India Company (EEIC) had come to establish a territorial empire in India, which for the first time created the context for extensive European travel and settlement throughout the country. During their gradual exploration of the newly conquered colony, the European merchant-rulers were forced to engage with the vast 'exotic' and 'wild' environment of India. When the colonisers began to undertake scientific excursions and surveys in order to acquire maximum information about the newly subjugated terrain and exploit its natural resources for material profits (Kumar, 2006, pp. 32-45), they frequently encountered venomous snakes, which were responsible for a huge number of snakebite deaths every year in India. The colonisers anxiously noted that 'every year a very great number of deaths occur, both amongst cattle and mankind, through the bite of snakes, and particularly through the bite of the cobra' (Pool, 1894, p. 144). Joseph Fayrer, from the Indian Medical Service (IMS) was the first person to attempt to collect and present statistics relating to snakebite mortality in India and he described these deaths as 'appalling' (Fayrer, 1877, p. 189). In a report in the journal *Nature*, he quantified snakebite deaths across seven administrative regions, representing about half of British India, and found that 11,416 people had died of snake poisoning in 1869 (Fayrer, 1882, p. 206). He projected that 'if information were gathered from the whole of Hindostan, it would be found that not less than 20,000 persons are destroyed annually by snakes' (Fayrer, 1882, p. 206). By one such estimate, 40,664 persons, including both Europeans and Indians, perished as a result of snake envenomation in British India during the year 1875-1876, whereas in the same calendar year only 7,645 persons were killed by other feral animals, such as tigers, leopards, elephants, bears, wolves and hyenas (Anonymous, 1878, pp. 132-133). Obviously, the actual number was certainly higher as many 'native' snakebite victims habitually chose village based traditional therapists and data went unreported as their deaths occurred outside the network of government hospitals and dispensaries. Thus, the situation had become critical because snakes, many being 'dangerously' venomous, were present in every corner of this alien land, thus throwing down a direct challenge to the everyday livelihoods of the colonisers, as well as affecting the growing administrative and commercial activities of the EEIC. The colonisers did not have sufficient knowledge about such a great variety of snakes and their envenoming power as lethal snakebites were rare in their homelands (Reid, 1976; Walker, 1945). Therefore, the western medical-zoological knowledge that the colonisers brought with them was not sufficient to effectively shield them and their 'native' collaborators from frequent snake envenomation. In order to address this critical situation, the colonial government felt that the gathering of medical-zoological knowledge about Indian snakes and the conducting of research on their venoms were essential in the struggle to provide the best possible management of this snake-infested terrain.

Therefore, a systematic study of the snakes of the terrain became a vital necessity and the first

tentative steps towards this objective was taken when an amateur Scottish physician, Patrick Russell, was appointed as the EEIC's 'Botanist or Naturalist' in the Carnatic region in 1785. Russell's *magnum opus*, entitled *An Account of Indian Serpents, Collected on the Coast of Coromandel*, published in 1796, is a ground-breaking work in the history of modern Indian medical-zoology (Russell, 1796; 1801). He examined live snakes including all the major venomous species and tried to differentiate venomous snakes from the other varieties (Russell, 1796, pp. 84-88), and pursue a perfect remedy for snake envenomation to minimise the 'terror' of the disease (Russell, 1796, p. v). Interestingly, his experiments with a 'native' antidote for snakebite, the 'Tanjore pill', provided a great impetus to the further metropolitan experiments with arsenic, the chief ingredient of the pill (Ireland, 1811, pp. 403-404). 'His comments about cobras were even quoted by Charles Dickens in his *Household Words* of 1852' (Starkey, 2018, p. 318). Thus, the originality and creativity demonstrated by Russell in his work were praised everywhere and spread the author's fame from the colonial periphery to the imperial metropole.

Soon afterwards, several colonial scientific and medical institutes, such as the Asiatic Society, the Oriental Museum (later the Indian Museum), major ancillaries to the early colonial establishment, decided to step in. From the early nineteenth century, the Calcutta Medical College (CMC), the Presidency College and the Zoological Garden of Calcutta, came to play a crucial role in the development of ophiological research on snake venoms and their action on living animals. These institutions created a space where it was possible for high quality medical engagement with Indian snakes and their venoms to gainfully converge. The engagement of these societies with the snake-ridden Indian landscapes, as well as their experimentation with venoms and popular indigenous snakebite remedies, produced a workable practical knowledge that was able to address the problem of snake poisoning. Interestingly, in several instances, such ophiological research was able to enhance existing western scientific knowledge regarding snakes and their venoms.

