

life should be interrupted during its earlier years, there is an urgent demand on the part of students for greater facilities of migration. In this brief article we can but give examples of the kind of subjects put down for discussion, but those to which we have referred will suffice to illustrate the thought which has guided the committee in their selection. All the items on the agenda paper are such as will lead to decisions which may issue in practical results.

A congress of this magnitude could not be organised without long and laborious preparation. Two years have elapsed since the Colonies were first consulted. Preliminary conferences were held in Canada and in Australia last summer, and in Delhi just before the Durbar. The subjects proposed for discussion by the several universities of the United Kingdom and of the Empire overseas were considered by the committee early in the autumn. The paper of agenda was drawn up in November. All the universities have sent in returns of information regarding their regulations and customs so far as these are relevant to the subjects to be discussed. Speakers will be in no uncertainty as to matters of fact.

The importance attached to the congress is indicated by the names of those who have promised to take part in it. There are absolutely no gaps in the list. All the Chancellors and Lord Rectors of the home universities are members of the general London committee. The executive committee consists of the Vice-Chancellors. The chairmen of its several sessions will be: Lord Rosebery, Chancellor of London and Glasgow; Lord Curzon, Chancellor of Oxford; Lord Rayleigh, Chancellor of Cambridge; Lord Strathcona, Chancellor of McGill and Aberdeen; Mr. Arthur Balfour, Chancellor of Edinburgh; Lord Haldane, Chancellor of Bristol. We shall take the opportunity of giving the names of invited speakers and readers of papers at a later date. Delegates will be received in the Marble Hall of the University of London by H.R.H. Prince Arthur of Connaught, president of the general London committee, on Tuesday, July 2.

In addition to the delegates and representative members nominated by the various universities, associate members, whose names are approved by the committee, will be admitted on payment of a fee of 10s. 6d. They will receive the report, and will be invited to certain entertainments offered to the members of the congress, but will not be entitled to take part in its discussions. Further information can be obtained from the secretary, Dr. Alex. Hill, at the Congress Office, University of London.

THE NATIONAL PHYSICAL LABORATORY.¹

VOL. VIII. of the Collected Researches of the National Physical Laboratory maintains the high standard we have learnt to expect in the publications issuing from our national scientific consultants. It is almost impossible to omit mentioning any one of the thirteen memoirs which the volume contains without feeling that an injustice has been done to a research of great interest.

In the standards department Dr. Kaye has constructed a standard meter of silica which by its low coefficient of expansion seems specially adapted for such a purpose. Advantage has been taken of the setting up of the Blythwood dividing engine in the laboratory to secure photographs of the various parts, and these add materially to the interest of the

¹ "Collected Researches of the National Physical Laboratory." Vol. viii. Pp. iv+251. (1912.)

description of the instrument contributed by Mr. Scoble. Every spectroscopist will join with Dr. Glazebrook in the hope that at no very distant date Lord Blythwood's engine will be turning out diffraction gratings free from periodic error.

The research on the alloys of aluminium and zinc carried out by Dr. Rosenhain and Mr. Archbutt under the auspices of the Alloys Committee of the Institution of Mechanical Engineers proves that these alloys are much more complex than has been previously supposed. Mr. Batson's work on the mechanical properties of hard-drawn copper and bronze wires for the Engineering Standards Committee shows that the uniformity obtained in modern manufacture is such that tests on specimens a few inches long agree with those on lengths of 50 ft.

Dr. Stanton breaks new ground in his measurements of the shearing stress in the flow of air through pipes with speeds which render the motion turbulent or eddying, and the frictional resistance at the surface proportional to the square of the velocity.

At the request of the Wiring Rules Committee of the Institution of Electrical Engineers, Messrs. Melsom and Booth have investigated the rise in temperature of electric cables of different sizes and types when transmitting current. They find that the currents allowed by the 1907 wiring rules of the institution give rises of temperature of much less than 20° F. for cables under 0.05 square in. in section and more than 30° F. for 1 square in. cables. According to the tests made by Messrs. Paterson and Kinnes on instruments sent on long railway and road journeys, watt hour meters of the induction type can be relied on to remain constant to within 0.5 per cent. The report by Messrs. Campbell, Booth and Dye on the results of tests of five samples of magnetic sheet iron and steel made in the first place at the laboratory, then at the Reichsanstalt at Charlottenburg and at the Bureau of Standards at Washington, and then again at the laboratory, shows that the methods now in use at the various laboratories give results which are in close agreement.

