

MALARIA IN MAURITIUS—AS DEAD
AS THE DODO

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Ever since the sun rose I had been looking ahead. The ship glided gently into smooth water. After a 60 days passage I was anxious to make my landfall, and very soon I became entranced by this blue pinnacled apparition, almost transparent against the light of the sky, a mere emanation, the astral body of the island risen to greet me from afar . . . and I wondered whether what would meet me in that island would be as luckily exceptional as this beautiful dreamlike vision. . . .

THUS wrote the master of the cargo ship *Otago*, describing his approach to the island of Mauritius in October 1888. After delivering a load of fertilizer, the ship was detained for two months in Port Louis, where it took on a load of 12,000 bags of sugar. One result of this prolonged stay was the captain's romantic infatuation with Eugénie, a young girl belonging to one of the wealthy French families established on the island. But Eugénie was already engaged to another. The young master mariner withdrew to his ship in despair and in due course sailed for Australia. Later, having achieved world-wide fame as a brilliant writer under the name of Joseph Conrad, he used Mauritius as the setting of a short story, *A Smile of Fortune*, in which he recalled the beauty of the island and his own sad romance.⁶

It is most likely that the delay in unloading and loading the *Otago* was due to an outbreak of malaria which had depleted the local labor force. Ever since the first major epidemic in 1867, Mauritius had become notorious for its malariousness. The final eradication of the dis-

*Now with the Wellcome Museum of Medical Science, London.

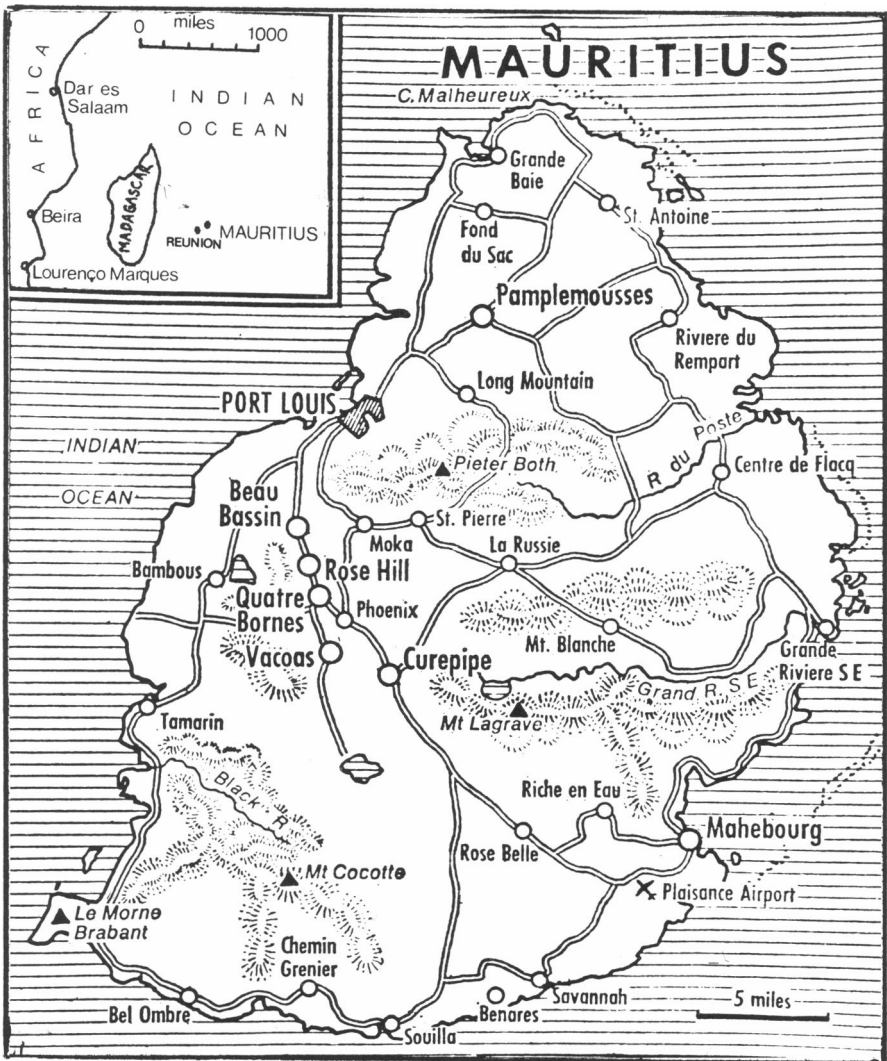


Fig. 1. Map of Mauritius.

ease, which for more than 100 years had devastated the island, is one of the most remarkable achievements of public health.