3. Colonial Laboratory-Based Research on Venoms

However, the latter half of the nineteenth century witnessed an important medical development with the initiation of extensive laboratory-based research on Indian snakes and the pernicious effects of their venomous bites, one that comprehensively changed the approach of the European physicians. During this period, colonial practitioners carried out more complex experiment with snake venoms in laboratories situated throughout the country than had previously been the case. Equipped with their new laboratory technologies and methods, European doctors were able to more precisely analyse the chemical components of venoms and their physiological actions on the human body. This also allowed further toxicological explorations to take place, providing the colonial physicians with additional diagnostic tools and ultimately providing a rational basis for the development of potential antidotes for snake envenomation. The Government of India (GOI) took advantage of these new developments in order to reinforce its rule over the snake-ridden country. Perhaps, the most prominent evidence of the benefits of the GOI's employment of laboratory research results was occasioned in the report produced by the Indian Snake Poison Commission, which consisted of Joseph Ewart, the president, and two members, Vincent Richards and S Coull Mackenzie. They were appointed in 1874 to investigate the influence of artificial respiration, the effects of the intravenous injection of ammonia and the administration of various drugs in snakebite cases in India (The Commission Appointed to Investigate the Subject, 1874). However, it is important to mention at this point

that while the GOI always encouraged the members of the IMS in their research on snake venoms to discover effective remedies, the major investment in toxicological experimentation in laboratories, as well as the appointment of scientists for this purpose, was predominantly to be found in Britain (Chakrabarti, 2012, pp. 122). Therefore, the research conducted in India often became intermittent in nature and was forced to struggle for proper recognition and success.

Against this backdrop, and prior to his departure for England in 1871 due to ill-health, the then Professor of Surgery and Senior Surgeon in the CMC, Joseph Fayrer, wrote his excellent tome entitled *The Thanatophidia of India*, which provided detail description of Indian snakes and report of investigations on their venoms (Fayrer, 1872). Fayrer's study of Indian snakes was a major work, which both noted and corrected many misconceptions in western knowledge about snakes and their venoms. For instance, until the 1860s, it was widely assumed that a single venom was common to all snakes and that this was also shared with scorpions (Hobbins, 2011, p. 5). It was George Britton Halford, the inaugural Professor of Physiology at the University of Melbourne, who first claimed that 'difference seems to exist between the effects of the poison of the *tiger snake* and that of both the *cobra* and the *rattle snake*' (Hobbins, 2014, p. 293). At approximately the same time as Halford was conducting his research, Fayrer also recorded that in India there were certain differences in the action of venoms derived from different families of snake. Regarding this he wrote 'the poison of the *Naja* kills without destroying the coagulability of the blood; whilst that of the Viper—the *Daboia*—produces perfect and permanent fluidity' (Fayrer, 1872, p. 4). Thus, Fayrer was the first to differentiate between the effects of the poison of *elapine* snakes and that of the *viperine* species (Vijayaraghavan, 2005, p. 3). That venoms from different noxious categories have different characteristics and act diversely was an important finding which, as will be discussed later, became instrumental in the invention of effective category-wise antidotes.

Colonial laboratory-based research on snake venom in the 1880s and later attained a high degree of sophistication as a result of the extensive research carried out by the distinguished Professor of Chemistry at the Presidency College in Calcutta, Alexander Pedler (1978), as well as the work of two Professors from the CMC, Alfred John Wall (1881, 1883) and Lawrence Augustine Waddell (1889). Like Joseph Fayrer, Pedler was deeply concerned about 'the enormous number of deaths, annually resulting from the bites of poisonous snakes' (Pedler, 1978, pp. 17-18). His research paper on the chemical analysis of Indian cobra venom was probably the first of its kind in British India (Basu, 1989, p. 320). Although, Pedler failed to discover any effective antidote, he was confident that his experiments would provide sufficient grounds for conducting more extensive research on this subject (Pedler, 1978, p. 29). In 1873, John Wall was ranked highly in the examination for the IMS and was appointed as Resident Medical Officer at Bhangulpore (Bengal) (Anonymous, 1898, p. 1296). He held the position for three years and, as consequence of his failing health, resigned and joined the CMC as deputy professor of anatomy (Anonymous, 1898, p. 1296). In one of his research papers, John Wall claimed that there were certain differences between viper and cobra poison, which pertained to the symptoms of poisoning, the destructive actions and the effects on blood and the body (Wall, 1881, pp. 361-362). Lieutenant-Colonel Waddell joined the IMS in 1880 and, after working for several years in India, China, Tibet and Burma, became a professor of chemistry and pathology at the same medical college (Thomas, 1939, p. 499). Like John Wall, he believed that two varieties of poison would act very differently on the human body when causing death (Waddell, 1889, pp. 47-

72). Another prominent physician, Cunningham, who conducted his ophiological experiments in the small and ephemeral Bengal Snake Laboratory in Calcutta, also held the same opinion (Cunningham, 1895).

