

PATIENTS AND METHODS

Four clinically prepubertal male patients with CF aged 13.5 years and above and attending the CF clinic at the Bristol Children's Hospital were assessed for height, weight, routine spirometry, bone age³ and serum luteinising hormone (LH), thyroid stimulating hormone (TSH), follicle stimulating hormone (FSH) and testosterone levels. All 4 patients had (a) stage 1 genitalia and pubic hair distribution,⁴ (b) heights below the third centile, (c) a bone age at least 2 years below their chronological age, and (d) serum testosterone level below 1 nanomole/litre.

All 4 patients were treated with 125 mg testosterone oenanthate (corresponding to 90 mg testosterone) intramuscularly once every month for 6 months after which the tests were repeated.

DISCUSSION OF RESULTS (TABLE)

Serum testosterone increases in patients 3 and 4 reached pubertal levels⁴ with weight gains of 4 and 5.5 Kg respectively. The serum FSH level increased in only one patient. Genitalia and pubic hair measurements reached stage 2 and 3⁵ in all four subjects.

Height velocity increased in 3 of the 4 similar to that in a previous report⁶ and improved morale and confidence in all. Spirometry showed no change in the pattern of decline in respiratory function during the six months.

The results suggest that further study of the use of physiological doses of testosterone to eliminate the physical and psychosocial consequences of delayed puberty in male subjects with cystic fibrosis is justified.

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REFERENCES

- ¹ Kopelman, H. Cystic fibrosis 6-gastrointestinal and nutritional aspects. *Thorax* 1991; **46**: 261-67.
- ² Zachman, M. Use and risks of androgen therapy: replacement, constitutional delay, and tall stature. In: Forest, MG. *Androgens in childhood*. *Pediatr Adolesc Endocrinol*. Basel, Karger 1989; **19**: 247-63.
- ³ Greulich WW, Pyle SI. *Radiographic atlas of skeletal development of the hand and wrist*. Stanford: Stanford University Press 1959.
- ⁴ Kempe CH, Silver HK, O'Brien D, Fulginiti VA. *Current pediatric diagnosis and treatment*. Norwalk, Connecticut: Appleton and Lange 1987.
- ⁵ Tanner JM. *Growth at adolescence*. Oxford: Blackwell Scientific Publications 1962.
- ⁶ Landon C, Rosenfeld RG. Short stature and pubertal delay in male adolescents with cystic fibrosis. *Am J Dis Child* 1984; **138**: 388-91.

TROPICAL MEDICINE IN THE TWENTIETH CENTURY: A REAPPRAISAL OF SOCIO-POLITICAL DETERMINANTS

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A programme on radio 4 provided an opportunity to discuss the importance of medical history in understanding health care in former tropical colonies—regions which now constitute much of the 'third world'. It was argued that not only has present health care policy been influenced by the past, but, the content of current research in tropical medicine is determined by factors rooted in the past priorities of colonial medicine.¹

The effects of social and political determinants on the provision of health care are now commonly reflected in the history of medicine, but the emphasis on these factors may turn attention away from the internal history of medical science and research. In the case of tropical medicine, interest in the power relationship of the colonized and the colonizers has dominated the social construction of western medicine as practised in non-western environments. To match the increasing interest in the cultural role medicine has played in the tropics, the medical research agenda also needs further exploration. A critical analysis of the social and political environment in which medical and scientific professionals worked needs to be balanced by understanding tropical medicine as a biomedical science of the twentieth century.

The history of tropical medicine has recently been reappraised. It is acknowledged afresh that western medicine has been practised in the tropics for several hundred years. Ships undertaking voyages of exploration and discovery were staffed with a surgeon who in addition to dealing with problems like scurvy and injuries due to accidents and warfare also encountered the 'exotic' diseases of the tropics.² Ague was well known in Britain, but the variety and severity of tropical fevers fell outside normal medical practice; similarly the fluxes. The tropical environment itself was seen as inimical to European habitation.³

Clinical and empirical research was undertaken by the army doctors charged with the care of the British Army overseas. The Indian Medical Service, dating back to the days of the East India Company, served the Indian sepoys and white civil servants of the Raj.⁴ Practitioners in the Colonial Medical Service were deployed in the islands of the West Indies and newer territories in Africa. Medical and non-medical missionaries worked all over the Empire offering care and conversion. Much less is known about the private practitioners who worked overseas, but a glance at the monographs of the eighteenth and nineteenth centuries gives a good idea of the range of issues encountered by doctors abroad.

