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‘Living in a State of Filth and Indifference to ... Their Health’: Weather, Public Health and Urban Governance in Colonial George Town, Penang

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ABSTRACT

This article explores the development of public health infrastructure in George Town, Penang, before the 1930s. It argues that the extreme weather of the tropical climate led to a unique set of health challenges for George Town’s administrators, as the town grew from a small British base to a multi-cultural and thriving port. Weather and public health were (and still are) integrally connected, although the framing of this relationship has undergone significant shifts in thinking and appearance over time. One lens into this association is the situation and expression of these elements within municipal structures. During the nineteenth century, government departments were fewer and shared roles and responsibilities. The Medical Department, for example, observed the weather, making connections between rain, drought and the incidence of disease. Engineers asked critical questions about mortality rates from disease after floods. As ideas about climate and health developed and changed, the shift became evident in the style, concerns and proliferation of governmental departments. This article thus considers the different ways in which weather, public health, and town planning were understood, managed and enacted by the Straits Settlements’ administration until the 1930s. It will start by exploring the situation facing the settlement’s inhabitants, in terms of specific climate and



health challenges. It will then consider how these challenges were understood and addressed, why and by whom, and how these elements were repositioned over the period in question.

KEYWORDS

Penang, public health, urban infrastructure, governance, climate, weather

INTRODUCTION

‘In November of 1847 the oldest inhabitants never remembered of having witnessed in the place so great a flood as the one then’.¹

‘Almost every road is severely cut up. In ... town the Pinang and Macallister roads – the widest and best kept in the island – have suffered especially. But the nature of the rains, the power and extent of the flood, will best be estimated from their effects on the Crammat road ... so great ... was the pressure of the body of water on the west-or hill-side of the road that about sixty yards of the length, entire width and depth, of the road were carried away’.²

Recently built stone bridges and new brick houses were devastated, trees were ripped up by their roots and landslips shrouded roads and fields. The task of rebuilding was described as ‘truly overwhelming’³ but the wider picture was far more worrying. The indiscriminate felling of trees on Penang Island was thought to affect the level and distribution of rainfall: ideas known collectively as desiccation. During ‘the wet monsoon [forests] afforded protection against the immediate bad affects [sic] of heavy rains in obstructing their descent and conducting the rain more slowly to the soil, by which means they are absorbed and retained and thus the evils of repeated deluges are escaped’.⁴ Those evils included not just the destruction of urban infrastructure but the malignant effect of standing water in drains and ditches ‘stagnating amidst the mass of vegetation which so quickly springs up under such circumstances, and slowly ... percolating beneath the roads or the neighbouring grounds, sapping and destroying the foundations of the former, and rendering the latter

1. *The Singapore Free Press and Mercantile Advertiser*, 6 Dec. 1850, p. 5. Available online at NewspaperSG, accessed 16 Jan. 2017.

2. *The Singapore Free Press and Mercantile Advertiser*, 16 Dec. 1847, p. 2. Available online at NewspaperSG, accessed 16 Jan. 2017.

3. *Ibid.*

4. *Singapore Free Press*, 6 Dec. 1850, p. 5. For contemporary thinking on the effects of desiccation in Penang, see J.R. Logan, ‘The Probable Effects on the Climate of Pinang of the Continued Destruction of its Hill Jungles’, *Journal of the Indian Archipelago and Eastern Asia* 2 (1848): 534–36.

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swampy and unwholesome ... and prejudicial to the public health’.⁵ Concepts of climate’s influence on health and notions of healthy cities were well established in Eastern and Western discourse.⁶ It is evident that George Town’s colonial administrators had made the connection of a healthy environment with a healthy populace. Consecutive governors from Philip Manington to Robert Fullerton, between 1794 and 1826, attempted to improve the town’s health by improving drainage and roads, and by removing public nuisances. Their attempts were met with varying degrees of success.⁷ Major Forbes Ross Macdonald (Superintendent of Prince of Wales Island, 1795–1799) even proposed to relocate George Town on grounds that the original settlement was unhealthy.⁸ From the very beginning, the combination of tropical climate and limited urban infrastructure challenged the creation of a healthy town.

In this article we explore the interconnected topics of weather and public health infrastructure in George Town, Penang (known locally as *Pulau Pinang*). George Town is a relatively understudied port city established in 1786 and once part of the British Straits Settlements (Penang, Malacca, Singapore and Labuan), that later formed British Malaya. Singapore, the administrative hub of the Straits Settlements from the 1820s, also plays an important role in George Town’s history as the originating point of many national town planning and health initiatives. Officers and knowledge were often interchangeable between the two towns. The tropical climate of Penang Island created a set of local conditions for its urban inhabitants and challenges for government in the form and direction of town planning. As Timothy Brook has argued, ‘climate sets fundamental perimeters within which people organize their social existence’.⁹ Thus we trace the development of understanding of the impacts of climate on urban health, and the expression of this knowledge within municipal structures. As in all social-ecological systems, this evolution was dynamically

5. *The Singapore Free Press and Mercantile Advertiser*, 28 Dec. 1849, p. 3. Available online at NewspaperSG, accessed 16 Jan. 2017.

6. A. Kessel, *Air, the Environment and Public Health* (Cambridge: Cambridge University Press, 2006), pp. 34–35. The nineteenth century was also a critical period for reforms, with texts like Benjamin Richardson’s *Hygeia: A City of Health* (London, 1876) influencing a generation of early urban planners and thinkers, including Ebenezer Howard and the Garden City Movement. An oft-cited classic text that connected climate, health and urban environments is Hippocrates’ *On Airs, Waters, Places*, written around 400 bc: Stephen Mosley, *The Environment in World History* (London: Routledge, 2010), p. 85. For ideas about urban and public health from China, see Ruth Rogaski, *Hygienic Modernity: Meanings of Health and Disease in Treaty-Port China* (Berkeley: University of California Press, 2004).

7. This was before the incorporation of the Straits Settlements or the establishment of a formal municipal system, the latter credited to Fullerton and the influence of Britain’s Municipal Corporation Act of 1835: City Council of Georgetown, Penang, *Penang Past and Present, 1786–1963: a Historical Account of the City of George Town since 1786* (Penang: George Town City Council, 1966), pp. 4–14.

8. *Ibid.*, p. 2.

9. T. Brook, ‘Nine Sloughs: Profiling the Climate History of the Yuan and Ming Dynasties, 1260–1644’, *Journal of Chinese History* 1 (2017): 27–58.

complex, drawing (then as now) from a variety of different temporal fields and factors, scales and sectors.

Central to the argument is the role of experiential factors in changing urban management. Urban decision-making operates within a complex system. In George Town the factors involved included extreme weather, evolving medical and meteorological knowledge, and public health needs. Over the period of this study, however, shifts in medical knowledge drove governance away from a direct cause-and-effect explanation for public health problems, to a more mature understanding, including the role played by weather. This shift in perspective was expressed in changing management structures. During the early nineteenth century, colonial government and municipal departments were fewer and shared roles and responsibilities. The Medical Department, for example, observed the weather. Civil engineers became embroiled in arguments concerning post-flood mortality rates. By the late nineteenth century, a transition was evident toward more specialised departments and functions enabled by more predictable sources of revenue. By the 1920s this transformation was ingrained in the municipal landscape.

In telling this story, we draw from a varied historiography, including climate and environmental history, colonial public health and town planning.¹⁰ It also takes into account recent calls to consider the origins of knowledge.¹¹ This focus has led to more consideration of local experience in the production of knowledge, and an effort to see beyond the imperial narrative, to think across borders and boundaries.¹² While this essay focuses on municipal governance

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10. See for example: A. Bashford, *Imperial Hygiene: A Critical History of Colonialism, Nationalism and Public Health* (Basingstoke: Palgrave Macmillan, 2014); R. Johnson and A. Khalid (eds), *Intermediaries, Subordinates, and the Practice of Public Health, 1850–1960* (London and New York: Routledge, 2011); Alfred W. Crosby, *Ecological Imperialism: The Biological Expansion of Europe, 900–1900* (London, 1986).
 11. K. Raj, *Relocating Modern Science: Circulation and the Construction of Knowledge in South Asia and Europe, 1650–1900* (Basingstoke: Palgrave Macmillan, 2007). See also J.A. Secord, ‘Knowledge in Transit’, *Isis* **95** (2004): 654–672. See also B.M. Bennett and J.M. Hodge, *Science and Empire: Knowledge and Networks of Science across the British Empire, 1800–1970* (Basingstoke: Palgrave Macmillan, 2011); L. Roberts, ‘Situating Science in Global History: Local Exchanges and Networks of Circulation’, *Itinerario* **33** (2009): 19–30; D. Lambert and A. Lester (eds), *Colonial Lives Across the British Empire: Imperial Careering in the Long Nineteenth Century* (Cambridge: Cambridge University Press, 2006); A. Lester, *Imperial Networks: Creating Identities in Nineteenth-Century South Africa and Britain* (London: Routledge, 2001); J. Golinski, *Making Natural Knowledge: Constructivism and the History of Science* (Cambridge: Cambridge University Press, 1998); A. Ophir and S. Shapin, ‘The Place of Knowledge: A Methodological Survey’, *Science in Context* **4** (1) (1991): 3–21.
 12. See A. Bala, *Asia, Europe, and the Emergence of Modern Science: Knowledge Crossing Boundaries* (Springer, 2012); W. Beinart et al., ‘Experts and Expertise in Colonial Africa Reconsidered: Science and the Interpenetration of Knowledge’, *African Affairs* **108** (432) (2009): 413–33; D. Wade Chambers and R. Gillespie, ‘Locality in the History of Science: Colonial Science, Technoscience, and Indigenous Knowledge’, in R. McLeod (ed.), *Nature and Empire: Science and the Colonial Enterprise*, Osiris Special Edition 15 (2001).

