philosophical of inquirers; and the material results of his own explorations give them a satisfying completeness, like the buried gold which should always reward the treasure-seeking hero of romance. One of the most exciting episodes in the volume, the exploration of the limestone cave on Dicte, the legendary birth-place of Zeus, affords an instance in point, and shows how unexpected may be the treasure that sometimes awaits the fortunate explorer. Having blasted a way into the cave through the fallen rock and boulders that blocked its entrance, a fortnight's careful search of the soil in the upper cave was rewarded by a certain number of votive offerings around an altar of burnt sacrifice. But it was at the end of the excavation, when it only remained to search the lower cave for objects that might have slipped down during the secret digging of the past few years, that the element of luck came in. The floor of the lower cave is covered with an icy pool which runs far into the hill about the bases of fantastic stalactite columns. Here, Mr. Hogarth tells us, he did not expect to find much spoil, since no native had ever found anything in the pool among the columns, except a few scraps of water-borne pottery from above. But with the true archaeologist's instinct of seeing for himself, Mr. Hogarth ordered a thorough search. Not much was found in the pool itself, but a zealous worker, wanting to put both hands to his work, happened to wedge his candle-end in the fluting of one of the stalactite columns, and by its light he perceived the green edge of a bronze blade in the slit. A further search was at once ordered:—

"Men and girls dispersed themselves along the dark aisles, and perching above the black waters on natural crockets of the pillars, peered into the flutings. They found at once—found blades, pins, tweezers, brooches, and here and there a votive axe, and in some niches as many as ten votive things together. Most were picked out easily enough by the slim fingers of the girls; but to possess ourselves of others, which the lights revealed, it was necessary to smash stalactite lips that had almost closed in long ages."

These were all votive objects, placed on the columns of that silent pool that formed the shrine of the god of Dicte. "As we saw those pillared aisles," Mr. Hogarth remarks, "so with little change had the last worshipper who offered a token to Zeus seen them three thousand years ago."

Another venture that was crowned with unexpected spoil was the excavation of the great Artemisium at Ephesus, when the resources of modern engineering had to be invoked to pump out the flooded excavation around the base of the "Great Altar" and the foundation-deposit. The illustrations to the volume, unlike those in so many modern works, really illustrate the text, and each fits naturally into the narrative. Of those we have chosen for reproduction, one shows the rigging of the great pump at Ephesus; another, representing a half-buried palm-forest at Baltim, well illustrates the constant eastward progression of the shifting sand-dunes which fringe the great flats of the Nile delta; the other, taken in the theatre of Aspendus in Pamphylia, forms a striking contrast to the Ephesus photograph, and shows the remarkable state of completeness in which a building of classical antiquity may be preserved. Of all Roman theatres this is perhaps the most perfectly preserved example.

The book contains several good stories, such as that of the young British subaltern who knew no word of Greek, but arrived on a polo pony "to be a father to some twenty Cretan villages," and whose judgments, delivered in knickerbockers and a cricket shirt, were worthy, in their practical aspects, of a Solomon. But we have already transgressed the space allotted to us,

and in any case we would not quote or summarise the many passages we have marked. We prefer to leave them unspoiled for the reader, to whom, whether he be of an archaeological bent or not, we warmly recommend the volume as excellent reading.

L. W. K.

ANTI-MALARIAL MEASURES IN INDIA.

A PERMANENT committee dealing with anti-malarial measures in India has been appointed by the Government of India. Its members are Lieut.-Col. Leslie (Sanitary Commissioner with the Government of India), Major James, I.M.S., Captain Christophers, I.M.S., and Lieut.-Col. Semple. Excluding the last-named, whose views on the matter have not yet been made public, the members of the committee, previous to their embodiment, allowed it to be understood that, in the light of the reputed failure of the Mean Mir "mosquito reduction" experiments of 1901-3, they hold any effort beyond quinine prophylaxis as rarely applicable to India. Indeed, they claim that conditions in that country are so different from those found in other parts of the world that further investigations—and not application of elsewhere approved anti-malarial measures—is the necessary rôle.

