

Public-health management in the Madras Presidency in early 20th century: the King Institute of Preventive Medicine, Madras and its pioneering surgeons

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The King Institute of Preventive Medicine, Madras (1905–1930)

The King Institute of Preventive Medicine (KIPM) in Guindy, about 10 km from the central business district of Madras, was formally opened by Lord Amptill (note 1) in November 1905, celebrating the life and achievements of Walter Gaven King, who was chiefly responsible for its start. KIPM was already functioning as a vaccine depot supplying smallpox-vaccine lymph (Figure 1) to people in the Madras Presidency, supervised by King from the 1890s. By 1905, it had grown into a large provincial facility, housing a well-equipped bacteriological laboratory and a public-health laboratory in addition to the original vaccine depot. It essentially included a vaccine section, which manufactured calf lymph for vaccination against small pox and a microbiological section, enabling investigations necessary in medical diagnosis and public-health related work¹. The main building housed the microbiological section and the vaccine section remained scattered all over the precinct. In 1903, KIPM had a guaranteed and secured water supply, lighting and sewerage system, besides a large refrigerating system which enabled storing of smallpox-vaccine lymph, bacterial vaccines, various sera and other perishable medical and veterinary supplies. As a public-health facility, KIPM uniquely included a series of



Figure 1. The vaccine depot, the precursor of the King Institute of Preventive Medicine (source: *The Hindu*).

experimental water filters ensuring clean water supply. Besides two sand filters, two – then state-of-the-art – Jewell and Paterson mechanical filters endowed with appropriate pumps existed at KIPM² (note 2), which were acquired sometime between 1906 and 1922. Vaccines for cholera and typhoid were produced at KIPM from 1920.

The vaccine-lymph section manufactured more than two million doses annually, supplying within the Madras Presidency through the Civil Department. Nevertheless, some quantities were also supplied to the British and French armies within India and to Ceylon (Sri Lanka). During World War I, large quantities of lymph were sent to the allied-army personnel in the East-African theatre. The microbiological section manufactured both curative and prophylactic bacterial vaccines to meet the requirements of hospitals in the Madras Presidency. In 1919, at the behest of the British Government, KIPM manufactured the anti-influenza vaccine on a large scale, for the first time in India, meeting the civil and military needs in the Presidency². Similar efforts were also made to mass-produce vaccines to combat outbreaks of cholera, typhoid and paratyphoid, and issue them to the general public at a nominal cost.

Further to these tasks, KIPM actively participated in testing water quality of the Presidency. Each year, water samples from every ‘protected’ water supply from various municipal regions and other locations where people usually gathered in large numbers (hospitals and jails) were subjected to quality control by KIPM. The various types of mechanical (the Jewell and Paterson systems) and sand filters then available at KIPM were used for testing water quality and running experiments with them. These investigations were carried out by a Committee on Water Purification in which the Director of KIPM was the secretary. Results of these experiments were periodically reported in the Medical Research Section of the Indian Science Congress². The Public-Analyst Department for food analysis

under the Madras Prevention and Adulteration Act was established in 1924 (note 3).

The total number of vaccinations performed in the Madras Presidency was 1,464,990 in 1905–1906. KIPM played a key role in achieving these staggering numbers. In 1905–1906 alone, the number of successful vaccinations rose by 53,595 accounting a near 5% rise, particularly in the context of smallpox management in the Presidency. Among vaccination of newborns, the 1905–1906 statistics indicates a near 30% improvement in the rates¹.

The smallpox vaccine manufactured at KIPM was essentially ‘lanoline-based lymph’, and glycerine-based lymph was produced at the Public Health Laboratory in Bangalore (note 4). Vaccine manufacture at this time required the retention of vaccine potency over a period, enabling them to be transported over long distances. Experiments on transferring the ‘disease inoculum’ included trials on animal models such as rabbits, buffaloes, donkeys and goats, since the Hindu tradition objected to using lymphs of cow source³. European vaccine-production units, at that time, made efforts to synthesize the best lymph that retained its potency in solution over a long period of time^{1,2}. Experiments were carried out across the globe utilizing lanoline, glycerine, petroleum jelly, even chloroform-infused glycerine paste. Until 1895, glycerine was used producing glycerinated-vaccine paste, enabling transport. KIPM during the leadership of King pioneered in stabilizing the vaccine lymph in lanoline, which was a new trial and was a major success⁴. With better facilities to preserve potent vaccines and transport them over long distances in the warm and humid India, by mid-20th century, the rate of vaccination for smallpox rose to 95%. Transport of vaccines changed from boxes to designed glass vials, using the right-sustaining substance and considering changes in temperatures. We need to recognize here that live-attenuated freeze-dried vaccines came into existence in the West in the 1940s and in India in 1965.