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which was of course limited to a small set of governmental representatives drawn from an elite, this recent discourse still has relevance here as the state of public health in Malaya was stimulated by the reality on the ground, independent of British administration from India or London. The Municipality, and later Legislative Council, drew its members from local ratepayers, including Chinese, Malays and Europeans.

The history of public health is an established, rich field,¹³ yet few scholars have addressed the public health history of the Straits Settlements (British Malaya). Those who have studied it have focused more on people, institutions or programmes, a point succinctly made by Manderson (1996) in her excellent study of health and illness in Malaya.¹⁴ Monnais and Cook (2012) also noted this omission, and suggested that the field had developed little in the intervening years.¹⁵ Wider thematic studies concerning climate, environment and health, such as those undertaken by Beattie for Australasia, Anderson for the Philippines or McMichael on a global scale have not been conducted for Malaysia or Singapore.¹⁶ With the exception of Kai Hong Phua and Mary Lai Lin Wong’s short overview of public health in Malaysia, Kai Khuin Liew’s study of the impact of bubonic plague in 1918 Malaya and Yeoh’s survey of public health strategies in Singapore, few scholars aside from Manderson have explicitly addressed health in the colony.¹⁷ Neither has work on environmental

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13. For an overview, see C. Hamlin, ‘Public Health’, in Mark Jackson (ed.), *The Oxford Handbook of the History of Medicine* (Oxford: Oxford University Press, 2011), pp. 411–228; D. Porter, ‘The History of Public Health: Current Themes and Approaches’, *Hygiea Internationalis* 1 (1999): 9–21; D. Schneider and D.E. Lilienfeld, *Public Health: The Development of a Discipline, from the Age of Hippocrates to the Progressive Era* (New Brunswick, NJ: Rutgers University Press, 2008).
 14. L. Manderson, *Sickness and the State: Health and Illness in Colonial Malaya, 1870–1940* (Cambridge: Cambridge University Press, 1996), p. xii.
 15. L. Monnais and H. J. Cook (eds), *Global Movements, Local Concerns: Medicine and Health in Southeast Asia* (Singapore: NUS Press, 2012), pp. x-xi.
 16. A.J. McMichael with A. Woodward and C. Muir, *Climate Change and the Health of Nations: Famines, Fevers, and the Fate of Populations* (Oxford: Oxford University Press, 2017); Monnais and Cook, *Global Movements*; W. Anderson, *Colonial Pathologies: American Tropical Medicine, Race, and Hygiene in the Philippines* (Durham, NC.: Duke University Press, 2006). See also S. Au, *Mixed Medicines: Health and Culture in Colonial Cambodia* (Chicago: University of Chicago Press, 2011); B. Pati and M. Harrison, *Health, Medicine and Empire: Perspectives on Colonial India* (Hyderabad: Orient Longman, 2001); R. McLeod and M. Lewis (eds), *Disease, Medicine, and Empire: Perspectives on Medicine and the Experience of European Expansion* (London and New York: Routledge, 1998); D. Arnold, *Colonising the Body: State Medicine and Epidemic Disease in Nineteenth Century India* (Berkeley: University of California Press, 1993).
 17. Kai Fong Phua and Mary Lai Lin Wong, ‘From Colonial Economy to Social Equity: History of Public Health in Malaysia’ in M. Lewis and K. MacPherson (eds), *Public Health in Asia and the Pacific: Historical and Comparative Perspectives* (London and New York: Routledge, 2008), pp. 170–187; and B. Yeoh, P.H. Kai and K. Fu, ‘From Colony to Global City: Public Health Strategies and the Control of Disease in Singapore’ in Lewis and MacPherson (eds), *Public Health in Asia and the Pacific*, pp. 188–205; Kai Khiun Liew, ‘Terribly Severe though

imperialism or climatic determinism, such as that undertaken by Harrison, been applied to the Malayan case.¹⁸ Yet, in a tropical British colony and protectorate, notions of climatic determinism affected ideas about health in Malaya. The concept that the weather and the environment had a direct impact on physical (and moral) health was widely held across the colonial world, especially in the early nineteenth century. Healthy cities meant industrious cities: inhabitants' health provided the baseline for socio-political wellbeing and economic productivity. Ensuring a healthy population was a constant source of anxiety for colonial officials, provoking a continual quest to allay the moral degeneration of European settlers and conserve the health of the workforce.¹⁹ Advances in science that connected contagion, public health and climate filtered into Malaya through British (and European) research. Medical research undertaken on the ground in Malaya helped move the field forward globally. For example, understanding of the thiamine deficiency disease, *beri beri*, was advanced significantly by studies of prison diets by Penang-based doctors F.K. Hampshire and T.S. Kerr, the latter also acting as Chief Health Officer for the town during the 1890s.

This paper is the first to be generated from an interdisciplinary research project related to urban health and municipal development in George Town, Penang. That research project, funded by the Wellcome Trust, addressed historical perspectives of the interplay between public health and town planning. We used archival material located in Singapore, Malaysia and the United Kingdom, including the Wellcome Trust Library in London, to examine the changing nature of the links between public health and town planning over the nineteenth and early twentieth centuries. In the wider context, future papers will explore how history can be used with concepts from system dynamics to build trans-disciplinary approaches to urban health problems. These are intended to inform discussions about the need for historical perspectives in any systems research.

GEORGE TOWN, 1786–1867: A TOWN OR A SWAMP?

Initially, Penang was the responsibility of the English East India Company (EEIC) at Fort William, Calcutta, though ostensibly under the control of the Board of Directors in London. The island was governed like a military fort by a superintendent and a team of just five men. Superintendent Francis Light

Mercifully Short: The Episode of the 1918 Influenza in British Malaya, *Modern Asian Studies* 41 (2) (2007): 221–252.

18. M. Harrison, *Climates and Constitutions: Health, Race, Environment and British Imperialism in India 1600–1850*, (Oxford: Oxford University Press, 1999).
19. J. Beattie, *Empire and Environmental Anxiety, 1800–1920: Health, Science, Art and Conservation in South Asia and Australasia* (Basingstoke: Palgrave Macmillan, 2011).

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(1786–1794) was responsible for the first municipal task: sinking a well on Light Street. Other early schemes can be attributed to the leadership of Acting Superintendent Phillip Manington (1794–1795). He appointed John McIntyre as ‘Clerk of the Market and Scavenger’ whose role was to collect rates and deal with municipal administration. The first municipal taxes were put towards draining swampy ground, constructing sewerage and drainage systems (often simply ditches alongside roads), building roads, cleaning, and maintenance.²⁰ It says much about the deficiency of these early ‘improvements’, and their impact on the health of the town, that Light died of malaria in 1794, and ill health forced Manington to resign after less than a year.²¹

In 1805, Penang became a colonial Presidency, and a Governor replaced the Superintendent. This marked a transition toward civil administration. In 1826 the settlement was joined with the Presidencies of Malacca and Singapore as the Straits Settlements, but in 1830 all three were reduced to residencies for financial reasons.²² At the same time, the British selected Singapore as the administrative capital, resulting in a loss of autonomy and prestige for Penang.²³ After 1835 a Medical Department and all health services were centralised in Singapore. It was headed by the Colonial Surgeon, with assistant surgeons stationed at each settlement, who managed local hospitals, quarantine and research into the spread and treatment of disease. Senior staff were British, trained and recruited abroad, while their subordinates were usually Eurasian locals. Physicians could not be trained locally until the opening of the Straits Settlements and Federated Malay States Government Medical School in 1905.²⁴

