"RIVERS OF DEATH"

BY

MICHAEL GELFAND

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"Rivers of Death in Africa" *
BEING AN INAUGURAL ADDRESS
DELIVERED BY
PROFESSOR MICHAEL GELFAND
AT THE
UNIVERSITY COLLEGE OF RHODESIA
AND NYASALAND

When I think of disease in Africa, malaria always comes to mind. Malaria and Africa are almost synonymous. The two are closely linked. No disease that I have been called upon to treat has earned my respect as much as malaria. There is no other illness I know that humbles a clinician as greatly as this one. No sooner have we treated a number of cases successfully, and no sooner has our confidence been restored, than we are presented with one that defies recognition and once again we feel humiliated. I do not know another disease that so mimics other disorders or that kills so rapidly that we can see the patient literally slipping away under our eyes. No matter how much experience we have had or how widely we read about the disease, we cannot be certain that we have mastered its recognition. Yet a patient is always safest with the doctor who has handled the disease most often. No matter how brilliant the young recruit, he too must go through the mill and learn by hard and bitter experience. For this reason I believe the doctor of 30 years ago in Rhodesia was better able to deal with malaria than the medical man of to-day who sees less and less of it. But although it seems to be dwindling, every now and then a victim is carried off by it, and those of us who practise amongst Africans still find it far from uncommon in our daily work.

The European living in Central Africa to-day must find it hard to believe that the opening up of Africa and the whole future of white settlement on this continent once revolved around the fever. People were very conscious of it in the nineteenth century and thought twice before coming to these regions. Missionaries were well aware of its existence, and both the U.M.C.A. and the L.M.S. often spoke of their "Christian soldiers" who were prepared to make the ultimate sacrifice, and when one of their workers was cut down by fever another was found to replace his fallen comrade. In the early nineties, when the administration of Rhodesia and Nyasaland was still young, mis-

* Published with the permission of the Principal of the University College of Rhodesia and Nyasaland.
Administrator to improve communications, as so many people were completely cut off from medical aid in the rainy season. Measures of improvement were already being taken. Standing pools were being oiled, drainage was being undertaken, people were persuaded to use mosquito nets and to wear boots in damp places, and houses were being improved. However, quinine was the accepted remedy and the recognised prophylactic. Most Europeans in Rhodesia took five grains of quinine with their whisky at night and the various governments ensured that quinine was cheap and readily available through their post offices. In Northern Rhodesia it was issued free to all officials and to some Africans. As a result of these measures the death rate gradually began to drop, and in North-Western Rhodesia, for example, in a white population of 1,012 in 1910, it decreased to 37.4 per 1,000 and in 1911 to 27.87 per 1,000. The First World War followed, holding back improvements a little, but after the war research workers were brought out to Southern Rhodesia from the School of Tropical Medicine in London.

**Table I**

DEATH RATE PER 1,000 FROM BLACKWATER FEVER, MALARIA AND FROM ALL CAUSES IN NORTHERN RHODESIA AND SOUTHERN RHODESIA

**COMPARING THE YEARS 1907-08 AND 1925 NORTHERN RHODESIA**

<table>
<thead>
<tr>
<th>Year</th>
<th>Blackwater Fever</th>
<th>Malaria</th>
<th>Total Death Rate (All Causes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1907-08</td>
<td>22.2</td>
<td>8.2</td>
<td>49.8</td>
</tr>
<tr>
<td>1925</td>
<td>1.52</td>
<td>1.3</td>
<td>13.7</td>
</tr>
</tbody>
</table>

(Quoted from N.R. Medical Report on Health and Sanitary Conditions (1925-1926).)

**SOUTHERN RHODESIA**

<table>
<thead>
<tr>
<th>Year</th>
<th>Blackwater Fever</th>
<th>Malaria</th>
<th>Total Death Rate (All Causes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1907</td>
<td>1.8</td>
<td>1.07</td>
<td>13.7</td>
</tr>
<tr>
<td>1925</td>
<td>0.7</td>
<td>0.57</td>
<td>9.44</td>
</tr>
</tbody>
</table>

(Quoted from Public Health Report for the year ended 31st December, 1907, Southern Rhodesia.)

The story in Nyasaland was a similar one. There the fever was so severe that from the start Sir Harry Johnston declared it could never be a white man’s country. By November, 1897, so many of the white settlers had been carried off by the disease that the survivors submitted a memorandum drawing the attention of Her Majesty’s Commissioner to the high death rate, which averaged between 9 and 10 per cent. of the very young population. Later a deputation was sent to make representations to the Foreign Office, and as a result a commission was sent out in 1899 under Dr. R. S. Christophers. A few years later, in 1907, as the disease was still so rife, another commission came out under Wakelin-Barratt and Warrington Yorke.

**Table II**

NYASALAND: COMPARISON OF THE MORTALITY FROM BLACKWATER FEVER IN NYASALAND IN 1897-98 WITH 1916

<table>
<thead>
<tr>
<th>Year</th>
<th>Blackwater Fever</th>
<th>Malaria</th>
<th>Total Death Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1897-98</td>
<td>30 per 1,000</td>
<td>53.5</td>
<td>107 per 1,000</td>
</tr>
</tbody>
</table>

(European population: 300.)

I have stressed these facts deliberately to remind you how different were the health problems 50 years ago from those existing to-day. You have gathered how important malaria loomed in any public health programme, but let me take you back even before Sir Ronald Ross’s discovery in 1897 of the important part played by the mosquito in the life cycle of the malarial parasite and to the days before quinine was used.

**MALARIA BEFORE THE CINCHONA PERIOD**

Malaria is one of the most ancient diseases known to mankind. Descriptions given by the Romans and the Greeks show they were well aware of it. Hippocrates wrote sensibly of the semi-tertian, tertian and quartan forms the fever may assume and believed that the quartan type, that in which the patient experiences shivering every 72 hours, was the worst.

The emphasis at that time was on the fever, but even then the fever was linked in some way with marshes. For instance, one Marcus
Map showing the main rivers referred to in the text.
of England spiders were imprisoned in a box, and as they withered away so it was believed the avenge feelings of it was thought that they absorbed the misfortunes or contagious air as a spider sucks up water. In 1608 there was a reference to a man who drove away the avenge by wearing three spiders round his neck. Some preferred to make the spiders into a plaster and others swallowed them either dried and powdered or alive in a pat of butter or in a little treacle. In India their webs were employed, and even as late as 1902 we find that the Indian Medical Gazette highly praises cobwebs as a cure for fever.

The Discovery of Cinchona Bark and the Location of Quinine

The discovery of cinchona bark in the seventeenth century was not only a turning point in the treatment of malaria, but also was one of the first specific remedies to be used for any disease, and thus, as great men like Ramazzini, a famous professor of medicine in Italy in the seventeenth century, claimed, was comparable to the invention of gunpowder in military affairs. The use of quinine for the fever had an impact on medicine similar to that of antibiotics today, and it has been said that the bark has proved more precious to mankind than all the gold and silver the Spanish had brought from South America. We tend to forget that malaria was very prevalent in Italy and Spain, very common in the low countries of Europe like Belgium and Holland, and of great significance in France and England. It was recognised as very serious in India, and in the few Portuguese settlements in Africa it was considered as almost the worst of all, not only because of its high mortality, but also because of its effects on the general health of the population.

Quinine is obtained from the bark of a tree of the genus Cinchona of the Order Rubiaceae and much of the story of its discovery and introduction to Europe is shrouded in legend and mystery, which perhaps adds to the fascination of the tale, which starts in Brazil about 300 years ago. It is certain that the Indians living in the neighbourhood of Lima were using it for the fever and that the Jesuit missionaries who had entered Peru just after 1560 became aware of its efficacy. The Indians were somewhat secretive. Historians suggest that it was a local remedy and myth has it that they first became aware of it through watching lions with a large eye eating the bark. Another delightful legend is that a Spanish soldier, dying of avenge in the forest, quenched his thirst with water from which a cinchona tree was growing and promptly recovered.

To return to facts, our first knowledge of the bark is that a Jesuit who had fever at Matarori in 1600 cured it in Indian and that one of the missionaries was using it between 1620 and 1630, when it was known as the Lava bark. It is told that the Archbishop of Cienfuegos, wife of the vicereine, became very ill with fever soon after she arrived at Lima from Europe, and on the advice of the Jesuit was cured with the bark. She was so grateful that she sent it back to Spain that it might cure others. According to some, she took back the bark with her and introduced it to Spain at the end of her husband's tenure of office and it became known as pereira cutis. Others maintain that this cannot be true, as she died before he completed his term of office in 1640, and from his diary it has been deduced that she never had fever at all and thus the whole romantic story is false. Some say that the Count and his physician de Vega took the bark back to Europe.

Probably the first to import the bark from Peru was the Jesuit Barnabé de Cobo, who lived from 1582 to 1657. He explored Mexico and Peru in 1632 and brought back the Lava bark to Spain and Rome, and it soon became known as the Cura plant. By 1641 it was being mentioned in Italian medical writings and its fame had reached Spain and the Netherlands, where some of its most bitter opponents dwelt. Bartholomé Talor, who succeeded de Cobo as Procurator of the Peruvian missionaries, also introduced the bark to Italy, journeying via Spain and France, and is alleged to have treated the Dauphin, later Louis XIV, with it. He succeeded the young theologian, Cardinal de Lugo in the remedy and convinced him of its tremendous efficacy. The Cardinal had the bark analysed by the Pope's physician, Gabriel Fonseca, who considered its use justifiable and recommended it so strongly for the rest of his life that it was distributed throughout Italy and was called Cardinalese puerariae or the Puerariae of Cardinal de Lugo. It was, however, a bitter pill and its fame was spread by the delegates who attended the General Councils of the Jesuit Order in Rome between 1616 and 1652. From 1650 it was used by the Jesuit Colleges at Genoa, Lyons, Louvain, Ratisbon and about this time reached England, where it was introduced in 1658 in London in a weekly Medical Pollictor that it could be obtained from several London chemists. It was even taken to the court of the Empress of Russia.

But there was an English remedy, Medical and conservative and A The bark was not accepted remedies dilution, it had been done in an age of rage; were apt to criticise were written decay Catholic Columnists wrote a book against its use. To disprove arose in the by the cinchonas bark the Peruvians had which produced which was a very precious bark was e not in short supply. Chants substituted cinchona bark, this is the true quinine lo the many doctors as a papal fraud to do with it, pred the bleeding medicines were very on account of the L of the physicians a make accurate recall. When the planted the Peruvian bark was still the retained in the Kingdom.

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But there was much opposition to the new remedy. Medical circles tend to be a little conservative and are slow to accept new ideas. The bark was not one of the Gallinicals—the accepted remedies of the profession. In addition, it had been discovered by the Jesuits, and in an age of religious intolerance Protestants were apt to criticise its value. Many pamphlets were written decrying it, and even in Spain a Catholic Colmenero, a professor of Salamanca, wrote a book against the bark, attributing death to its use. To discredit it still further, confusion arose in the seventeenth century between the cinchona bark and that of a similar tree, the Peruvian balsam tree, Myroxylon peruiferaum, which produced a resin used in ointments and which was very popular for chronic ulcers. This balsam bark was called quinaquina, and as this was not in short supply many dishonest merchants substituted it for or added it to the cinchona bark, thus ruining the reputation of the true quinine bark with the medical profession. Many doctors regarded the cinchona bark as a papal fraud and refused to have anything to do with it, preferring almost without exception the bleeding of the sufferer. Spurious medicines were very common at the time, mainly on account of the lack of knowledge on the part of the physicians who, as yet, had not learnt to make accurate recordings of their use of a new drug. When the cinchona bark finally supplanted the Peruvian balsam as a febrifuge, it still retained the name of quinaquina.2

The bark was introduced to England by 1650 by James Thomson, a merchant of Antwerp, but it became famous through the spectacular practice of Robert Talbor, self-styled “feverologist” or “pyretiatro,” who soon made a fortune with this secret remedy. Fever was particularly rife in England between 1655 and 1660, with 1658 as an extremely bad year, and during this time Talbor first appreciated the value of the bark. He was apprenticed to an apothecary at Cambridge and noticed that cinchona was given to patients with the ague. He then became a


sizar at Cambridge at St. John’s College for five years from May, 1663, but did not obtain a degree. He moved to a village in a nearby district near the Essex coast and thus more malarious, and there came into greater contact with the disease and had much experience with the remedy that he kept secret. He then went to London and set up his sign at Holborn and became popular and made a fortune. In 1672 he published a book on the cure of the ague, saying that it could only be given by people who knew the secret which he kept very carefully. As an unqualified man he was liable to prosecution, but when Charles II became ill he was called to Windsor, where he successfully treated the King, who then conferred on him a licence to practise and ordered the College of Physicians not to molest or disturb him. The same year as his book was published he became physician to the King in spite of the opposition of his own physician, and Talbor was later knighted.1 Charles sent him to Paris to cure the Dauphin Charles, son of Louis XIV, and as a reward the French Government gave him a pension of £100 a year. He sold his remedy to the King of France. It was called the “Englishman’s Cure” and was simply an infusion of a considerable quantity of cinchona bark in a good claret wine. In 1679 Talbor attended the Queen of Spain and in 1681 he died.2

Doctors gradually began to use the bark in England and it found favour with Sydenham, the great English physician of this period. The normal dosage was about 8 gr. bark, which is equivalent to 12 gr. of the alkaloid, given at the onset of the illness. Sydenham preferred to mix 48 gr. of the alkaloid in about two pints of red wine, divided this into 12 equal doses, but gave it to the patients at the end of a paroxysm. We realise to-day that the remedy should have been given much earlier in the disease, and it was only in 1768 that James Lind showed that it was most effective given as a full dose as soon as the fever was recognised. In 1659 Willis noticed that the bark cured acute attacks, but that relapses were still frequent. It is quite possible that the malaria seen in England at that time was the benign tertian form which, although not necessarily as serious as the African falciparum variety, frequently relapses.

Very soon workers began trying to isolate the bark’s different alkaloids, and as early as 1745 Claude Touissant Marot de Cagarage discovered what he called a salt derivative, an alcoholic liquor of cinchona bark. Next, in 1810, Bernadino Antonio Gomes of Lisbon isolated a crystalline substance that he called Cinchonino, but did not purify it. Ten years later a great discovery was made by the pharmacists Pierre Joseph Pelletier and Joseph Caventou, who isolated two out of the four basic cinchona alkaloids of quinine. These were used for the first time the following year for the treatment of intermittent fever. As a result of this discovery the demand for the bark became so great and the forests of Peru, Equador and Bolivia were so exploited that it was feared their supplies might cease. Man had perforce to cultivate the plant. This was started by the Dutch in 1852 and the English in 1860. By 1865 the Java plantations were flourishing and the Netherlands East Indies were acquiring a monopoly of the cultivation of quinine bark. This quinine alkaloid isolated by Pelletier and Caventou was first supplied in sulphate salt and then later in bisulphate, which made it more soluble. But in spite of Lind’s observation, until about 1835 many authorities still used it only when the fever began to subside. It was obviously not first on their list of remedies and they preferred

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bleeding, purging or treating with emetics or antimonials. Mercurials were very popular with many doctors who had great faith in calomel. Strange to relate, although many workers observed that cinchona was effective, not only as a cure, but also as a preventive, there was still much opposition to it in the first half of the nineteenth century. In India it was not used. In 1801 in Calcutta, James Johnson, a naval surgeon, tried the bark on a patient, who died on the third day. His next patient recovered with venedection and evacuations, so he concluded that the bark was useless. When he came to England in 1813 he published a book entitled The Influence of Tropical Disease on European Constitutions and led a crusade against cinchona. His book reached several editions and in India the bark was used merely as a tonic for debilitating illnesses. In the middle of the century Edward Hare, impressed by Lind's work, treated 7000 patients over nine years with cinchona alkaloid, recording a mortality of less than 1 per cent. This was most impressive and the main hospital in Calcutta then gave the drug a trial for a year. During this period their mortality figures for malaria was reduced ten times. The remedy was established at last.1

The Effect of the Discovery of the Bark and Quinine on Africa

We now come to the effect the discovery of quinine had on Africa. Although the Portuguese were trading along the west coast of Africa as early as 1443 and founding trading stations mainly for slave traffic, Britain became vaguely aware of the continent in the sixteenth century when slaves were brought to England. Portugal had gained a foothold on the east and west coasts and later the Dutch established a trading settlement at the Cape. The Portuguese probably owed their ability to maintain their foothold in the unhealthy coastal belts of Africa to their belief in the virtues of the Peruvian bark. Reports from naval visitors to their ports confirm their preference for the bark to any other measures advocated. However, this should not be taken to mean that the Portuguese did not suffer from the fever. By means of the bark they managed to hold on, despite much sickness and death. The "Angel of Death," as the malaria was often called, prevented the Portuguese from penetrating into the interior. Several of their expeditions to Monomotapa in search of the gold mines proved disastrous and the invaders, to quote Boxer (1962), were "discomfited not by the Negro but by the Ague, the malignity whereof is the same sauce of all their golden countries in Africa."2

