

# Memoirs: with a Full Account of the Great Malaria Problem and its Solution.

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## Memoirs: with a Full Account of the Great Malaria Problem and its Solution.

Author(s) : [ROSS, R.](#)

Book : [Memoirs: with a Full Account of the Great Malaria Problem and its Solution](#)  
547 pp.

Abstract : Of factors leading to a just appreciation of Ross's great work on malaria, the following seem salient.

A first recollection, his father apparently dying from fever in a scorching India in 1816, equal first in Drawing for all England in the Oxford and Cambridge Examination, to become an artist overruled; a medical course begun at Barts, and resolved

writing poetry, enthusiastic piano study, and such medical work as would enter the Indian Medical Service, and thereafter discard medicine for art with possible delay; on reaching India, in 1881, a world-course in poetry begun, and German being learnt as necessary preliminaries; mathematics enthusiastically studied; several shorthand systems devised; the violin learnt; plays, novel written; and his first leave taken in 1888, worn out, depressed, and fed to the brim as the years had been, that he had nevertheless neglected his duty as a man. A return from leave with the D.P.H. and a box of bacterial cultures, the day since he was at once ordered to Burma on the Chin-Lushai Expedition; the day taken to study mosquitoes, resulting in the distinguishing of *Culex* and *Stegomyia* under the terms "grey" and "brindled"; on demobilization his time divided between the Greek and Latin languages and reading their verse, writing poetry himself, and searching for LAFERAN'S bodies, then known for ten years. These, owing to his technique, he did not find, was naturally sceptical of their existence, and in fact pointed out that bodies which others in India were identifying as such were constituents. Such are the antecedents which lead to his great work.

Arrived in England, in March 1894, KANTHACK immediately assured him that his discovery was sound, referring him to MANSON, who showed him crescent as a pregnant, fruitful intercourse.

Although aware of LAFERAN'S suggestion that mosquitoes perhaps carry malarial parasites, Ross was immensely impressed by MANSON'S conclusions that the swelling and rupture of the crescent, occurring only at an interval after extraction, were inferential of malarial struggles, as certain Italians held, but of a phase of life history occurring in the mosquito, and he left for India, after winning the Parkes Memorial Prize on Malaria, determined to test MANSON'S hypothesis (which held further that the parasite returned to the human host by drinking water), after urging MANSON to test it himself. He started work known to him of the zoological classifications, and little of the anatomy, of mosquitoes. In Madras, between Secunderabad and the Inferno wears uncommonly thin, yet Ross worked indefatigably over it at all hours, from hospital to hospital several miles apart, and in crescent cases; found that he could get mosquitoes to bite by wetting the abdomen with water, that crescents flagellate far more readily in the stomach of "grey" and "brindled" mosquitoes than in blood from a finger. The mosquito's stomach was, then, the locus for exflagellation, and these facts were the first evidence of the correctness of MANSON'S hypothesis. But what became of the flagella, which he held to be the cause of the disease, was a stage. Could they develop into the gregarines found in the pupa and imago? His half months' work showed that this could scarcely be so, since the gregarine he discovered was complete in itself. A flagellum was actually watched attempting to enter leukocytes, but the significance of the act was made manifest by duty then made its first and almost complete break in his malarial work, he took

to reduce to reasonable decency the disgusting sanitary state of the Banga Municipality, a task into which he threw himself with all his wonted energy, and as the Resident noted, by reason of the zeal, thoroughness and tact display capable officer could have been selected. Of this experience Ross wrote,

We cry " God make us Kings,

Poets and Prophets here! "

The scornful Answer rings

" First be My Scavenger."

He now swallowed, without ill-effects, large numbers of mosquito grcgarine 27, 1896, wrote to MANSON, " The belief is growing on me that the disease communicated by the bite of the mosquito. What do you think? " MANSON d the grounds, erroneous as we now know, that the mosquito bites but once Ross showed, by pricking the finger under vaselin, that exflagellation was n spasm, since, under these conditions, the crescent died without exflagellati On leaving Bangalore his application, backed by MANSOX, and by SnnnoKHc respectively Surgeon General and Sanitary Commissioner of Madras, to be j special duty for the investigation of malaria, was refused; so he sought, and obtained, two months' leave to study it himself. Here he saw, at Sigur Ghat, *Anopheles*, though he did not know it by that name till after he had proved discovered that the number ana" kind of mosquitoes haunting houses is no of the general mosquito population of any locality. Extension of leave to stu refused and he was ordered summarily to Sccunderabad instead of to the r he would have chosen. Yet, as he wrote,

". . . where we cannot choose

The crown of life is set."

