

for a ground reflecting with an albedo as high as 25 per cent. This discrepancy must clearly be due to the scattering by suspended dust and particles. This last reference to the scattering by particles suggests that, since we now have an exact theory for determining the molecular component of the sky radiation, we have a means of analysing the non-molecular component of the sky radiation.

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- <sup>2</sup> Arago, Fr., "Samtliche Werke" (German translation), 7, 359 (Leipzig, 1860).
- <sup>3</sup> Brewster, D., *Trans. Roy. Soc. Edin.*, 23, 211 (1864).
- <sup>4</sup> Sorét, J. L., *An. Chim. Phys.*, 14, 503 (1888) and *C.R. Acad. Sci., Paris*, 106, 203 (1888).
- <sup>5</sup> Hurion, A., *An. Chim. Phys.*, 7, 456 (1896).
- <sup>6</sup> Pernter, J. M., *Meteorol. Z.*, 6, 401 (1889).
- <sup>7</sup> Exner, F. M., "Meteorologische Optik" (Leipzig, 1922; also the earlier edition published in 1910).
- <sup>8</sup> Jensen, Chr., *Meteorol. Z.*, 30, 84 (1913).
- <sup>9</sup> Ahlgrim, Fr., Dissertation (Kiel, 1915).
- <sup>10</sup> van de Hulst, H. C., "The Atmosphere of the Earth and the Planets" (edited by G. P. Kuiper), 79 (Univ. Chicago Press, 1948).
- <sup>11</sup> Chandrasekhar, S., *Astrophys. J.*, 104, 110 (1946).
- <sup>12</sup> King, L. V., *Phil. Trans. Roy. Soc. London*, 212, 375 (1913).
- <sup>13</sup> Tichanowsky, J., *Phys. Z.*, 28, 252 (1927).
- <sup>14</sup> Hammad, A., and Chapman, S., *Phil. Mag.* (7), 28, 99 (1939); also Hammad, A., *ibid.*, 36, 434 (1945); 38, 515 (1947).
- <sup>15</sup> Tichanowsky, J., *Phys. Z.*, 23, 680 (1927).
- <sup>16</sup> Hammad, A., *Astrophys. J.*, 108, 338 (1948).
- <sup>17</sup> Chandrasekhar, S., *Astrophys. J.*, 106, 162 (1947).
- <sup>18</sup> For the extension of these considerations to include elliptic polarization see "Radiative Transfer", chapter 1.
- <sup>19</sup> Stokes, G. G., *Trans. Camb. Phil. Soc.*, 9, 339 (1852).
- <sup>20</sup> The equations will be found in "Radiative Transfer", § 17.
- <sup>21</sup> By an unfortunate error in the numerical calculations, the contrary statements made in "Radiative Transfer", p. 282, are incorrect; the two diagrams on the right-hand side of Fig. 28 on p. 284 are therefore to be ignored.
- <sup>22</sup> This phenomenon was first discovered by Busch, Fr., *Meteorol. Z.*, 6, 81 (1889).
- <sup>23</sup> Tichanowsky, J., *Meteorol. Z.*, 41, 352 (1924).

## SCIENTIFIC RESEARCH IN BRITISH COLONIES

"COLONIAL Research 1949-50"\* is an omnibus work which includes, besides the annual report of the Colonial Research Council, the seventh annual report of the Colonial Products Research Council, the sixth annual report of the Colonial Social Science Research Council, the fifth annual reports of the Colonial Medical Research Committee and the Committee for Colonial Agricultural, Animal Health and Forestry Research and the third annual reports of the Colonial Insecticides, Fungicides and Herbicides Committee and the Colonial Economic Research Committee. Its 155 pages constitute a record of research which bids fair to become wellnigh as impressive as that in the annual reports of the Department of Scientific and Industrial Research; nevertheless, in spite of information regarding staff and publications, "Colonial Research" in its present form still falls far short of being the reference work that the annual report of the Department of Scientific and Industrial Research now provides.