The William BOLTS Expedition to Delagoa Bay (1777-1779)

Britain became really interested towards the end of the eighteenth century with the growth of her commerce and the birth of her imperialistic outlook on one side and her interest in humanity on the other. About this time people in Britain were horrified by the slave trade, and in an endeavour to remove the ignorance of the civilised world about this continent the African Association was formed in 1788. Africa was still regarded as linked with barbarism and the climate and its fever were considered hostile to settlement. Early expeditions into the interior confirmed only too well the tales of the terrible mortality of malaria and it was believed well-nigh impossible to penetrate into the continent.3 Knowledge as to the correct treatment for the fever was still lacking and so attempts to explore or settle in these parts met with tragic results. Perhaps the earliest experiment to settle Europeans in the more tropical part of Africa was that of William Bolts, an Englishman who had served with the East India Company in Bengal and then managed to secure financial support from the Empress Maria Theresa of Austria to trade and colonize in Africa. He selected a spot at Delagoa Bay for his trading station and sailed from Leghorn in September, 1776, with a number of Europeans whom he settled on either side of the mouth of the Masoomo river in 1777 after hoisting the Austrian ensign to take possession of the area. He had full power to enter into treaties with the Africans and a charter to trade with the Middle East as well as goods with which to start. He was soon bartering with the local inhabitants and with India across the ocean, but his men began to suffer badly from fever. He took little notice of this, feeling it was merely seasonal and that they would soon become hardened to it. After two years he returned to Austria for more financial support, but unfortunately the Empress had died and he was thrown on his own resources. According to Scott (1942), malaria continued to play havoc with his men, who became so weakened with fever that, when the

Africans rose against them, several of their officers were killed and one of their stations was destroyed.\(^1\) In the meantime the Portuguese, who considered this territory within their sphere of influence, sent out a man-of-war from Goa with 300 men to put an end to this little colony. The settlers were so fever-stricken they were unable to offer any resistance, and the few survivors were taken prisoner and the whole settlement destroyed after an existence of only three years.\(^2\)

Of precise details concerning the health and mortality of the 152 souls in the Bolts expedition there is little helpful information. Only five of the 25 soldiers managed to return in 1780. The remainder died during the occupation of their fort in Delagoa Bay or during the subsequent crossing to India after their capture. There is, however, a document with a list of 19 names signed by William Bolts and dated 15th March, 1792, mentioning the illnesses suffered by some of these soldiers. Two contracted scurvy, three had diarrhoea, one pain in the chest and five developed a "fever." One must assume that these illnesses were diagnosed by Fontana, the Italian physician, who accompanied the expedition. Most of the soldiers died between 1777 and 1779 and fever would seem to be the important cause of death. Nothing is known of the fate of the seamen, clerks and workmen, but in a letter from Bolts to his representative Ryan on 6th September, 1777, there were already 29 deaths in the country, among whom was a woman. After this, practically all died in Africa, but some were taken by the Portuguese and removed to India, where they either died or escaped.

**Table III**

**FATE OF THE BOLTS EXPEDITION TO DELAGOA BAY (1777-1779)**

| Number of Europeans who set sail (Oct., 1776) | 152 |
| Number of soldiers | 25 |
| Number of soldiers who died | 20 |
| Number of soldiers who returned | 5 |
| Nothing definite known of fate of others (malaria probably most important factor) | 127 |
| Up to September, 1777, number of expedition dead | 29 |


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For many centuries little was known of the plateau or mountainous areas beyond the coastal belts. Unlike other continents, Africa has few deep bays to shelter ships, and so, as attempts to penetrate it were generally made from the sea, the early expeditions naturally entered one of the enormous rivers such as the Congo, the Nile, the Niger and the Zambesi. Most of the early British expeditions were planned and advised by the Navy and most of them ended disastrously because of lack of knowledge. To start with, the rivers often had several mouths and it was difficult at first to determine which was the right one. Then, too, they were not always as navigable as was expected, and again the men were held up by cataracts and other impediments in unhealthy regions and it took them about 70 years to learn how to handle the fever. Although landing parties were often attacked by unfriendly tribes, it was the fever that really accounted for so much loss of life. The Niger in particular took its toll. No European as yet knew this mighty river. Herodotus, the Father of History, vaguely referred to it in his writings when he mentioned that Hanno, a Carthaginian navigator, travelling in fifty-oared ships, was the first man to explore the west coast of Africa in about 500 B.C. to a little beyond Sierra Leone. Herodotus described a large inland river flowing from west to east, but knew not its termination. In the eighteenth century men wondered whether it was a tributary of the great Nile itself or if it flowed into a great internal lake. Some thought that Herodotus was mistaken and that it flowed from east to west, entering the sea on the west coast.

James Bruce (1730-1794), who explored Abyssinia for two years, found the source of the Blue Nile and traced its meeting with the White Nile.\(^3\)

**MUNGO PARK ON THE NIGER**

Anxious to solve the riddle of the Niger, the African Association sent Major Houghton to trace the source of this river. Believing the Gambia joined with it, he ascended the river, travelled through the kingdom of Bambouk, was robbed of all his possessions soon afterwards and died at Jarra. The task was then taken over by the famous Mungo Park, a doctor who had qualified in Edinburgh and at the age of 21 joined the East India Company, serving on a ship which returned to Britain in May, 1793, after collecting botanical specimens. He heard

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The Niger River
of the association's interest in the Niger and offered his services. In 1794 he was instructed to explore the continent of Africa by ascending the Gambia river and passing on to the Niger either through Bambouk or by any similar route he thought fit. He was to visit Timbuktu, known to exist on the Niger, and return to England by way of the Gambia. He was also told to ascertain the fate of Major Houghton, whom it was assumed had recently perished in these regions. He left Portsmouth on 22nd May, 1795, but remained at his base Pisania, on the Gambia river, for six months, living with a Dr. Laidley, an English merchant, and waiting for the end of the rainy season, little realising that it was equally unhealthy on the shore and that he was prolonging his sojourn in these malarious regions. At last, on 17th December, 1795, he moved into the interior accompanied by two African servants. He travelled on horseback and they rode asses. After an eventful journey, during which he suffered many attacks of fever, was robbed and then imprisoned by Moors, he reached Segou, on the south bank of the Niger, on 20th July, 1796. He crossed the Niger at this point and then travelled eastwards along its north bank to Sansanding, where he was again imprisoned by the Moors. Still he continued until he reached Silla where, yellow-skinned, emaciated from fever after following the river for 300 miles, he retraced his steps to Pisania and reached England on 22nd December, 1797, after an absence of two years and seven months.1

For the next five years he practised as a surgeon at Peebles whilst he was recovering his health. In the meantime interest in the Niger was growing, and in 1803, aware of his previous journey, the Secretary of State invited Park to and ascertain what commercial prospects existed lead an expedition to Africa to explore the Niger there. This time he was to be given a small military force for protection. Again he was to cross from the Gambia to the Niger, where he would build boats to take him downstream to the mouth of the river. He took with him his brother-in-law, Alexander Anderson, a surgeon, and George Scott, an artist, as second in command. It is interesting that in the equipment he requisitioned in 1804 he asked for a mosquito net and two pairs of mosquito trousers for each man, obviously having become well acquainted with this insect, although com-


Mungo Park sailed from Portsmouth in the Crescent on 31st January, 1805, and at Goree in Sierra Leone on 6th April picked up Lieutenant Martyn, 35 soldiers and four carpenters as well as some donkeys to be used as pack animals. He reached the Gambia at Jelfrree three days later and set off from Kayee on 4th May with his troop of soldiers in their top hats and red coats, escorted by Isaaco, a Mandingo priest, to act as their guide. It seems strange that once again he should have elected to reach these parts at the wrong time of the year and so expose his men to the additional risk of the rainy season. Perhaps if he had waited at Goree until the bad weather was over he might have brought back more of the men who set off so gaily, but he seems to have been obsessed by the idea of reaching his goal at any cost. They immediately ran into difficulties, the asses were obstinate, the weather hot, fever and dysentery soon reared their ugly heads. By June the rains had broken and they had to wade through heavy mud and swollen rivers, con-
tinually exposed to the weather, sleeping on wet bundles, finding it difficult to procure food, mostly wet, hungry and ill. In the beginning sick men were placed on the spare asses or horses, but soon the animals were all in use and these men had to struggle on as best they could or were left behind in African villages. Park bought asses where possible and tried to hire men to carry loads, but with little success. He obtained milk wherever he could and from 13th June boiled a camp kettle full of "decotions of cinchona" at night. It is not known whether he gave his men a large enough dose, but to-day we do know that this treatment should have been started much earlier and that rest too was needed. The fever seemed also to invite the onset of dysentery, which placed them in a very sorry plight indeed. By 6th July the whole company were actually ill or so debilitated they could only be prevailed upon to continue the march by careful persuasion. They reached the Niger at Bamako on 17th August, after four months of this nightmare journey with three-quarters of the men dead, including Scott. After going back along the Niger to Marabu for permission from Chief Mansong to travel through his kingdom, they settled down to build a vessel. Park contracted very severe dysentery at Marabu and treated himself so thoroughly with mercury that for several days he was unable to salivate. The remnants of the fine company set to work to convert a large canoe into a schooner. Several of them died of fever during the effort, including Dr. Anderson; and when at last their flag was hoisted and the little schooner sailed down the river on 16th November, it was manned by four Europeans and a few negroes whom they had been able to recruit for the first time on the expedition. They sailed off gallantly, resolved to find the termination of the river or perish in the attempt. Issaco was sent back to the coast with Park's journals and his letter seems to sum up his desperate plight. "I am sorry to say that of 11 Europeans who left the Gambia in perfect health, only five at present are alive, namely, three soldiers (one deranged in mind), Lieut. Martyn and myself." They passed the town of Timbuktu, were deserted at Yaour by their new guide, and at Bussa, where the river narrows into a series of rapids, they were attacked by Africans and all drowned.\(^\text{1}\)

\textbf{Table IV}

\begin{center}
\begin{tabular}{|l|c|}
\hline
MORTALITY FROM MALARIA IN PARK'S SECOND EXPEDITION TO THE NIGER, 4TH MAY, 1805, TO 14TH NOVEMBER, 1805  \\
\hline
Number of Europeans in expedition & 44  \\
Number who died of malaria & 35  \\
Number who died from other causes (three dysentery, one epilepsy) & 4  \\
Number remaining alive on 14th November (drowned at Bussa) & 5  \\
\hline
\end{tabular}
\end{center}

\textbf{CAPTAIN TUCKEY'S EXPEDITION TO THE CONGO RIVER, 1816}

Mungo Park's failure to find the termination of the river and the heavy loss of life by his venture did not deter further exploration. The next expedition was sent by the Navy to verify the theory that the Congo was the outlet of the Niger. If this were true, by ascending the Congo (or river Zaire, as it was known) from its mouth, they should eventually reach the Niger. In the past the Portuguese had been deterred by the unhealthy territory with its hostile Africans, but it was hoped to avoid the mistake made by Park, starting in the dry season. The expedition consisted of a large body of men under Captain James Kingston Tuckey and included two negroes who happened to be in England at the time. Mr. James McKerrow was assistant surgeon, and the botanist and comparative anatomist, Mr. Tudor, was also a doctor. Very little medical advice was given by the Navy in its list of instructions. Tuckey was told not to remain longer than he could help in the neighbourhood of mangrove swamps, from which it was believed unhealthy miasms arose; not to expose his men to the heat of the midday sun nor to heavy rain. They were not to sleep in the open air, but to be protected by an awning from the evening mists. They left England in February, 1816, and reached Cape Padron on the mouth of the Zaire on 5th July.

There the transport ship, the \textit{Dorothy}, waited while the expedition went up the river in the sloop \textit{Congo} (Fig. 6). The mouth was 15 miles wide and it was difficult to find the branch that would take them upstream, but after a few days they were in the river. After travelling 110 miles from Cape Padron at the mouth of the river they reached the rapids or narrows about which they had already heard. There they had to leave their sloop and proceed on foot for 40 miles to Inga, where the river broadened again and they hoped to procure canoes. Captain Tuckey, Professor Smith, Tudor, Galwey, Hodder, with another 13 Euro-

\footnote{Park, M. (1815). \textit{Travels in Africa. Journal of a Mission to the Interior of Africa in the Year 1805}. John Murray. (Any material quoted in this section is extracted from this book.)}
pean men, set off on this journey. By 16th August Tudor had a violent attack of fever and had to be carried in a litter. The men were becoming exhausted and were suffering from blistered feet, often making their way along the watercourse bristling with rocks because of the impenetrability of the wild land on the river banks. When they were able to walk across country they frequently had to climb steep hills. Few felt fit enough for this long journey. They were short of provisions too and only able to purchase a few fowls and eggs. They took 5 gr. calomel when unwell. Carriers were extremely expensive at first. At
Inga they were unable to obtain canoes and had to continue as before, but on 5th September at Crudo Inga they obtained enough canoes to carry some of their goods. Five days later they abandoned their journey at Soondy Nsanga, 280 miles from Cape Padron, because of the malaria, and hurried back. On 13th September they reached Inga again. By this time there was much sickness in the party and every effort was made to reach the sloop as quickly as possible. On 16th September they reached the sloop which had been moored in a reach of water surrounded by hills. To their horror they found that there had been almost as much sickness on the little vessel as on the actual expedition up the river. This was probably because the men had often gone on shore, whereas on the transport which waited at the mouth of the river the crew were not encouraged to go ashore and so remained healthier. The sick were sent down to the transport boat on 17th September and the Congo followed more slowly. In less than three months 18 persons had perished, and subsequently three others, who were very ill, died after the transport had left the coast, thus making a total of 21 deaths out of 44. There were also two Negroes who died. Of the 18 who travelled beyond the cataracts, 14 lost their lives.

### Table V

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Europeans</td>
<td>44</td>
</tr>
<tr>
<td>Number who died of fever in river</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>(40.9%)</td>
</tr>
<tr>
<td>Number who died outside river</td>
<td>3</td>
</tr>
<tr>
<td>Total number of deaths from fever</td>
<td>21</td>
</tr>
</tbody>
</table>

Dr. McKerrow, who had been left on the sloop, mentioned in his report that the men succumbed to the most violent fever of the remittent type and that this was contracted by practically the whole crew, even those who survived. He observed that those who landed, travelled to the African villages or slept in them or in the open air at night suffered most. He considered that this could not have been caused by alcohol as, except for some African beer, none was obtainable. He blamed the baneful effects of the vapours arising from the water mixed with decomposed foreign matter, such as dead carcases of crocodiles, hippopotami, lizards and decaying mangroves. He believed that exposure to the tropical sun was harmful and that the fever might even be contagious, since those who tended the sick were attacked and the rest of the crew and even those on the transport ship waiting at the mouth of the river were attacked.
We obtain an excellent account of the fever from McKerrow's description of the disease. He mentions that it is ushered in by cold rigors and records the severe headache, suffused eyes, prostration, yellow suffusion, dry skin, frequent pulse, clammy perspiration, yellowish flushed face with pale shrunken features and, after some days, delirium with low muttering and a great aversion for medicines. On the third or fourth day the patient might die or he might live a little longer. "With regard to treatment," he writes, "I shall here only observe that bleeding was particularly unsuccessful. Cathartics were of the greatest utility, and calomel, so administered as speedily to induce copious salivation, generally procured a remission of all the violent symptoms." After the violent symptoms had passed he administered one or two doses of bark and could not understand why his results were so bad in spite of the general belief that bleeding was so helpful. In every case the bark was administered as a final resort—too late, as we know to-day.1

The Canoe Expedition up the Zambesi, 1823

When the Royal Navy sent its canoe expedition up the Zambesi in 1823 the treatment of the African fever still left much to be desired. Nothing was gained from the expedition which ascended the Congo river, for the treatment still rested on the different measures, including bleeding, and when the bark was administered it was given later in the course of the illness. Nor was the quinine sulphate, just recently isolated, known to Dr. Kilpatrick, the surgeon who perished in the Zambesi with his two comrades. A study of the material published on the expedition is therefore of some historical value.