The methods and apparatus used in testing the flash points of petroleum products have received a thorough investigation at the hands of Dr. Harker and Mr. Higgins, who conclude that the temperature which determines the flash is not that of the bulk of the oil as indicated by the thermometer, but that of the oil and vapour interface which is not measured. It is hoped that the further work on the subject in contemplation will lead to a marked increase in the value of flash-point determinations. The report on the equipment of the Froude national tank by the superintendent, Mr. Baker, shows that it is now in order, and that preliminary runs have been made.

One cannot close the volume without realising how important the work carried out at the laboratory must be for the future of many of our industries. It seems now almost incredible that those industries were without such a national institution until the beginning of the present century. C. H. LEES.

THE ETIOLOGY OF KALA-AZAR.

ON March 27 of this year Captain W. S. Patton, I.M.S., gave a university lecture at the Senate House, Madras, on his investigations into the etiology of kala-azar. His Excellency Lord Carmichael, Chancellor of the University, presided, and there was a large audience of fellows and graduates. Captain Patton first directed attention to the deadly nature of kala-azar, and pointed out that little at present was known regarding the extent of the disease either in Madras or in the Presidency. He

referred to the brilliant discovery of the parasite by Sir Wm. Leishman, R.A.M.C., and of the discovery of the flagellate stage by Major Rogers, I.M.S. It was at this stage of our knowledge of the parasite that, the lecturer said, he began his experimental work in 1905, and a detailed description was then given of how this problem was attacked, and the results which have followed this work during the last seven years. There were two main theories as to how the parasite leaves man's body in order to undergo its extracorporeal flagellate stage. Sir Patrick Manson had suggested that the parasite was discharged from ulcerated surfaces, either cutaneous or intestinal, and that it was then ingested by some foul-feeding fly. Against this hypothesis, however, was the fact that the parasite would not flagellate in any medium containing bacteria. Two years ago the lecturer had fed a large number of bred house-flies (*Musca nebulosa*) on fresh splenic juice, and had found that the parasite disappeared from the alimentary tract of the fly in a few hours; it was difficult, then, to understand how the parasite could be transmitted in this way.

The other hypothesis, first advanced by Major Rogers, and later by Major Christophers, was that the parasite was ingested by some blood-sucking insect. In order, however, for this to take place it was necessary for the parasite to be present in the circulating blood of an infected person. Colonel Donovan, I.M.S., Major Christophers, I.M.S., and the lecturer had no difficulty in finding the parasite in the circulating blood of practically every case of kala-azar. The lecturer also pointed out in 1907 that in certain stages of the disease, namely, severe dysenteric attacks, the parasite could be found in large numbers in a drop of finger blood. Captain Patton then went on to describe how he fed *Pedicularis capitis*, *P. vestimenti*, *Culex fatigans*, *Neocellia stephensi*, *Stegomyia suguens*, and *Ornithodoros savignyi* on cases of kala-azar in the peripheral blood of which there was a large number of parasites, but was unable to observe any developmental changes undergone by the parasite in these insects. He next described his feeding experiments with the Indian bed-bug *Cimex rotundatus*, and pointed out that he was able to trace the parasite from its unchanged state in a leucocyte in the stomach of the bug up to the formation of the mature flagellate stage. In twelve bugs which had only fed once on a patient, and which were all dissected by the fifth day, he was able to confirm these earlier observations. As he was then unaware of the probable final stages in the development of the parasite, the bugs were not kept long enough. The failure to obtain a massive infection with the bug when fed on a case in the peripheral blood of which there were immense numbers of parasites was extremely disappointing, and it was felt that there was some factor in connection with the development of the parasite in the bug which had yet to be discovered. Assuming that kala-azar is an insect-borne disease, it is a remarkable fact that it has scarcely, if at all, spread outside Madras. In order to explain this curious epidemiological truth, Captain Patton came to the conclusion that, in addition to the small number of parasites which are found in the peripheral blood in the majority of cases, there was some natural obstacle which came in the way of the parasite completing its life-history in the bug. Further work on kala-azar was then abandoned, and the study of insect flagellates of the genus *Herpetomonas* taken up. As a result of these studies, Captain Patton was able to show not only how several insects containing these flagellates became infected, but also