Imperial, colonial and commonwealth history have their own established historiography, but usually with little focus on disease and its implications.⁵ Interdisciplinary work has sought to incorporate medical issues into existing views of economic and political history. Historians who work on a particular geographic region have used the medical experiences to widen their arguments about

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the colonizers and colonized.⁶ Anthropologists have studied indigenous medical practices, and this approach has been incorporated in area studies to provide a two-way analysis.⁷ Interest in this field is not the monopoly of the west and indigenous scholars are contributing their own picture of medicine during the period of imperial rule.⁸ While the ongoing results of colonialism have been addressed to some extent by sociologists, economic and social historians and others concerned with 'development' 'underdevelopment' and the 'third world', medical historians have only recently turned to this area of research.

The late nineteenth and early twentieth century have been the predominant focus of recent literature.⁹ Medical historians have been interested in tropical medicine in the context of aggressive European expansion, and in the development of the germ theories of disease. Such expansion embraces territory acquired by rival imperial powers, the economic development of land and people in a direction which served the interests of the colonizers, and, most perniciously, the imposition of a western value system. The aim of historical researchers is to link the biological and social forces together in order to understand and explain the past practice of medicine in the tropics and the associated research agenda both at home and abroad.¹⁰

In the early years of this century a 'tropical disease' was defined as a protozoan or helminth infection, whose life cycle included man and a further, usually invertebrate, host. However, it was the diseases of poverty, especially epidemic cholera and plague, which frightened the world into organising international sanitary conferences and imposing quarantine legislation, often against the interests of trade.¹¹ Such diseases were regarded as 'tropical' despite their previous occurrence in Europe. It was a while longer before the direct and indirect effects of under-nourishment were noticed¹² and attempts to deal with the problems of hunger still remain fuddled, despite billions of dollars poured into aid and a string of UN organizations primed to help.¹³

Institutionalization of tropical medicine

The institutionalization of tropical medicine, and the development of post-graduate research, were not the natural outcome of increased scientific interest and applied knowledge alone. It reflected not only medical discovery, technology, and discourse, but extraneous non-scientific factors as well. The cultural element of the 'civilising mission' represents a potent force in imperialism. Medicine can be considered as a part of the cultural component of imperialism, but the internal dynamics of practice and research require analysis to test and refine this argument.

In Britain two schools of tropical medicine were founded, at Liverpool in 1898 and London in 1899.¹⁴ In a public sense these two institutions brought together the previously disparate activities of research and practice.¹⁵ The involvement of the Secretary of State for the Colonies, Joseph Chamberlain, and the medical careerism of Patrick Manson, are familiar in the origins of the London school.¹⁶ Equally well known is the involvement of the ship owners and traders in the port of Liverpool, and the work of Ronald Ross, the first Professor of Tropical Medicine.¹⁷ Less well known is the subsequent development of tropical medicine in the schools especially in the context of advancing biomedicine in the twentieth century.¹⁸

In both London and Liverpool the emphasis on parasitology (helminthology),

entomology and protozoology, was reflected in the department structure and in the syllabi for the diplomas in tropical medicine and hygiene. The infection of man with parasitic worms had been known for centuries,¹⁹ but the shocking results of elephantiasis, observed in the eastern outposts prompted fresh investigations using the techniques of bacteriology and microscopy.²⁰ The effects of smaller, simpler, unicellular organisms offered a new and exclusive field of study to the tropical practitioner.²¹ The discovery that insects played not only a mechanical but also a developmental role in the transmission of these organisms fuelled interest in the natural history of insects and the sub-specialty of medical entomology.²² Specialist journals for tropical medicine and hygiene were established, supplementing the publishing opportunities of the general medical press.²³

The two schools began with a dual mandate of teaching and research in an attempt to make the tropical colonies safe for the colonizers, including the troops vital to imperial control.²⁴ This was expanded to include indigenous labour forces. The remainder of the population were effectively ignored until their bodies came to be seen as reservoirs of infection. The initial solution was often to uproot such people, moving them away from the vicinity of the Europeans.²⁵ In some cases tropical hygiene was initially aimed at such specific tasks as the reduction of breeding places for malaria carrying mosquitoes.²⁶ The focus, as in Europe, remained on specific diseases not general health.²⁷ This narrow vertical focus on individual diseases has characterised tropical medicine for much of the twentieth century.