In 1821 the Admiralty despatched an expedition from England to explore the east coast of Africa, the island of Madagascar and the shores of Arabia. It consisted of two ships—the Leven, a sloop under the command of Captain W. F. W. Owen, and the Barracouta, under Commander William Cutfield. Mr. John Forbes was appointed as the botanist. The expedition left England in early 1822 and by January the following year both ships had anchored at Mozambique. The Barracouta now departed from the Leven and, when it reached Quelimane, landed the party of three officers to explore the Zambesi. The party consisted of Lieut. Charles William Brown, an executive officer, Midshipman J. Forbes, a botanist, and George Kilpatrick, surgeon to H.M.S. Leven, attended by two African servants, one from the dockyards at Cape Town and the other a "free" man who spoke Portuguese. On 23rd July, 1823, they left Quelimane, an important Portuguese port and slave market which had been founded on a marsh that had never been drained and so had a notorious reputation for deadly jungle fever caused by the "bad vapours" from the swamp. The fever was more prevalent and more severe in the rainy weather, but many had died in July, August and September the previous year, although they were the dry months. In spite of the deadly fever, many Portuguese had lived in the district for as many as 20 years. They all looked sick and languid, wore of a yellowish colour and tottered when they walked, but they survived their attacks of fever because they used the Peruvian bark early. They lived in proper substantial houses and were thus less at the mercy of the mosquito. According to Boleter (1835), they had little confidence in European medicine which favoured bleeding and mercurials, but trusted mainly in the bark. Their most popular medicines were Peruvian bark, Colombo root rhubarb and the Marcella pill composed of Peruvian bark and rhubarb. Thus here we meet with the main reason why the Portuguese survived in those parts. They appreciated the significance and value of quinine.

The little expedition left Quelimane in the evening to the accompaniment of the good wishes and cheers of the crew of the Barracouta and two of the Leven's boats which were there at the time. They travelled in a large canoe capable of carrying a load of up to ten tons, supplied by the Governor of Quelimane, in charge of an African subaltern. Passing Masave on the 24th, they arrived at Marangane, where Forbes collected several botanical specimens. They reached Boca de Rio on the 28th, 17 miles from Quelimane, and here Forbes, assisted by Kilpatrick, added many new specimens to their collection. In order to reach the Zambesi they were carried in muchis a few miles overland, as this was the dry season, and reached the river on the 3rd August at the point where it divides to form the Luabo. Then they came upon the nearby village of the Maroora, where

1 Narrative of an Expedition to Explore the River Zaire, usually called the Congo, in South Africa in 1816, under the direction of Captain J. K. Tuckey. 1818. London, John Murray. (Any quoted material is from this volume.)
2 Lancet. 24th Aug., 1861. A note from Dr. Livingstone to Dr. M'William on Fever on the Zambesi.

a Portuguese colonel of the militia named Pasco Mariano lived. He was extremely kind to the men, received them well and offered them his house to live in. On the day they arrived, Forbes fell ill with fever and the next morning he was put to bed. Although he appeared to improve, on the evening of 4th August he had a severe relapse and Kilpatrick bled him, much to Mariano’s disapproval. His treatment for jungle fever, which he insisted was often effective, was to induce at all costs profuse perspiration by drinking large quantities of rice water. He so disapproved of Kilpatrick’s treatment that he begged him not to repeat the bleeding and to try the “native” method instead.

Dr. Kilpatrick, however, dismissed Mariano’s advice and continued with his own method of treatment, alleging that a European required far different remedies from those necessary to be adopted with persons “inured to the climate.” The fever was attributed to the extensive swamp from which arose the fetid vapour. By the evening of the 5th, Forbes was still very ill, but having improved during the night he felt better and wished to proceed with his comrades to Shapunga, where lived Donna Pascoa de Almeida, a rich Portuguese woman with much influence in the district.

The canoe carrying Forbes was made as comfortable as possible with a canopy of rushes above and a well-arranged couch beneath. That evening, after travelling at the rate of 1½ miles an hour, the expedition arrived at Shapunga, where they were welcomed at the residence of Donna Pascoa, who at once gave Mr. Forbes a bed. She lived in a comfortable house and her table was covered with expensive silver. Mr. Forbes continued to be ill, although at times improving a little, but then relapsing into a more serious state. Anxious that he should not hold back the expedition, and feeling better on the 11th, he insisted on accompanying the others. Two canoes were taken, one being large and made specially comfortable for the patient and the doctor. Before taking leave of their kind hostess, Kilpatrick presented her with various medical preparations which might help should she ever need them in this remote place.

The next day (the 12th) Forbes took a turn for the worse and his friends began to regret having brought him. On the 15th they were still ascending the river and had passed the Morambula range of mountains, but Forbes had become critically ill and died the following day when they were still a day’s distance from Senna. Brown sent forward a despatch informing the Commandant of the death of their companion and asked for a coffin and for arrangements to be made for the funeral. That night they were attacked in their canoe by myriads of mosquitoes and had very little rest. When they arrived at Senna the Commandant received them coldly, but set aside a house to accommodate them, and the day afterwards they proceeded to church for the funeral of Forbes. Thoroughly dispirited by the loss of their comrade, they had to remain on in Senna to wait for permission to visit Tete, 60 leagues further. Illness again attacked the party on the morning of the 27th August, when Lieut. Brown, who had often suffered mild bouts before, succumbed to a severe form of fever. The following day Adonis (one of the black servants) developed fever, and on the 1st September the doctor himself and the second steward Antonio became ill with malaria. By this time permission for the party to visit Tete was granted, but it was too late. Brown was on his death bed and died on the 4th September. He must have contracted the cerebral form of the disease, for his mind wandered and his speech was incoherent. He became very restless and tried to tear away the blisters formed on his head by Kilpatrick’s treatment.

Kilpatrick was now so ill that he was confined to his bed, leaving the servants to make the funeral arrangements. This was not easy, but after some hours the Commandant granted a site for the grave. With the help of some Africans hired with a few beads, Antonio and Adonis buried their master. Kilpatrick was so upset by Brown’s demise that he appeared to give up all idea of his own recovery and lingered on despondently, taking little interest in his surroundings. His two servants packed all their belongings and beseeched him to leave at once for Shapunga. He refused, saying that in a few days he would have breathed his last. However, they eventually persuaded him to leave Senna and carried him to the canoe. The remnant of the expedition then set out for the return journey and reached Shapunga in a few days. Donna Pascoa, on hearing of the death of the two men, strongly advised that Kilpatrick should try the Portuguese remedies, but he refused. He was broken-hearted and completely indifferent to his future. He refused to eat and turned to spirituous liquors when he could obtain them, although he had apparently never been addicted to them before. He remained in bed and refused to speak to people. Three weeks later he suddenly stopped drinking and,
greatly to the pleasure of his friends, started eating again, but some days later again found consolation in drink. He died on the morning of the 28th October. A coffin made of bamboo was prepared and the doctor was buried near the Donna’s house. In the afternoon Adonis and Antonio, followed by some of Donna’s slaves, buried him.

The two servants suffered great hardship and privation after his death owing to lack of funds. The Donna refused to house them any longer because of an argument over the deceased’s belongings, which she claimed as part of the debt owed her by the expedition. They were obliged to find other accommodation and food and remained in Shapunga in precarious circumstances for about 14 days. Meanwhile Antonio managed to find a canoe and take his sick comrade downstream to Mariano, who helped them reach Quelimane. On their way they stopped at the village of Mongalloos for a fortnight, as Adonis’s condition had become much worse. An African medicine man was called in and seems to have saved the situation. After the patient had recovered they continued their journey and reached Quelimane on 2nd December and reported the deaths of the three Europeans.¹

| Number of personnel (three European, two African) | 5 |
| Number of deaths (European) | 3 |
| Number of survivors (both African) | 2 |

¹ Table VI

Mortality Figures of Zambesi Canoe Expedition (23rd July to 28th October, 1823)

HUGH CLAPPERTON’S EXPEDITIONS

Tuckey’s failure to trace the course of the Congo upstream on account of the malaria only

served to intensify the desire to solve the mystery of the Niger. The next move was an approach early in 1822 across the desert from Tripoli by Hugh Clapperton, Walter Oudney, M.D., and Major Dixon Denham, who discovered the kingdom of Bornu to the west of Lake Chad after an arduous journey through a large portion of the Sudan. At this stage Denham broke away from the others to explore Lake Chad whilst Clapperton and Oudney moved towards the Niger, as they learnt that they were about 100 miles to the south-east of the part of the river explored by Mungo Park. In January, 1824, Oudney died and Clapperton continued on his own through Kano to Sokoto; but as he was not permitted to proceed further west, returned to Tripoli, arriving there in June.

Encouraged by his first expedition and armed with the knowledge he had gained, Clapperton made another attempt in 1825, accompanied by Capt. Pearce, a ship’s captain, Mr. Dickson, a surgeon, Dr. Morrison, a naval surgeon and naturalist, and Richard Lander, their personal attendant, from England. Clapperton, using the findings of his previous journey, wisely selected a jumping-off ground into the interior much further south than that of the Gambia chosen by Mungo Park. The party reached Badagry, on the Bight of Benin, on 26th November, 1825, planning to move overland to Sokoto and then to Timbuktu and thence to trace the Niger to its mouth. Dickson departed on his own and, after reaching Char and Youndere, was murdered by his followers. Houtson, an English merchant who had lived in those parts for many years, joined the expedition at Badagry. They set off from there on 7th December and travelled 60 miles to Jannah, where they all became ill with fever and were treated by bleeding or blistering. Clapperton was anxious to send Dr. Morrison and Captain Pearce back to their ship in the care of Mr. Houtson, as they were so bad, but they refused and demanded to continue at all costs. On 22nd December the party left Jannah, passed through Becchy and arrived at Tschow, from where Clapperton insisted on sending Dr. Morrison back to the ship with Houtson on account of the serious deterioration of his health. But it was too late to save his life and he died on the way. Houtson died shortly after at Accra from fever. In the meantime the depleted expedition moved onwards in spite of the heavy rains and the fever-ridden conditions to which Clapperton and Pearce were reduced. Captain Pearce became worse after they reached Engwa, passed into
a cerebral state and died. Clapperton and Landet continued on their way, reaching Katunga on 15th January, 1826, where they rested until 7th March and then set out for Bassa, the point on the Niger where Mungo Park was believed to have been drowned. They crossed the Niger at a ferry called Comi below the village of Bussa, journeyed through Zonari and Zegere to reach Kano in July, exhausted by fever. After a short stay there they moved on to Sokoto, where they remained for six months. But on 12th March, 1827, Clapperton became ill with dysentery and soon after with fever. After 20 days of great suffering he died on 13th April, 1827. Landet buried his master and then retraced his steps to Kano, from where he returned to Baghdad on 22nd November and sailed for home, reaching England in April, 1828. Thus the path of the Niger was still untraced and yet another expedition ended disastrously.1

Table VII

<table>
<thead>
<tr>
<th>Mortality of Clapperton's Second Expedition to the Niger (17th December, 1825, to 22nd November, 1827)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Europeans in party</td>
</tr>
<tr>
<td>Number of deaths</td>
</tr>
<tr>
<td>Number of survivors</td>
</tr>
</tbody>
</table>

Whilst Clapperton and Landet were recovering their strength at Sokoto, another attempt was being made to discover the source of the Niger. Major Alexander Gordon Laing, a native of Edinburgh, who had had considerable experience exploring the west coast of Africa, was sent by Lord Bathurst to travel to the Niger via Tripoli and Timbuktu, which was already known to be inaccessible. With his guide and companion, a sheikh called Bahani, was killed on the way in May, 1829, when they were attacked by Arab snipers, and despite much suffering from malaria, Laing reached Timbuktu—the first European to see this town. But soon after leaving it on 26th September, 1826, he was killed by Arabs who were opposed to Bello, the chief of the Fulani, who had shown him hospitality.

Richard Landet's Discovery of the Mouth of the River Niger

Thus the riddle of the Niger was still unsolved, but by this time there was a growing body of opinion which believed that after passing Timbuktu the mighty river curved round and flowed into the Atlantic after all. Richard Landet, his appetite whetted by the part he had taken in the Clapperton expedition, resolved to continue the exploration previously attempted by this expedition and offered his services and those of his brother John to the British Government, suggesting that they travel to Bussa and from there downstream in a canoe. They set out together from Portsmouth on 6th January, 1830, for West Africa. From Baghdad they travelled overland, following the route taken by the Clapperton expedition as far as Bussa. From there they set sail down the Niger on 23rd June with four negroes in a small open canoe, protected only with umbrellas. On 25th October they passed the confluence of the Niger and the Benue and reached Elor, close to the Atlantic, on 14th November, 1830. Here they had some difficulty in deciding which of the many diverging branches of the Niger to take in order to reach the open sea, but were saved from this decision by being captured by some Benu traders at the Kiri market and being delivered into the hands of Chief Obe. He passed them over to King Bay of Brass, near the mouth of the Niger. When he finally released them they found their way to the Atlantic through this unfringed outlet and reached the island of Fernando Po and from there found a passage to Rio de Janeiro and thence home, reaching England in July, 1831. They had completed their journey without any deaths or fever. In their account of this expedition they list the medicines and surgical equipment taken. This includes 1 oz. of sulphate of quinine. They had been recommended to take two to five grains of this in the form of pills every six hours to strengthen them after fever or dysentery. Obviously it was not yet recommended as the main treatment for malaria, but only as a tonic after the disease had been treated. Their survival was evidently a matter of good fortune. Landet perhaps had become partially immune through his former journey.

Mention should be made of René Caillié, a Frenchman born in 1800, who also entered Timbuktu after Laing had reached it. His undertaking was quite remarkable and heroic. He had previously been to Senegal and learnt a great deal about the country and its peoples. He started for Timbuktu on 22nd March, 1827, from Freetown and reached the Niger at Gourma on 11th June. He continued his journey; in November he broke down with acute scurvy and suffered great agony, but through the help

of a Negress he managed to recover and renew his journey early in January, 1828. On 23rd March he embarked on the Niger for Timbuktu and on 20th April saw the great capital of the Sudan, so long the mystery of civilised Europe. On 4th May, 1828, he joined a caravan for Tarflet and from there he made for Fez and so on to France.\(^1\)

**Table VIII**

**Expedition to Determine the Course and Termination of the Niger by Richard and John Lander from 23rd June, 1830, to End of November, 1830\(^2\)**

<table>
<thead>
<tr>
<th>Number in expedition</th>
<th>Europeans</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negroes</td>
<td>4</td>
</tr>
<tr>
<td>Number who died</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Number of survivors</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

The 1832 Niger Expedition

The discovery of the mouth of the Niger by the Lander brothers was received with great enthusiasm by government, commercial and scientific circles alike. It was reminiscent of a national victory and England could not afford to lose such an opportunity or promise of entry into the interior of Africa with the hope of a flourishing trade with the indigenous population. At the same time, the presence of Britain inland would deliver a mortal blow to the slavers.

A company was formed in Liverpool by business men to equip and despatch an expedition to follow up the new discovery. They had received encouraging reports of ivory and the valuable products which could be traded for the goods of the white man. Richard Lander was to head the expedition, for which two steamers, vessels of light draught, were built, the larger one being named the *Quorra* (145 tons) and the smaller boat the *Alburkah* (55 tons). They were accompanied to the west coast by the *Columbine*, a brig equipped with goods for barter. The *Quorra* carried a crew of 29 white men, of whom one was a doctor (Dr. Thomas Briggs, the senior surgeon to the expedition), whilst that of the *Alburkah* was 12 Europeans, which included one surgeon. The expedition was joined before leaving Liverpool by William Allen, R.N., who was sent by the Admiralty to prepare a survey of the rivers. All the men were carefully selected, the emphasis being on their good physique. All were between 25 and 35 years of age. MacGregor Laird, writing later on the expedition which departed from Liverpool on 19th July, 1832, says this about the fitness of the ship's complement: "... little did I think, as I beheld their athletic and powerful frames, that in a couple of months the only survivors of us all would be myself and three others."\(^3\)

The *Quorra* was under the charge of Capt. Harries, and Richard Lander was also aboard it. At Freetown in Sierra Leone in September the *Quorra* selected 10 Kroomen for service, and at Cape Palmas in October 10 further Africans were recruited for the ship. The coastal belt was of course very dangerous, and nothing can better illustrate the perils of such a venture than the grim figures which MacGregor Laird and Oldfield mention in their book. In 1824, when the fort in the Cape Coast was garrisoned by white troops of 600 men, 295 "fell victims to the climate." In 1825 and 1826, of 329 Europeans admitted to hospital, 32 died. This great reduction in the mortality in the garrison was attributed to the seasoning induced by previous attacks of the fever and not to "any decrease of poisonous miasmata."