It is worth mentioning here that a hypothesis had somehow developed among the colonial physicians that suggested that the venoms of certain varieties of snake acted differently on living species. This hypothesis suggested that if an antidote were ever to be invented, it would have to be specific to the particular venom and could not be universal. In the late eighteenth century, the Scottish surgeon Patrick Russell first noted that different categories of poisonous snake were not adversely affected by their own poisons (Russell, 1796, p. 56). Later, as noted above, Fayrer also proved that the venoms of cobras and vipers were different in character and not poisonous to their host. Interestingly, Indian snake-charmers had also gained the same knowledge through either experience or tradition; the colonial physicians might well have generated their ideas based on the work of these indigenous practitioners. In the November 1870 issue of the *Madras Medical Journal*, Surgeon-Major Edward Nicholson wrote that he had witnessed a Burmese snake-catcher inoculate himself with cobra venom as an antidote against cobra poisoning; but he would remain cautious when handling the vipers as he was not sure of the antidotal effect of his inoculation against the poison of these varieties (Nicholson, 1874, p. 148). It was perhaps within this context that Nicholson began to examine the potential for the gradual inoculation with the poison of a certain variety as an antidote against envenomation of the same. Following the studies of Russell, Fayrer and Nicholson, Waddell and John Wall initiated their work on using snake venom as a possible remedy for snake poisoning. But, without proper government support and adequate financial aid, their research failed to reach any final conclusions and therefore remained unreported.

4. The Invention of an Anti-Venom Serum in the Metropole

Meanwhile, in the metropolitan arena, Sir Thomas R Fraser, a well-known toxicologist and Professor of *Materia Medica* and Clinical Medicine at the University of Edinburgh, followed the lines suggested by Fayrer, Waddell and others, i.e., that venomous snakes were self-immunised against their own venom, and invented a specific serum, particularly effective against cobra venom in 1895 (Fraser, 1895). He named his protective serum 'Antivenin'. In his research paper, Fraser illustrated that it was possible to immunise animals against the venom of the cobra as well as against other serpents and also demonstrated that the antidotal properties were inherent in the blood serum of such immunised animals. Although, his research was useful for the treatment of snakebite victims in India and other tropical countries, it failed to receive attention in the official or public discourse in Britain and in India, which was fully focused on Pasteurian discoveries.

It was Léon Charles Albert Calmette's Pasteurian intervention in snake venom research, conducted in Paris and Lille, as well as production of his *antivenene* for clinical use in 1896, which certainly revolutionised the medical management of those victims who in the past had died in India and elsewhere from venomous snakebites. Calmette's claim to have invented a universal anti-venom serum scientifically applicable to all types of snake envenomation quickly received the recognition of high officials and scientific communities in Britain and India because of its Pasteurian connections (Chakrabarti, 2012, pp. 127-131). Calmette's achievement drastically altered the line of colonial toxicological studies in India, which until then had centred on the theory that each toxin required its own specific anti-toxin. Contrary to this, Calmette's investigations supported the theory that a 'particular toxin may be counteracted by several anti-toxins of different origin' (Frankland, 1897, p. 82). In this regard,

Pratik Chakrabarti pertinently argued that when compared to the British-Indian tradition, Calmette's research was new and 'devoid of the prehistory that characterized British pharmacological research: the engagement with tropical flora and fauna' (Chakrabarti, 2012, p. 127).

5. The Return of Peripheral Toxicological Research

For a certain period of time following Calmette's invention, India became a site only fit for the collection of venom samples, which were dispatched to Paris for the production of *antivenene*. The new anti-venom serum was then distributed to the various provincial centres (Chakrabarti, 2012, pp. 129-131). Colonial practitioners who had previously been engaged in toxicological research now turned to a new field of study—a new paradigm of clinical bacteriology. Thus, for the first time, research in India became largely confined, merely following the lead of metropolitan epistemology. This was obviously a major departure from the diverse experimentation with venomous Indian snakes that had been conducted by earlier British naturalists. However, the earlier study of the natural history of Indian snakes did not completely lose its place of importance (Beddome, 1863, 1877, 1878, 1886; Mason, 1888; McCann, 1940, 1941; Phipson, 1887; Wall, 1908, 1909, 1921). During the latter years of the nineteenth century, as well as the early years of the twentieth, the Bombay Natural History Society and its journal were the main providers of space for such natural history scholarship and associated publications.