As the discipline developed and the tropics were recategorised from imperial possessions to independent nation states, external factors continued to influence the practice of western medicine in the tropics and the agendas of research institutes here and abroad. The diversity of interests in the tropics and the priorities and perceptions of funding bodies have been crucial to the way research has been undertaken and applied. Two examples illustrate these points. The first example is from the early 'colonial' years of this century and describes the conducting mechanics of research at the Liverpool school. The second example looks briefly at the problem of malaria in the era after the second world war when global solutions came to the fore.

Early research at the Liverpool School of Tropical Medicine (LSTM)

The endowment of a school of tropical medicine in the metropolis of empire and not in the periphery, shaped the way such an institute functioned and the nature of the work conducted. The early years of the LSTM were remarkable for the series of overseas expeditions, thirty-two between 1899 and 1914, which supplied the researchers in temperate Merseyside with the raw materials of tropical medicine.

In addition to the LSTM's independent ventures, members of staff were seconded to visits organised and financed by outside bodies.²⁸ The *Annual Reports* listed sponsors who gave to the general funds and made donations for specific expeditions. Contributions were also made in kind.²⁹ It could be argued that much of the direction in which research moved in the early years was determined by such sponsorship, hence Worboys description of 'patronage-led' science.³⁰ Although the staff went either where they asked to go, or to where they were given free passages, the problems tackled were perceived to be the central issues in tropical medicine at that time. Knowledge of the natural history of parasites

and vectors, and the study of clear clinical syndromes were emphasised. Of the 32 expeditions, 8 investigated malaria, 6 sleeping sickness or trypanosomiasis, and 4 yellow fever.

Each expedition varied in its terms of reference, but a lot of time was spent in microscopic examination of parasites, vectors, tissue samples and pathological specimens. The remainder was usually spent performing clinical examinations. Often new members of staff were hired to take part in expeditions, and to maintain the specimens to be brought back. Separate laboratories were set up in Runcorn: an area housing heavy chemical plants and a burgeoning pharmaceutical industry. It was at Runcorn that the early work on chemotherapy for tropical diseases was undertaken. The link between the chemical industry and drug development were well established.³¹

The overseas research material was supplemented by the bodies of the tropical sick in the LSTM's wards at the Royal Southern Hospital and later the Royal Infirmary. These beds formed the clinical basis for the school (the equivalent of the Branch hospital of the Seaman's Hospital Society at the Albert Docks in London).³²

The early *Annual Reports* of the school contain detailed lists of those treated. Month by month are recorded the sex, occupation, nationality, duration of stay, discharge condition and disease suffered by the patients. The hospital facilities were an extension of existing arrangements for those who had fallen ill overseas or while working on board ship. The innovation, as in London, was the organised use of this clinical material for teaching tropical medicine to post-graduate students.

For research purposes the material from the tropical wards was inadequate. The clinic was probably more effective as a service to the school's patrons, and hence as a revenue raiser, than as a satisfactory adjunct to the research interests of the staff. The merchants of Liverpool appreciated the economic sense in making an annual donation which entitled them to have their employees admitted and treated by specialist clinicians.

Supplies of some parasites were available from the patients' bodies. In the case of organisms which could not be cultured *in vitro* or did not affect laboratory animals, the only way to maintain supplies was to use human carriers. Biopsy and pathological samples were available from the hospitalised victims of tropical disease, but it was not always possible to find patients in all the stages of a disease. The lack of complete clinical pictures from infection to death or recovery led to some initial confusion in diagnosis. Stages in the natural history of infections were erroneously held to be separate diseases viz. negro lethargy, sleeping sickness and human trypanosomiasis. In 1905 researchers in the Belgian Congo brought five Congolese suffering from sleeping sickness back to Liverpool, waited for them to die, and then conducted detailed post-mortems, with particular reference to the brain tissue.³³ Initially tropical entomology relied on material brought from abroad although strains were gradually established and maintained in the insectary.