It was when the ships were coursing their way to the Nun that Capt. Harries fell ill with the complaint of a stiff neck. Dr. Briggs prescribed a medicine, but Harries became obstinate, as so often occurs with the fever, and refused any treatment. He applied a blister to the back of his head. But now, too, George Curling, the second engineer, fell ill and the unfortunate *Quorra* was anchored off the mouth of the Nun on 10th October, 1832, with both Captain Harries and Curling delirious. It was a sad affair for the beginning of the expedition. On 18th October Harries was dying in the arms of Dr. Briggs and George Curling passed away, having suffered the same symptoms as Harries. But the *Alburkah* did not escape, for about the same time Lander buried a man who died of the fever. Oldfield, the junior surgeon of the expedition, while still on the *Alburkah* when it

---

first arrived at the coast, treated his cases by cupping and blistering their shaven heads and by giving calomel 5 or 10 gr. every four or six hours until marked salivation was induced. But they were not to be discouraged. There was no thought of altering their course, and on the 19th October the Alburkah, with Lander on board, followed the Quorra over the bar. Dr. Oldfield remained behind on the Columbine at the entrance to the river while Briggs, the senior surgeon, served on the Quorra. The Alburkah therefore had no medical officer of its own in the river.

It was now raining without stop, but the men were once again all in good health and spirits as the vessels got under way on 26th October and ploughed their way on to Eboe, passing through country surrounded on both sides of the river by extensive swamps covered with dense vegetation and mangrove and palm trees. Thus it will be seen that the vessels remained in the Delta for at least seven days—a delay which probably turned out to be hazardous. We read that on the 30th October the men of the Quorra were ashore collecting wood, and it is on this day that Laird reports two of his men indisposed and on the following day one of his crew down with ague. Yet Laird was pleased with the state of the health of his crew, and on 3rd November wrote: "It afforded me much satisfaction to find that my crew continued healthy—since we had entered the river the whole crew had gradually recovered their health."

On 7th November the ships reached Eboe, which stands by the side of a creek. The inhabitants were busily engaged in the slave trade and the sale of palm oil. The voyagers were pestered by "the torrents of sandflies and mosquitoes."

Eboe was left behind on the 9th in the light of a splendid moon, and after crossing the Benin branch of the Niger, 15 miles from Eboe, the Quorra ran aground. At this time Jordan in the Alburkah went down with fever as well as four Europeans on the Quorra. Little did anyone realise that these cases were the forerunners of what could best be called an epidemic on the Quorra. By the 12th November Allen himself, with Dr. Briggs, was attacked and there were nine fresh cases among the crew. Two days later all the whites were down except

King Obie visiting the steam vessels.
(From Narrative of an Expedition into the Interior of Africa by the River Niger in the Steam Vessels Quorra and Alburkah.)
Harvey, and Captain Hill of the Alburkah came on board to take charge. Hill himself expressed his displeasure at coming on board a ship which was regarded as filled with the miasmata of malaria, as the Alburkah until now was relatively free. Deaths quickly filled the tragic picture.

On the 18th, two died; on the following day—the 19th—two more; on the 20th, three; 21st, three more; 22nd, one death; 23rd November, no mortality; but on the 24th another European expired. By now the Quorra had lost 13 of its crew and the Alburkah two. On the 27th the ships reached Attah. The state of the crew’s health on 5th December was still critical. “I have living Alexander Hector, John the second steward, Harvey, Kirby, Belfrage and Davies, seamen; all as weak as myself and crawling about the decks more like spectres than men.”

On 6th December Capt. Robert Miller died. They still unfortunately had little idea of the way the fever could be controlled. Laird, with the advice of Dr. Briggs, advocated—

1) that the double awnings should be spread fore and aft the vessel;
2) the sides of the vessel were raised by canvas to a height of eight feet from the main deck.

Laird considered that the principal predisposing cause for the fever was the abrupt change from the open sea to the narrow, winding river, combined with the wind and sea breeze and the prevalence of the noxious vapours. Laird tells us something about the treatment meted out to the men on the Quorra. The men were bled and blistered. He thought that the application of a blister over the head afforded the most relief and he attributes Richard Lander’s recovery as well as that of Dr. Briggs at this stage to blistering the head. As to the value of drugs, Laird remarked that emetics and purgatives were more beneficial than drugs, which did more harm than good. But on leaving Attah on 5th December, 1832, the Quorra was to experience a recrudescence of the fever.

On 7th December Dr. Briggs was seriously laid low by the fever and then rallied, but now Allen was so ill that his life was despaired of. He was bled by Dr. Briggs, who was also prescribing laudanum for those wanting sleep. It is not surprising, with all this unhappy state of the health of the Quorra’s crew, that at the confluence the Quorra stuck on a shelf of rocks and thereafter ran adrift on a sandbank. All efforts to shift her were in vain, and there she lay for days. By now the Alburkah had lost the third member of its crew. Christmas was passed at this unhealthy spot, yet despite all, the men were able to toast their friends at home.

The crews on both ships now went through a silent struggle for their very existence. When Laird suffered a severe relapse, Dr. Briggs
administered an emetic and six grains of calomel and resigned him to his fate. On 7th January, 1833, Laird and Briggs were just alive. Laird wrote: "We were both like scarecrows, with our long beards and razor faces." The vessel was still aground. On the 17th January it was decided that with the Quorra still stuck, the Alburkah should proceed with goods up the river to Attah and Busa; but after leaving, the Alburkah could not proceed much further because there was not sufficient depth of water for it.

With continued illness on the Quorra, Harvey the boatswain was the only man who had tolerable health. Lander decided to send a man down the river to the brig waiting at the mouth. And then a sad turn came with the death of Dr. Briggs on the 27th January, 1833. Dysentery complicated the picture, and with repeated attacks of fever he was scarcely recognisable by his fellow men. He was 28 years of age, a Charterhouse and Cambridge man, full of promise. A fine tribute was paid to him by Laird: "The uncommon equanimity of his temper, the total absence of all selfishness and his desire to make the best of everything rendered him a most invaluable companion at all times. . . ."

At the latter end of March Laird ascended the Benue (Tchadda) in a canoe and reached Fundah. On his return he found that the Quorra was afloat, the river having risen considerably. Lander was away, having taken Capt. Hill, who was desperately ill, down to the sea, as this offered a chance for his life. At this stage Laird, finding that the present health of the crew was so bad, decided that they should leave the river and make for Fernando Po. On 10th July, 1833, the Quorra got under way, taking the Alburkah in tow, and proceeded down the river. Near Bocqua they espied a boat returning with Lander and Oldfield, the surgeon. They learnt from Oldfield that the mortality in the brig was slight as compared with other vessels which had entered the river, and this was attributed to the open sea breeze. Eboe was reached on 9th August; on the 19th they saw salt water and on 28th August arrived at Fernando Po.

The men on the Columbine did not escape entirely. Shortly after the Quorra and Alburkah had entered the river, Oldfield, who had been on a visit to Brass Town, fell ill and he himself removed 20 oz. of blood from his left arm, which he claimed afforded him considerable relief. On the third day he ordered his head to be shaved and blistered and began taking 12 grains of calomel in three days every six hours. Two days later the surgeon became delirious and continued in this state for nearly 11 days, even attempting to throw himself overboard. We know that Oldfield had quinine on board with him because the captain of a Spanish brig which happened to be in the mouth of the Nun had sent a request for a little quinine, as 30 of his men had perished from the fever and he appreciated the great value of this remedy.

After five months of anchorage at the river mouth the Columbine men became anxious about their comrades in the river and were preparing to go to their assistance when Lander arrived with Hill in the canoe. On 8th June Lander and Oldfield left in a boat to reach the Quorra and Alburkah. When Oldfield went aboard the Quorra he was shocked at the dreadful state of all the men. The Quorra next left for the sea, but the Alburkah, with Oldfield and Lander on board, proceeded up the Niger as far as Itaba, having just before explored the Benue for a distance of 101 miles from its confluence with the Niger.

The vessel was back in the river Nun on 27th November, when it fell in with the Quorra. In the meantime Lander revisited the Nun mouth in canoes, leaving Oldfield in charge of the vessels. Lander began re-ascending the river, but his canoes were fired on and he was pursued by men from the Brass River. He received a musket ball in his thigh and was taken back to Fernando Po, where he died in early February.

It was now decided that Oldfield should re-enter the river, and on 20th December the Alburkah ascended the Niger. It reached Idaho on the 23rd, and on New Year’s Eve Oldfield celebrated the occasion of his two years’ stay in Africa by issuing rum to the Kroomen. After exploring the river they returned to Idaho and arrived at Fernando Po on 9th July, 1834.

Oldfield strongly felt that Britain should take an interest in the west coast of Africa, but aimed for trade, not conquest. He felt that the risk of the loss of human life in such efforts would be far less if as few white people as possible were employed. Four or five white men on a steamer were sufficient and the rest of the crew should be Kroomen or American Negroes who were more fit to stand up to the climate.
Also he suggested the ships should spend as little time as possible loading on the coast.1

Table IX

Mortality Figures for the “Quorra” and “Alburkah” from 19th October, 1832, to 9th July, 1834.

<table>
<thead>
<tr>
<th></th>
<th>A. Total European complement</th>
<th>Number who died apparently from the fever</th>
<th>Number of European survivors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>41</td>
<td>32</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>B. Alburkah—</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total number of Europeans on Alburkah</td>
<td>12</td>
<td>Number of Europeans who died of fever</td>
</tr>
<tr>
<td></td>
<td>Number of Europeans who died of fever</td>
<td>8</td>
<td>Number of survivors</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>C. Quorra—</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total number of Europeans on Quorra</td>
<td>29</td>
<td>Number of European deaths</td>
</tr>
<tr>
<td></td>
<td>Number of European deaths</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Number of European survivors</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

Between 8 and 10 Kroomen died, chiefly from poison.


The Great Niger Expedition of 1841

In spite of the apparent failure of the 1832 expedition and its disastrous mortality, opinion in Britain was becoming even more interested in West Africa and was determined to oppose the slave trade. The Navy was doing its best along the West African coast and liberated 57,000 slaves between 1825 and 1845, although the death rate of those serving on stations on this coast was 54.4 per 1,000; and in 1834, of 792 men serving on the seven British ships engaged in this work, no less than 204 died. As can be imagined, ships' surgeons were in great demand.

Failure is often the stimulus to further endeavours, and both the British Government and the public jointly financed the Great Niger Expedition of 1841. Nothing was to be left to chance. If medicine could not provide the answer, then the latest design of ship and other scientific advances would be introduced. Under MacGregor Laird's fine supervision at Liverpool, the Albert (459 tons), the Wilberforce (159 tons) and the Soudan (250 tons) were built. A novel plan was the ventilation apparatus which was fitted in each steam vessel. It was based on the system introduced in the Houses of Parliament, the object being to supply a constant

Left to right: Soudan, Albert, Wilberforce. Niger Expedition, 1841. (Coloured aquatint by E. Duncan after S. Walters.)
amount of fresh air between the decks and in this way reduce the miasmata to a minimum.  

Everything that could improve the health of the crew was considered. Each vessel was to be placed under the charge of a surgeon and the ventilating system was to be his responsibility. It was to be tested frequently, and so as to avoid the night air (there was already suspicion that the night-time was more dangerous than the daytime) all the white crew were to sleep below when up the river and under no circumstances was any European permitted to lie about the upper deck. Only the Kroomen, because of their known tolerance to the fever, were to sleep there. All these minute health instructions contrasted greatly with those taken with the Tuckey expedition of 1816. During the night as few white men as possible were to remain on deck on duty, especially should rain fall or dew form. During the hottest hours of the day extreme caution was to be exercised so as not to expose any European to the sun’s rays. At night time or in the early hours of the morning white men should be allowed to go ashore in order to avoid the dew. The ships should be delayed as little as possible in the unhealthy delta.

Even the men’s dress was taken into account. A deck frock and trousers were to be worn by the Europeans in the day with flannel next to the skin. Every man had to be issued with two broad flannel waist belts so that the perspiration be absorbed. This would tend to minimise the vapours. A white straw hat was also to be provided. Every night each man was to be clothed in his blanket dress, beneath which he had to wear his flannel clothing. Should any man become wet, the officer in charge was responsible for seeing that he was issued with dry clothing. All surfaces giving out moisture and all vessels filled with water were to be removed and wet clothing was never to be permitted below the deck. No member of the crew might wash himself on the lower deck. Every European was to be issued with a cup of warm coffee in the morning, and finally temperance was to be encouraged.

The food provided was of good quality, there being a great assortment of meats and vegetables. The men selected, as with other expeditions, were of robust build and in the prime of life. The public interest in this new attempt on the Niger was considerable. “Thousands of all ranks flocked on board while the vessels were at Deptford and Woolwich.”

James Ormiston M’William was appointed surgeon of H.M.S. Albert as well as being the senior medical officer of the expedition. Capt. Hersey Dundas Trotter was placed in command of all three vessels, with Capt. William Bird and Capt. Allen in charge of the other two ships.

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2. From M’William’s Medical History of the Expedition to the Niger during the years 1841-2.
they called at the English fort at Accra, an outpost with a bad reputation for fever. In 1827 it became necessary to withdraw the troops because of it. The expedition left Accra on 10th August and on that date all the ships, including the schooner *Amelia* and the transport *Harriott*, were anchored close to the mouth of the Nun branch of the Niger. Fever had appeared on the three ships, but the men were convalescent and all was ready for the contest with the Niger. On 13th August they entered the Nun mouth, with the *Albert* being the first to negotiate the bar and followed by the *Soudan*. On 15th August William Buck died of fever. It will be observed that whereas all the thought was concentrated on the river itself, the men nevertheless, were allowed to visit the unhealthy stations on the way out from England. The *Wilberforce* joined the other ships on 15th August in rainy weather.

**Table X**

**Niger Expedition, 1841. Total number of Men on H.M. Ships**

<table>
<thead>
<tr>
<th>H.M. Ships</th>
<th>Total Europeans</th>
<th>Total Africans</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Albert</em></td>
<td>51</td>
<td>58</td>
<td>109</td>
</tr>
<tr>
<td><em>Amelia</em></td>
<td>7</td>
<td>30</td>
<td>37</td>
</tr>
<tr>
<td><em>Wilberforce</em></td>
<td>57</td>
<td>49</td>
<td>106</td>
</tr>
<tr>
<td><em>Soudan</em></td>
<td>30</td>
<td>21</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>145</td>
<td>158</td>
<td>303</td>
</tr>
</tbody>
</table>

It was not until the 19th August, however, that the necessary arrangements for completing the objects of the expedition were ready and the vessels steamed ahead. The expedition reached Idah on the left bank of the river, and up to this point the expedition had been fortunate beyond all expectations.

On 4th September at Idah a most virulent form of fever struck the crew of the *Albert*, following almost at once in the other vessels. In the midst of all this it was decided to move on, and on 8th September, 1841, the *Albert* and *Amelia* departed from Idah. However, the following day several more men fell ill with fever on the *Albert*, including Dr. Nightingale, the assistant surgeon of the *Soudan*, who was taken on board the *Albert* for treatment. By 10th September the first death occurred on the *Soudan*. Mr. Marshall, another surgeon, fell ill with the same disease. The ships were now approaching the confluence of the Niger and Tehadda. About here, at Stirling Hill, Mr. Carr and his farm people, together with their farming implements, were transferred ashore in the gruelling heat. This was chosen as a site for the model farm where Africans could be taught good agricultural methods and which would be a centre from which opposition to the slave trade would emanate.

Several deaths had already taken place on the ships and the sickness rate rapidly mounted. Indeed, the expedition now faced disaster. It could hardly remain with so many men lying desperately ill and deaths fast following upon each other. On Dr. M'William's recommendation it was decided to send the *Soudan* out of the river as quickly as possible with all the sick of the three ships to Fernando Po, where better medical facilities could be obtained. On the 19th September the *Soudan* steamed down the river carrying no less than 40 men ill with malaria (including 13 from the *Albert* and six from the *Wilberforce*), under the care of Dr. Thomson, the assistant surgeon of the *Wilberforce*.

But this measure was not the answer, for shortly after leaving the confluence several fresh cases of malaria appeared on the *Wilberforce* and *Soudan*. Such a fresh blow made it clear that the squadron should leave the river. However, it was felt that one more effort should be made, so it was decided that the *Wilberforce* was to take the sick down to the sea, leaving the *Albert* to continue its ascent. The *Wilberforce* departed on 21st September just before Mr. Collman, the assistant surgeon of the *Soudan*, went down with the fever.