An earnest of this attitude is exhibited in the publication by it, under the auspices of the Government of India, of a brochure entitled "Paludism," which it is announced will appear at irregular intervals—as results from its labours become available. The editor (Major James) in describing the functions of the committee and its relation to Sanitary Departments and local bodies under provincial Governments, states that the conference on anti-malarial measures in India, held at Simla in 1909, "strongly supported the establishment of this organisation." The terms used by the editor, however, seem unduly optimistic. A reference to the Proceedings of that conference shows that the appointment of this committee was not open to option, but was definitely announced as an accomplished fact by the Government of India; and that there are recorded marked objections by members, not to the existence of the committee as a scientific body, but to its possessing the extraordinary administrative power to "direct (*sic*) and coordinate investigations" throughout India, which, in the presence of Indian official methods and the huge area involved, cannot fail not only to trammel the initiative of local Governments and their Sanitary Commissioners, but must hopelessly delay the execution of practical measures.

Although, doubtless, having regard to the excellent *personnel* of the committee, the publication will from time to time furnish scientific matter of value, in the absence of insistence by the Government of India that practical anti-malarial measures be undertaken, public opinion will be apt to hold that its primary function is that of a convenient financial scapegoat. The first number of *Paludism*, after referring to the functions of the committee, affords an original paper by Captain Christophers on the use of statistics in investigating the epidemiology of malaria, and gives abstracts of papers relative to paludism in countries other than India.

In the meantime, sanitarians with no lack of local experience have failed to see that there is in the environment of the mosquito in India more startling conditions than have been met with and overcome elsewhere. Major Ross, C.B., especially, has from time to time called in question the correctness of the Mean Mir experiments; and, in person, he challenged the methods and conclusions of the officers concerned

at the Indian Medical Congress held at Bombay in 1908. It was therefore a wise decision on the part of the Government of India, on the termination of the Simla anti-malarial Conference of 1909, to depute a special committee of inquiry on this subject. The officers selected were the Hon. Mr. Nathan, I.C.S., Colonel Thornhill, I.A., and Major Leonard Rogers, I.M.S. Whilst all its deductions cannot be accepted, this committee has produced a report which, though omitting important details, is a remarkable product of a single month's work. The experimenting officers, Major James and Captain Christophers, apparently elected to test statements made by Major Ross, and regarded Mean Mir as a suitable locality for this object. Of several typical extracts from his publication and speeches quoted in the report as justifying their methods, the following is selected as of the most definite nature:—

"It is now a matter of the general experience of many investigators that where mosquitoes abound in a house their larvæ can easily be found at a short distance, say within a few hundred yards of the house. Occasionally, where the house is isolated and no stagnant water is in its immediate vicinity, mosquitoes may attack it from a greater distance; but this is exceptional, and in the great majority of cases, especially in towns, almost every house breeds its own mosquitoes in its backyards or in puddles or drains in the streets close by."

To meet the necessities of a test experiment guided by such very general data, it would have been well, whilst relying upon the importance of the observation as to pools in the vicinity of houses, also to have ascertained from the authority concerned what he implied by a "few hundred yards" of the house and even "a greater distance"; especially as by making pools unfit for the reception of larvæ by "oiling" in the neighbourhood of houses, there was fulfilled—so far as the mosquito is concerned—the condition that "no stagnant water" be available in that position.

The area selected by Major James was an oblong—and not an isolated—portion of two square miles of the total of eight square miles of the cantonment of Mean Mir, whilst the line defining its limit, except on the west, was "drawn close round the residential quarters, no attempt being made to deal with the outlying uninhabited areas." The map furnished with the report proves that the distance of dwellings from untreated portions of the cantonment varied from 40 to 260 yards, and that the limiting line abruptly excluded numerous pits and rain-fed depressions. It is a curious commentary upon this haphazard method of conducting an important experiment that Dr. Balfour, in his successful work at Khartoum, did not similarly interpret Ross's dicta with which he professed agreement.