Some of the information appended to the annual report of the Colonial Research Council duplicates that already published in Colonial 107 in the return of schemes made under the Colonial Development and Welfare Acts by the Secretary of State for the

\* Colonial Office, Colonial Research, 1949-50. Reports of the Colonial Research Council, Colonial Products Research Council, Colonial Social Science Research Council, Colonial Medical Research Committee, Committee for Colonial Agricultural, Animal Health and Forestry Research, Colonial Insecticides, Fungicides and Herbicides Committee, Colonial Economic Research Committee. (Cmd. 8063.) Pp. 155. (London: H.M. Stationery Office, 1950.) 3s. 6d. net.

Colonies. Disbursements for the year were well over £1½ million, bringing the total sum allocated for research schemes from Colonial Development and Welfare funds since 1940 to about £7½ million net, to which must be added something like a further £1½ million additional assistance provided by Colonial governments. About 32.5 per cent of the total allocation has been for agricultural, veterinary and forestry schemes, 14.4 per cent for medical research, 14.0 per cent for fisheries research, 8.7 per cent for social science and economic research, 7.6 per cent for tsetse and trypanosomiasis research, 6.5 per cent for insecticides research, 4.6 per cent for Colonial products research, 4.1 per cent for anti-locust research and 7.6 per cent for other miscellaneous purposes. Important schemes made during the year include provision for expanding and maintaining for five years the former Rockefeller Yellow Fever Institutes at Lagos, in Nigeria, and at Entebbe, in Uganda, which were taken over as a British responsibility on January 1, 1950, and will in future deal with all virus diseases affecting West and East Africa, respectively; provision for the maintenance for five years of the Institute for Research and Training in Fish Farming at Penang, in Malaya, and the establishment of an East African Marine Fisheries Research Station in Zanzibar, and of a Fisheries Research Station at Fort Roseberry in Northern Rhodesia to serve that territory and Nyasaland.

The recruitment of scientific workers, especially the younger men, showed a definite improvement during the year, which witnessed the introduction of the Colonial Research Service; and the Colonial Research Studentship Schemes, notably those in soil science and fisheries, attracted a considerable field of candidates and should lead to many useful research workers being secured for service in the Colonial Empire. Reference is also made to the promotion of co-operation between Colonial governments and the Department of Scientific and Industrial Research, particularly in building, road and water pollution research and with the Pest Infestation Laboratory. Further research was undertaken during the year by the African Studies Branch of the Colonial Office into the contemporary history and problems of African administration, while Lord Hailey has now completed his survey of African native administration and the organization of native courts. The Colonial Local Government Advisory Panel has been of great assistance to Colonial governments, and the work of the regional anti-locust organizations in Africa, administered and financed on an international basis, is developing steadily. The second volume of the late Dr. Kuczynski's Colonial Demographic Survey, covering East Africa, the South African High Commission Territories, Mauritius and Seychelles, was issued during the year, while the Crown Agents' Engineering Advisory Service continued to furnish technical information to visiting Colonial officials and in reply to inquiries from the Colonies.

The Mauritius-Seychelles Fisheries Survey ended in December 1949, the final results of the Gulf of Aden Fisheries Survey have now come in and a first report on the Fisheries Survey in Sarawak has been received. The work of the Directorate of Colonial (Geodetic and Topographic) Surveys was again directed chiefly to the preparation of maps of specific areas scheduled for immediate development, but some progress has been made in the preparation of standard topographical series. Recruitment of geologists improved very considerably, and besides the

expansion of the existing geological surveys in Kenya, Uganda, Tanganyika, Nyasaland, Nigeria, the Gold Coast, Sierra Leone and British Guiana, new surveys were formed in Jamaica and in the British territories in Borneo. The Tsetse Fly and Trypanosomiasis Committee has been reconstituted with the following terms of reference: "To consider and advise on the co-ordination of action, including research and reclamation, directed against human and animal trypanosomiasis"; and during the year forty correspondents with the Water Pollution Research Laboratory of the Department of Scientific and Industrial Research were nominated by Colonial governments.