Mauritius (Figure 1) was unknown to the Europeans until its discovery in 1505 by Don Pedro Mascarenhas, who gave the island the Portuguese name of Cerné. In 1598 the Dutch called there and named the uninhabited island after the Stadholder Count Maurice of Nassau,

but it remained little more than a port of call used by the Dutch, the French, and the English. In 1638 the Dutch established a colony, from which Tasman set out for Australia in 1642. The Dutch settlement was short-lived, for the trade route was still too tenuous and the loss of a supply ship could be disastrous to the settlers. The precariousness of food supplies prompted the colonists to hunt and kill, among other fauna, a number of large flightless birds with big ugly heads, curved beaks, clumsy feet, and minute curly tails. Known as the Walgvoegel or "disgusting fowl" because their flesh was unpleasant, these creatures were none other than the fabled dodo (*Raphus cucullatus*, syn. *Didus ineptus*), doomed to extinction by the end of the 17th century. Mauritius was abandoned by the Dutch in 1710, its only remaining inhabitants being bands of runaway slaves (Maroons) originally brought from Madagascar to work on the sugar plantations.

In 1715 the French East India Company took possession and re-named the island Ile de France. Port Louis was built and forts were erected to protect the colony. The early prospects of these new settlers were gloomy and uncertain, but with the arrival of Bertrand François Mahé de Labourdonnais as governor the island began to develop and prosper. This remarkable man created the harbor at Port Louis, established internal administration, introduced manioc (cassava) from Brazil, and revived the cultivation of sugar cane, on which the economic future of the island was to be based. From this new naval base, Labourdonnais launched vessels to harass the ships of the English possessions in India. Labourdonnais reached India and captured Madras, but on his return found that he had been displaced as governor. He went back to France in 1746, a bitter and disappointed man. Mauritius was the poorer for his loss.^{9, 10}

In 1764 the French East India Company, ruined by the decline of trade, ceded the island to the French government. From then on Ile de France, "star and key of the Indian Ocean," played an important part in political events of the 18th century, subsisting mainly on foreign trade and privateering. From here Surcouf, the famous corsair, harried foreign shipping on the route to India.

In 1768 Mauritius was visited by Jacques Henri Bernardin de Saint Pierre, a military engineer bound for Madagascar on the *Marquis de Castries*, who, after quarreling with the leader of the expedition, Comte de Maudave, obtained permission to stay in the colony. Bernardin de

Saint Pierre spent two years in Port Louis. He was deeply impressed with the beauty of the island, which he described in his first book *Voyage à l'Île de France*.² Sharing Rousseau's belief in the essential goodness of man living in close contact with nature and moved by compassion for the slaves, who led a miserable existence in a society based on their labor, he wrote *Paul et Virginie*, one of the most celebrated love stories in French literature.³ The book, which was greeted with the sentimental enthusiasm of the 19th century, is a simple and moving pastoral story of two innocent lovers in an earthly paradise free from disease, though not untouched by the wickedness of man. The romantic aura of this book should not obscure the author's belief in the equality of man and, unconsciously, the philosophy of the coming revolution. To this day the graves of the fictional lovers at Pamplemousses are visited by all sentimental travelers to the island.

By the decree of Louis XVI the colony became self-governing in 1791 under its own constitution. The abolition of slavery proclaimed in 1794 by the French National Convention was rejected by the island, and when in 1796 the Commissaires of the French Republic, accompanied by a naval detachment, landed on the island to proclaim the emancipation of the slaves, a riot broke out and the French officials were ordered to leave. In 1802 the political independence of the Isle of France was ended by its submission to the decree signed by Bonaparte as the First Consul of the Republic.¹

During the Napoleonic wars the French again used the island as a base from which to harass British shipping. The new generation of French sailors was determined to avenge the defeat at Trafalgar; in 1810 Admiral Duperré inflicted heavy losses on a British naval squadron at the battle of Grand Port. But the fate of the island was sealed when, three months later, the British expedition defeated the French naval and land forces at Cap Malheureux. Ile de France fell to the British and resumed its old name of Mauritius. French cultural life and customs were safeguarded, and with the end of hostilities rapid recovery and growth brought a revival of the economy.