The constant overseas travel extended the school's laboratory beyond the confines of the Liverpool University precinct to the apparent satisfaction of the research workers. These men took their brief seriously. Rather than being reluctant to venture overseas or keen to rush back home, they spent long periods away from Liverpool, inadvertently or otherwise, developing the 'great estate' of

Joseph Chamberlain's imperial vision.³⁴ They were enthusiastic and dedicated: Dutton and Todd investigating sleeping sickness in the Belgian Congo, wrote to Ross that 'they did not want to leave the Congo until they "had something good" or were "fagged out" and if the School could not afford to continue paying them they were prepared to finance themselves'.³⁵

In the period from the foundation of tropical medicine to the First World War, in an era where each basic biological discovery increased the opportunity for exploration of tropical resources, the work of the LSTM was shaped by the extended geography of its location and the links of the host city with the tropics.³⁶

Malaria approached anew

After the Second World War, colonialism was gradually replaced by internationalism and globalism. The problems of the less developed countries were no longer to be solved by imperial powers but by large organisations which purported to act in the best interests of the recipient country. In the rhetoric of the United Nations organisations, these new countries were to be the leaders in their own development. This was practically impossible without financial and technical help. Aid was often contingent on conforming to desirable political and social objectives, in particular America was concerned to combat the spread of communism during the cold war era.³⁷

Among the diseases redefined as 'global problems', malaria has received the most money and attention. In the post 1945 era, malaria maintained its hold on the imagination of researchers, policy makers and fund providers alike. The quintessential tropical disease of the colonial period retained its premier position, despite other pressing priorities of the tropical rural poor. Money was spent on DDT and chloroquine that could not be spent on the sanitation or any other aspect of the social infrastructure. The antecedents of post-war eradication and control programmes can easily be found in the vertical health care policies of the past. It was also part of an effort by WHO to launch itself as the world health agency. After the Second World War UNICEF sought to tackle tuberculosis with the BCG vaccination. WHO required a similar focus. As one United States representative wrote to the Director General:

Perhaps the great work of WHO in the next years lies in some other direction—but it must have some great immediate objective that can be understood by the peoples and legislations of the world and which can be defended as an attainable goal; I fail to see any objectives which meet the requirements as well as malaria.³⁸

Malaria did appear a conquerable disease amidst the flurry of persistent pesticides and new anti-malarial drugs.³⁹ The eradication schemes, like much of the economic thinking, relied on the idea that developing countries could emulate the process of development in the west if sufficient technology could be transferred. The appropriateness of this transfer was often not adequately considered.⁴⁰ Moreover welfare schemes were only gradually given prominence. It was assumed that such niceties would come in the wake of economic progress.⁴¹

The malaria eradication programme relied principally on the spraying of houses with DDT. Through the use of this residual insecticide it was intended that mosquitoes which lived in the vicinity of houses would be destroyed. In this way the parasite's life-cycle would be interrupted and the transmission of malaria halted. The existing cases could be treated using the synthesised anti-malaria

drugs whose production had been greatly aided by war-time circumstances. The programme of spraying and surveillance was considered to be a finite one, where within a specified period of years the deployment of resources would be scaled down as malaria ceased to pose a public health problem. Unforeseen difficulties arose with the sheer magnitude of the operation in less developed countries. The problems of available trained manpower, and the logistics of spraying all houses in a potentially mobile rural population in countries without clear natural boundaries, were realised by bitter experience. Operational problems were compounded by technical difficulties with insecticide resistance, and drug resistance, and resources were channelled into dealing with these.

In the wake of increasing difficulties with eradication and the switch to seemingly open ended control strategies, fund providers such as the United States Agency for International Development (USAID) attempted to find an alternate solution in the form of a malaria vaccine. According to Desowitz, USAID was not a research orientated body and its interest in supporting basic immunological or any other kind of research had no precedent in the organisation. The funding was not controlled by experienced malariologists, and the claim is made that the advice of those who were consulted was ignored. The result is portrayed by Desowitz as a calendar of huge spending with negligible results over a period from 1965 to the late 1980's.⁴² Notwithstanding this rather jaundiced view, AID's funding of a particular group of workers directly affected the type and style of research undertaken.