More reasonable measures were, however, employed by Captain Christophers when operations fell under his charge. He found that the flight of the mosquito could be estimated at 1320 yards, and, thereupon, he reports, he extended the area maintained by Major James three-quarters of a mile "in every direction." Unfortunately, however, action was not taken by him on this basis until the end of August, 1903, which, having regard to the duration of life of the mosquito, was perilously close to the ensuing three months known locally as the "fever season." Moreover, on comparing the map accompanying his own report with that furnished by the committee, it will be seen

that confusion exists as to the essential point of measurement being made from the most external of the houses of groups of dwellings protected, and not, for example, "from the centre of the inhabited area"—a method which seems to have been erroneously adhered to by the reporting committee. Comparative measurements show that, in reality, he extended Major James's area 220 yards in the north, 465 yards on the west, 500 yards in the east, and a little more than three-quarters of a mile on the south. Yet, had the same solicitude been afforded in other directions as to the south, so as to secure a uniform extension of three-quarters of a mile "in every direction," there would have been included the native cavalry lines, the west infantry lines, the east native infantry lines, the lowlying dhobies' ground, and part of the pits of the east rifle range.

The map showing present conditions, and the accompanying description by the committee of work done in the filling of pits, subsequent to abandonment of the experiments by Captain Christophers, prove that under this arrangement there must have remained untreated very numerous and favourable spots for larvæ. The committee, in summing up its evidence, has recorded its opinion that mosquito reduction, under conditions prevailing in Lahore, was impossible; but it seems to us clear that the experiments were based upon an erroneous interpretation of data said to have been adopted for guidance, and, in execution, so lacking uniformity of method as to be of no sanitary value.

On completion of the "mosquito reduction" experiments at Mean Mir, the Government of India left the cantonment to its fate until Surgeon-General Hamilton, C.B., urged the employment not only of "mosquito reduction" methods, but the systematic improvement of surface drainage, the abolition of canals, and irrigation within a definite (but we think insufficient) radius of dwellings, and the employment of quinine prophylaxis. This highly practical advice met with warm support from General Kitchener, who was in charge of the division, and operations were accordingly carried on from 1904 to 1909. Nevertheless, those who would support a *laissez-faire* policy in India have declared that these efforts have also proved inapplicable. But, it is evident from the committee's report that in no detail has the advice of Surgeon-General Hamilton, up to date, been acted upon in so complete a manner or with such a grade of efficiency as would warrant final conclusions as to possible benefits.

In its conclusion, the committee holds that the "general prosecution" of major schemes, such as conducted in Panama, Lagos, and Sweetenham, is financially impracticable; it regards anti-larval measures combined with quinine prophylaxis as offering "great possibilities," and advises action by Government on this system, but would defer this pending investigations by the committee referred to above, in our notice of *Paludism*. For the rest, it would trust to education of the people, which they state "thus lies at the root of the problem." There is here therefore a diminution of hope as to practical measures by a process of whittling, and a suggestion of the Greek Kalends as to consummation. In using the term "general prosecution" of schemes, the committee has presumably laboured under the common misapprehension that sanitarians would desire the sudden expenditure of crores of rupees on anti-malarial "major works" throughout India. What, however, is pleaded for is that the Government of India should no longer be guided by results of experiments conducted at Mean Mir by haphazard methods, and thus fail, as it has for several years—apparently in

¹ Second Report Wellcome Research Laboratories (Khartoum), p. 21.
² Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India, No. 9, p. 8.

consequence of advice founded on such results—to insist that local governments and local bodies serving under it shall no longer fail to class anti-malarial measures as practicable, but shall estimate for and finance them when feasible.

As to the combined anti-larval measures and quinine prophylaxis, of the "great possibilities" of which the committee is hopeful, obviously they could be conducted continuously, at the least feasible cost, by the Government of India insisting that a correctly organised and well-educated executive sanitary service should be available in each province, as, if the still incomplete service in the Madras Presidency be excepted, not even the skeleton of such an organisation yet exists in India.

As for "education," the only form that will appeal to the average Indian villager for the next century is practical demonstration of what correctly conceived anti-malarial works can accomplish. His acquiescence in Western theories would be but a polite fiction, although no race can more quickly, or more gratefully, appreciate sanitary works demonstrably decreasing sickness and death; nor, in the face of his conviction as to their utility after their completion, would he grudge his contribution towards them.