The *Imperial Gazetteer of India* refers to the contribution of KIPM in the context of smallpox vaccination (ref. 5, p. 386):

‘Vaccination is compulsory in the city and is attended to with more than usual care, the number of successful operations in 1903–04 being 52 per 1,000 of the population, compared with an average for all municipalities of so per 1,000. At Guindy, near Madras, is the King Institute of preventive medicine, from which animal vaccine is supplied in sealed tubes throughout the Presidency, and where bacteriological work and the preparation of various sera are also carried on.’

Pioneers of KIPM

W. G. King

Lieutenant Colonel Walter Gaven King (4 December 1851–1854 April 1935, Figure 2) after qualifying for MBCM (MBBS) from Aberdeen in 1873 entered the Indian Medical Service as a surgeon in 1874. He qualified for Diploma in Public Health in 1888, became a Colonel in 1905, and retired in 1910 (note 5). After two years of military service, King worked as Civil Surgeon in different hospitals in the Madras Presidency, held the posts of professor of physics (Presidency College, Madras) and hygiene (Madras Medical College), Special Sanitary Officer for Madras city, Central Jail Superintendent of Mandalay, Burma, Superintendent of the Government Lunatic Asylum, Madras, and the Deputy Sanitary



Figure 2. W. G. King (Source: <http://www.geni.com/people/Col-W-G-King/>).

Commissioner, Madras. He was appointed the Sanitary Commissioner of the Madras Presidency in 1894. He worked for relief during the Great Madras Famine (1876–1877), and again 20 years later, in a subsequent famine, when he was the Sanitary Commissioner. He rejoined service during the War, and later was a consultant at the Tropical Diseases Clinic and lecturer in tropical hygiene at the King’s College, London⁶. He wrote the *Cultivation of Animal Vaccine* (1891), *Plague Inspector’s Manual* (1902), *Sanitary Rules for the Prevention of Plague in Municipalities* (1903), and *Simple Sanitary Rules during Cholera Epidemics* (date?). In addition, while at KIPM, King published periodical reports on vaccination in the Madras Presidency for 1902–1903, 1903–1904 (Government Press, Madras, 42 pages each).

Scarification method was pioneered by King, who based his words from a translation of a text on variolation (note 6) with both cow and human pox attributed to the *Danvantari Nikandu* (supposedly written 2000 years before Edward Jenner). Lord Amphill reiterated this point while inaugurating KIPM in 1905. Nicholas⁷ indicates that in the 16th-century India only a humoral (that all diseases occurred from the four recognized humours) and theurgic (that diseases were due to either divine curse or magic) explanation for smallpox existed; variolation is not mentioned in any Sanskrit texts. However, what needs to be reckoned here with is that King may have had access to Tamizh texts⁸.

King broke new ground by introducing trained sanitary inspectors in the Madras Presidency. In the *British Medical Journal* (1922), he says:

‘The Madras Government was thus the first in the tropics to require compulsory technical training of sanitary inspectors. That the training afforded is efficient may be judged without my taxing your space with details. I may state that the general educational standard for admission to the course is the matriculation examination of the Madras University, which is equivalent to the FA (First in Arts) of the Calcutta University. Assistant sanitary inspectors attend courses of physiology, bacteriological demonstrations, and theoretical hygiene, under the professors of the Madras Medical College, and practical hygiene under selected sanitary officers.’

The above quote speaks well of the quality of public-health education that existed in Madras and the efforts that the Government of Madras made to ensure quality in public-health management.

The Madras Plague Regulations and Rules for the City of Madras (1902) and *The Plague Inspector’s Manual* (1902) were issued during King’s administration of sanitation management in Madras. These include facsimiles of a ‘passport’ system that was operational in Madras to regulate the spread of epidemics (e.g. cholera and plague; Figure 3). The issue of a passport was not new at that point of time, since this procedure was operational in the Madras Presidency at least before 1869. For example:

‘The Madras Sanitary Regulations made elaborate provisions for the prevention of cholera during native festivals. Native migrants to Madras from infected areas were excessively policed, put under close police surveillance, and issued with “passports”; and emergency powers were introduced to summarily punish both male and female offenders. By 1869, every conceivable agglomeration was brought under systematic sanitary control (ref. 9, p. 96).