The relationships of the colonized and the colonizer with respect to tropical medicine have figured in much of the recent literature. Tropical medicine has often been portrayed as the crude and faceless effect of imperial policy upon a subject people. It has in these recent appraisals, been recast from its former aggrandising role as the positive benefit of colonial rule to become an indication of the limits of colonial power and the propagator of its most disastrous down side.⁴³

CONCLUSION

In a recent article Megan Vaughan reviews the work of anthropologists and medical historians who seek to present a coherent picture of 'healing and curing' in Africa.⁴⁴ She points out that 'whilst anthropologists and historians describe in nuanced detail the practices of African healers, for scientific medicine they frequently rely on an account, not of practice but of theory'.⁴⁵ In the case of tropical medicine, the definition of disease is often reduced to infection with a parasite/bacterium/virus transmitted by an insect or other invertebrate vector. Vaughan makes the important point that western science applied in a non-European setting may be interpreted without regard for the social and cultural influences ascribed to indigenous practices in their homeland. Such medicine may therefore appear as more appropriate to its social context than the western counterpart. However, in a tropical country which has remained independent, or in post-colonial countries, this appearance of appropriateness may be an artifact of the research and not be truly representative of the situation.

The history of tropical medicine is, however, about more than social control and power politics, although we seem still to be trying to tell the people of the third world that the supply of biomedicine is worth our interference in their affairs. Harrison has shown for public health in India how the role of the local

people is under-represented in the existing literature.⁹ Vaughan rightly suggests that a way forward is to look at the work of indigenous practitioners of western medicine.⁴⁴ However, this must also be tied in with a greater understanding of the western practitioners of tropical medicine, at home and abroad, and the motivation behind their work and of those who provide the funds. The application of tropical medicine as science throughout the twentieth century requires further study especially in relation to the post-Second World War internationalism in which neo-imperialism and developing and underdeveloped state authorities have replaced direct colonial power.

The history of tropical medicine has much to offer those interested in current health problems of the third world.⁴⁶ Current agendas of care and research into the diseases peculiar to or prevalent in tropical areas reflect past dialectics as well as current problems. Contemporary agendas should more often be juxtaposed with those of the past rather than seen as a linear development. Marxist overviews often miss important details in order to make their political point.⁴⁷ An understanding of the internal medical content of the past is overlooked or ignored, yet this is a crucial element in any appreciation of health policy in the colonial and post-colonial period. Medical history cannot provide all the answers. It can start with the assumption that science and medicine are not value-neutral, but constrained and influenced by internal dynamics as well as by outside pressures.

REFERENCES AND NOTES

- ¹ Power, H. Radio 4 Bright Sparks series: 17.7.1993 and 10.12.1993.
- ² Crosby AW. Ecological imperialism: The biological expansion of Europe 900-1900. Cambridge: CUP, 1986.
- ³ Livingstone DN. Human acclimatization: Perspectives on a contested field of inquiry in science, colonial medicine and geography. *History of Science* 1987; 25: 359-94; Kennedy D. The perils of the midday sun: Climatic anxieties in the tropics, Mackenzie J, ed, *Imperialism & the natural world*, Manchester: MUP 1990, 118-40.
- ⁴ Crawford DG. A history of the Indian Medical Service, 1600-1913, 2 vols. London: Thacker Spink & Co 1930.
- ⁵ For an accessible introduction to British imperialism see Porter B. The lion's share: A history of British imperialism 1850-1970. London: Longman 1975; for an economic history see Havinden M, Meredith D. Colonialism and development: Britain and its tropical colonies 1850-1960. London: Routledge 1993.
- ⁶ In the Indian context see Arnold D. Colonizing the body: State medicine and epidemic disease in nineteenth century India. Berkeley: University of California Press 1993.
- ⁷ Feierman S, Jansen J, eds. The social basis of health & healing in Africa. Berkeley: University of California Press 1992; Vaughan M. Curing their ills: Colonial power and African illness. Cambridge: CUP 1991.
- ⁸ Among Indian historians of science and medicine see Kumar D, ed. Science and empire: Essays in Indian context 1700-1947. New Delhi: Anamika Prakashan 1991; Ramasubban R. Public health and medical research in India, their origins under the impact of British colonial policy. Stockholm: SAREC 1982; Bala, P. Imperialism and medicine in Bengal: A socio-historical perspective. New Delhi: Sage publications 1991.
- ⁹ Harrison M. Anglo-Indian public health. Cambridge: CUP 1994; Lyons M. The colonial disease: A social history of sleeping sickness in Northern Zaire 1900-1940. Cambridge: CUP 1992; Cranefield, PF. Science and empire, East Coast fever in Rhodesia and the Transvaal. Cambridge: CUP 1991; Farley J. Bilharzia: A history of imperial tropical medicine. Cambridge: CUP 1991; Macleod RM, Lewis M, eds. Disease medicine and empire. London: Routledge 1988; Arnold D, ed. Imperial medicine and indigenous societies. Manchester: MUP 1988; Worboys M. Science and British colonial imperialism, 1895-1940. DPhil thesis, University of Sussex 1979.