Above the confluence Dr. M'William and Dr. Stanger cared for the sick and Capt. Bird Allen joined the *Albert* to act together with Capt. Trotter. But there was little chance of shaking off the malaria. By 23rd September many of the crew were seriously threatened with death and fresh cases were being reported. There was little substance in the hope that by moving further up country the "noxious vapours" would diminish. Then Capt. Allen went down with the fever, and when the ship reached Egga 20 Europeans were ill, two having already died.
On 3rd October Capt. Trotter fell ill with fever and Allen was in a critical condition. The plan to reach Raba was abandoned and a hasty return to the coast preferred. M'William, being one of the few who was fit, had to help with ship duties. In his delirium, on 8th October one of the patients jumped overboard, but was pulled out of the river. However, when the second engineer did the same thing he could not be saved. A stop had to be made at Stirling Hill to learn how the people on the model farm were progressing. Here all the Europeans were confined to bed and had to be taken aboard the Albert.

As the Albert steamed down, deaths continued. On 14th October it joined the other vessels at the Nuni mouth and they all departed for Fernando Po. Among the men who perished were Capt. Bird Allen and Mr. James Woodhouse, the assistant surgeon, Dr. Horatio Collman, assistant surgeon, and Dr. Vogel, the botanist.

Table XI
Mortality of Europeans on "Albert" (including the "Amelia"), the "Wilberforce" and "Soudan" in the Niger River (Practically all the deaths were from malaria)

<table>
<thead>
<tr>
<th>Name of Ship</th>
<th>Number of African and Coloured Men</th>
<th>Name of Ship</th>
<th>Number of African and Coloured Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albert (including Amelia)</td>
<td>58</td>
<td>Wilberforce</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>Soudan</td>
<td>30</td>
</tr>
<tr>
<td>TOTAL</td>
<td>145</td>
<td></td>
<td>145</td>
</tr>
</tbody>
</table>

After several months the British Government decided to recall the expedition. One last duty remained. Another short ascent of the river had to be made to the confluence to learn how the few non-European men left on the model farm were faring. Accordingly, on 2nd July, 1842, H.M.S. Wilberforce re-entered the Niger. Fever again broke out, only Commander Webb escaping. On 29th July the Wilberforce was back at Fernando Po and set sail for England.

Table XII
Mortality from Malaria Among African and Coloured Personnel on "Albert" (including "Amelia"), the "Wilberforce" and "Soudan" in the Niger River

<table>
<thead>
<tr>
<th>Name of Ship</th>
<th>Number of African and Coloured Men</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albert (including Amelia)</td>
<td>88</td>
<td>0</td>
</tr>
<tr>
<td>Wilberforce</td>
<td>49</td>
<td>0</td>
</tr>
<tr>
<td>Soudan</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>158</td>
<td>0</td>
</tr>
</tbody>
</table>

Table XIII
Mortality of H.M.S. "Wilberforce": Second Voyage up the Niger in July, 1842

<table>
<thead>
<tr>
<th>Number of Europeans on board</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number attacked with fever</td>
<td>7</td>
</tr>
<tr>
<td>Deaths on board</td>
<td>2</td>
</tr>
</tbody>
</table>

Out of the whole expedition there were only 15 Europeans who did not contract the fever.

M'William provides us with his medical findings and opinions on what led to the failure of the expedition. He found general blood-letting of no value at all, despite the apparently favourable results he had had with this treatment in the West Indies and elsewhere. Writing in his book on the Niger expedition, M'William says: "When I was surgeon of H.M.S. Scout in the Mozambique Channel in 1838 there were several cases of fever among the crew. The symptoms were those of strong vascular excitement and general blood-letting adopted in every case." Nor was local bleeding, such as cupping of the temples or the nape of the neck, any better. Dr. M'William was not favourably impressed with blisters applied to the nape of the neck. He too induced ptyalism with large doses of mercury. The method of administering quinine left much to be desired, for it was generally withheld until later in the course of the illness. To quote Dr. M'William's own words: "In general, when the tongue began to clear and the other symptoms indicated that the functions were returning to their normal conditions, quinine was given in large doses with benefit. But it was not to this period alone that the use of this valuable remedy was restricted, for there were many cases in which, from the tendency to sinking from the very beginning, it was necessary to commence with
quinine, wine or light soups. In a disease like the Niger fever, so little amenable to treatment, no rule can be laid down for the exhibition of a particular remedy; but no medicine was found so efficacious as quinine in diminishing the severity of the paralysis.”

Dr. M'William gives details of eight autopsies he carried out. All died of the malaria, and it is perhaps relevant to mention here that he stresses the marked staining of some of the organs with bile. In three cases the gall bladder was distended with bile “of the colour and consistency of tar.” The colon, too, was generally empty except for a dark pultaceous matter viscous and tenacious. It was these particular findings which so greatly struck David Livingstone and caused him to prepare his famous pill of quinine with purgatives.

Dr. M'William also provides us with the clinical details of treatment given to 16 illustrative cases who fell ill with the river fever. Whilst we are not told how he chose these particular cases, the results of the treatment from the quinine aspect are worth analysing. The table illustrates fairly clearly that quinine was of definite value when it was given early. This point escaped the keen and observant eye of Dr. M'William.

**Table XIV**

**Results of Treatment in 16 Men Suffering from the River Fever, with Particular Reference to the Administration of Quinine**

<table>
<thead>
<tr>
<th>Case</th>
<th>Number</th>
<th>Recovery</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. No quinine given</td>
<td>6</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2. Quinine given at once</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>3. Quinine given late (a few days after commencement of symptoms)</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>4. Quinine given very late (more than 10 days)</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

1 M'William, James Ormiston, M.D., Surgeon of H.M.S. Albert and Senior Medical Officer of the Expedition (1843), Medical History of the Expedition to the Niger during the years 1841-2 comprising an account of the fever which led to its abrupt termination. London, John Churchill. (All quotations on the Great Niger Expedition are from this reference.)


**Alexander Bryson and the Discovery of the Prophylactic Use of Quinine in Malaria**

By this time more medical officers had had experience of malaria on the west coast and were beginning to make known their observations and even to criticise current methods of treatment. For instance, Dr. M'Cormac, of Belfast, who had known the disease at Sierra Leone, wrote a note on the Niger expedition in the form of a letter to the *Edinburgh Medical Journal* in 1845 pointing out that high mortality was to be expected in a crew of white men not used to the tropical climate. Those who had lived there a long time became almost as immune as the African and were the best people to be used on such an expedition. He also recommended Kroomen for this work as, besides being intelligent labourers and used to English ships, they were immune to the disease. He felt that a party of Kroomen should be employed on such expeditions to work the ship, keep watch, go ashore for wood and other purposes, with a few acclimatised white officers to supervise them.

When all seemed hopeless the answer came from a naval medical officer, Alexander Bryson.
M.D., F.R.S. (later Director General of the Naval Medical Service), who had served in the tropics for nine years, mostly off the west coast of Africa. His first book, *Report on the Climate and Principal Diseases of the African Station*, was published in 1847, and his second, *Account of the Origin, etc., of the Epidemic Fevers of Sierra Leone*, in 1849. He wrote an important article on the prophylactic influence of quinine in the *Medical Times Gazette* in 1854, mentioning that it was a standing rule in the Naval Instructions for Naval Surgeons that when men were sent ashore in tropical climates they should each receive one dram of powdered bark in half a gill of wine before leaving the ship and then again on their return. This was not always done, as the bark did not seem to be of the same quality always and the men did not think it much use. He quoted the instance of 20 men and one officer who went ashore for one day in Sierra Leone from the *North Star*. The men were given the bark, but the officer refused to have any, and he was the only one of the party who contracted fever. Again, he recorded the case of two boats which left the *Hydra* in 1844 to explore the Sherbro river. Their crews were given the bark, and although they were away for two weeks not one person developed fever. Yet a whole gig’s crew, who were exposed in the same locality for only two days without quinine or bark, practically all suffered badly from fever. Quinine had been introduced into the Navy by Sir William Burnett when he was Director-General at a time when its value was still in great doubt, and so it was never given a proper trial. In 1847 Bryson recommended it as a prophylactic, suggesting that it should be administered not only when men were being exposed on shore or in a boat in swampy places, but continued afterwards for at least 14 days after they returned on board. It was less nauseous than the bark, tasted better and was certainly more compact and easier to take. His scheme was tried out between Delagoa Bay and Mozambique on all vessels cruising in mouths of rivers or blockading the coast. Four grains of quinine were added to 1 oz. wine, and 1 oz. of this solution given to each man daily for 10 days. This proved most successful, and in only one instance did mild fever develop after taking the prophylactic quinine. This contrasted markedly with the development of fever by a whole crew in March, 1851, when the wine was lost crossing a river. By this time he was quite sure of the efficacy of prophylactic quinine and so strongly recommended it in his communication of 1854.

**The 1854 Niger Expedition Under Dr. William Baikie**

It was the great loss of life which delayed the next major attack on the Niger. The all-important contribution of Bryson, and the realisation that it is an error to take too large a body of Europeans who are unseasoned to the tropical climates, ensured the success of the next attempt. In 1852 the whole matter was re-opened largely as a result of the information received about the journeys which Dr. Barth had undertaken. After crossing the great desert he reached Timbuctu, and in his journey southwards crossed on 18th June, 1851, a large river named the Benue (*Tchadda*), which he thought was the upper part of the Niger. Dr. Barth was the only survivor of the party and the Admiralty therefore decided to explore the Benue from Dagho, which was the further point reached by Allen and Oldfield in 1833.

Accordingly, John Laird, of Liverpool, was commissioned to build an iron screw schooner. The vessel, named the *Pleiad*, was of 220 tons. In contrast to other similar expeditions, as few Europeans as possible were enlisted, and the second point of interest was that all Europeans on board were to be served with prophylactic quinine. The river was to be ascended with the rising waters and therefore during the rainy season so as to obviate any hold-ups in the river through the vessel going aground.

On 21st May, 1854, the *Pleiad* set sail from Plymouth. The expedition was put in charge of Mr. Beecroft (who had served in one of the steamers of the West Africa Company) and who had ascended the Niger. Dr. William Baikie, who was also a medical man, was chosen as the naturalist. Also included was Dr. W. Bleek, a German ethnologist. The medical officer was Dr. Hutchinson.

Before reaching the river Nun, Beecroft’s health broke down and he returned to England, and Dr. Baikie assumed the command of the vessel. The whole complement of the *Pleiad* consisted of 12 Europeans and 53 Coloured men. On 12th July the *Pleiad* crossed the bar of the river Nun. On 4th August it reached the con-

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fluence and here Baikie refers to the great nuisance of the mosquitoes, which were causing the men sleepless nights.

Towards the end of September some peculiar form of fever broke out among the Kroomen, its main features being great debility and swelling of the lower limbs. Baikie also noticed that some of them were suffering from scurvy. As they were now short of food, any further idea of ascending the Benue was abandoned. The vessel sailed as far as Tshomo.

Dr. Hutchinson's duties were not at all heavy, and from the malarial aspect there were neither deaths nor even any serious sickness amongst the European crew. Dr. Baikie's report on the health of the expedition showed how few were troubled by malaria. "Of the measures employed as hygienic, most were of a general nature, the only more specific one being the free use of quinine. The amount of sickness was very little, so that, except with the scorbutic cases, Dr. Hutchinson's real medical duties were not onerous. Of the Europeans, the most exposed to climatial influences were Mr. Harcus, Mr. Guthrie, Mr. May and myself. Mr. Harcus was chiefly exposed during the day and suffered only from frequent headaches from the effects of the sun's rays. Mr. Guthrie, besides undergoing daily an immense amount of fatigue, slept regularly on deck and nevertheless escaped entirely. Mr. May and I went ashore whenever opportunities occurred and as often by night as by day; we had frequently to land in swamps and other unhealthy spots, yet Mr. May had only one very short and not severe febrile attack. I, in addition, always slept on deck and was roused regularly at 12 o'clock and at three in the morning for the purpose of recording meteorological observations, but while in the river I had constant health. I mention these circumstances to show that under proper precautions Europeans may not only live quietly, but even commit with impunity what, some years ago, would have been considered as terrible indiscretions." 1

1Baikie, W. B. Narrative of an Exploring Voyage Up the Rivers Kwora and Benue (commonly known as the Niger and Tchadda). London, John Murray, 1856. (Material quoted is from this volume.)
Mortality Figures of Baikie’s Expedition to the Niger and Benue (12th July, 1854, for a Period of Four Months)

| Number of Europeans in ship’s complement | 12 |
| Number of Europeans who died | 0 |

A few years later Baikie published a report in the *Edinburgh Medical Journal* on remittent fever as he knew it on the west coast of Africa. He mentioned its prevalence in swampy areas, its incubation period of five to 18 days, gave a very good account of the symptoms and recommended quinine to cure it. He suggested giving it in solution in water, stirring up the mixture well before the patient drank it, unless the latter objected to it or vomited, in which case it could be given as a pill with a little morphia to soothe the stomach and stop the vomiting. He mentioned that occasionally in extreme cases, when all other methods have failed, cures had resulted from giving quinine by injection. He believed in large frequent doses, but recommended it during the remission, just before the commencement of the cold stage. “Some practitioners in Africa,” he said, “give quinine freely during the hot stage, but of this I have had hardly any experience.” He disapproved of mercurials, but used blistering for cerebral malaria. He mentioned Bryson’s introduction of prophylactic quinine and his own experience on his Niger expedition, when he spent four months in most unhealthy surroundings with hardly any sickness amongst his 12 Europeans. He gave them 3-4 grains each morning and occasionally again in the afternoon in port or sherry and noticed that they seemed to develop a craving for it. It appeared to help them.  

David Livingstone on the Zambesi

Now that the Niger had been conquered, the interest of the British returned to the Zambesi, which became news because of the travels of David Livingstone, who had arrived in Bechuanaeland in July, 1841, just before the ill-fated Niger expedition of that year ascended that river. M’William’s treatment of venesection had proved inadequate, but little value was placed on the use of quinine. We know that Livingstone read M’William’s medical account of the expedition, for he was struck by the excess of bile in the liver and other organs in one of the autopsy cases. Yet it is all the more remarkable that Livingstone should have decided that quinine was the answer. How did he discover this? We know that he read widely and in his letters he refers to a number of medical journals which he constantly studied on his journeys. Although he could not have been aware of Bryson’s view on the value of quinine as a prophylactic, it may well be that this outstanding figure in African history came to this deduction by his own genius. He had to leave Bechuanaeland — there was no future here for him. The Boers had no intention of allowing him to remain in the country. But how could he escape to the north and start his new mission in Sebetwane’s country around the Chobe river unless he had an answer to the fever, for north of Lake Ngami and the Zouga river there was no possibility of Europeans surviving. “One of the chief objects of my present expedition is to investigate the character of that disease, which is the main obstruction to Africa being opened to beneficial intercourse with the rest of the world. If I can only discover a healthy range of country and means to foil that terrible plague I shall be content to let the unicorn sleep in everlasting oblivion.” These were not mere words. He was determined at all costs to reach Sekeletu, with whom he had already made contact. By 1850 he had decided on a course of action by placing complete reliance on quinine. He managed to lay his hands on a copy of M’William’s *Medical History of the Niger Expedition*, published in 1843. He must have read it carefully, analysed minutely the details of treatment given to 16 patients by M’William, and deduced that when quinine was given early the results were much better. He reveals that this was so in a letter he wrote to the *Lancet* in 1861 in which he explains at the same time how he devised his now famous “Livingstone Pill.” “In the typical cases given in Dr. M’William’s *Medical History of the Niger Expedition* the gall bladder was found distended with black bile and, if my memory does not deceive me, most of the cases treated with quinine at an early period of the disease either recovered or were subjected to the milder or to the remittent form of fever.” “In 1850 I adopted the plan of giving quinine mixed with a purgative as the first step of the treatment and was successful in the cases of two of my children and an English party whom we found at Lake Ngami and of whom one had died before our arrival. I have lost the notes of my reasons for adopting the practice, but I have been successful in every case since. The
prescription employed is: Resin of jalup and calomel, of each 8 grains, quinine and rhubarb, of each 4 grains, mix well together and when required make into pills with spirit of cardamons. Dose from 10 to 20 grains. ... Quinine is then given until the ears ring, etc."

So when Livingstone left in April, 1850, for Sebethwane's country he was armed with his special pill which he had himself compounded in Bechuanaland and quinine, and he had good reason to have these in his possession. Despite the risks he ran, he was accompanied by his wife and three children. The family reached the Zouga river and crossed it, but because of the tsetse fly they were forced to return. On recrossing the Zouga, however, he learned that a party of Englishmen who had come up to Lake Ngami were laid low by fever. One of the men had already died. He successfully treated the other two—Wilson and Edwards—with quinine. It was now that Livingstone and his own family were attacked by the disease, and it was on this occasion that he was able to confirm the efficacy of his remedy which was later to become so famous and be his mainstay on his subsequent journeys.