A detailed description of the measures adopted by the Government of Madras, in their endeavours to prevent the spread of plague in the Madras Presidency is available in a paper by Spencer Low¹⁰, Medical Officer of the Plague Camp and Railway Inspection Station, Jalarpet (note 7). This paper also includes a description of the then prevalent passport system (pp. 78–81) and a facsimile of the same.

S. R. Christophers

Lieutenant Samuel Rickard Christophers (Figure 4) will be remembered for his monumental contributions to medical entomology in general and to the science of mosquitoes in particular. Christophers was the first formal director of KIPM, being appointed in 1904. While working at KIPM he confirmed Charles Donovan’s discovery of the Leishman bodies in the spleen of patients suffering from visceral leishmaniasis (kala-azar), a widespread tropical disease characterized by fever, diarrhoea, anaemia, weight loss and spleen enlargement (note 8). High mortality usually eventuated. He investigated the transmission of *Leucocytozoon*

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Figure 3. (Left) The contents page from *The Madras Plague Regulations and Rules for the City of Madras* (1902); (Right) The plague passport (from p. 50 of the same document).



Figure 4. S. R. Christophers (source: http://en.wikipedia.org/wiki/Rickard_Christophers).

canis (today, *Babesia canis*, Aconoidasida: Piroplasmida: Babesiidae) by *Rhipicephalus sanguineus* (Parasitiformes: Ixodidae)¹¹. Christophers was later posted as the Director of Central Malaria Bureau, where he made impressive contributions to malariology and to the knowledge of mosquitoes. While at the

London School of Tropical Medicine, after his return to England, a revised edition of the *Indian Anophelini*¹² was published in 1933 and this volume remains a milestone in the science of Indian anophelines even today.

W. S. Patton

Captain Walter Scott Patton, while serving on the scientific staff at KIPM made great strides in medical entomology within the wider context of public health. Because Donovan, professor of physiology at the Madras Medical College was blazing new trails studying kala-azar (refer to note 7), interest in knowing more about the kala-azar-inducing protozoan and the transmitting agents was naturally strong at this time. Patton published a series of papers while working at KIPM: 'A preliminary report on the development of the Leishman-Donovan body in the bed bug' (1907), 'The development of the parasite of Indian Kala Azar' (1912), and 'A preliminary report on an investigation into the etiology of Oriental sore in Cambay' (1912). He also published on

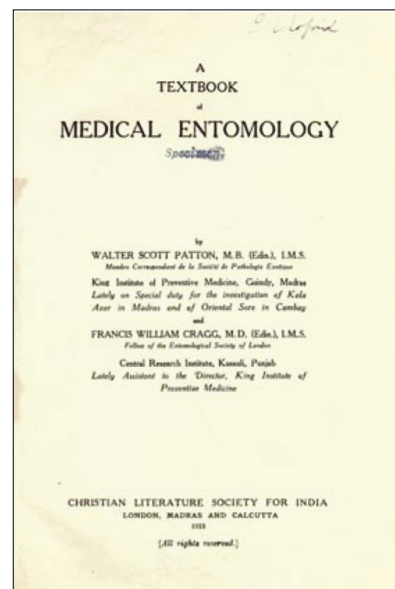


Figure 5. Cover page of the Patton and Cragg's book.

other medically important Protozoa (e.g. 'Studies on the flagellates of the genera *Herpetomonas*, *Crithidia* and *Rhynchomonas*', 1912). Patton's role as one of

the two principal investigators in the Royal Society of Kala–Azar Commission examining the disease and its agents in China in the late 1920s is a different story and the reader is referred to Killick-Kendrick¹³ for details. For a period Patton also officiated as the Superintendent of KIPM. In 1913, he published the *Textbook of Medical Entomology* (Figure 5), along with Francis Cragg, who earlier worked at the Central Research Institute, Kasauli (Punjab) and in later days was an assistant to the Director of KIPM. Patton will be remembered for his monumental book *Insects, Ticks, Mites and Venomous Animals of Medical and Veterinary Importance* (1929–1931), published after his return to the UK.