pointed out that they had three phases in their life-histories—pre-flagellate, flagellate, and post-flagellate—and that in the majority of instances insects become infected by ingesting the post-flagellate stage. He then gave a detailed description of the life-history of *Herpetomonas muscae-domesticae* and *H. culicis*. As a result of this work he came to the conclusion that the parasite of kala-azar, in order to be transmitted to man, must pass back to its post-flagellate stage. He directed attention to the fact that almost every blood-sucking insect was infected with these natural flagellates, and that in order to investigate the kala-azar problem it is imperative for the observer to have first-hand knowledge of these insectan forms. Further, by studying *H. culicis*, he found that blood had an injurious effect on the flagellate stage of the parasite, and this has led to the remarkable discovery that if a bug contains the flagellate stage of the parasite of kala-azar, this stage is destroyed within twelve hours when the bug again feeds, either on man or on a monkey. He further found that if the bug, which contains flagellate stages, is not fed again, the parasites by the eighth, ninth, and tenth days pass on to their post-flagellate stage, and finally round up in the stomach of the bug by the twelfth day. His previous failures to find a massive infection in the bug or to observe the rounding up of the parasite were obviously due to the bugs having been repeatedly fed, and not being kept long enough after their last feed.

This observation is of extreme importance, because if we are to attempt to try and infect a susceptible animal by means of the bug, it would be futile to feed infected bugs on the animal before the post-flagellate stage had been formed. Captain Patton believes that the destruction of the flagellate stage of the parasite by fresh blood is the natural obstacle referred to above. It would at present appear that the bug only becomes infected when it feeds on a case in the peripheral blood of which there are a large number of parasites, and it can only become infective if the interval noted above is obtained for the parasite to complete its development.

Captain Patton then gave a short description of his recent work on Oriental sore in Cambay, and stated that he had only succeeded in obtaining the development of the parasite in the bed-bug. He believed that his failures to transmit this parasite to man by the bite of the bug were due to the fact that the bugs used in the experiments were repeatedly fed, and that an interval for the parasite to complete its development was not allowed. He was at present carrying out further transmission experiments with the parasite of Oriental sore, and he hoped, in the light of his recent discoveries, to transmit this parasite by the bite of the bed-bug.

He fully realised that the conclusive proof that the bed-bug is the transmitter of the parasite of kala-azar was still wanting. Unfortunately, at present it is impossible to infect any known animal with this parasite; he would therefore ask those who would be ready to criticise his work to exercise still further patience. The investigation of the problem of the method of transmission of the parasite of kala-azar bristles with difficulties, but he believed that a distinct advance in the right direction had now been made. He was at the present time repeating all his experiments with blood-sucking insects by feeding them once on a case of kala-azar in the peripheral blood of which there were large numbers of parasites, so that all the different kinds of insects utilised would certainly ingest many parasites. He hoped in this way conclusively to prove that the parasite will only develop in the bed-bug. He had in this way

already utilised *Conorhinus rubrofasciatus*, and had found that the parasite, after being ingested by this bug, degenerated. Further, an exhaustive attempt was being made to find whether kala-azar existed in dogs in Madras, and a long series of experiments by inoculating dogs and many other animals would be carried out at the first opportunity in order to find a susceptible animal.

Captain Patton then shortly referred to the human and canine forms of kala-azar which occurred along the Mediterranean littoral. He very much doubted whether the human form was of canine origin, and that the dog-flea or human flea transmitted the parasite. The flagellates found in human and dog-fleas in Italy and elsewhere were unquestionably natural flagellates of the fleas, for he had found identical Herpetomonads in the dog-fleas in Madras. He had studied these parasites, and knew that the flea became infected in its larval stage, so that no precautions had been taken by other observers to exclude these parasites. He was aware that one observer claims to have transmitted the parasite of canine kala-azar by the dog-flea, but these experiments were lacking in precision, and certainly required confirmation. Even though it may eventually be found that the parasite was transmitted by the dog-flea, there was no proof whatever that the human parasite would be transmitted by the human flea. He also doubted whether the recent observations of the development of the human parasite in mosquitoes were accurate, for the two mosquitoes which were utilised, namely, *Anopheles maculipennis* and *Stegomyia fasciata*, were known to be infected in Europe with natural flagellates.