However, the overwhelming predominance of this metropolitan scientific achievement over peripheral scholarship ultimately came to an end when practitioners engaged in Indian laboratories began to pertinently question the universal efficaciousness of Calmette's *antivenene*. Leonard Rogers, Professor of Pathology at the CMC, believed that both cobra and viper venoms affected the nervous system of the body and therefore a common antidote for both kinds of envenomation could be invented (Rogers, 1902-1903, p. 491); however he did not support Calmette's concept of a 'universal' anti-venom serum. He commented that Calmette's antivenin was 'not a specific against all kinds of snake venom' (Rogers, 1902-1903, p. 495). Similarly, in questioning the universal applicability of Calmette's anti-venom serum, George Lamb, an IMS member, and later Director of the Pasteur Institute of India, wrote:

> I have carefully guarded myself by saying that this serum is useful at least for cases of cobra-bite...I have demonstrated, in many experiments with different animals, that it is of no avail whatever in counteracting the poisonous effects of daboia venom. I have also recently made some series of experiments with Calmette's serum and the venom of bunganus fasciatus. These experiments, which are in process of publication, definitely show that this serum has no neutralising power for this venom (Lamb, 1903B, pp. 14-15).

Colonial physicians thus observed that *antivenene* was not effective against every variety of snakebite and therefore did not contain the universal antidotal elements claimed by Calmettee.

Given the situation, both Rogers, working in the laboratory of the Zoological Gardens of Calcutta (Rogers, 1904, 1905), as well as Lamb, from the Plague Research Laboratory in Bombay and later from the Pasteur Institute in Kasauli (Lamb, 1902, 1903A), sought to improve upon Calmette's anti-venom serum. While Rogers failed to achieve any conclusive success, Lamb, gave up the idea of developing a singular panacea and successfully developed two different antivenins—anti-*Naja* serum in 1904 and anti-*Daboia* serum in 1905 (Chakrabarti, 2012, pp. 133-135). Thus, Lamb restored the long scientific tradition 'which had closely investigated the distinct actions of different venoms on the human body rather than the production of a singular antidote as Calmette had done' (Chakrabarti, 2012, p. 133). By 1905, these two antivenins, which were less-expensive

and more readily available than Calmette's *antivenene* as they were produced in an Indian laboratory, were distributed to several government institutions for trial purposes (Chakrabarti, 2012, p. 133). The evidence in hand testified that Lamb's anti-*Daboia* serum, when used with victims bitten by Russell's viper, was more successful than Calmette's *antivenene* (Anonymous, 1907, p. 66). However, there were also cases where this remedy failed to be fully effective. Within a decade of its invention, practitioners reported that Lamb's anti-*Daboia* serum was not effective in combating the bite of the *phoorsa*, a particular variety of poisonous viper in India (Stevenson, 1913, p. 310). As a result, research continued in Kasauli and Calcutta to create the standardisation of anti-venom serums for all kinds of envenomation (Bradfield, 1938, p. 220).

6. Conclusion

There is no doubt that European scientists who were working from the 1780s to the 1910s, either in the metropole or in the colony, achieved limited success in producing anti-venom serum for all kinds of snakebite in India. However, a specific issue in relation to Lamb's achievement must be mentioned here. Lamb was definitely resonating in response to the legacy already inchoate in the colonial tradition of research in India, as initiated in the days of Patrick Russell—a tradition that had emphasised the distinctiveness rather than the universality of snake venom (Lamb, 1903B). Lamb was thus inspired to question the extent of the applicability of a universal panacea (in this case *antivenene*) that had come to be highly appreciated and acknowledged in the West and himself went on to invent two different remedies—one for cobra and the other for viper bites. In reality, it was the specificity of the colonial experimental condition that prompted colonial practitioners to gradually create a research methodology that was completely different from the one followed in the metropole. Both their mode of thinking and their knowledge of nature were developed within the context of their experience in the tropical conditions; they were thus able to construct their distinctive world of inferences for the medical management of snake envenomation. This particular aspect made the colonial practitioners confident and creative and their original contributions were increasingly honoured and followed in the scientific circle of the metropole. Thus, the colonial scientists, engaged as they were in the transmission and transformation of Western ophiological knowledge in British India, were not mere passive bystanders, nor was it the case that actual process constituted only one-way traffic.

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