- ¹⁰ Risse G. Epidemics and medicine: The influence of disease on medical thought and practice. *Bull Hist Med* 1979; **53**: 505-19.
- ¹¹ Howard-Jones N. The scientific background of the international sanitary conferences 1858-1938. Geneva: WHO 1975.
- ¹² Worboys M. The discovery of colonial malnutrition between the wars, Arnold D ed, *op. cit.* note 9 above, 208-25.
- ¹³ Bollini P, Reich MR. The Italian fight against world hunger. A critical analysis of Italian aid for development in the 1980s. *Soc Sci Med* 1994; **39**: 607-20.
- ¹⁴ Acheson R, Poole P. The London School of Hygiene and Tropical Medicine: A child of many parents. *Medical History*; **35**: 385-408; Maegraith BG. History of the Liverpool School of Tropical Medicine. *Medical History* 1972; **16**: 354-68; Liverpool School of Tropical Medicine: historical record 1899-1920. Liverpool: LUP 1920.
- ¹⁵ Worboys M. The emergence of tropical medicine: A study in the establishment of a scientific specialty. Lemaine G ed. Perspectives on the emergence of scientific disciplines. The Hague: Moulton 1976, 76-98. Duggan AJ. Tropical medicine. Gibson WC ed. British contributions to medical science. London: WIHM 1971.
- ¹⁶ Amery J. The life of Joseph Chamberlain. London: Macmillan 1951; Haynes DM. From the periphery to the centre: Patrick Manson and the development of tropical medicine in Great Britain 1870-1900, PhD thesis, University of California 1992; Kubicek RV. The administration of imperialism: Joseph Chamberlain at the colonial office. Durham: Duke University Press 1969, 141-53.
- ¹⁷ Worboys M. Manson, Ross and colonial medical policy: Tropical medicine in London and Liverpool, 1899-1914. Macleod RM, Lewis M eds, *op. cit.* note 9 above, 21-37; Jones J. Science, utility & the second city of empire: The sciences and especially the medical sciences at Liverpool University 1881-1925, PhD thesis. Manchester: UMIST 1989.
- ¹⁸ Current work is looking at the history of the schools of tropical medicine, Wilkinson L, Hardy A. Public health at home and abroad; Power H. The Liverpool School: A history of tropical medicine in the twentieth century.
- ¹⁹ Grove DI. A history of human helminthology. Oxon: CAB 1990.
- ²⁰ Manson P. The *Filaria sanguinis hominis* and certain new forms of parasitic disease in India, China and warm countries. London: HK Lewis 1883.
- ²¹ Laveran CLA. Un nouveau parasite trouvé dans la sang de plusieurs maladies affeintes de fièvre palustre. *Bull Soc Méd Hôp Paris (Mem)* 1881; **17** (2 sér); 158-64; Ross R. On some peculiar pigmented cells found in two mosquitoes fed on malarial blood, *BMJ* 1897; **2**: 1786-88, *idem*, The role of the mosquito in the evolution of the malaria parasite. *Lancet* 1898; **2**: 488-89.
- ²² The Entomological Society founded in 1833, received its Royal Charter in 1885. Service MW. A short history of medical entomology. *J Med Entomol* 1978; **14**: 603-26. Busvine JR. Disease transmission by insects: Its discovery and 90 years of effort to prevent it. New York: Springer-Verlag 1993.
- ²³ Chernin E. The British and American Journals of Tropical Medicine and Hygiene: An informal survey. *Med Hist* 1992; **36**: 70-83.
- ²⁴ Curtin P. Death by migration: Europe's encounter with the tropical world in the nineteenth century. New York: CUP 1989; Ramasubban R. Imperial health in British India, 1857-1900, Macleod RM, Lewis M eds, *op. cit.* note 9 above, 38-60.
- ²⁵ This served the racialism of the colonizers as well as their fears over morbidity and mortality, see Swanson M. The sanitary syndrome: Bubonic plague and urban native policy in the Cape Colony 1900-1909. *J Afr Hist* 1977; **18**: 387-410; Marks S, Andersson N. Typhus and social control: South Africa, 1917-1950, Macleod RM, Lewis M eds, *op. cit.* note 9 above, 257-83.
- ²⁶ Ross R. First progress report of the campaign against mosquitoes in Sierra Leone (1901), Memoir 5. Liverpool: LUP 1901.
- ²⁷ Dumett R. Disease and mortality among gold miners of Ghana: Colonial government and mining company attitudes and policies 1900-1938. *Soc Sci Med* 1993; **37**: 213-32; Packard R. White plague, black labour: Tuberculosis and the political economy of health and disease in South Africa. Pietermaritzburg: University of Natal Press 1990.
- ²⁸ The Royal Society, British South Africa Company, Panama Canal Commission, Government of the Belgian Congo and the Colonial Office, all either commissioned expeditions or seconded members of staff.
- ²⁹ For the Jamaica Expedition of 1908, Alfred Lewis Jones defrayed the cost of local board &