In theory, before 1839, the Government in India directly managed the affairs of George Town. In practice, the difficulty of managing day-to-day affairs of a town so far distant limited governance to granting funds for civil or military schemes. In 1839, some power was devolved formally to George Town’s officers (nominated in India) to raise local taxes on land and property. This power was extended in 1848 so that taxes could be levied on horses and carriages, in an effort to defray the cost of the police force and public works necessary in the burgeoning town. The Municipal Board, originally set up in 1800, was extended to five members (three elected by local ratepayers which

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20. N. Hussin, *Trade and Society in the Straits of Melaka: Dutch Melaka and English Penang, 1780–1830* (Singapore: National University of Singapore Press, 2006), pp. 237–45.
21. Hean Teik Ong, *To Heal the Sick: The Story of Healthcare and Doctors in Penang, 1786–2004* (Penang: Penang Medical Practitioners Society, 2004), p. 1.
22. For a detailed overview of George Town’s municipal development, see City Council of Georgetown, *Penang Past and Present*.
23. For a comprehensive introduction to Penang’s administrative history, see C.M. Turnbull, ‘Penang’s Changing Role in the Straits Settlements, 1826–1946’ in Yeoh Seng Guan, Loh Wei Leng, Khoo Salma Nasution and Neil Khor (eds), *Penang and Its Region: The Story of an Asian Entrepôt* (Singapore: National University of Singapore Press, 2009), pp. 30–53.
24. Manderson, *Sickness and the State*, p. 15.

usually included one ethnic Malay or Chinese) in 1852, and a new legislative Act gave these men greater power over the conservancy of the city streets and public spaces.²⁵ With regard to the British provision of medical services, these came in the form of military hospitals and small infirmaries, which mainly catered to the needs of Europeans.

Between 1852 and 1867 major changes occurred in Straits Settlements' governance. Pressure from the well-to-do inhabitants of George Town coupled with precedent then being set in India, led to George Town's Municipal Board gaining more independence in 1857. Then, in 1867, the Straits Settlements became a Crown Colony, a move that relocated governance from India to London. A Legislative Council was inaugurated in Singapore to manage the entire Straits Settlements, along with a medical service designed to treat the whole population, not just Europeans.²⁶ Council membership comprised eighteen men, including medical doctors, ethnic Malays and Chinese, while the majority was based in Singapore. Penang was entitled to only one member²⁷ and it was very hard to find someone who could travel from Penang to Singapore to attend the twice-monthly sessions and vote on new legislation. The journey was only possible by sea until the connection of localised railway services after 1910.²⁸ From 1867 Singapore authorised all major decisions affecting George Town, including planning and public health.

During this period (1852–1867) the responsibilities of the municipal departments overlapped considerably. Penang's Municipal Council comprised leading community figures, chosen on the basis of their social standing, not necessarily their relevant skills and experience. These men had overall responsibility for all civic matters. The Municipal Council provided the administrative structure for the Sanitary and Conservancy Boards. The Conservancy Board was responsible for cleaning streets, sweeping leaves, removing dirt (all conducted by scavenging teams, often convicts, under contract), for public latrines, sewerage, regulating animals in urban streets and graveyards. Municipal Works (forerunner of the Public Works Department) dealt with public lighting (post 1857); roads; bridges; house demolition; drainage; canals and river works; and civil engineering for anti-malarial measures, flood prevention and restoration, and water supply. Municipal Works shared overlapping responsibility with the Sanitary Board for drains and anti-malaria measures. All these departments worked closely with the police, whose job was to enforce sanitary rules and monitor illegal activities, such as people dumping

25. *Accounts and Papers of the House of Commons, Vol. 49* (Great Britain: House of Commons, 1870), p. 62.

26. Kai and Lai, 'From Colonial Economy to Social Equity', p. 171.

27. See, for example, the minutes of the Legislative Council printed in the *Straits Times Weekly Issue*, 13 July 1887, p. 1. Available online at NewspaperSG, accessed 2 Feb. 2017.

28. Tse Siang Lim, *The Imperial Locomotive: A Study of the Railway System in British Malaya, 1885–1942*, p. 11. https://www.academia.edu/1517283/The_Imperial_Locomotive_A_Study_of_the_Railway_System_in_British_Malaya_1885-1942, accessed 2 Feb. 2017.

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muck in the street or causing public obstructions. It was also necessary for the Medical Department to co-operate closely with public works and conservancy over public health. The Medical Department was also responsible for meteorology, as no dedicated meteorological department existed until 1929.²⁹ Thus many, though not all, early meteorological registering stations were located at hospitals. The Department compiled all weather observations centrally and issued annual summaries for the British Government, usually as addenda to the annual medical reports, as well as sending the observations to the local newspapers. Some of the earliest can be found in *The Singapore Free Press and Mercantile Advertiser* during the mid-1830s. The Department’s involvement in meteorological research intimately linked weather with urban health.

The diluted structure of governance combined with a perpetual chronic lack of funding impacted on George Town’s infrastructure and public health. Provisions for drainage, sanitation, housing and fresh water were constantly inadequate for the rapidly expanding population. The combined effects of the tropical climate and human-induced environmental degradation, caused by land clearing for urban expansion and agriculture, created a dire situation. The town resembled a swamp for much of the year.³⁰ Heavy rains and tropical storms, especially during the north-east monsoon of December to January, characterised the weather. The island had originally been densely wooded³¹ but indiscriminate forest clearing (Figure 1) had increased soil erosion around the settlement, resulting in lower water absorption and faster run-off during heavy rains.

During the wet season, floods were common, resulting in costly infrastructural damage and peaks in illness and disease. Solutions to these challenges tended to be *ad hoc* and reactive. For example, the original settlement had been constructed from wood and *attap*. A serious fire in 1814 had reduced ‘A greater portion of this populous town ... to ashes’.³² It was essential that plans to rebuild incorporated measures to fire-proof houses, which had the co-benefit of improving public health. Initiatives to improve urban conditions included widening some streets, rebuilding with sturdier brick and tile and inspecting choked wells.³³ Nevertheless, the township’s facilities – especially the drains and sewers – were inadequate for much of the nineteenth century. In the

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29. For more on the evolution of meteorological services in Malaya, see F. Williamson, ‘Weathering the British Empire: meteorological research in the early nineteenth-century Straits Settlements’, *The British Journal for the History of Science* 48 (3) (2015): 475–92.
30. C.M. Turnbull, *The Straits Settlements 1826–67: Indian Presidency to Crown Colony* (London: University College London, 1972), p. 14; Hussin, *Trade and Society*, pp. 237–45.
31. British Library (hereafter BL), India Office Records (hereafter IOR) G/34/1 ff.241–64. Copy of a report on Penang by Capt. Alexander Kyd, Bengal Engineers, Calcutta 1 September 1787.
32. M. Langdon, *Penang: The Fourth Presidency of India 1805–1830, Volume 2, Fire, Spice and Edifice* (Penang: George Town World Heritage Incorporated, 2015), pp. 177–200.
33. Langdon, *Penang*, pp. 191–200.



Figure 1. Watercolour showing forest clearing on Penang Island in 1848. Source: Penang State Museum and Art Gallery and Creative Commons.

1830s the main drainage outlet was described as ‘an evil-smelling’, clogged and filthy ditch encircling the town.³⁴ More than a generation later, little had changed: the ‘ditches are choked up with rubbish saturated with an indescribable blackfluid [sic]’ like a ‘laboratory of stench and malaria,’ the *Singapore Free Press* reported.³⁵ The failures of municipal planning were illuminated in the town’s 1856 annual report

Of the present Municipal Act, of its deficiencies and shortcomings, it seems unnecessary here to say anything, as many months cannot now elapse, ere it will be superseded by the more comprehensive enactments so long expected. There is every reason to hope and expect, that under the new Acts, the general funds of the Committee will be considerably augmented ... and the Conservancy of the Towns more stringently adhered to.³⁶

34. P.J. Begbie, *The Malayan Peninsula* (Madras, 1834, reprinted Kuala Lumpur, 1967), p. 373.

35. *The Singapore Free Press and Mercantile Advertiser*, 22 Mar. 1860, p. 3. Available online at NewspaperSG, accessed 21 Apr. 2017.

36. R.J. Jarman, *Straits Settlements Annual Reports*, Vol. 1 1855–1867 (Cambridge: Cambridge University Press, 1998), p. 21 (1856).