Municipalities do at the present time undertake large sanitary works (other than anti-malarial) at a cost from Rs.4 to Rs.12 per head of the population served. But it is apparently the typical "small town" under district board jurisdiction that presents to the committee the insuperable difficulty of financing "major schemes." But in this is involved an erroneous method of regarding the matter. In severe cases of malaria justifying major schemes, when a town is impoverished by sickness and mortality, and, moreover—as such places must be—is a danger to the surrounding inhabited areas of the district in which it is situated, by reason of its wandering human malaria germ-bearers, it is sound political economy to require not solely the already impoverished locality but the district board, and, in exaggerated cases, the provincial government concerned, to afford financial aid, in part or whole. Nor need such a distribution of responsibility be regarded as financially impracticable if these principles be recognised. The borrowing powers of district boards remain practically unexploited, whilst the expenditure of funds in their charge is so erratic, and in such ill-considered proportions to the various requirements of the Acts they administer, that the best value is not obtained.

Average taxation for district board purposes does not exceed three half-pence per head *per annum*; but a single attack of fever (against several possible) *per annum* in the case of an adult, if the standard treatment by quinine approved by the Simla Conference be resorted to, would cause an unproductive expenditure of 10d. for this single drug, besides that due to extra luxuries during sickness, adjuvant medicines, and ceremonies, &c., irrespective of loss of labour. Yet, in the Punjab, where, during 1908, in round figures, there occurred 700,000 deaths from malarial fevers (giving a rate from this cause alone of 34.6 per mille of the population), the district boards concerned thought it proper to spend 24 per cent. of their incomes for education, against 1.5 per cent. for sanitation, including nothing for new water supplies. In connection with malarial fevers and "the drain upon the resources of India" they bring about, it is worth remembering that, during 1908, there were treated in the civil hospitals of India (where necessarily but a fraction of the population resort) a total of 5,211,851 cases of malarial fevers.

W. G. KING.

THE VOLUME OF THE KILOGRAMME OF WATER.

THE volume referred to below¹ contains three important memoirs relative to determinations which have been made during recent years by the Bureau International des Poids et Mesures, or under its auspices, on the volume of the kilogramme of water.

Since the fundamental work of Lefèvre-Gineau and Fabbri, made towards the end of the eighteenth century, on which the prototype standard kilogramme was based, the question of the specific mass of water has been the subject of a number of inquiries in various countries. In spite of the critical and detailed examination to which these inquiries have been subjected, it is not easy to institute an exact comparison between the results, partly because the measures have been made and expressed in units of which the relation to the metric units is more or less uncertain, and partly because certain elements in the reductions and calculations have not been set out in sufficient detail.

A *résumé* of this work is given by M. Guillaume in the first of the three memoirs above referred to. From this account, in which the previous work has been carefully revised, and all corrections introduced, so far as known data would permit, it appears that the most probable values for the mass of a cubic decimetre of water deducible from the most important of the determinations subsequent to those of Lefèvre-Gineau and Fabbri, are as follows:—

	kg.
1821. Shuckburgh and Kater	1.000475
1825. Svanberg, Berzelius, Akerman, and Cronstrand	1.000290
1831. Sarnier	0.999750
1841. Kupffer	0.999931
1893. Chaney	0.999850

The original work on which Lefèvre-Gineau and Fabbri established the first standard kilogramme has also been minutely examined and discussed by several authorities, and M. Guillaume has subjected these revisions to a further scrutiny, from which it would appear that the following are the most probable values of the mass of the cubic decimetre of water:—

	kg.
According to the revision of Broch (minimum)	0.999880
" " " Mendeleeff	0.999966
" " " Guillaume	0.999970

These numbers, it will be seen, differ notably among themselves, and even after due weight has been given to their relative probable value, it still remains uncertain in which direction the difference between the kilogramme as defined and as it actually is really lies.

The exactitude of these values ultimately depends upon the precision with which the linear and hence the cubical dimensions of bodies can be ascertained. Within recent years great increase in accuracy has been secured in such measurements by the application of the phenomena of optical interference as worked out by Fizeau and Michelson. In 1897 the late M. Macé de Lépinay ascertained the precise dimensions of a cube of quartz by this method and by means of it made a series of determinations of the mass of a kilogramme of water, and obtained the value 0.999959. In 1899, MM. Fabry and Perot made similar determinations by a modification of the method on the same cube of quartz, and found the value 0.999979.

These methods, with all the improvements which experience has suggested, have formed the basis of the series of determinations made by M. Chappuis, on

¹ "Travaux et Mémoires du Bureau International des Poids et Mesures." Tome xiv. (Paris: Gauthier-Villars, 1910.)