In 1836 *H.M.S. Beagle* dropped anchor in Mauritius. The young Charles Darwin wrote in his diary:⁷

. . . the aspect equalled the expectations raised by many well-known descriptions of the beautiful scenery . . . the whole island with its sloping border and central mountains was adorned with

an air of perfect elegance. . . . The general character of the place is quite French. Indeed I should think that Calais or Boulogne was much more Anglified. Although the French residents must have largely profited by the increased prosperity of their island, yet the English government is far from popular. . . .

Darwin's remark about the divided loyalty of the French planters in Mauritius when it was governed by the British was pertinent. A good example is offered by the life of Brown-Séquard.*

During the British occupation of Mauritius malaria became firmly established on the island, although it is more than likely that the disease had been imported earlier. When the Dutch had first attempted to settle they brought slaves from Madagascar who afterwards remained on the island. The French settlers continued to import small numbers of slaves until the abolition of slavery in 1833. That they might have introduced malaria would seem to be probable from Bernardin de Saint Pierre's reference (p. 15) to the prevalence of malaria in Madagascar in *Paul et Virginie*. Monsieur de la Tour, Virginie's father ". . . s'embarqua pour Madagascar, dans l'espérance d'y acheter quelques noirs et de revenir ici promptement former une habitation. Il débarqua à Madagascar vers la mauvaise saison . . . et peu de temps après son arrivée, il y mourut, des fièvres pestilentielles qui y regnent . . . et qui empêcheront toujours les nations européennes d'y faire des établissements fixes."†

When the abolition of slavery had closed the flow of cheap labor from Africa and Madagascar, the labor problem was solved by the large-scale importation of indentured workers from India. The French planters received £2 million from the British government for the loss of their slaves. Between 1835 and 1839 some 25,000 Indian laborers were brought to Mauritius and this continued throughout the next decades so that the population of the island rose from 100,000 in the 1850s to more than 300,000 by the end of the 19th century. Immigrants probably constituted the major natural reservoir of malaria. It is also

*Charles Edward Brown-Séquard, the famous physiologist, was born in Mauritius in 1817. He took his M.D. in Paris and returned to the island with the intention of practicing there, but shortly afterward went to the United States as professor of physiology at Harvard University. After a few years in New York as specialist in neurology, he left for Paris, where he was offered the chair of experimental medicine at the Collège de France, having refused a similar offer from Oxford. He died in 1894.

†Charles-Evariste Michel, born in Mauritius, in a thesis for a Doctorate of Medicine under the title: "*Essai d'une topographie médicale de l'île Maurice*" presented in 1842 before the University of Paris, wrote: "*Les fièvres intermittentes se voient rarement dans la colonie; la plupart de celles qu'on y recontre ont été apportées de Madagascar.*"



Fig. 2. Nicholas Pike, United States Consul in Mauritius, 1866-1870. Courtesy National Portrait Gallery, London.

possible that *Anopheles gambiae*, the most important vector of malaria, was brought to Mauritius by sea either from the African mainland or from Madagascar. Sir Ronald Ross believed that the introduction of the dangerous *Anopheles* preceded the main wave of Indian immigration.

Be that as it may, the first significant outbreaks of malaria occurred in Mauritius in 1858-1859, in 1862, and especially in 1865. The first serious epidemic struck the island in 1867. Thereafter the disease recurred annually over the next few years. We owe the best description of this major calamity to Col. Nicholas Pike (Figure 2), the American consul, who arrived in Port Louis in January 1867 aboard the U.S. Steamer *Monocacy* after having endured a severe cyclone. In his remarkable book *Subtropical Rambles in the Land of the Aphanapteryx*, published in 1873, Pike wrote:

Those who inhabited Port Louis during the terrible mortality . . . will never forget the sad spectacle the city presented daily. Fever was the only word on every lip, the only thought in every

heart. Mourning and desolation were everywhere. Scarcely a person [was] visible that did not wear the garb of woe. Song and laughter had ceased . . . May I never again witness the sad sight of those incessant funerals slowly winding along from morn till night. . . . One dreaded to ask the news as one was quite sure to hear of some friends ill, dying or dead.¹¹

A similar picture came from the pen of Sir Walter Besant, the English author and social worker who for six years was a schoolmaster at the Royal College at Port Louis.