In conclusion, Captain Patton believed that the parasite of kala-azar had once been a natural flagellate of the bed-bug, and that as this insect had altered its habits from being a plant-feeder to a blood-sucker, the life-history of the parasite had been so modified that the post-flagellate stage had become transferred to the host of the bug, in whom it had become the pre-flagellate stage. In support of this view there was the fact that human blood was at the present day unsuitable for the flagellate stage of the parasite in the bug. He shortly referred to *Conorhinus rubrofasciatus*, which was at the present day becoming sanguivorous, like its ally, *C. megistus*, which is now entirely a blood-sucking insect. *C. rubrofasciatus* in Madras was known to be infected with a species of Crithidia, and it seemed probable that the life-history of the parasite may in course of time be so modified that it will become transferred to the host of this bug.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Public Orator, Sir John Sandys, spoke as follows on June 6 in presenting Major Leonard Darwin for the degree of Doctor of Science *honoris causa* :—

Salutamus patris illustris filium, fratrum insignium fratrem dignissimum, Societatis illius perquam idoneum praesidem, quae populum totum in illis omnibus rebus educandum curat quae nomine novo εὐγενικά nuncupantur. Salutamus Regiae Societatis Geographicae praesidem emeritum, qui a Societate illa nominatus studiorum geographicorum concilio nostro iam dudum profuit. Olim in exercitu Britannico scientiae machinalis peritissimus, et itineribus longioribus scientiarum causa interfuit, et planetam Venerem praesertim solis orbem trans-euntem, primum abhinc annos duodequadraginta, deinde abhinc annos triginta, patria procul observavit. Senatui Britannico per triennium adscriptus, diuque

scientiae oeconomicae deditus, et libero de commercio et municipiorum de commercio luculenter disputavit; idem, velut iudex aequus, illorum sententiam exposuit, qui non unius tantum metalli sed auri atque argenti e valore monetae mensuram petendam putant. Quot gentium leges monetales subtiliter examinavit; quot orbis terrarum in partibus impigre peregrinatus est; quot scientiarum provincias inter se diversas feliciter peragravit!

Duco ad vos virum ingenio perquam versatili praeditum, virum et suo et fratrum suorum Cantabrigiensium nomine nobis acceptissimum, Leonardum Darwin.

The General Board of Studies have reappointed A. Henry, of Gonville and Caius College, as reader in forestry; Dr. Myers as lecturer in experimental psychology; Dr. Nicholson as lecturer in Persian; W. H. R. Rivers, of St. John's College, as lecturer in physiology of the senses; and R. P. Gregory, of St. John's College, as lecturer in botany. Approved by the General Board of Studies for the degree of doctor of science, Francis Hugh Adam Marshall, of Christ's College. The General Board of Studies have appointed G. Udney Yule as University lecturer in statistics for five years from October 1, 1912, until September 30, 1917, and this appointment has been confirmed by the Special Board for Economics and Politics. The electors to the Sandars readership in bibliography, palaeography, &c., have appointed Dr. Greg, librarian of Trinity College, to be Sandars reader for the year 1913. The Forestry Committee are prepared to appoint an adviser in forestry, whose duties will commence on October 1, 1912. The appointment will be for three years. The chief duty of the adviser will be to supply to land-owners and others, in a group of counties in the east of England, advice on the management of their woods and plantations. He will also be required to study in detail local conditions in all matters pertaining to forestry. Applications should be sent to the secretary of the Forestry Committee, School of Agriculture, Cambridge, to arrive not later than July 31, 1912.

OXFORD.—A decree will be proposed in Convocation on June 18, authorising the Vice-Chancellor to apply, on behalf of the University, to the Board of Agriculture and Fisheries for a grant of 300l. a year for the expenses of agricultural research relating to the soils of Oxfordshire and parts of the adjacent counties, to be conducted in the School of Rural Economy under the direction of the Sibthorpean professor (Prof. W. Somerville). On the same day a decree will be submitted to Congregation, authorising the curators of the University chest to receive a sum of 900l., which has been offered by the Development Commissioners through the Board of Agriculture and Fisheries, to be applied under the direction of the Committee of Rural Economy in aid of investigation into the economics of agriculture; and to provide from the resources of the University a sum of 300l. a year for each of the three years from October 1, 1913, for the same purpose, if the Development Commissioners shall in each of the same years, according to their offer, make to the University a grant of not less than 600l. towards the same object. Prof. Karl Pearson, F.R.S., having declined it, the Weldon Memorial Prize for 1912 has been awarded by the electors to Dr. David Heron.

LONDON.—Mr. W. J. Dakin, assistant lecturer and demonstrator in zoology in the University of Liverpool, has been appointed senior assistant in the department of zoology and comparative anatomy at University College.