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George Town relied on convict labour to make up the shortfall of ‘inadequate’ municipal funds and labour. It was to convicts, then, that the ‘charge of all the roads and bridges’ fell ‘especially after the damage effected by heavy rains’.³⁷ It is most surprising that there was still no fresh-water supply within the town limits at this stage: plans to pipe water from the surrounding hills had been mooted for some years but not enacted.³⁸ The Municipal Board blamed their slow progress toward ‘bringing ... the much needed supply of water’ on ‘their poverty’.³⁹ The problem was partially addressed by the generosity of Mahomed Noordin who gave 1000 dollars to run pipes ‘from the Aqueduct to Pitt Street, for the conveyance of water to one of the most populous parts of the Town; a boon which we are fully confident will be highly valued by the poorer classes of the population’.⁴⁰ Indeed, were it not for the generosity of the town’s minority of wealthy merchants, many municipal schemes would never have got underway.

One of the underlying reasons of for the Municipality’s ‘poverty’ was the system of revenue collection. Municipal works were funded by rates chargeable on property but, in the early years, there were few rateable properties, and much resistance to paying. Money sourced from the British Government was channelled into military works and buildings, an inheritance of the original settlement’s purpose as a defensible port and fort. The situation began to shift only from the 1860s.⁴¹ Rebuilding some 400 *attap* houses in brick increased the number of rateable properties, and generated additional municipal revenue.⁴² The Magistrates Court was also given the authority to issue fines to inhabitants for municipal offences, for instance, obstructing alleyways or dumping waste in public space.⁴³

AFTER 1867: SHIFTS, DEVELOPMENTS AND ENDURING CHALLENGES

In 1867 governance of the Straits Settlements changed drastically, when the East India Company was dissolved. The Settlements became a British Crown Colony administered directly by the Colonial Office in London. Nevertheless, the administrative change was slow to impact on the everyday state of the town. Drainage, water supply and sanitation continued to be major challenges for

37. Jarman, Vol. 1 1855–1867, 1856, pp. 88–89.

38. Jarman, Vol. 1 1855–1867, 1858, pp. 166–67.

39. Jarman, Vol. 1 1855–1867, 1859, p. 227.

40. ‘Pinang’, *The Singapore Free Press and Mercantile Advertiser*, 12 Sept. 1851, p. 3; Khoo Salma Nasution, *The Chulia in Penang: Patronage and Place-making around the Kapitan Kling Mosque 1786 – 1957* (Penang: Areca Books, 2014), p. 112.

41. Jarman, Vol. 1 1855–1867, 1859, p. 218.

42. Jarman, Vol. 1 1855–1867, 1864, pp. 609–10.

43. Jarman, Vol. 1 1855–1867, 1862, p. 427.

urban dwellers. In the 1870s George Town, although ‘quite capable of becoming a very beautiful as well as a very commodious town’ desperately needed better drainage and flood management.⁴⁴ It was anticipated that a sea wall, to be constructed alongside a broad road from the jetty for the length of the town, would improve the situation. This, the Governor argued, would enable Penang to ‘present to the sea a handsome front instead of the present reeking mud banks. It would also, I believe, render the town healthier’.⁴⁵ However, the project failed to address the core public health needs of the town. Even in 1890, George Town was still being described as a ‘hotbed of disease’:

It is an open secret that nine tenths of the population of Penang are living in a state of filth and indifference to everything that concerns their health [it] is truly pitiable to behold ... we find at every turn, our drains filled with accumulations of corruption emitting smells of the most revolting nature ... the state of filth in which most of our streets are allowed to remain is of itself a fruitful source of danger to the public ... we believe that the question of sanitation is of quite as much importance ... it would be desirable to send out for a sanitary engineer with a view to report upon the best ways and means to secure the sanitation of the town ... Many of the houses are built on a lower level than the streets, and there is no outlet for the water collecting in the compounds adjoining the streets.⁴⁶

At the same time, investment in drainage was kept at a minimum, the extant system unable to cope with heavy rains, and coolies making up shortfalls with hard labour. The main drainage system was based on embankments and ditches, which radiated from town to suburbs, designed to draw water away from the town itself. Intercepting channels built of brick and tile led normal and flood waters from the suburbs directly into the sea. During excessive rain, the systems would be overloaded and floods were likely.⁴⁷ A proper pumping system was not adopted, even by the early twentieth century, because of the costs involved. A more cost-effective option was the availability of cheap labour. Coolies were employed to keep the drains and ditches clear from muck, and to prevent faecal matter from entering the water-supply system. As in most colonial towns, water closets were built inside domestic houses, and night-soil and household waste collected in the early hours of the morning by coolies and scavenging carts.⁴⁸

Although bacteriology and virology were in their infancy in the nineteenth century, poor drainage and sanitation were known to relate to disease. The

44. R.L. Jarman, *Straits Settlements Annual Reports* Vol. 2, 1868–1883 (Cambridge: Cambridge University Press, 1998) pp. 166, 172 (1872).

45. *Ibid.*

46. *The Straits Times Weekly Issue*, 18 Mar. 1890, p. 1. Available online at NewspaperSG, accessed 23 Jan. 2017.

47. C.C. James, *Drainage Problems of the East* (Bombay: The Times Press, 1906), pp. 302–04.

48. *Ibid.*, p. 303.

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theory of the ‘cardinal humours’ described by the ancient Greeks connected climate with health, and provided a baseline for medical thought until the nineteenth century. The theory influenced the notion of miasma or ‘bad air’, whereby disease was transmitted through atmospheric vapour, and the negative effects of excessive moisture and heat on the body. In the tropics, moisture and heat were profligate. Inspired by this ancient legacy and by contemporary understanding of the importance of observation, medical officers studied the weather. They concluded that excessively wet weather led to an increase in influenza, fevers and dysenteric illnesses, while dry weather led to more cases of cholera. Diseases of stomach and bowels (including ulcers and dysentery), fevers, lung disease, cholera, rheumatism (affecting ‘mainly Chinese working in wet and swampy grounds or lascars exposed to the weather’), ranked high in hospital admissions in the 1850s.⁴⁹ In the 1870s and 1880s, the situation was much the same, with phagedena and dysentery-related phagedena (ulcers) ranking first and second on the top causes of death.⁵⁰ Regardless of the scientific accuracy of their understanding, there was value in connecting environmental conditions with poor health. Stagnant or standing water bred malarial mosquitos, and understanding the nature of miasmas led ultimately to vector ecology. The lack of clean piped water and reliance on polluted well-based water supplies meant a high incidence of water-borne infection including diarrhoea, dysentery and cholera. Many contemporary illnesses continued to be erroneously attributed to the climate, including anasarca and beri-beri. Anasarca (often linked to protein deficiency) was listed as the third highest cause of death in 1873, the same year that beri-beri (B1 deficiency) first entered Penang’s medical records.⁵¹ At that time, beri-beri was considered symptomatic of extremely wet weather. New Chinese migrants, for example, were thought to be particularly susceptible because they were not yet acclimatised.⁵² The correlation of the illness with the staple polished rice of the Chinese diet was not made until 1910.

In 1887 another significant change occurred for municipal governance and for health. This was the last year of the old Penang Municipality, which had operated since 1857, with jurisdiction over the whole island. In 1887 jurisdiction was restricted to George Town, ‘confined to limits which extend along the coast for about ten miles (from Bagan Jermal to Batu Lanchang) ... altogether about nine square miles’. Direct authority for the remainder of Penang Island was given to the administration in Singapore, a move which sanctioned the latter’s right to collect Penang’s rural rates and taxes.⁵³ A Municipal Ordinance

49. Jarman, Vol. 1 1855–1867, pp. 722–24.

50. Jarman, Vol. 2 1868–83, 1873, p. 196; 1880, p. 160.

51. Jarman, Vol. 2 1868–83, p. 196.

52. Manderson, *Sickness and the State*, p. 72.

53. R. L. Jarman, *Straits Settlements Annual Reports* Vol. 3 1884–1891 (Cambridge: Cambridge University Press, 1998), p. 266 (1887).

of 1887 also established a separate Municipal Health Department, which took localised sanitary measures out of the hands of the Municipality.⁵⁴ This saw a first step toward diminishing municipal responsibility for urban health, with greater emphasis on specialist responsibility. It also happened to be a bad year for the colony's health with two epidemics: cholera and smallpox. The former was, according to Principle Chief Medical Officer (Colonial Surgeon) Dr Thomas Irvine Rowell⁵⁵ 'in no doubt, result of the drought, and the consequent deficiency of wholesome drinking water'. The smallpox was at its height in the hot and dry months of January to April, and 'was of the most virulent type'.⁵⁶ Nevertheless, although the climatic conditions were believed to exacerbate the spread of the diseases, it was generally supposed that smallpox was introduced 'by the steam ship *Bintang*, from which a person suffering from the disease in an aggravated form was surreptitiously landed on the island'. The dissemination of the disease across George Town was then traced from Chow Rusta, where the sick man had been lodging.⁵⁷