The report of the Colonial Products Research Council is in two parts—a general report and a most interesting review of some research work in progress. The former refers to the important observation made during the year that banana plants resistant to attack by *Fusarium oxysporum cubense*, the cause of Panama disease, harbour in their root system certain bacteria, which produce antibiotic substances highly active against fungi and other micro-organisms. In the root systems of the Panama disease-susceptible Gros Michel variety of banana, such bacteria are apparently absent or very rare. Following further work by Dr. A. C. Thaysen and his collaborators, Drs. Arnstein, Cook and Lacy, working in the Imperial College of Science and Technology, London, have found that the actinomycete toxic to *Fusarium oxysporum cubense*, isolated from a Jamaican soil, gave a mixture of pigmented strains, and from the fluid culture of the red strain an antibiotic, musarin, was isolated which is a powerful anti-fungal agent but less effective as an antibacterial antibiotic. Working in the University College of the West Indies, Prof. C. H. Hassall and Miss L. Wong have separated seven strains from Meredith's actinomycete, from one of which they have isolated an antibiotic differing completely in its properties from musarin, and which has been designated manamycin. Dr. L. F. Wiggins's synthesis of the cyclic ketonic acid, 2-acetylcyclohex-4-one-1-carboxylic acid by condensation of butadiene and  $\beta$ -acetylaacrylic acid is of special interest as providing an example of the conversion of sucrose derivatives into a homocyclic compound and thus facilitating the industrial utilization of sugar. The properties of sugar cane waxes are being carefully studied, and, in Prof. M. Stacey's laboratory at the University of Birmingham, Mrs. C. E. M. Tatlow has continued to study new trifluoroacetyl derivatives of the sugars. The dextran blood-plasma substitute is now being marketed under the name 'Intradex', and Prof. Stacey is investigating a number of new problems, notably the optimum molecular size of the degraded dextran for transfusion. At the University College of North Wales, Prof. S. Peat has developed comparatively simple methods for producing high-quality amylose and amylopectin from potato starch. Work carried out during the year at the Colonial Microbiological Research Institute has given a general picture of the types of micro-organisms which are active during the fermentation of the cocoa bean in Trinidad and Grenada, and has shown the complexity of the problem of the nature of the substance or substances responsible for the development of the chocolate aroma in fermented cocoa beans. Investigations on the polyphenolic substances in fresh and fermented cacao beans have been extended. Prof. T. P. Hilditch and his collaborators have continued the investigation of vegetable drying oils and have

proved that heat treatment of the oil seeds from *Tetracarpidium conophorum* prevents the development of free fatty acid in the seeds on storage, while further technical trials have established the superiority of this oil to linseed oil. Oils from various varieties of groundnuts and sunflower seeds grown in East Africa have been examined at the request of the Overseas Food Corporation. Dr. J. C. Smith and Mr. C. Pickering have further investigated the wetting agents obtained from certain hydrocarbons present in Trinidad petroleum, while the study of the chemistry of eugenol has been continued in Prof. G. R. Clemo's laboratory. Some progress has been made in the study of the saponin isolated from the wood of *Mora excelsa*, and the Council has supported the study of plant materials of potential medicinal or insecticidal value.

The sixth annual report of the Colonial Social Science Research Council refers to the particular attention given during the year to the staffing of regional institutes and to their relation with Colonial universities, to the further employment of sociologists and other workers who have become accustomed to Colonial conditions and to the fullest possible utilization of the experience of research workers. Progress has been made in the establishment of the Institute of Social and Economic Research attached to the University College of the West Indies, and Dr. Audrey Richards has been appointed director of the East African Institute of Social Research, the programme of which for the next five years will be concentrated on linguistic studies, basic ethnographical studies recommended in reports on social research needs prepared for the Council, the utilization of these basic studies in a comparative study of local government, and an urban survey of Jinja and its periphery. Building on a modest scale should start shortly. The new Colonial universities are beginning to be in a position to sponsor research in the social sciences, while among projects in progress may be mentioned the ethnographical survey of Africa, a handbook of African languages, the socio-economic surveys of Zaria (Nigeria), Mba-Ise, Owerri (Nigeria) and Oshogbo (Nigeria); psychological testing in Nigeria, studies of the political organization of typical communities in the Gambia and sociological research at Genieri (Gambia), and anthropological studies of the Turkana (Kenya), the Acoli, Lugbara and the Alur and Jonam (Uganda); and also sociological studies in North Borneo and Singapore.