- lodging; the Direct West African Mail Service Company provided free passages to and from Jamaica, the Royal Mail Steam Packet Company paid for the transport to other West Indian Islands, and the Apollinaris Company gave 25 dozen bottles of mineral water. *Ann Rep for 1909*, 23.
- ³⁰ Worboys M, *op. cit.*, note 17 above.
- ³¹ Weatherall M. In search of a cure. Oxford: OUP 1990; Beer JJ. Coal-tar dye manufacture and the origins of the modern industrial research laboratory. *Isis* 1958; **49**: 123-31; Rose FL. Origin and rise of the synthetic drugs. *J Chem Soc* 1951; 179-97.
- ³² Cook GC. From Greenwich hulks to Old St Pancras: A history of tropical disease in London. London: Athlone Press 1922.
- ³³ Thomas HW, Brinell A. Trypanosome, trypanosomiasis and 'sleeping sickness'; Bonce R, Sherrington CS. Thompson Yates & Johnston Laboratories Reports, 6, New Series. Liverpool: LUP 1905, 1-97.
- ³⁴ Smith GJ. The Liverpool School of Tropical Medicine expedition to Senegambia, 1902 as revealed in the letters of Dr JL Todd. *Ann Trop Med Parasitol* 1977; **71**: 391-9.
- ³⁵ Lyons M. *op. cit.* note 9 above, 81.
- ³⁶ D Arnold, briefly discusses this correlation in the 'The Indian Ocean as a Disease Zone, 1500-1950'. *South Asia* 1991; **14**: 1-21.
- ³⁷ Cleaver H. Malaria and the political economy of public health. *Int J Health Serv* 1977; **7**: 557-79.
- ³⁸ WHO archives, 1st generation files, 400-1-13 letter data 25/7/48 Van Zile Hyde, US representative to the WHO Interim Commission to Brock Chisholm the Director General WHO Interim Commission.
- ³⁹ For a contemporary optimistic view see Russell PF. Man's mastery of malaria. London: OUP 1955.
- ⁴⁰ Headrick DR. The tentacles of progress: Technology transfer in the age of imperialism. Oxford: OUP 1988.
- ⁴¹ Havinden M, Meredith D 1993, *op. cit.* note 4 above.
- ⁴² Desowitz RS. The malaria capers: More tales of parasites and people, research and reality. London: WW Norton & Co 1993.
- ⁴³ Lyons M. Death camps in the Congo: Administrative responses to sleeping sickness 1903-1911. *Bull Soc Hist Med* 1984; **34**: 28-31. Arnold D. Disease, medicine & empire, Arnold D ed, *op. cit.* note 9 above, 1-26.
- ⁴⁴ Vaughan M. Healing and curing: Issues in the social history and anthropology of medicine in Africa. *Soc Hist Med* 1994; **7**: 283-95.
- ⁴⁶ Najera JA. Malaria control: Present situation and need for historical research. *Parasitologia* 1990; **32**: 215-29.
- ⁴⁷ Doyal L. The political economy of health. London: Pluto Press 1979.