The 1880s witnessed a shift toward greater investment in infrastructure and public health of George Town under the new Municipal Council. Conservancy received priority. The new Health Officer (with funds provided directly from the Municipality) oversaw much of the conservancy, which involved works that later would be considered a separate responsibility of the Public Works Department. From 1884, works included the widening of roads, preservation of open spaces and tree planting; construction and improvement of surface drainage; watering and sweeping of roads; collection and disposal of town refuse; extension and improvement of the water supply, and the rebuilding, improvement and supervision of markets. By 1887 all streets were linked to a running water supply channelled from Ayer Hitam.⁵⁸ In addition, the Municipal Council put money toward a coastal land reclamation scheme (discussed below) designed to fill 'acres which were formerly a seething and reeking surface of excrementitious matter at low water', and towards preserving an area of forestland. The latter had the explicit aim of 'maintaining the rainfall, and consequently ensuring an adequate water supply'.⁵⁹ The reclamation also eradicated an area of swampland, and helped to alleviate a source of contamination of the town's water supply. Water contamination was a continual worry. It was often blamed on Chinese cultivation practices, including the application of manure to local crops with night-soil. Indeed this often brought the Chinese

54. Makepeace, *One Hundred Years of Singapore*, p. 321.

55. For Rowell's short biography, see: <https://www.mbras.org.my/article4.html>

56. Jarman, Vol. 2 1868–83, 1877, p. 338.

57. *Ibid.*

58. H.T. Ong and Y.L. Choong, 'The Battle against Infection', in H.T. Ong (ed.), *To Heal the Sick: The Story of Healthcare and Doctors in Penang* (Penang Medical Practitioner's Society and Phoenix Press: Penang, 2011), pp. 14–17, 15.

59. Jarman, Vol. 3 1884–1891, 1884, p. 246.

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communities into conflict with the Municipality, resulting in legal prosecutions and fines on occasion.⁶⁰ It was believed that the ‘constant rains and a tropical sun’ acted as ‘powerful agents on organic matters’ in the water.⁶¹ Plans put forward to deal with the problem included building public latrines and a public abattoir (to ensure waste was properly disposed of), draining the remaining swamps in the central parts of town, and increasing the supply of water from a secondary, external source.⁶² The year 1887 was a particularly wet one, with floods affecting large parts of the Malay Peninsula, especially Selangor. While Penang had the good fortune to have avoided the worst of the devastation on this occasion, the floods elsewhere served as a reminder of the problem of excess rainfall to a town built on swampland.⁶³

The continual threat of flooding greatly influenced medical thinking in Penang over this period. Serious flooding devastated much of the Malay Peninsula at least once a decade, with minor flooding events affecting the towns almost every year. However, the 1880s and 1890s were decades of particularly strong El Niño/Southern Oscillation (ENSO) conditions, which influenced the frequency and severity of drought or flood. There was an increase in severe flood events across the peninsula in 1881, 1884, 1891, 1892 and 1896, with minor events in 1883, 1885 and 1886. In 1881 Dr Hampshire, Penang Medical Officer, made public his hypothesis ‘from his experience of this climate ... that heat and dryness diminish mortality amongst the native population, whilst frequent or heavy rains increase the same’.⁶⁴ It is perhaps no coincidence that from 1881 detailed meteorological reports highlighting monthly rainfall and temperature were included in the annual medical report for each settlement, plus commentary on particularly wet, dry or hot periods.⁶⁵ This development was considered significant as ‘the meteorological conditions of the settlements have such an effect for good or evil upon the public health that it is quite fitting that the tables shewing the meteorological observations for the year in each Settlement should form an appendix to the yearly report of the Principal Civil Medical Officer’.⁶⁶

60. ‘Report of the Proceedings of the Legislative Council of the Straits Settlements, 7 August’, *Straits Times Overland Journal*, 13 Aug. 1869, p. 7; ‘The Nuisance Question’, *The Daily Advertiser Singapore*, 6 Nov. 1893, p. 2.

61. *Ibid.*, p. 247.

62. *Ibid.* pp. 247–8.

63. For Penang’s 1884 rainfall returns, see Jarman, Vol. 3 1884–1891, 1884, p. 21.

64. Jarman, Vol. 2, 1868–83, 1881, p. 524.

65. For more on this subject, see Williamson, ‘Weathering the British Empire’; F. Williamson and C. Wilkinson, ‘Asian Extremes: Experience and Exchange in the Development of Meteorological Knowledge c. 1840–1930’, *History of Meteorology* 8, Special Issue: ‘Relocating Meteorology’ (2017).

66. *The Straits Times Weekly Issue*, 6 March 1886, p. 5. Accessed online courtesy of NewspaperSG 11 Apr. 2017.

Medical concerns spilled over into the responsibilities of town planning for public health. Dr Hampshire advised the engineers and Legislative Council on water supply, sewerage and proper sanitary facilities for domestic housing, and even gave advice on workmanship and materials.⁶⁷ The relationship worked both ways. During the severe weather of 1892, Singapore's Municipal Engineer revealed a keen interest in the health of the colony's inhabitants, leading an investigation into the number of deaths caused directly by the severe ENSO-related flooding of May that year. He also drew attention to defects in burials, burial grounds and burial administration. He addressed these issues, even though the former was responsibility of the Medical Department and the latter under the separate jurisdiction of the Inspector of Burial Grounds.⁶⁸

There was a parallel effort to improve drainage to alleviate the worst excesses of floods and the effects of standing water on public health. The Prangin Ditch, for example, had been an historic point of contention. For many years, it had served as the main drainage outlet, encircling the town like a moat. Works over 1885–1886 had extended the drains that vented into the ditch and covered them, but this was not enough. Many parts of the town, especially outside the immediate centre, still flooded periodically, creating peaks in water-borne disease. In May and June 1885 there had been high mortality from cholera and bowel ailments, which the Medical Officer attributed to overcrowding, the absence of proper sanitary arrangements and the weather.⁶⁹

The major land reclamation scheme of the 1880s was Weld Quay and Beach Street. It was completed under the instruction and guidance of Consulting Engineer Sir John Coode and Engineer Henry McCallum between 1883 and 1886, and it forever altered the town's eastern coastline and natural mangrove habitat. Drainage was gradually added to the new lanes and *ghauts*, which crossed the reclaimed land to channel waste and rain water out to the sea. However, the reclamation scheme attracted a great deal of criticism, with complaints levelled at McCallum for failing to understand local conditions, a reference to subsidence and inadequate drainage.⁷⁰ Further reclamation and drainage works in the central areas were temporarily postponed until 1888 due to lack of funds.⁷¹ Interestingly, this can be linked to a severe La Niña across 1886–1887, which created regional trade fluctuations and market shortfalls.⁷²

67. NAS, Straits Settlements Annual Medical Reports (hereafter SSAMR), Vol. I. D/27 1887–95; 1890, p. 41.

68. NAS, NA426 Minute Book of the Municipal Fund of Singapore, 22 June 1892–30 Dec. 1897: Ordinary meeting of 22nd June 1892: Colonial Engineer's Notice, ff. 2033–41.

69. Jarman, Vol. 3 1884–1891, 1885, pp. 95, 104–5.

70. Staff writer: The Hon. Major McCallum, *Straits Times Weekly Issue*, 28 May 1884, p. 4 and Anon, Notes from the Kampong, *The Singapore Free Press and Mercantile Advertiser*, 6 Nov. 1886, p. 8. Accessed online courtesy of NewspaperSG 10 Apr. 2017.

71. Jarman, Vol. 3 1884–1891, 1886, p. 210.

72. M. Davies, *Late Victorian Holocausts: El Niño Famines and the Making of the Third World* (London & New York: Verso, 2001), pp. 121, 124.

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In his annual address in October 1886, Straits Settlements Governor Frederick Weld noted the ‘falling off’ of imports and exports, and that the annual meteorological returns revealed ‘unusually wet’ conditions.⁷³ For Penang, reliant on trade for a major part of its income, this was a deep blow.