Livingstone was able to satisfy himself that here lay the answer to the fever. He was right. Early and large doses of quinine were the solution. In the same note already quoted to the Lancet, he adds, "I cured myself and native companions in this way during my long journeys between 1852 and 1856." Having worked out a proper way of handling the fever, he was the first European to cross Africa from coast to coast. But this achievement, great in itself as a feat of exploration, showed, as he claimed it did, that the white man could live and rear a family in the tropics. He wrote enthusiastically in this vein to the British Government. He was so convinced of the correctness of his line of treatment that after reaching the east coast in 1856 he severed his connection with the London Missionary Society, and thus, being a free agent and incidentally a hero in the eyes of the British public, was better able to plan his return to Africa, where he could be left alone to find a suitable or healthy centre for his mission and so begin to disseminate Christ's teachings and to develop for commerce the resources of the interior of this vast continent.

The whole of Britain, but especially the people of England, were so impressed by his Christian mission and undertakings in Africa, coming fairly soon after the disasters of Mungo Park and others who went out to West Africa, that university and government circles saw fit to support his plans which would lead to the opening up of Central Africa. No doubt the public were moved to help the "heathen" and the government saw that benefits might accrue to British commerce. All were bitterly opposed to the slave trade, which England was committed to stamp out. David Livingstone had comparatively little difficulty in finding the active support for the expedition he suggested. His plan was to ascend the Zambesi from the coast as far as the Chobe, and somewhere near the "healthy" Batoka plateau he would plant his mission. Through the Zambesi waterway he hoped to find an easy and cheap means of feeding his mission. Livingstone found the Foreign Office ready to sponsor this undertaking. He was delighted and at once set about planning and equipping his expedition. Being of an obsessional make-up, he left nothing to chance. He took every precaution to ensure that the fever was not going to ruin the expedition. By now he had read of Baikie's success with prophylactic quinine in 1854. This he had not used. He could cure the fever, not prevent it, and here lay an important advance; therefore he instructed John Kirk, his medical officer and botanist appointed to the expedition, that all the Europeans before entering the delta of the Zambesi were to be given two grains of quinine in sherry every day. Livingstone left no stone unturned and he was careful to see that his expedition reached the mouth of the Zambesi in the dry season. Once there, Livingstone wanted his men out of the delta and lower river as soon as possible in order to avoid the risk of fever. The expedition arrived off the mouth of the Zambesi on 6th May and on the 11th they commenced taking two grains of quinine in half a glass of sherry each day. Livingstone was not entirely convinced that this small amount of quinine would prevent the fever. At least he hoped that it might influence the system to a certain degree and render it less difficult to induce cinchonism. At this time the health of the men was excellent; and Commander Bedingfield, who was appointed naval officer in charge of the steam launch Ma-Robert, was critical of the fuss Livingstone was making about the fever, the weather at the time being well-nigh perfect. But he was soon to learn. When the men reached Expedition

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1 On Fever in the Zambesi: A Note from Dr. Livingstone to Dr. W. William. Quoted from the Lancet, 24th August, 1861.
Island, only a few miles up the river, where the goods were to be transferred to the Ma-Robert, fever appeared. Baines was delirious at times and had lost all sense of time and could not distinguish between morning and evening. Livingstone was beginning to doubt the value of prophylactic quinine, although it is clear that two grains was probably too small a daily dose. But one cannot be certain that the men even took this dose of quinine as ordered by Livingstone, for by July Livingstone and Bedingfeld were at loggerheads. There were a number of reasons for this break. Both men had strong personalities and on 31st July, 1858, Bedingfeld handed in his resignation. It is interesting to note that one of the reasons advanced by Livingstone was that he refused to take his daily quinine. This must have angered Livingstone, for he wrote: "... No matter what plan was followed, he knew of a better. He found out even that it would be better not to take quinine daily like the rest. for then he would receive its full benefit when he needed it."

Bedingfeld was instructed to return to the Cape. Until he could obtain conveyance to the coast, he would have to wait at Expedition Island. In his letter accepting his resignation, and whilst arranging for his departure, Livingstone was still unable to resist taunting Bedingfeld: "A supply of quinine is at your service should you think it proper to adopt the safety precautions followed by the rest of the expedition."

The expedition now left to settle at Tete, whilst the Ma-Robert had to bring up loads from further down the river. The men must have been taking the quinine fairly regularly, for most of their stocks had been used. Livingstone, despite his attitude towards the fever of his personnel already recorded, was pleased with the regime he had advocated, for in his Journal he wrote on the health of the expedition: "... In endeavouring to open up the interior of Africa the fever obviously requires the greatest consideration. I shall therefore mention the precautions we have employed to escape its deadly power. We have with one exception continued the daily use of quinine ever since we entered the river. We have not been able to detect from its long-continued use any such effect as our homeopathic friends would lead us to expect, but we can at any time by an extra dose or two produce cinchonism (deafness, ringing in the ears, etc.), showing the system to be fully under the influence of the remedy."
Livingstone also believed in the importance of movement or of active exercise for the body in order to reduce the recrudescence of the fever. He repeatedly stressed this need. Whether there is any value in this measure is not clear, but it would seem doubtful, although for a long time afterwards—even until fairly recent times—rest was discouraged once the fever had subsided. Livingstone contended that whilst he was not certain about the prophylactic properties of quinine, he was more impressed with exercise as a preventive measure. "Quinine daily for sake of effect on imagination and as its use brings the system into a state in which cinchonism can be produced in a few hours by an extra dose. It is decidedly curative but questionably prophylactic, if we deduct the effect on the imagination. A much more important precaution than quinine is constant employment and sufficient bodily exercise to produce perspiration every day. When anyone halts in the mangrove swamps or leads a listless inactive life he is in danger!"

Livingstone was ever ready to pursue every detail which could avoid the fever. He appreciated that the state of his expedition depended on this. So he learnt from Dr. M'William's Medical History of the Niger Expedition that no one must remain in any hothed of fever for any length of time, but was to be moved out as quickly as possible. "When we first anchored in the mouth of the Luane, close under a Mangrove Swamp of great extent, although it would have been more agreeable to my own feelings to observe the next day (Sunday) as one of rest, after asking the consent of the men I at once proceeded with all vigour to get out the launch so as to leave the hothed of fever we were in without a moment's unavoidable delay. After the experience gained by Dr. M'William . . . I shall have considered myself personally guilty had any of the crew of the Pearl or of the Expedition been cut off by delay in the Mangrove Swamps." It should not be thought that the members of the expedition did not suffer from fever, despite the precautions insisted on by Dr. Livingstone. Throughout, Livingstone kept a close watch on any fever and it is likely that by administering the quinine early and in large amounts he was able to prevent deaths, although not sickness. "Quinine has a good and prompt effect in all cases if used with other remedies and in sufficient quantities. I took about 30
grains in six hours and it made me deaf soon after. . . ."

Indeed, Livingstone rather tended to disregard the complaints of the men and was at times difficult to convince that his men had fever. Baines, Charles Livingstone and Thornton were all ill; Baines, in fact, suffered from the cerebral form.

Livingstone was unable to go beyond Tete because of the Kebrabasa cataracts. This did not deter him, even though quarrels had broken out among his comrades largely because of the effects of the fever. There must be some other way which would lead him to open up Central Africa. He certainly was not giving up and withdrawing from the river. The Shire offered him some hope. He had some vague idea that high up in the reaches of the Shire there might be some great expanse of water.

Livingstone temporarily abandoned prophylactic quinine after 1859. In April, 1859, he discovered the Shire Highlands and Lake Shirwa, but he did not go beyond on to Lake Nyasa until another occasion. But he was wildly excited, for he had come upon a healthy, elevated and fertile land, easy of access and suitable for European settlement. The region was elevated 3,000 to 4,000 feet above sea level. But on the return of the party to the Ma-Robert, which was waiting to take them down the river, they found that Walker, one of the crew, was delirious with fever and dangerously ill. Livingstone was puzzled at this, as Walker had been taking quinine regularly, whereas he and Dr. Kirk had ceased to take it. "The use of quinine had been completely abandoned and we were inclined to attribute our good health to our regular and active exercise by navigating the vessel. . . ." Therefore Livingstone deduced that as Walker had fallen ill with the fever despite the quinine that he was taking, and as both he and Kirk had escaped the fever without taking any such precaution, there was no longer any need for quinine to be given as a prophylactic. Walker recovered with Kirk's careful malarial regime and in July, 1859, he was invalidated to the Cape.

On their return to Tete he found that the health of the European members of the Ma-Robert left much to be desired. Still, they managed to survive. Charles Livingstone (David's brother) was liable during his malarial bouts to show hysterical symptoms of fits of laughter and crying. Thornton, the geologist, was dismissed by Livingstone for being lazy.

The expedition on the Zambesi, 1859. The party in one of the boats passing the palm grove, Majado.
(From a water colour by Baines. By courtesy of the National Archives, Salisbury.)
Just as serious were the unpleasant relations with bitter quarrels which developed between the Livingstone brothers on the one hand and Baines the artist on the other. Charles accused Baines of having given away property belonging to the expedition to the Portuguese, and eventually David Livingstone suspended Baines. He clearly had not learnt all the different guises the fever could assume—certainly not the cerebral manifestations. “Had he done it openly, as he had some head affection when troubled by fever, we would have put it all to that, but he took precious sharp care of his own good, went off skylarking with the Portuguese to whom he had given the things. So I have been obliged to suspend him.”

At this stage both Livingstone and Kirk, after having spent the unhealthy season on the Zambesi, felt that they had gained sufficient experience to submit a full report on the African fever. They were still well pleased with the discovery of the salubrious Shire Highlands and had confirmed the favourable response of the fever to quinine. So convinced were they with their regime of treatment that they (no doubt Livingstone more than Kirk) felt impelled to reveal their experiences to the Foreign Office, as Central Africa was so well suited for Euro-

pean occupation. They jointly prepared a memorandum which they submitted on 26th July, 1859, to the Earl of Malmesbury. They claimed that the fever on the Highlands was of a milder and less vicious type than on the coastal belt and therefore they both considered it an advantage to be attacked only by the milder type of the disease in the Highlands. They had further decided to discontinue the use of prophylactic quinine, which they had adhered to long after most of them were convinced of its futility. Nonetheless they agreed that an acute attack of fever was not to be dismissed lightly and they considered it essential for the quinine to be administered early after purgation had been induced with their “Livingstone Pill.” Not long after this communication, Livingstone discovered Lake Nyasa on 17th September, 1859.

News was now received that the U.M.C.A., formed in response to Livingstone’s appeal, was about to come to Central Africa to settle in the site chosen by him in the healthy Shire Highlands; and whilst waiting for this David Livingstone with Dr. Kirk set out by foot on 17th March, 1860, to see Sekeletu, who succeeded Sebetwane, near the Victoria Falls, where they learned of the frightful ending of
the Helmore-Price Expedition. Here six out of nine Europeans died at Linyanti, Sekeletu's capital on the Chobe river—a most unhealthy place for fever. Although it was alleged by Price that the missionaries were poisoned, a study of the material available leaves little doubt that they died in fact from malaria. Livingstone and Kirk were in no doubt that the fever was the cause of the break-up of this mission outpost. Livingstone, needless to say, was most upset that there was no proper medical care for these people, that they showed not the slightest knowledge of how to handle the fever, and Kirk expressed surprise that no medical person had accompanied them. Once again Livingstone felt impelled to write to the Foreign Office reminding them that there was no reason why these settlers should have died and if only they had taken the simple advice he had suggested for the sickness. Here, then, we again can see the dangerous features of the African fever and how it could decimate a mission if quinine was omitted and not taken at once.

Table XVI
Mortality Figures of the Helmore-Price Mission to Linyanti (Sekeletu's Country) from 6th July to End of May, 1860; At Linyanti from 14th February to End of May, 1860

| Number of Europeans in party | 9 |
| Number who died from malaria | 6 |
| Number who escaped alive | 3 |
| Number of Africans in party | 10 |

On their return to the coast the story of the expedition revolves largely around the settlement of the U.M.C.A. Mission at Magomero and also of Livingstone's efforts to maintain his position in these regions. Livingstone by now had changed his vessel the *Ma-Robert* for his new boat, the *Pioneer*, which was staffed by four officers, 14 European crew and some Africans. Despite Livingstone's careful warnings and liberal advice, which he was always ready to give, and despite the fact that the U.M.C.A. was provided with a doctor, the project came to a fairly rapid end necessitating the transfer of the mission for some time to Zanzibar. What concerns us here is how much the fever was responsible for its withdrawal. David Livingstone reminded Bishop Mackenzie, the young and enthusiastic head of the U.M.C.A. Mission, who had had much experience of Zululand, that they should ascend the Shire between May and August, the healthiest time of the year. He also advised Mackenzie to bring out black or half-caste workers with them, as the indigenous people will bear the fever much better than outsiders. Livingstone was now clearly aware of the greater tolerance shown by the Africans to malaria in the Niger expeditions.

An event not without medical interest took place in the earlier part of 1861. Livingstone, again displaying his obsessional trait, thought he could reach Lake Nyasa through the Rovuma river and so avoid the Portuguese. He therefore took the *Pioneer* to the Rovuma with the newly-arrived Bishop Mackenzie aboard. He arrived on 25th February, 1861. But he was to be bitterly disappointed; the water dropped fast in the river as he ascended it and there was a good chance of the expedition being stranded here in unfriendly country. The tempers of the crew were high and the patience of Kirk and others exhausted. They had to hurry out, not only for this reason, but also because fever had broken out. The Bishop suffered his first experience of the fever, and within a few days of leaving the river mouth almost everyone was laid low except the few seasoned members. Therefore, in order to avoid the noxious vapours of the coastal plain, they set out to sea. The ship was virtually converted into a hospital ship. Kirk, writing in his diary, describes this outbreak: "... Driven out for the sake of the sick. After being at anchor, fever among the men and officers became so alarming in amount and tedious that it was necessary to be off, although the vessel could muster but one quartermaster and two sailors. One leading stoker took the engines, and between us we managed to navigate the ship, the helm being taken by volunteers. The Commander (D.L.) was sick but able to look up occasionally, while all the other officers of the ship were down, incapable of doing anything." On 31st March Kirk wrote: "The current being against us and the wind also, we had to get up steam and we have been drifting back on our course. The state of the people on board now is, crew and passengers, 23 white, 19 black. On the sick list there are 12 fever, one rheumatism, being nearly a third, but of the available hands to do anything with the ship we have only seven, including officers and men of both deck and engine departments and passengers." So ill were the men that they were forced to remain at anchor off the river mouth for a week until the engineer was convalescent and they were able to get up steam.
and proceed to Johanna, off the Mozambique coast.

From about May, 1861, until the expedition left the Zambesi regions in 1862, its history is largely medical, affecting both the men on the Pioneer and more seriously the missionaries who settled themselves at Magomero. It is difficult to abbreviate the account too much, otherwise the thread of the story will be difficult to follow. On the whole the crew on board the Pioneer fared much better, even though they spent a great deal of their time in the unhealthy reaches of the lower Shire and Zambesi rivers. This was due largely to the greater skill and experience of the medical men on board the Pioneer, whereas John Dickinson of Magomero probably lacked training in this regard and was himself a sickly person until he died at Chibisa.

Magomero, the site chosen for the missionaries as the healthy station, was in a hollow, and even though it was over 3,000 feet it was far from a health resort. Moreover, the Bishop, spurred on by his Christian fervour, was unable to disentangle himself from tribal squabbles and in no time was surrounded by an unfriendly people. His food supplies began to suffer, especially when the mission station began to build up an African population of men, women and children. Actually John Dickinson, the doctor, arrived some time after the mission had started. He with three other Europeans (Henry de Wint Burrup, Clarke and Blair) reached the Mozambique coast in August, and hardly had the party set foot in the country when it was attacked by fever. Blair suffered the most—so much so that it was deemed unwise for him to proceed any further, but should instead return to Cape Town. Burrup never really recovered from his first attack of fever. Next, Dickinson and Clarke were laid low with the disease, but as they were so anxious to reach the mission they ignored the fever, borrowed two canoes and engaged some African boatmen. Neither the Europeans nor the Africans knew anything about the journey up the Shire, but they managed to survive the Elephant Marshes, reaching Magomero on 29th November worn out by the fever. Dr. Dickinson, probably as a result of this terrible journey and himself afflicted with a chronic disease of the lungs, was hardly fit to cope with a mission badly in need of urgent medical attention.