K. V. Venkatraman

Kandā dai Venkatasubramanian Venkatraman (b. 28 April 1903, Figure 6) was the Director of KIPM in 1948–1949 and will be remembered for his contributions to the biology, epidemiology, and management of cholera. He earned his MBBS (1925) and MD (Bacteriology, 1930) titles studying in the Madras Medical College. Venkatraman worked with Arthur Duncan Gardner (Rheede Lecturer at Cambridge and Litchfield Lecturer at Oxford), characterizing the differences in the sugar composition of the heat-stable surface somatic ‘O’ antigen and classified *Vibrio cholerae* serologically¹⁴. Clinical specimens need to be rapidly transported to the laboratory to prevent growth of any other contaminating microbes. This can be achieved using ‘transport’ media. Such media prevent



Figure 6. K. V. Venkatraman (source: K. V. Krishnan, Puducherry).

drying of specimen, maintain the pathogen to commensal ratio, and inhibit growth of any contaminating microbes. Venkatraman, collaborating with C. S. Ramakrishnan (Water Analyst, King Institute), developed the Venkatraman–Ramakrishnan medium¹⁵ (V–R medium; note 9), which efficiently anchored *V. cholerae* in the faecal sample obtained from the sick for more than six weeks at room temperature. This medium enabled the transport of the bacteria from outbreaks in remote areas to laboratories to study the epidemiology. Venkatraman also served as the Serologist and Chemical Examiner (Government of India) in Calcutta, where he remained till he retired in 1960. He died on 16 June 1966.

Conclusion

KIPM in Madras, along with the Central Research Institute, Kasauli and Pasteur Institute of Southern India, Coonoor, have been serving India’s public-health management needs over the last 109 years. Starting as a vaccine depot in a tiny shed, today KIPM stands magnificently providing the state-of-the-art medical research involving serology and immunology and manufacturing of vaccines for use not only within India, but outside as well. Post-1947, several changes have occurred in the day-to-day and long-term activities of KIPM. For example, freeze-dried smallpox vaccine (1952), tetanus toxoid (1960), anti-snake venom serum (1969), anti-rabies vaccine (1981) and diphtheria toxoid (1989) have been produced¹⁶.

Notes

1. Lord Ampthill (Arthur Oliver Villiers Russell, 1869–1935) was the Governor of Madras in 1900–1906. He was the relieving Viceroy of India during April–December 1904.
2. J. Cunningham² indicates that KIPM had Jewell and Paterson mechanical water filters. Obviously, Cunningham refers to Jewell water filters and Paterson water filters and not Jewell–Paterson filters. As much as we could track down, Jewell water filters were made by O. H. Jewell Water Filter Co, Chicago and the Paterson water filters were made by Paterson Engineering Co (UK?) in the late 19th century. Both filters worked the principle of gravity with filtration achieved using sand. Fascinating details are available in *The Jewell Water Filter* published by

- O. H. Jewell Filter Co, W. Jackson Street, Chicago, 1897, pp. 73–75).
3. Analytical work on food and water is not done presently at KIPM.
4. The Bengaluru-based Public Health Laboratory is not traceable. Harrison (ref. 3, p. 86) indicates the Vaccine Institute at Belgaum produced over 600,000 doses of calf-lymph smallpox vaccine in 1911. Did J. Cunningham² get confused between the Belgaum Vaccine Institute and any other medical laboratory in Bengaluru? But that possibility appears highly unlikely.
5. One Henry King, also a medical practitioner, worked in Madras Medical Service. He wrote the *Madras Manual of Hygiene*¹⁷ in 1875. Allan Ewan Grant revised this book and re-published it as the *Indian Manual of Hygiene*¹⁸. The Henry King (1875) and Grant (1894) editions cover a range of health and hygiene information relevant to the tropics: from house designs to ventilation, nutrition, and sewerage system and referred to the best European practices of sanitary engineering and public hygiene. The 1875 and 1894 editions neatly spanned over the two decades in which Louis Pasteur (1822–1895) had proposed the germ theory.
6. Variolation was the earlier used method to ‘immunize’ individuals against smallpox (= variola) using material obtained from a person afflicted by smallpox in the hope that a mild but not lethal infection would eventuate.
7. Jalarpet (today Jōlārpēttai) a key rail junction on Chennai–Bengaluru rail track.
8. William Boog Leishman discovered the protozoan parasite in 1900, from an English soldier who was earlier stationed in Bengal but died at the Army Medical School in England. Leishman mistook the parasite to be degenerate trypanosomes, already known protozoan parasites in Africa and South America. Leishman published his discovery titled, ‘On the possibility of the occurrence of trypanosomiasis in India’ in 1903 (ref. 19), Donovan²⁰ in Madras found the parasite in the spleen tissue and in blood of an infected young boy who was admitted into Madras General Hospital on 17 June 1903 (ref. 20). He identified the Leishman bodies as the causative agents of kala–azar. Donovan wrote a commentary of his discovery in relation to that of Leishman in the *British Medical Journal*. Soon controversy arose as to whom such monumental discovery should be credited. Ronald Ross, professor of Tropical Medicine in Liverpool, resolved the conflict of priority in the discovery and gave the name ‘Leishman–Donovan bodies’, thereby crediting the two equally²¹. But the reconciliation was not embraced by the Londoners, who still wanted to remove Donovan’s name. Donovan continued to study the disease in