The suspension of the drainage scheme in 1887 contributed to a worsening state of public health in the town. Dr Rowell, Colonial Surgeon, noted how the same year, despite the lack of epidemic cholera and smallpox, Penang had experienced an exceptionally high death rate. He attributed this to ‘a faulty drainage system’ where

from the ventilation openings of the main sewer issue forth pestilential emanations and gases dangerous to life. One workman actually lost his life when keeping the main sewer clean, so overpowering did the gas therefrom prove to be. The fatality in question shows that sewer gas can accumulate in drains ... and can be as destructive to human life as in colder climes ... in the long-run [this will] start diseases like those manifesting themselves in several towns in Europe.⁷⁴

The Health Officer similarly put forward a compelling case that ‘a thorough system of drainage should be taken up without delay’.⁷⁵ Penang’s Dr Hampshire was also critical. A scathing letter published in *The Straits Times* commenting on Hampshire’s 1887 annual medical report noted that the ‘alarming spread of small-pox in Penang ... will not have surprised those who know how sanitary matters stand there’.⁷⁶ Perhaps with some irony too, the decade ended with the retirement of Dr Rowell due to ill health, and serious illness forcing Dr Kerr to take a sabbatical leave in England.⁷⁷

These descriptions provide an insight into the shift of ideas connecting climate with health. By the 1890s, improved biomedical understanding of disease causation, driven especially by advances in parasitology, bacteriology and virology, meant that climate was now recognised to be primarily a factor in, rather than the sole cause of, the spread of illness. Thus, climate might provide the conditions in which certain microbes or insects can survive and reproduce, rather than the direct cause of disease.⁷⁸ In 1890 (a year of excessive rainfall now known to be linked to La Niña), the usual dry season between February and April failed to occur. Hampshire argued that this was the cause of the lack of cholera that year, but generated the high incidence of fever, ulcers and so

73. Jarman, Vol. 3 1884–1891, 1886, p. 163; 1887, p. 324.

74. *The Straits Times Weekly Issue*, 21 Feb. 1887, p. 6. Accessed online courtesy of NewspaperSG 10 Apr. 2017.

75. NAS, SSAMR, Vol. I. D/27 1887–95, 1889, pp. 1–3.

76. *The Straits Times Weekly Issue*, 5 Oct. 1887, p. 6. Accessed online courtesy of NewspaperSG 11 Apr. 2017.

77. NAS, SSAMR, Vol. I. D/27 1887–95, 1889, p. 3.

78. A pivotal influence in this field was Patrick Manson, *Tropical Diseases: a Manual of the Diseases of Warm Climates* (1898).

on.⁷⁹ The following year, Hampshire reported 900 more deaths in Penang than during 1890, which he attributed only in small part to cholera because the outbreak had been limited to Chinese sailors arriving in Penang from Amoy.⁸⁰ Neither Kerr nor his assistant, Surgeon Captain O'Sullivan, found that they could make an unequivocal argument for the effect of the weather that year on health. Kerr noted that the spring drought of March to May led to a scarcity of pure water and the consumption of polluted well water, and it was followed in quick succession by unusually heavy rain.⁸¹ This may have been the cause of a 'fever of a severe and fatal character', Kerr reasoned, but he was unable to draw any definite conclusion 'as to the effects of meteorological change, or alteration in the level of groundwater, on the health of the population'.⁸²

Three years on, Kerr noted that, although May, June and July were 'the most unhealthy' months, it was because 'during these months the subsoil water fluctuates more than at other times'.⁸³ That same decade, Dr Charles Dumbleton, the first Municipal Health Officer appointed to the Straits Settlements and based in Singapore, argued publically that high urban mortality (in Singapore) could not be attributed to the insalubrious tropical climate because the death rate was far higher than in other comparable colonial cities. Instead, he blamed the Municipality and its lack of attention to public health and sanitation.⁸⁴ Poor town planning generated critical factors in the spread of disease. For example, the tendency of people to live near polluted or standing water increased their vulnerability to climatic conditions. In 1919 drought conditions led to a rise in cholera cases.⁸⁵ In 1926 extreme flooding produced the high number of deaths from malaria, which the Municipality had just recently brought under control.⁸⁶

Changing ideas about causation of disease are also revealed in statistics collected by health officers on urban geography and disease incidence. The districts most affected by cholera, for example, were near the port and harbour, traditionally home to the Chinese population. More than eighty per cent of people affected by cholera were Chinese. Previously a common view had been that certain illnesses were associated with particular ethnic groups. By

79. NAS, SSAMR, Vol. I. D/27 1887–95; 1890, pp. 40–1.

80. NAS, SSAMR, Vol. I. D/27 1887–95, 1891, pp. 1–3.

81. Jarman, Vol. 3 1884–1891, 1891, p. 616.

82. NAS, SSAMR, Vol. I. D/27 1887–95, 1891, pp. 1–3.

83. *The Straits Times*, 22 May 1895, p. 2. Accessed online courtesy of NewspaperSG 12 Dec. 2016.

84. B.S.A. Yeoh, *Contesting Space in Colonial Singapore: Power Relations and the Urban Built Environment* (Singapore: NUS Press, 2003), p. 89.

85. Jarman Vol. 7: 1915–21, 1919, p. 298.

86. *The Straits Times*, 26 Jan. 1927, p. 11. Available online at NewspaperSG, accessed 15 Apr. 2016; NAS, RM I.E/57, 1923, B171; Jarman Vol. 8, 1922–26, 1926 p. 540. For more on this flood, see F. Williamson, 'The Great Flood of 1926: Environmental Change and Disaster Governance in British Malaya', *Journal Ecosystem Health and Sustainability, Environmental Impact of Disasters – Special Issue* 2 (11) (2016).

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the 1890s, a growing acceptance of the bacterial theory of disease transmission had changed popular thinking. Disease transmission was now associated with low levels of personal hygiene of those groups (typified by Asiatic domestic practices) and with unsanitary living conditions. The Chinese habit of spitting and the level of domestic overcrowding in that community were given as causal factors in the spread of disease.⁸⁷

Conversely, the British applauded the Chinese for recognising that impure water was a vector for disease, and for travelling ‘a considerable distance for pure water’. The Penang-born Chinese were also praised for considerably improving domestic sanitation, waste disposal and drainage.⁸⁸ Therefore, the idea of certain racial types as more susceptible to disease gradually gave way to a better understanding of the connection between certain racial types and their socio-economic circumstances. Nevertheless, this did not eradicate structurally embedded racism within general medical thinking. In 1900 a comment piece written by an anonymous author on a recent medical report argued the case for keeping Europeans segregated from ‘the natives in Asiatic towns to avoid the spread of malaria which is transmitted from native to European, never European to European’.⁸⁹

These shifts in thought led to less emphasis on doctors watching the weather and more on interventional strategies and public health measures. These new ideas moved medical practice further from meteorology and more toward town planning. Over the next few years, these transitioning ideas were formalised in a separation of the Health Department from meteorological matters. The shift started with the transfer of weather services to the Museums Department under Herbert C. Robinson, himself a keen meteorologist, before responsibility passed to the Public Works Department in 1926. This might have linked the efforts of the meteorologists more closely with urban planners, but it was a temporary move. A new dedicated meteorological service was established between 1927 and 1929. The change in thinking was clearly demonstrated in the Surveyor General’s call for the new service in 1919. Although he had noted the value of meteorological observations to those involved in health and sanitation, it was the needs of the agricultural sector and the nascent aviation service that formed the core of his justification for a new service.

87. Yeoh, *Contesting Space*, p. 93.

88. NAS, SS Annual Medical Reports, Vo. I. D/27 1887–95; 1890, p. 41.

89. *The Straits Times*, 28 Nov. 1900, p. 2. Accessed online courtesy of NewspaperSG 4 Apr. 2016.

AUGMENTING DEPARTMENTS AND SWELLING STAFF:
TWENTIETH CENTURY VICISSITUDES

The period 1900–1930 saw the jurisdictional separation of other key municipal services and a considerable top-down investment in public health. For most of the early nineteenth century, public health had operated in an *ad hoc* fashion. Committees were established reactively, and public health had been subsumed within and across wider municipal activities. There had not been a Municipal Engineer responsible for public works until 1858 (the first appointee was J.W. Reeve) and he was based in Singapore. Experts commissioned by the government provided technical advice for special projects, such as the Weld Quay reclamation.⁹⁰ It was only in 1916 that the Municipal Engineer's responsibilities were split into three independent areas: lighting, waterworks, and roads and sewers. The Medical Department had traditionally worked closely with the civil engineers and the police for enforcement. It was not until the creation of the Municipal Medical Department in 1887 under Dr W. Gilmore Ellis that a dedicated urban medical entity existed in each settlement, and where public health remained integrated within urban decision-making. A critical juncture was when Ellis' successor Dr W.R.C. Middleton gained a Diploma of Public Health in 1894. Middleton was the first colonial doctor in the Straits Settlements to attain this qualification, and he went on to become the first Municipal Health Officer for the Straits Settlements. He was able to devote time to urban health matters, with the assistance of Dr J.A.R. Glennie.⁹¹ In 1910 a dedicated Health Branch was established under the auspices of the Medical Department. Health Officers were also appointed to towns outside Singapore. Their responsibilities were wide-ranging, from anti-malarial measures, the inspection of water supplies and enforcement of sanitary regulations (a job previously undertaken by the police), to supervision of the public health aspects of housing, licensing, school inspections and public health education for the general populace.⁹² By the late 1920s, public health education focused not only on general sanitation and hygiene but what was politely referred to as 'social hygiene', i.e. venereal disease. This had been such an unremitting scourge of the colony throughout its existence that a Social Hygiene Advisory Board was instituted in 1925.⁹³

Several factors acted as catalysts to the separation of jurisdictional responsibility and investment. One was a surge in epidemic disease. In 1899, bubonic plague came to Penang, probably from Hong Kong. This led to a tightening of

90. Makepeace, *One Hundred Years*, pp. 320–21.

91. Makepeace, *One Hundred Years*, p. 322.

92. Kai and Lai, 'From Colonial Economy to Social Equity', p. 172. A full overview of the Health Branch duties can be found in Wellcome Trust Collection (hereafter WTC) P24 J.W. Scharff, *A Note on Public Health Administration in the Northern Settlement (Malaya)*, 1933.