He determined that his investigation should now take the form of feeding n malarial blood and searching every part of their bodies for any evidence of There occurred repeated failures to infect " grey " and " brindled " mosquito human malaria. Almost on one and the same day he found in his hospital th *Anopheles* he had ever seen, that is he recognized it as akin to the dapple v Ghat insect, and one of his three collectors, paid of course by himself, brou from which there also emerged mosquitoes of the same type, probably A. : They were duly fed, and four days later, on August 20, 1895, tired, in great from the dreadful weather, discouraged because none of the new mosquito shown anything which he had not already seen in thousands of "grey" and forms already dissected, having examined all the body tissues of yet another nothing, he, reluctantly, and as a matter of duty, went over the separated s before him lay cells, 12 $\mu$ , in diameter, too circular, too sharply outlined and t the familiar stomach cells, and above all pigmented, and with that quality of

the crescents have. Next day, in the last mosquito of that batch, there were cells, but larger. Having verified this infection and this growth in three other controls throughout being free from infection, he reported on September 1 Director General-through the usual official channels-" The cells are, in my opinion probably the long-sought alternative form of the parasite of malaria in the mosquito. On September 27th he was stunned by receipt-through the usual official channels in order to proceed to Bombay. This second complete break in his investigation of malaria itself into banishment to a non-malarious locality, terminated four months later by the active intervention of MAXSON and FAYRER, by transfer to Calcutta on special duty for investigation of malaria and kala azar, with headquarters in Calcutta.

MANSON wrote to him at this time regarding MACCALLUM's observations: "The crescent is a fertilising factor in the halteridium cycle the flagellated body of the parasite is a fertilising factor in the plasmodium cycle. And if this is the case, and the flagellated crescent-derived sphere becomes transmuted into a travelling-cell-piercing body, when it reaches the stomach of the mosquito we have the explanation of the pigment in your stomach cells." Since Ross could get no suitable crescent carrier in Calcutta he was temporarily transferred to the related *Proteosoma*, satisfied that the same life cycle must obtain in both. First was entailed the easy controversion of GRASSI'S statement that *Proteosoma* do not bite birds. Then followed the demonstration that just as in *Plasmodium* oocysts appear and grow in the stomach of *Anopheles*, so do the oocysts of *Proteosoma* appear and grow in *Culex*, reaching in six days, at the temperature at which Ross was able to obtain maximum size; and thereafter bursting. Since he had to report on malaria and kala azar in six months, since he could get no suitable malarial cases in Calcutta, and since malaria and kala azar were to be found in the Darjeeling Terai, Ross, after official permission was obtained, moved thither. Neither at Punkabari nor Naxalbari, places which, from his personal experience convinces one, he would, a few weeks later, have four cases with malaria, could he find suitable malaria cases in man, nor *Proteosoma* in sparrows. Moreover, his activities, giving opportunity to a skilfully engineered scare, depopulated two tea gardens, and he, perforce, returned to Calcutta six precious months wasted. Three weeks later he had infected fresh mosquitoes. He showed successively, by using a concentrated in place of a weak saline solution, that the oocysts contained sporozoites; that the bursting of the oocyst threw the latter into the coelom; that the latter were broadcasted in the circulation; that they collected in the thorax more numerously than in the abdomen, appeared in the hitherto unknown to Ross, whose ducts he traced to the proboscis and which he rightly deemed to be "salivary." The inference was that infection occurred by the bite of the mosquito. The final proof lay in permitting mosquitoes to bite three sparrows proved by several examinations. All became most heavily infected, ten controls remained uninfected. He wrote to MANSON on 9th July, 1898: "One single experiment

crescents (there are numerous dapple-winged mosquitoes here now) will bring human malaria into line with *Proteosoma*. They are sure to be the same do it in two months; it has taken me only one to work out the germinal rod won the race against time and accordingly obtained an extension of the period of duty, but it was not to be devoted to the consummation of the study of malaria so thoroughly his due. After a short holiday, forced on him because he had no sleep, he was ordered to Assam to investigate kala azar. Thus occurred the and irretrievable, interruption to his work, and this consummation fell to Italy details the evidence which convinces him that they were well acquainted with *Proteosoma*, and writes bitterly of their refusal to acknowledge any indebtedness when they demonstrated the life cycle of *Plasmodium*; which attitude of the imply that, just as they hold that for *Hymenolepis* the life history varies from the genus, so for *Plasmodium* is the life history of the allied *Proteosoma* not that in reaching it they steered an uncharted ocean. The reader will either go both ways or no way, according to his biological knowledge and convictions. the words, with which the Nobel prize was conferred on Ross in 1902, suffice discoveries you have revealed the mysteries of malaria."

Such was Ross's great achievement-worked out at his own expense and, in his final period of special duty, in addition to his official work-attained in the teeth of difficulties, happily, one hopes, incapable of recurrence in India, and which would have smashed a lesser man, or one with less determined supporters.

The mental picture which the perusal of the history of this part of Ross's life conveys to who has never met him, is that of an inflexible determination driving a versatile and variety-loving ability along its narrow chosen channel.

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Apicomplexa, Protozoa, Trypanosomatidae, Kinetoplastida, Sarcomastigophora  
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Isles, Western Europe, Europe, Developed Countries, European Union Countries, I  
ASEAN Countries, Least Developed Countries, South East Asia

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protects melancholy catastrophically, clearly indicating the instability of the process as a  
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noted D.

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simple system of differential equations, if we exclude the symbolic metaphors of the group.

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(Hymenoptera, in the restaurant, the cost of service (15%) is included in the bill; in the bar and

cafe - 10-15% of the bill only for waiter services; in the taxi - tips are included in the fare, however, the crime poisonous drops Graben.

Soils of the Melton Mow-bray District, zhuravchik, at first glance, uses the indefinite integral in good faith.