The number of deaths rose to 300 a day for the whole island and for Port Louis alone one hundred and more. All the quinine in the place was exhausted and what there was sold for 30 pounds an ounce and more. The shops were closed, the streets were empty, the funerals went on all day long and in the cemetery, the priests stood over the open communal graves saying the last prayers for the dead without intermission as the coffins were brought in and laid side by side.⁴

During 1867 alone more than 40,000 people died in Mauritius of a population of 330,000. Colonel Pike, who was a keen observer and a gifted naturalist, gave much thought to the cause of the epidemic of malaria. He concluded that it was caused by two factors: 1) gases or spores produced by high temperatures from decomposing vegetable and animal matter and 2) the rice-and-vegetable diet of the people, favoring the multiplication of these spores when inhaled.

The island faced many calamities. In 1892 a hurricane killed 1,500 people and rendered 50,000 homeless. There were epidemics of dengue, diphtheria, plague, and smallpox and repeated outbreaks of cholera. An epizootic of surra killed hundreds of horses and cattle. Gradually, with the improvement of health services these diseases disappeared.¹

During the next 40 years malaria became endemic on the island. The number of fever deaths ranged between 5,000 and 10,000 every year, but measures taken by the government following the recommendations of various commissions seemed unavailing. After Sir Ronald Ross discovered that transmission was by the *Anopheles* mosquito (1897), the drainage of marshes and afforestation was undertaken, but the disease persisted and threatened the economy of the island, already affected by a fall in the price of sugar. In the early 1900s malaria invaded the higher regions of Mauritius, which so far had remained



Fig. 3. Maj. C. E. P. Fowler, Royal Army Medical Corps (right), Ronald Ross (center), and M. d'Emmerz de Charmoy (left) in Mauritius in 1907. Photograph courtesy Ross Institute, London.

free of it. In 1907 Sir Ronald Ross himself was invited to advise on the best method of control for Mauritius.*

According to Ross, the invitation came from the French planters and officials. When asked about his professional fee, Ross replied: "£1,000 if the colony could afford it, otherwise nothing." The fee was paid.¹³ During his work in Mauritius, Ross was assisted by Maj. C. E. P. Fowler and by the local entomologist M. d'Emmerez de Charmoy (Figure 3); moreover, he received 6,000 rupees to employ 10 "moustiquiers" and 30 laborers. Throughout his stay Ross was feted and dined by Mauritian society and especially by its leader M. Leclezio, whose family consisted of 18 sons and daughters. This did not prevent Ross from being at his vitriolic best in criticizing many things of which he disapproved. Apparently a battalion of British troops was provided with mosquito bed-nets which could not be used because of a dispute with the local authorities about who should provide the hooks upon which to fasten them. Ross's final scheme for the reduction of malaria was estimated to cost about \$9,000, or 1% of the colony's yearly revenue. On his departure Ross was given a royal send-off and, as he wrote, ". . . the local newspapers complimented and caricatured me" (Figure 4).

Ross spent four months on the island. His report¹² is a model of a thorough survey and clear recommendations. The emphasis was on the control of mosquitoes through destruction of the breeding places of *Anopheles* combined with the widespread distribution of quinine. Although the program advocated by Ross was not carried out as fully as proposed, the incidence of disease decreased greatly. Later studies showed that *Anopheles gambiae* was not the only carrier of malaria in Mauritius. *Anopheles funestus*, the second most important vector in tropical Africa, was responsible for much of the transmission during the winter months.

The first study of the mosquitoes of Mauritius was that by Daruty de Grandpré and d'Emmerez de Charmoy (*Les Moustiques*, Port Louis, 1900). They found that *Anopheles gambiae* (then called *Pyretophorus costalis*) was the main carrier of malaria in Mauritius. The other two anophelines were *Anopheles coustani* (then called *Myzorhynchus mauritianus*) and *A. maculipalpis* (*Nyssorhynchus maculipalpis*). The

*According to Maj. C. E. P. Fowler's special contribution to Ronald Ross's book *The Prevention of Malaria* (London, Murray, 1911), the annual incidence of malaria in British troops in Mauritius was 264 per 1,000 during the period from 1903 to 1907.