93. NAS, SSLCP, RM I.E/59, 1925: Appendix C, No. 48, p. C102: Monday 24 Aug. 1925, First Report of the Advisory Committee on Social Hygiene.

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emergency port quarantine measures and a concerted effort to get the town’s rat population under control.⁹⁴ In 1918 the global influenza epidemic came to Malaya, resulting in the highest annual death rate since records began, except for that of 1911.⁹⁵ There was a brief resurgence of the disease in 1920, along with a smallpox outbreak.⁹⁶ These peaks of disease occurred against a backdrop of malaria, which showed no sign of abating. By 1911, the malaria problem was deemed so serious that an Anti-Malaria Committee was instituted to work with the Health Branch and the Public Works engineers to revise and improve urban drainage and anti-malarial measures, including lime-washing.⁹⁷ The epidemics came at a time of expanding European interest in understanding the causes of, and treatments for, tropical disease. In the Straits Settlements, like other parts of Southeast Asia, some investment and direction came from the Rockefeller Foundation as well as the British Government. The opening of the two British Schools of Tropical Medicine in Liverpool (1898) and London (1899) heralded a similar investment in new medical training and research facilities overseas, including the Straits and Federated Malay States Medical School in 1905.

Rapid population growth in George Town put pressure on public health services. In 1833 the population of Penang Island and Province Wellesley was 86,275.⁹⁸ In 1898 Dr Kerr estimated it was 154,835,⁹⁹ and by 1911 it had risen to 278,003.¹⁰⁰ For Penang Island alone, the population was 163,951 by 1922.¹⁰¹ Development of urban services did not keep pace with population growth, and resulted in overcrowding and slums. The British Government was well aware of the situation. In 1907, a leading expert in public health for the British colonies, W.J. Simpson, published a damning report on the sanitary conditions in Singapore.¹⁰² Noting how infant and adult death rates were ‘abnormally’ high as compared with other equivalent British colonies, Simpson pointed the finger directly at the state of public health in Malaya. He stressed the inadequacies of planning as a major causal factor: for instance, the Chinese burial grounds were located on the hills overlooking the town, yet the residents were ‘crowded

94. National Archives of Malaysia (hereafter NAM) 2601/1899. Bubonic Plague at Penang, 17 July 1899 and NAM 2959/1899. Penang declared an infected port, 15 June 1899. On the rat cull, see *The Straits Times*, 8 Mar. 1900, p. 2; *The Singapore Free Press and Mercantile Advertiser*, 16 May 1900, p. 2; *The Straits Times*, 30 June 1900, p. 2. Available online at NewspaperSG, accessed 12 Apr. 2016.

95. Jarman, Vol. 7: 1915–21, 1918, p. 206. For more on the influenza in Malaya, see Kai, ‘Terribly Severe though Mercifully Short’.

96. NAM, Secretariat Selangor 50/1920; NAS, RM I.E/54, SSLCP 1920.

97. NAS, RM I.E/53 B107, Appointment of Anti-Malaria Committee, 1911.

98. Singapore Chronicle and Commercial Register, 7 Aug. 1834, p. 1.

99. Jarman, Vol. 4 1892–1900, 1898, p. 661.

100. Jarman, Vol. 7, 1915–21, 1920, p. 457.

101. Jarman, Vol. 7, 1915–21, 1921, p. 542.

102. WTC, WA670.JS6. Report on the sanitary condition of Singapore by W.J. Simpson 1907.

together' on low-lying riverine swamps 'to such an extent as to render them unhealthy'. Worse still, terraced shophouses had been expanded vertically and horizontally to cope with the pressures of a rapidly increasing population. Typical Straits Settlements shophouses incorporated what were known as 'five-foot ways' or 'verandahways' which provided an open passage around the terrace block.¹⁰³ Extensions meant that the courtyards, verandahways and alleys which had previously provided light and the circulation of air had been built over, a 'state of affairs ... absolutely destructive to healthy lighting and ventilating of houses', as well as drainage. Simpson's detailed study of the spread of tuberculosis in one town-centre block in Singapore starkly revealed how the disease was intimately connected to overcrowding.¹⁰⁴

In George Town the situation was little different. In the mid-1920s the impoverished conditions of many urban inhabitants was a regular topic at council meetings, with diseases including malaria, slums and overcrowding, and increasing high costs of living cited as particular issues.¹⁰⁵ Tubercular disease also ranked as one of the highest causes of death outside epidemics in early twentieth century George Town.¹⁰⁶ A description of local housing provided in 1927 suggests that the causal factors for this were akin to those given for Singapore.

In the early days of Penang, before the formation of the Municipality, land was given out in large blocks. It was subdivided, and later again subdivided, until we have small lots which do not abut on any public roads, which have no drains, no back-lanes and no sanitary arrangements at all. A large proportion of this land is very flat and is not drained at all easily by natural means. On a good many of these districts there are large numbers of *attap* houses and wooden houses without any sanitary arrangements at all ... We have very long shophouses without back-lanes resulting in night-soil having to be removed right through the house ...¹⁰⁷

In Singapore, this situation resulted in the establishment of a housing improvement trust. In George Town it was deemed sufficient to extend the scope of the Municipal Engineer's Department. To achieve this, the Municipality, of course,

103. Wan Hashimah Wan Ismail, *Houses in Malaysia: Fusion of the East and West* (Skudai: Universiti Teknologi Malaysia, 2005), p. 28.

104. *Ibid.*, pp. 6, 9, 11, Diagram 1.

105. NAS, RM I.E/59, Straits Settlements Legislative Council Proceedings, 1925, B170: Money requested for slum improvement by Mr Mohamed Unus bin Abdullah, 26 Oct. 1925; NAS, RM I.E/60, Straits Settlements Legislative Council Proceedings, 1926, B181: Questions on from the health perspective of the Batu Ferringhi Water Scheme from Mr Mohamed Unus bin Abdullah; NAS, RM I.E/62, Straits Settlements Legislative Council Proceedings, 1928: Mr Mohamed Unus bin Abdullah asks various questions to the Statistical Dept. as to the percentage rise in food and rental prices.

106. WTC, WA28.JM2S89. The Municipality of Georgetown, Straits Settlements. Health Officer's Annual Report (hereafter GTHOAR), 1920; 1927.