Magomero, the first station of the U.M.C.A. missionaries.  
(By courtesy of the National Archives, Salisbury.)
There now follows a series of frequent movements or journeys between the mission parties and the men on the Pioneer. On 1st January, 1862, the Pioneer was at Chibisa, where it ran aground on a mudbank and where Livingstone was forced to remain for six weeks. All hope of his reaching the coast and returning with supplies in time to meet the Bishop, as arranged, was gone. The Bishop was not aware of this and so he set out from Magomero to walk overland to the appointed place where the Ruo enters the Shire. The enforced sojourn in the marshes for the Pioneer was far from salubrious. Fever broke out on the ship. Kirk wrote: “In every case the blood is quite poisoned and I feel confident that only the excessive action of kidneys and liver saved me.”

On 16th December, 1861, Mr. Ferger, their carpenter, died, this being the first death on the expedition itself. The usual remedies did not act. We are told by Kirk: “The unbleached quinine was used and we feel that it is a most uncertain remedy. The dose must certainly be very great, equal to that of the white and pure sulphate such as we had before.” Kirk performed the autopsy and made the following interesting observation (one of the earliest references to what we now know as blackwater fever): “In many cases we see the kidneys run off fluid like blood. This is a safety valve and a means of clearing out the poison. . . .”

Clearly Kirk and Livingstone were patient and careful observers of the malaria and, having once discontinued the use of prophylactic quinine, they were quite ready to start it again should they find a reason to do so. Their minds were not closed to change. “The experiment of preventing the disease by the daily use of quinine was tried formerly in this ship with the pure sulphate. Now we have begun it with the impure. It was commenced in the morning of the 17th, there being only about ½ oz. of the pure left.”

As soon as they managed to leave the sandbank Livingstone hastened down the Shire river to where the Ruo joined it to keep his appointment with the Bishop. But as he was not there he pushed on to the Kongone mouth to await H.M.S. Gorgon. Here he picked up his wife the who had come out to join them, as well as some ladies for the mission station. He loaded the Pioneer with the Lady Nyasa, which he was to take to the lake. The ship with her heavy load struggled against the strong current of the Zambesi as far as Shupanga, where Livingstone was forced to change his plans. He sent Kirk with Commander Wilson and Dr. Ramsay in the gig to guide the mission party to Magomero. In the meantime the mission was to suffer a succession of blows which were to lead to its closure. The rains had begun. Poor food and malaria both contributed to the fierce outbreak of gastro-enteritis and dysentery which struck all the inmates of the mission, the effect being particularly severe on the African children. Rev. Rowley wrote: “The place is condemned, and it is only a question of convenience as to when we shall move from it. . . . We cannot enter it now without feeling that we have been robbed of vitality and without finding our physical powers reduced to the lowest ebb. I only hope it will not prove another Lineyanti.” Despite all this sickness, the Bishop with Burrup left on 3rd January for Chibisa and Ruo, never doubting that David Livingstone would wait for him at the appointed time and that supplies would be there. The women and children were dying in large numbers and now tropical ulcer, the inevitable sign of malnutrition, had made its customary appearance. The Bishop’s journey to the Ruo junction was one of continuous exposure to the elements. Heavy rains hampered the walk.

On 8th January His Lordship and Burrup reached Chibisa, procured a canoe and set off for Malo, the island in the Ruo mouth where they were to meet Livingstone. All down the river they were plagued by myriads of mosquitoes and on 10th January arrived at a spot where they hoped to snatch a night’s rest, but finding the place infested with mosquitoes, it was suggested that the Bishop continue further down the river to another village. They moved off in the gathering darkness, and upon entering a side current the canoe overturned and all their possessions were lost, including their food and, worst of all, their medical supplies. They had to spend the night on the nearest bank, but they managed to reach Malo, and to their horror on arriving they learned that David Livingstone, not finding the Bishop there, had left four days before. The Bishop, greatly disappointed, decided to wait on the island for the return of the Pioneer. He managed to find a hut and food, but he missed the quinine. On 16th January he seemed to be fit enough, although he expressed fears about the absence of the fever remedy. “I am myself, thank God, in almost perfect health, and only regret on my account the loss of the little packet of
drugs, inasmuch as I shall probably have a touch of fever soon for want of quinine."

As the incubation period of malaria is 10 days, the Bishop must have been infected after he left Chibisa. They realised there was little hope if they remained on the island without care and medicines, but when the fever came it was too late to leave. The Bishop was struck down, rapidly lost strength and soon could scarcely move from the hut. On 24th January he became delirious, passed into a comatose state and died on 31st January of cerebral malaria. Burrup decided to return to Magomero and reached Chibisa completely exhausted. The Makololo constructed a litter and carried him the rest of the way. He arrived back a complete wreck. Dickinson cared for him, but his condition deteriorated, and a few days later he died on 21st February, 1862. The missionaries, completely disheartened by the loss of their Bishop, decided to move to Chibisa at a spot just above the river bank, fondly imagining that it would be healthier than Magomero. By 6th May they were settled at Chibisa. Little did they realise that they had selected a far worse place than Magomero, for the river was a hotbed of fever. The heat in the valley was almost unbearable. Mr. Hawkins was soon repatriated to the Cape on account of ill health, but he returned to England, only to die there of fever.

Livingstone at once realised that his plans for settling the mission in the Highlands would come under strong criticism on the grounds of its unhealthiness. He failed to understand why it was that his men had fared much better than the missionaries. He wrote to Lord John Russell on 15th March after the Bishop’s and Burrup’s deaths. "We cure the fever so readily that they could not realise the danger of the climate, and warnings were thrown away when it was found that Mr. Burrup managed to come up unscathed through all the marshes of the Shire in a common country canoe."

The Bishop had always been contemptuous of the fever, being of a strong constitution himself, but he was inclined to treat it too lightly. One blow after another befell Livingstone. They appeared to come from all sides. His wife Mary was now to be carried off by malaria. On 11th April the Pioneer set sail for Shupanga. Mrs. Livingstone had been suffering from short bouts of fever lasting but a few hours each time. Kirk, however, thought that life on the ship was not agreeing with her.

Events are liable to take a sudden turn in anyone harbouring the malarial germ. One can never predict when an apparently innocent attack may assume a fulminating form. She took a sudden turn for the worse on board the ship and it was imperative that she be removed to a house in Shupanga, where she gently passed into a comatose state. She could not take the quinine by mouth, and blisters, applied, would not rise. Her coma steadily deepened. Livingstone blamed the lowland, with its delta fever, for her death. It is a pity that intramuscular quinine was not available on the expedition (it was introduced in the 50’s), for had this form of quinine been available she might well have lived.

Livingstone did not give up, but the succession of catastrophies was leading up to the recall of his expedition. He was not to be daunted in his resolve to prove that the lands he had come across by the grace of God should not be vacated. By 13th June the Lady Nyasa was ready for launching, but there was still no chance of entering the Shire for some months yet, as the river was too low at this time of the year. They must perforce wait till December. However, one by one his crew was breaking down with fever and dysentery. He wrote on 21st June, 1862, to his friend, Thomas Maclear, Astronomer Royal at the Cape: "We never had so much fever and dysentery as we have suffered by our detention in the lowlands." He continues: ". . . and I had on the average a fresh case every day during a month. It was cured quickly, but back it came to the same patient repeatedly. Five or seven white men were sometimes down at once." His wife was the only fatal case. The engineer, however, was very ill with jaundice. "We have had no other fatal case, but trying to get rid of the fever in the Delta is like trying to cure fever in the low overcrowded lodging houses in London or in houses with open cesspools beneath; but we could not leave and cannot now until we meet a man-of-war with provisions."

It was necessary for Livingstone to replenish his stores and, finding himself with time on his hands and ever spurred on by his obsession make-up, he decided to revisit the Rovuma river. He reached it on 29th September much against Kirk’s better judgment, as all the crew knew from before that the river was not navigable. Needless to say, he took the ship up, but soon had to retrace his steps on 17th October, 1862. The final blow came with the complete collapse of the mission at Chibisa. Bishop Tozer
arrived in 1863 to try to save the mission by establishing it in a healthier place or to withdraw it altogether from the country.

Dr. Dickinson was so badly affected by malaria that it was decided that he should return as soon as possible to England. But then came the drought which practically cut off the mission from all sources of food. So great was the scarcity that the missionaries were obliged to go in search of maize in this trying climate. One death followed the other. First the Rev. Scudamore died from fever on 14th January, 1863. Thus in a year the mission had lost Bishop Mackenzie, Burrrup and Scudamore. In March that year (1863) Dickinson passed away from malaria. Clarke nearly died from it and was saved by the measures Dr. Kirk took, who happened to be there at the time. Whilst Dickinson was so critically ill, the Rev. Rowley and Thornton, a geologist, who had come back to rejoin the Livingstone expedition, left the mission to cut across the country to procure some fresh meat for him. They managed to bring back some sheep and goats, but Thornton himself succumbed to malaria on 1st April, 1863.

The fate of the mission was sealed, although a new Bishop was on his way out. David Livingstone had much to say about the “mistake” of moving from Magomero to the hills of the low-lying Shire Valley. Bishop Tozer reached the coast in May, 1863, and with him came the news that the British Government, shocked at the high mortality of the missionaries and of the ill health among the crew of the expedition, had ordered the recall of Livingstone and the Pioneer. Livingstone finally left Mozambique on 16th April, 1864, on his return to England.

Table XVII

Mortality Figures for U.M.C.A. Mission to Nyasaland from 30th January, 1861, to 6th August, 1863

<table>
<thead>
<tr>
<th>European</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number attached to mission</td>
<td>12</td>
</tr>
<tr>
<td>(Seven from 30th January, 1861; three from 17th August, 1861.)</td>
<td></td>
</tr>
<tr>
<td>Number repatriated</td>
<td>2</td>
</tr>
<tr>
<td>(Rev. Hawkins was repatriated, but died later of fever in England.)</td>
<td></td>
</tr>
<tr>
<td>Number who died of malaria</td>
<td>5</td>
</tr>
<tr>
<td>(Bishop Mackenzie, Scudamore, Burrrup, Dickinson, Hawkins.)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coloured</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Coloureds attached to mission</td>
<td>4</td>
</tr>
<tr>
<td>Number who were repatriated</td>
<td>3</td>
</tr>
<tr>
<td>Number who died</td>
<td>0</td>
</tr>
</tbody>
</table>

Although his expedition had spent so many years in this very unhealthy part, loss of life was very small. In the Ma-Robert from 1858 to 1860 there were no deaths amongst the seven Europeans.

Table XVIII

Mortality from Malaria in Livingstone’s Zambesi Expedition (May, 1858, to January, 1861, on the “Ma-Robert”—Approximately 20 Months

| Number of Europeans on the expedition | 10 |
| Number who left the expedition (one because of malaria) | 3 |
| Number who died from malaria | 0 |

On the Pioneer only three out of 18 died (16.67 per cent.). Dr. Charles Meller, who came out on the Pioneer, felt that the prophylactic quinine helped tremendously. Even if a person had an attack of fever, it was greatly mitigated by the quinine. Both he and Livingstone noticed that the fever seemed to come when there were myriads of mosquitoes, and Meller suggested using a net. He did not realise how near he was to knowing the cause of the disease.

Table XIX

Mortality Figures on the Livingstone Expedition to the Zambesi of People on Board the “Pioneer” from February, 1861, to October, 1862

| Number of Europeans (crew 18) | 23 |
| Number of deaths | 2 |
| (One carpenter, Ferger; Mrs. David Livingstone.) | |

Table XX

Mortality Figures on the Livingstone Expedition to the Zambesi (and Shire) on Board the “Pioneer” from 1st November, 1862, to 30th June, 1863

| Number of European crew | 18 |
| Number who died of fever | 2 |
| Number invalided | 1 |

Comments on the Zambesi Expedition (11th May, 1858, to 16th April, 1864)

Livingstone as well as Dr. John Kirk and Dr. Charles Meller (who had come out in 1861 to replace Kirk when his contract of service on the expedition was drawing to a close) appreciated the value of quinine, even though it was not realised that it was not the whole

1 Gelfand, M. (1957), Livingstone the Doctor, His Life and Travels. Oxford, Blackwell. (All quotations on the 1858 Zambesi Expedition have been taken from this study.)
answer. Indeed, both Kirk and Meller considered the treatment of malaria not as simple as Livingstone had alleged. They had seen what was later to be called blackwater fever and were also now aware of the dysenteric form of malaria. However, Meller and Kirk both supported the prompt administration of quinine in the form of the “Livingstone Pill,” followed an hour later by 5 to 10 gr. doses of quinine every two to three hours until deafness was induced. In other words, Livingstone was correct. They all recognised the importance of prompt and energetic doses of quinine in the fever. David Livingstone always advanced as one of the reasons for the white man being able to live well in Central Africa the fact that the Portuguese managed for over 300 years to hold on to their possessions in Africa. The truth of the matter was that the Portuguese relied mainly on the cinchona bark. They were great supporters of the treatment, just as Livingstone advocated the early administration of quinine. Another factor which probably helped the Portuguese was the introduction of brick houses at the coast. The European type of house tends to drive off the mosquito in contrast to the pole and dagga huts.

Although Meller noticed a variety of forms of malaria, some being more serious than others, he did not basically alter the Livingstone regime, if at all. Meller spoke of the sthenic form of malaria which responds well to the Livingstone method, as well as the ephemeral type, which is merely a milder variety of the sthenic form. But he observed that the asthenic type was particularly serious, and this we recognise to-day as being a dangerous form of malaria which requires intravenous drip therapy in addition to the antimalarial drug employed. Meller also referred to the jaundiced case (hepatic form) for which quinine was also the only answer.

The medical men in the expedition were not enthusiastic about quinine as an effective prophylactic agent. But on the whole they must have had some leaning towards its use, as it was withdrawn after a year or so in the river; but later, when the Pioneer was ploughing its way through the unhealthy lower Shire and Zambesi, it was re-introduced. Meller came to the conclusion that quinine could not be depended upon to avoid attacks, as every morning for a year he had taken a dose of 3 gr. in a little wine or rum, but he still experienced attacks of fever. He noticed, however, that when men who were taking the drug regularly fell ill with the fever, 10 to 30 gr. at the first indication of an attack would control the paroxysm very quickly, whereas in those who were not taking the prophylactic drug the attack was more severe. It is more than likely that a daily dose of 3 gr. was somewhat on the low side, and had 5 gr. been taken regularly it is quite likely that the response would have been far better. Indeed, Meller in his report mentions that the Royal Navy were then using 8 gr. each day.

David Livingstone and his team were all well aware that the Africans possessed an almost perfect immunity to the fever. Finally, Meller was at variance with Livingstone over his alleged favourable remarks on the healthy Highlands. Meller maintained that even if this were so it was impossible for the European to remain in these more elevated parts for long, as they had to come down regularly to the coast to replenish their stocks. In any case, the U.M.C.A. missionaries fared very badly in this environment. Meller, however, was quite adamant in his report that the fever of Central Africa was as virulent as is found anywhere else in Africa.

Although Bryson’s experiences and the Baikie expedition had proved the efficacy of quinine, there was still a certain amount of opposition to its use. Gradually even this was overcome, but as long as the noxious vapour hypothesis was accepted there could be no progress. The next event of great importance to our knowledge of the disease was the discovery on 6th November, 1880, of the causative protozoon in the blood by Alphonse Laveran, who was working in Algeria as a military surgeon. Whilst examining the blood of a malarial patient he found pigment present in cyst-like bodies within the red blood corpuscles. Later, on 6th November, 1880, he observed long flagella being extruded from one of these hyaline bodies. He then visited Rome, where he demonstrated his findings, but his work was not accepted until 1884, when the great Italian malariologist, Marchiafava, also observed the parasite in the blood of a malarial patient. This was called plasmodium, and in 1889 the tertian, quartan and malignant types were differentiated.