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considerable depth and much of our knowledge of kala-azar is essentially due to his work.

9. V-R medium is prepared by dissolving 20 g of unrefined sea salt (NaCl) and 5 g of peptone in 1 litre of distilled water, maintained at pH 8.6–8.8. The competitive medium for V-R transporting medium is the Cary-Blair medium (C-B medium), which is a solid medium, made of NaCl, C₂H₃NaO₂S, Na₂HPO₄, CaCl₂ and agar, maintained at pH 8. The C-B medium is good for the transport of not only species of *Vibrio*, but also those of *Salmonella* and *Shigella*.

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1. Leslie, J. W. T., *Annual Report of the Sanitary Commissioner with the Government of India*, Superintendent, Government Press, Calcutta, 1906, p. 160, + several appendices.
 2. Cunningham, J., In *The Madras Handbook, MCMXXII [1922]*, Indian Science Congress Association, Madras 1922, pp. 165, 72–76.
 3. Harrison, M., *Public Health in British India: Anglo-Indian Preventive Medicine 1859–1914*, Cambridge University Press, 1994, p. 324.
 4. Biggs, J. T., *Leicester: Sanitation versus Vaccination: Its Vital Statistics Compared with those of Other Towns, the Army, Navy, Japan, and England and*

Wales, The Anti-Vaccination League, London, 1912, p.784.

5. *Imperial Gazetteer of India*, The Secretary of State for India in the Imperial Council, London, Clarendon Press, Oxford, 1908, 16, pp. 1–438.
6. Rao, C. H., *The Indian Biographical Dictionary*, Pillar & Co, Madras, 1915, p. 472.
7. Nicholas, R. W., *J. Asian Studies*, 1981, **XLI**, 21–44.
8. Wujastyk, D., In *Studies on Indian Medical History* (eds Meulenbeld, G. J. and Wujastyk, D.), 2001, Motilal Banarsidass, Delhi, pp. 121–154.
9. Kumar, M. S., In *Postcolonial Geographies* (eds Blunt, A. and McEwan, C.), Continuum, London, pp. 85–98.
10. Low, S., *Trans. Epidem. Soc. London*, 1899–1900, **XIX** (N.S.), 59–86.
11. Christophers, S. R., *Sci. Mem. Office Med. Sanit. Dep., Govt. of India*, 1907, **28**, 1–11.
12. Christophers, S. R., *The Fauna of British India, including Ceylon and Burma, Diptera, Vol. IV, Family Culicidae, Tribe Anophelini*, Taylor & Francis, London, 1933.
13. Killick-Kendrick, R., *Bull. Soc. Pathol. Exot.*, 2013, **106**, 131–137.
14. Gardner, A. D. and Venkatraman, K. V., *J. Hyg.*, 1935, **35**, 262–282.
15. Venkatraman, K. V. and Ramakrishnan, C. S., *Indian J. Med. Res.*, 1941, **29**, 681.

16. King Institute of Preventive Medicine and Research, Institution History, <http://www.kipm.ac.in/> (accessed on 1 November 2014).
17. King, H., *The Madras Manual of Hygiene*, Government Press, Madras, 1875, p. 419.
18. Grant, A.E. and King, H., *Indian Manual of Hygiene; Being King's Madras Manual of Hygiene, Revised, Rearranged, and in Great Part Rewritten*, Higginbotham & Co, Madras, 1894, p. 443.
19. Leishman, W. B., *Br. Med. J.*, 1903, **1**, 1252–1254.
20. Donovan, C., *Br. Med. J.*, 1903, **2**, 79.
21. Ross, R., *Br. Med. J.*, 1903, **2**, 1401.

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