107. NAS, RM I.E/61, 1927, Appendix B53–4.

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hoped to receive additional funds from the administration in Singapore. A statement to this effect, made by P.M. Robinson to a standing ovation at a Legislative Council meeting in March 1927, revealed how new knowledge about public health was increasingly supported by the British Government in Malaya. The groundwork for this had been made possible by a change in attitude toward the provision of healthcare for native populations in the late nineteenth century. Although the need to protect British expatriates from tropical contagion had long been recognised,¹⁰⁸ the transition of the colony from a male-dominated military garrison and port into a thriving commercial community necessitated a different approach. This was critical in achieving a noticeable change in public health investment and administration across the 1920s and 1930s. From 1920, the George Town Health Officer presented, for the first time, a public health report as a separate publication from the medical report. This showed how the branch had grown from its humble beginnings in the late 1890s (with a staff of three in 1891) to a department employing 25 people by 1920, most of whom had joined after 1911.¹⁰⁹ That year also saw more intervention by the Health Officer’s Department, when it contributed to monitoring conditions on private property that promoted mosquito-breeding sites, and issued compliance notices to owners.¹¹⁰ The staff monitored, reported and enforced sanitary laws for public and private property, and issued notices for ‘filthy premises’, lime washing, latrines, drains and more. Staff also issued ‘nuisance notices’ to force property owners to comply with new rules that specified natural light and ventilation standards, and repairs to buildings. They identified land necessary to create back lanes and to re-instate public passages.¹¹¹ After 1919, female district nurses were also employed within the growing team, a circumstance which enabled an extension of the Branch’s role, especially in the areas of children’s health and public education.¹¹² The latter role reveals how public health philosophy was transforming the profession. Under this new direction, sanitary officers were ‘taught to advise and encourage rather than adopt the role of the policeman’. An important component was education: of officers as well as the public. Officers were trained in Singapore, and then updated at monthly lectures at local headquarters. Health ‘propaganda’, as it was labelled, was conveyed to the public through the distribution of leaflets, posters, lectures and school exhibits. Most interestingly, a section of the George Town Health Office was given over to a public health museum, ‘for instructional purpose amongst the staff, but also for the education of the general public’.¹¹³

108. Yeoh et al., ‘Public Health Strategies in Singapore’, p. 190.

109. WTC, WA28.JM2S89. GTHOAR, 1920, p. 2.

110. Ibid., p. 27.

111. Ibid., p. 27.

112. WTC, WA28.JM2S89. GTHOAR, 1920, p. 2; WTC, WA28.JM2S89. GTHOAR, 1923, 1925, 1927.

113. WTC, P24. Scharff, *Public Health Administration*, 1933, p. 35.

CONCLUSION

The ways in which the relationships of health, public health, climate, town planning and administration were framed and performed over this period reveal many transitions. These shifts arose from changing medical practices and knowledge, but also from the challenges generated by an expanding urban population. George Town had been established as a military and trading post, which reflected British strategic and commercial interests as these evolved over time. What was missing was the detailed planning and long-term arrangements needed for the success of a colonial settlement. A chronic lack of funding characterised municipal governance through most of the nineteenth century. Urban services were thus rudimentary in the beginning, driven by the fundamental health and survival needs of the (European) community. The tropical climate and extremes of rainfall put stress on an already inadequate budget and infrastructure and, concurrently, led to peaks of illness, and general poor public health. As medical science was in a preliminary stage of development, public health at this time was best addressed by avoidance of the natural hazards associated with known diseases. Thinking on tropical diseases was tightly linked to climate and the frequency of extreme weather events, which were known to increase diseases spread by pathogens (micro-organisms) and by vectors (biting insects), although the exact connection was not fully understood. At the same time, urbanisation increased the likelihood of disease. Land clearing, for example, was a necessary part of establishing a new settlement. Such activities took workers into the jungle where they faced threats from vectors linked with diseases such as malaria, known locally as 'Penang fever'. Clearances and deforestation also increased the likelihood of flooding, which, in turn, put pressure on existing sanitary and drainage provisions in the town.

Over the period of this study, changes to the local governance structure brought greater capabilities to the municipal administrators to raise rates and pay for improvement works. It has been noted earlier that a new governance structure for Penang was introduced under a new Municipal Act of 1887. This removed responsibility for the rural parts of Penang from the Municipality, which allowed it to concentrate on urban problems. In combination with increased revenue, new urban infrastructure was developed in response: coastal land was reclaimed, drainage works were expanded, burial grounds moved from town to suburb and the town's fresh water supply improved. The upturn in revenue also allowed the colony to take advantage of advances in medical science. For 1920–1933 the Health Office Reports for Penang and Medical Reports for the Straits Settlements show a growing awareness of links between tuberculosis and housing density and poor ventilation, between nuisance from unsanitary water and enteric diseases, between coastal swamps and malaria, and between general ignorance about hygiene and poor quality of urban life.

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These new understandings led to increased efforts in health promotion via education.

The later nineteenth century also produced significant medical advances globally – advances that changed long-held worldviews about cause and effect in urban health. For instance, the nature of cholera was better understood once the link with contaminated drinking water was made in London in 1854. Concurrent developments in medical technology, such as the hypodermic needle, also contributed to improvements in public health through extensive vaccination programmes. By the 1890s, the invention of the compound microscope allowed scientists worldwide to explore and finally understand the nature of many diseases. In Penang, urban health was improved by the advent of the theory of vector-borne disease, which explained the cause–effect relationship between unhealthy environments, mosquitoes and malaria. Advances in the science of infectious diseases strengthened the link between sanitary reforms and improved town planning.

The rise of global professional associations was also important here. During the mid to latter half of the nineteenth century, global organisations emerged in response to colonial health crises. For example, the first International Sanitary Conference was held in 1851, discussing international cooperation on cholera, plague and yellow fever. Later, the Rockefeller Foundation played a major role in funding research into tropical diseases. The same level of international interest was also evident in town planning. In 1898 the first urban planning conference was held in New York. In Britain in the following year the British Town and Country Planning Association was founded and in 1909 the University of Liverpool introduced the first academic course in town planning. The latter had implications for colonial towns and cities of the British Empire, where building codes began to appear from the 1920s. At the same time, the garden city movement had gained momentum, particularly in response to Ebenezer Howard and Alfred Marshall’s 1898 book *Garden Cities of Tomorrow*. This made explicit links between opening up urban space, greening cities and the mental and physical health of urban inhabitants. Concurrently, government faced escalating pressure from inhabitants to improve living conditions more generally in keeping with the progressive social reform movements (especially for the working classes) sweeping Britain and much of the world across the 1920s. A 1933 report on public health administration for the northern settlement highlighted how

As knowledge of disease prevention becomes more widespread, its usefulness will gather force. Each individual will learn to sense his share in health responsibility, not for himself alone, but as a factor in helping the community towards the ideal of happiness through health.¹¹⁴

114. WTC, P24. Scharff, *Public Health Administration*, 1933, p. 35.

These few lines reveal the shifts in thinking and in need since George Town had been founded almost a century and a half earlier. From the provision of basic services, like wells, by 1933 urban needs had become more complex, and demanded a range of services focused on improving many aspects of town living. Indeed, the diverse range of government departments operating by the 1930s to deal with public health, planning and medical matters clearly reveals this growing complexity.

Nevertheless, although some sense of a progressive transition can be detected in the forms and structure of public health administration, this argument should not be extended to medicine, health and scientific knowledge more generally. Many traditional ideas and methods persisted, existing in tandem with new knowledge. Neither should we place 'new', i.e., Western knowledge over and above 'traditional' knowledge.¹¹⁵ Chinese medical lore was still widely practised amongst the Chinese communities. They often preferred to rely on their traditional methods to deal with illnesses, or to maintain particular living standards over and above those prescribed by the Europeans. Indeed, this often brought the Chinese community into conflict with the British Government, the latter not always approving of Chinese ideas of hygiene and health. Within European communities too, traditional practices and ideas continued to be influential. In the 1930s, for instance, popular advice for staying healthy in the tropical climate included avoiding 'too much meat and farinaceous food' because of their 'heating' effects on the blood¹¹⁶ and avoiding excessive exertion or over-indulgence.¹¹⁷ Well into the 1930s doctors were connecting extremes of weather with the prevalence of certain diseases; a heatwave in 1936, for instance, was credited for a flu outbreak due to a 'general lowering of resistive powers' across the peninsula.¹¹⁸ As Margaret Shennan noted, 'next to the cost of living, physical symptoms induced by the climate were a frequent topic of conversation'. The continued attractiveness of the hill station resorts for a healthy respite and change of air was testament to the enduring notion of a causal relationship between climate and human health.¹¹⁹ At the same time, reports such as that by W.J. Simpson in 1907, or contemporary descriptions of urban Malaya in the 1920s cited above, show that public health and town planning still had a long way to go to resolve the problems of urban living. The history of relationships between health, environment, and governance thus

115. Kapil Raj provides a helpful summary of new research around this area: Kapil Raj, 'Go-Betweens, Travelers, and Cultural Translators' in B. Lightman, *A Companion to the History of Science*, Blackwell Companion to the History of Science Series (Chichester: John Wiley & Sons, 2016), pp. 39–57.

116. 'Prickly Heat', *The Singapore Free Press and Mercantile Advertiser*, 10 July 1889, p. 43;

117. 'Prickly Heat', *The Straits Times*, 12 May 1919, p. 14.

118. 'Malaya's Severest Heat Spell', *The Singapore Free Press and Mercantile Advertiser*, 8 June 1936, p. 6.

119. Margaret Shennan, *Out in the Middy Sun: The British in Malaya 1880–1960* (Singapore: Monsoon Books, 2015), p. 172.

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reveals some of the dynamic complexity that emerged during the interaction of different sectors, and across local and global scales operating in the urban system of George Town until the 1930s.

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