The next step forward was the discovery of the vector of the disease. As a result of this work was started in 1876 by Sir Patrick Man-

1 Meller, Charles J. (1864). On the Fever of East and Central Africa encountered by Livingstone’s Zam- 
son, often referred to as the Father of Tropical Medicine, who demonstrated that the embryos of \textit{W. bancrofti} were imbibed by the culex mosquito and developed inside it. It was later shown, as a result of Theobald Smith's researches on redwater fever in cattle, that the same insect thereupon bites man and the cycle is repeated. Manson suggested to Ronald Ross, a doctor in the Indian Medical Service, that malaria might be transmitted in the same way. He was struck by the flagella of Laveran, which he believed must have an extracorporeal existence. Ross was on leave in England at the time (1894) and Manson showed him the parasite Laveran had found in the blood. This fired his enthusiasm, and when he returned to India the following year Ross started work on the mosquito. On 21st August, 1897, he discovered the oocyst in the outer stomach wall of the mosquito and the next year (1898) was able to report the complete cycle of these hyaline bodies of transmission by infecting birds with avian parasites. He allowed the culex mosquito to feed on infected birds and thereupon detected cells packed with sporozoites in its salivary gland. By feeding these infected mosquitoes on healthy birds he was able to induce malaria in them. Now that the causative agent was known, effective methods of destroying them could be found.\footnote{Singer, C. & Ashworth Underwood, E. (1962), \textit{A Short History of Medicine}. London, Clarendon Press.}

New developments in the treatment of the disease also followed. With the political strife in Europe and the coming of the First World War it became all the more pressing that a quinine substitute be found, more especially in the field of prophylaxis. Before 1914 it was fairly well established that quinine was effective against the asexual forms of \textit{P. falciparum}, \textit{P. vivax} and \textit{P. malariae}, but not against their gametocytes. Therefore clearly what was wanted was a drug which would also remove the sexual forms. Confidence in quinine was shaken somewhat by the First World War; and with Germany threatened with isolation in Europe in the event of a major conflict and unable to obtain supplies of quinine for her campaigns to be waged in malarious countries, her scientists set about in earnest to discover a synthetic substitute.

As early as 1891 Guttmann and Erhlich had experimented with methylene blue which was used to stain the plasmodia which took it up. So they tried it out on two patients. whose fever dropped after this treatment and the plasmodia disappeared from the blood. But this observation seemed to have been forgotten until after the First World War, when Schulemann used it as a starting point in his endeavour to find a new antimalarial. This led firstly to an amino-compound of methylene blue and that to quinoline compound containing nitrogen atoms in an aliphatic side chain, and finally to Plasmoquin, the first synthetic major antimalarial. It was tried out in Hamburg in August, 1925, where it stopped febrile attacks. It proved more effective against the gametocytes than quinine and was used in combination with quinine for relapses. But there was still need for a synthetic drug which would act on the schizonts of \textit{P. falciparum}, and quinine was still superior to Plasmoquin in this respect. The next step was to substitute an acridine ring for the quinoline ring and then introduce a chlorine atom and methoxyl group into the ring. This produced the compound atebri (9-amino-acridine), a less toxic drug and certainly a major advance. Although ineffective against the gametocytes in \textit{P. falciparum}, it is very successful against the ring (asexual) forms and is thus a useful drug. It also proved a valuable preventive agent in the Second World War taken daily in small amounts. Thereafter an even more effective group of drugs than Atebrin was rapidly evolved. The two available drugs constituting this 1-amino-quinoline group are Chloroquine and Amodiaquine; they are both excellent and have complete prophylactic action against vivax, malariae, quartan and ovale and are free of toxic effects. Chloroquine and Amodiaquine (Camoquin) are rapidly absorbed and slowly metabolised and secreted so that efficient concentration can be kept up in the plasma for a week. Their action is against the asexual parasites when they are liberated from the primary exoerythrocytic parasites. They are good suppressant drugs and excellent schizonticides and descendants of Plasmochin. A further two valuable drugs are the biguanides and pyrimethamine. Both act on the malaria parasite by inhibiting nuclear division. Proguanil (biguanide) is rapidly absorbed and excreted with no prolonged accumulation in the blood or tissues, and its main action is on the primary exoerythrocytes. It is successful given daily. Pyrimethamine (Daraprim) is a more simple compound than Proguanil and has a similar action on the exoerythrocytic forms, but its elimination is slow and therefore it can be used once a week with a 25 mg. dose as the basis. The nature of its action is not
certain, but it may destroy the merozoites liberated from primary exoerythrocytic forms or may act against these forms. It is certainly a very good prophylactic, highly effective against *Plasmodium* malaria, a reliable suppressant and cheaper than the others. It was discovered by George Hitching, of the Burroughs Wellcome Laboratories.  

To complete the picture, great advances in malaria control came with the introduction of effective insecticides. When the scientific world accepted that the mosquito was the agent in the transmission of malaria it seemed as if all that had to be done was to eliminate the insect from the regions it frequented. Despite much thought and research and much devoted and excellent service by scientists, the task proved too difficult until fairly recently, when the residual insecticides became known. Side by side with these tremendous strides in mosquito eradication went the other important measure of drug prophylaxis, by means of which the individual is protected when the parasite injected through the bite of a mosquito into his body is destroyed effectively at an early stage of its development. Furthermore, those public health measures such as correct drainage, the spraying of collections of water with oil larvicides and the gauzing of houses could also be used with advantage. The introduction of the newer insecticides and the drug prophylactics have completely altered the prospects of life in the tropics, and recent comers to Central Africa must find it hard to believe that tropical Africa carried so much risk, just as it must be for anyone to believe that Europe was once so greatly affected by malaria.  

Many kinds of insecticides have been employed since 1898 to destroy the mosquito. Some owe their efficacy to a chemical action (e.g., chlorinated hydrocarbons, organic phosphorus insecticide and pyrethrum flowers). Others again are effective (1) through their ingestion or inhalation by the insect, e.g., ingestion through the mouth—Paris Green by the anopheline larvae; and (2) by inhalation through the trachea, e.g., benzine hexachloride (B.H.C.) or organic phosphorus insecticides  

act by inhalation or, as it is generally held, by fumigant action. Yet a third and most important method of action is by contact by the chemical penetrating the external body surfaces or cuticle of the insect, thereby poisoning the nervous system. The two best examples are dichloro-diphenyl-trichlorethane (D.D.T.) and B.H.C. Both D.D.T. and B.H.C. are mainly contact insecticides, although B.H.C. also kills by fumigant action. 

D.D.T. was first synthesised in 1874 by a German chemist, Zeidler, who described the synthesis in his thesis, never imagining that some 65 years later it would revolutionise malaria control. It was only in 1939 that Paul Müller in the Geigy laboratories in Basle, after screening a series of products with a view to finding which had a suitable insecticidal action, found that Zeidler's chemical, D.D.T., fulfilled this requirement. Its first trials took place during the Second World War. 

B.H.C. was synthesised much earlier than D.D.T. by Faraday in 1825, and its insecticidal activity was discovered six years before that of D.D.T. in the U.S.A. It is easily prepared by the chlorination of benzene in the presence of ultraviolet light. Soon after the Second World War many countries were able to produce it before they could be equipped to manufacture D.D.T. It is a most effective residual insecticide when applied to the places the mosquitoes are likely to inhabit. It is capable of killing 80 per cent. of *A. gambiae* six months after spraying and was used during the building of the Kariba dam, as it is highly absorbable by mud walls. 

**Lake Kariba**

All these advances mean that we are able to introduce effective antimalarial measures, both preventive and curative, and can open up the more obscure tropical parts of the continent with little fear of the once-dreaded “scourage of Africa.” The construction of the Kariba dam is an excellent example of what can be done with the help of modern medicine. The Zambesi valley is at an altitude of 1,300 feet above sea level, is tropical and was remote from established communities and services. The Kariba dam was started in June, 1956, and virtually completed before the beginning of 1960. The health services of this major undertaking, which was estimated to cost 80 million pounds, were so well carried out that not once in the progress of the scheme was work held up or even embarrassed by preventable disease.

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On 1st February, 1956, Dr. M. H. Webster was seconded from the Federal Health Service to the Federal Power Board for full-time supervision of the medical and health arrangements until 11th May, 1957, when he was succeeded by Col. H. I. Smithwick. The health problems with which he was faced were influenced by the topographical and meteorological features of the site, the nature of the undertaking, the rapid importation of enormous numbers of African workers from many parts of Central Africa and of very many Europeans who could be expected to have little or no immunity to the specific disease risks likely to be encountered and, in fact, no experience of tropical illness whatsoever.

After following a fairly sluggish meandering course for 130 miles from Devil’s Gorge across a flat alluvial plain, at Kariba the Zambesi suddenly accelerates up to 12 knots even in the dry season and plunges into a deep gorge formed by the jutting out escarpments from the north and south. It thus produces a deep, narrow, treacherous channel running for 14 miles. Just before its entrance to the gorge it is joined by the confluence of the Sanyati and Naodsa rivers, both with many tributaries and large catchments, thus adding substantially to the mighty waters of the Zambesi. These rivers thus produced conditions ideal for the breeding of mosquitoes, and the evergreen bush that flourished there provided a magnificent dry weather habitat for tsetse fly. The rocky hills seemed a formidable obstacle to the development of a township and more especially of sanitation services. But for the health and comfort of the workmen living-quarters had to be on high ground to avoid the fly and mosquito lower down and to catch the breeze and alleviate the heat.

Meteorological records for the Kariba gorge were scanty in 1953, but some indication of what could be expected was obtained from the records kept at Chirundu, where maximum temperatures of 113° F. and relative humidities of 75-80 per cent, had frequently been observed in October and November. Recording stations were needed at all important points to assess the probable effects on the work and comfort of the men. Temperature records were kept throughout the course of work at two of the most important sites—the working area and the
housing one. These demonstrated the extremes of temperature encountered on the working site and the considerable modifying effect produced by an altitude difference of 1,400 feet on both high and low extremes. The temperature difference of 3° at the higher altitude combined with the cooling effects of air movement there made it worth while siting the living quarters on the high ground in spite of the difficulties of building a township on precipitous rocky slopes where the risk from mosquitoes was reduced. The records of the relative humidity and wet bulb temperature readings demonstrated that high humidity did not coincide with periods of extreme heat and, further, never approached dangerous levels in the open (Webster, 1960). From the beginning all workers were educated into the dangers of heat stroke, heat exhaustion, imbibing large quantities of fluid and salt, fatigue and excessive consumption of alcohol. Employers were urged to allow all their workers a period of acclimatisation before starting heavy work.

More important perhaps than the dangers of heat stroke were the favourable conditions for vectors of tropical diseases induced by the heat and humidity. Unless action was taken, the abundance of anopheline mosquitoes, tsetse fly and house fly would be a serious menace to the project. A malarial survey in the area showed a spleen rate of 80 per cent. and a parasite rate in excess of 30 per cent, in the local inhabitants. *A. gambiae* was breeding prolifically in the rocky and sandy pools of the Sanyati and Naodsa rivers and *A. funestus* was present in other reaches of these rivers, and at Kariba the same conditions existed. Hundreds of highly susceptible white men and thousands of Africans were employed.

As a first measure the Board appointed its first medical officer as malarial control officer, and with a gang of Africans he set to work spraying all interior wall surfaces of all European and African dwellings with benzene hexachloride (B.H.C.). This insecticide was used exclusively during the first two years of the project for all types of dwellings. Even the temporary polymorphic structures were treated, and throughout the project residual spraying was carried out three times a year over the whole area and constant watch was kept on all compounds and camps. Unauthorised ones were ruthlessly destroyed. In order to establish malaria control as quickly as possible, and before the arrival of enormous numbers of workers, it was considered advisable to augment the effects of the spraying programme by a direct attack on breeding places. For this they used High Spread Malariol (Shell) on selected rock pools and breeding places. This was done once only in order to establish control and it was shown to be effective by the results of mosquito counts at catching stations, so there was no need for the wholesale use of larvicides. After this initial clearing of pools this method could be discontinued and reliance placed on house spraying, regular checks and prophylactic antimalarials.

It was compulsory for all workers to take the prophylactic drug with which they were provided. Webster was as insistent at Kariba as Gorgas was at Panama in 1904. In the beginning, 0.4 g. Camoquin weekly was recommended for Europeans and 100 mg. Mepacrin for Africans; but for administrative and economic reasons pyrimethamine (Daraprim) was substituted, the dose being 25 mg. each per week. Sunday was Daraprim day for the majority of Europeans, and the Africans received theirs whilst queueing for their meat ration (which of course they never missed, so could not avoid taking the drug). There was a little difficulty amongst the Europeans of those territories who considered themselves "immune." All windows of the houses of the European township were screened, partly as a protection from mosquitoes and partly to keep out the millions of other insects. As a result of all these measures malaria played a very small part in causing disability or death amongst the workers and their families. During the first two years of the scheme not one death from malaria occurred amongst European families living on the site. But there were two deaths from cerebral malaria amongst European operators which need not have occurred. Both men were living in temporary camps outside the controlled area, and according to their companions both neglected to take a prophylactic drug. The severity with which the fever attacked these two men was grim evidence of the fate that might very well have befallen the whole population of Kariba had it been there in the days before residual insecticides and prophylactics were available. Nearly all European cases of malaria gave a history of irregular prophylaxis or of night-time fishing or hunting outside the controlled area.

The notified cases of malaria among Africans included many that were discovered within
a short time of their arrival at a routine medical
examination, which included the examination of a blood film. Some of them were symptom-
less, but in others there appeared to be an
exacerbation of latent malaria in persons re-
cruited from hyperendemic areas, probably due
to the long tiring journey, sudden change of
environment and unaccustomed physical exer-
tion.¹

Table XVI

Mortality from Malaria at Kariba
(1956-59)

(From M. H. Webster, 1960)

A. Europeans—
Number of Europeans who died ....... 33
Number of deaths from malaria ....... 2
Number of deaths from accidents ....... 22

B. Non-Europeans—
Number of non-Europeans who died ....... 240
Number of deaths from malaria ....... 4

In January, 1956, there were 132 Europeans and
2,787 non-Europeans living at Kariba. In January,
1957, there were 1,511 Europeans and 7,613 non-
Europeans living at Kariba.

Concluding Thoughts

But the medical story of Africa is not only
that of malaria. We can think of many other
diseases no less important and giving rise to
many problems that still have to be solved. I
hope that this evening I have given you some
idea of the scope of the Chair I occupy by
showing you how fortunate it is that man has
learnt to cope with this disease.

Every story has a moral, and the one I have
told has several. Firstly, it shows that when
man is faced with a sufficiently pressing prob-
lem he can find a solution, and that sometimes
the answer may come through one who does not
seem qualified to give it. For instance, the
Jesuits realised how much the bark was needed
and brought it to Europe. Again, when Ger-
m any was threatened with a shortage of quinine
her chemists set to work and discovered other
methods of prevention and treatment of malaria
far superior to that known before. My story
shows how lay people took health matters into
their own hands and how the medical profession
was so indoctrinated with their ancient methods,
and so resistant to change from the much out-
dated practices of Galen, that they woefully
lagged behind, out of contact with reality. We
see how the Portuguese laymen on the coast
urged members of our profession to treat with
the bark, but they were so conservative that
they persisted in blood-letting.

We can learn another lesson from Ronald
Ross’s discovery in 1897 that the anopholene
mosquito is the vector of malaria. He was a
doctor with simple qualifications and no scien-
tific background, yet, in spite of discouragement
from his own department, he was inspired by
Sir Patrick Manson and carried out his out-
standing research, probably unequalled by
anyone in the tropical field. Laveran was an
army surgeon, yet he discovered the malaria
parasite in the human blood.

Often paid research is not the most inspired.
Each type has its place in the medical world,
and while we are keen to do our share in the
new medical school, we should at the same
time not frown on the amateur, but encourage
men such as government medical officers and
others who have the opportunity and interest

In Africa it is a mistake to think of medicine
in terms of individual territories. Instead, we
should consider our problems as part of those
of the whole continent. Perhaps we are apt to
remember the difference in pattern in Rhodesia
rather than to consider the whole picture which
occurs in every part of tropical Africa.

When I think of the courage of the men who
tried to open up this continent and of the
pressures that influenced them to attempt it, as
well as the risks they ran, I cannot help but
be impressed by the fact that, although they
were interested in trade, their main motive was
to eliminate the slave trade and plant people
in this strange clime to bring what they con-
sidered a better way of life to the African.
Of course, it may be argued that the African’s
way of life is superior to that of the white man.
Be that as it may, there is no doubt about the
sincerity of the U.M.C.A. missionaries, for
example, or those who perished at Linyanti.
On the whole it was fortunate that the British
people came out to this continent. I am im-
pressed by the courage of the men in the various
expeditions. Tuckey, M’William, Mungo Park
and David Livingstone were all men of quality,
all volunteered for service in Africa, all were
dedicated and all wished to bring a new way
of life to the people here. Although to-day we
may find fault with their methods and ideas,
yet the service they tried to render to Africa
will be greatly appreciated by African people
themselves in time to come. This wish to serve

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the people of this continent is still with us. Is there any basic difference in the ideals held by the men who tried to set up an agricultural settlement for the African at Stirling Hill on the Niger in 1841 and those who have come out from Britain about 120 years later to teach them at Mount Pleasant? The same spirit breathes.

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