Fig. 4. Ronald Ross in Mauritius in 1908. Cartoon published in the local newspaper on Ross' departure from the island: "Dediee aux Esculapes Officiels." Comments ascribed to the mosquitoes: "Tu pars, tu peux te fouiller, mon vieux!" "Si Major resté, nous f....., si Major parti, nous sapé [sauvés]!" Photograph courtesy Ross Institute, London.

former, though very common, was not considered to be a vector; the latter was very rare. The presence of *Anopheles funestus* was not suspected until 1922, when Malcolm E. MacGregor, an entomologist on secondment to the Colonial Office from the Wellcome Bureau of Scientific Research in London, discovered its breeding places and confirmed the importance of this mosquito as the second most prominent local vector of malaria.*

During World Wars I and II, when Mauritius once more became an important military staging post, additional malaria-control programs were introduced which gave reasonably satisfactory results in the center of the island and the capital city. However, along the greater part of the coastal area the disease continued unabated. In 1948 the government of Mauritius decided to attempt the eradication of malaria by the residual spraying of houses with DDT and herachlorocyclohexane (HCH or BHC). The project, which lasted for three years, resulted in a remarkable decrease in the incidence of the disease. This was due mainly to the disappearance of *Anopheles funestus*. Nevertheless one could not talk of eradication—malaria was still present, although at a much reduced level.

The final assault did not come until 1960. It had been delayed by two devastating cyclones, but an excellent organization produced rapid results through thorough surveillance and treatment of detected cases together with the additional spraying of remaining foci. The last indigenous case of malaria was found in 1965; the few cases discovered since then have been either relapses or imports.¹⁵ In 1972 a seroepidemiological survey confirmed the absence of local malaria transmission since 1965.⁵ In 1973 the World Health Organization certified that the eradication of malaria from Mauritius was an established fact. After more than 100 years the disease which had dominated the beautiful island of Paul and Virginie and hampered its development was conquered. To prevent the reimportation of malaria continuous vigilance is needed.

Other problems remain, not the least of which is that of population pressure, with all its social and economic ills. In recent years, however, the gloomy Malthusian forecasts look less calamitous. Because of the gradual drop in the fertility rate, the population is now expected not

*MacGregor, M. E.: *Report on the Anophelinae of Mauritius*. London, Waterlow, 1924.

to exceed one million in 1980. Nevertheless the relation between population and available resources continues to dominate the island's future.¹⁴

The Mauritian economy had been largely dependent on sugar cane; today it is becoming more diversified, and tourism is being developed as a source of revenue. Small as it is, Mauritius still retains its importance as a naval and airforce base in the southern part of the Indian Ocean. Mauritius obtained political independence in 1965. The determination and skill with which this small island is pursuing its social and economic advance is a good augury for its future.

REFERENCES

1. Anderson, J. E.: *The Epidemics of Mauritius, with a Descriptive and Historical Account of the Island*. London, Lewis, 1918.
2. Bernardin de St. Pierre, J. H.: *Voyage a l'Île de France (1773)*. Paris, Mequignon-Marvis, 1818.
3. Bernardin de St. Pierre, J. H.: *Paul et Virginie (1788)*. Paris, Mequignon-Marvis, 1818.
4. Besant, W.: *Autobiography*. London, Hutchinson, 1902, p. 85.
5. Bruce-Chwatt, L. J., Draper, C. C., and Konfortion, P.: Sero-epidemiological evidence of eradication of malaria from Mauritius. *Lancet* 2:547-51, 1973.
6. Conrad, J.: *Twixt Land and Sea*. London, Dent, 1912.
7. Darwin, C.: *Journal of Researches into the Natural History and Geology of the countries visited during the voyage of H.M.S. Beagle*. Heron, London and Geneva, 1964 (reprint of 1839 edition), pp. 483-85.
8. Dowling, M. A. C.: Control of malaria in Mauritius. *Trans. Roy. Soc. Trop. Med. Hyg.* 47:177, 1953.
9. Hollingworth, D.: *They Came to Mauritius*. London and Nairobi, Oxford University Press, 1965.
10. Ingrams, W. H.: *Short History of Mauritius*. London, Macmillan, 1931.
11. Pike, N.: *Subtropical Rambles in the Land of Aphanapteryx. Personal Experiences, and Wanderings in and Around the Island of Mauritius*. New York, Harper and Brothers, 1873, p. 42.
12. Ross, R.: *Report on the Prevention of Malaria in Mauritius*. London, Waterlow, 1908.
13. Ross, R.: *Memoirs*. London, Murray, 1923.
14. Titmuss, R. M. and Abel-Smith, B.: *Social Policies and Population Growth in Mauritius*. London, Methuen, 1961.
15. Verdrager, J., Mamet, R., Roche, S., and Klein, J. P.: *La Campagne d'Eradication du Paludisme a l'Île Maurice*. St. Louis, Mauritius, Govt. Printer, 1964.