The fifth annual report of the Colonial Medical Research Committee, besides the continuance of all the main research schemes initiated or supported by the Committee during 1948-49, records the initiation of new investigations of leprosy, particularly in relation to the use of the sulphone group of drugs, and of loiasis, as well as the strengthening of the filariasis unit at Mwanza, Tanganyika Territory. The East African Medical Survey has been transferred to Mwanza from Malza, and in Jamaica a study of the infectivity and habits of the suspected malaria vectors, particularly in relation to housing, and the possibility of control by residual insecticides has been initiated. The East African Malaria Unit was established with headquarters at Muleza, Tanganyika, and arrangements for taking over the research laboratory at Freetown, Sierra Leone, were completed during the year. Following preliminary therapeutic trials which showed that African subjects with bancroftian filariasis tolerated much higher doses of 'Hetrazan'



than the level of 2 mgm./kgm. usually employed elsewhere, in prolonged courses, the toxicity of 'Hetrazan' was tested on two hundred Africans free from filariasis and it was concluded that doses considerably higher than those usually employed could safely be given. Extensive surveys have been made of the incidence of infection of *L. loa* and other filarial infections both in human beings and in *Chrysops*, the vector species, in the Kumba and Bamenda divisions in the Cameroons and elsewhere, and the wide distribution of *Chrysops* in Africa has been noted, including its presence in areas where loiasis is not a problem.

A disturbing development in malaria therapy in Malaya has been the appearance of proguanil-resistant strains of *P. falciparum*. The Hot Climate Physiology Laboratory at Oshodi, Nigeria, has been completed and equipped, and studies have been made on the ability of native-born West Africans to work in severe heat and humidity, the effect of arterial occlusion upon the sweat rate and sweat composition, the metabolic costs of common tasks, blood chemistry and daily sweat loss in routine tasks. Physiological research at Makerere College, Uganda, has included red blood cell counts of students and the preparation of precipitin sera; investigations have been carried out of tick-borne relapsing fever, and the success of chloromycetin in the treatment of scrub typhus has been amply confirmed. A field research unit based on the Institute for Medical Research, Kuala Lumpur, Malaya, is making a long-term study of scrub typhus.

The fifth annual report of the Committee for Colonial Agricultural, Animal Health and Forestry Research reviews the regional agricultural research, as under the East African Agricultural and Forestry Research Organization, where work is being done in mycology, including a study of the canker disease of cypresses, and where absence of staff has impeded the research into the sudden death disease of the clove trees. The individual research projects are assisted from Colonial Development and Welfare Funds and research work is undertaken as part of the programme of Colonial departments. Under the banana research scheme administered by the Imperial College of Tropical Agriculture, Trinidad, work on the breeding of male parents carrying the factors of immunity to Panama disease has reached a stage at which little further progress can be made until the projected expedition to south-east Asia can take place; and under the cocoa research scheme, similarly administered, work is proceeding on the completion of testing the I.C.S. clones, the establishment of a collection of cacao types, of *Theobroma* species and allied types, and breeding of improved strains, including those resistant to witches broom. Individual research projects include the appointment of an officer in charge of termite research in the Colonies to study termites in the field and train entomologists for this specialized work, in the first place in East Africa. In British Guiana manurial research in progress aims at the solution of the phosphate problem, while in the Federation of Malaya mechanical cultivation trials of rice received special consideration. On the Gold Coast, research into lime die-back disease has shown that a virus is responsible, that most sweet citrus is capable of carrying it and that *Aphis citricidus* Kirkaldy (*A. tavaresi* del Guercio) is one of the vectors. In Mauritius, research is being carried out to find means of controlling or eradicating the introduced shrub *Cordia macrostachya* (Jacq.),

which is a serious weed in sugar plantations; also clonal selection trials are in progress at the Lya-munga Coffee Research Station, Tanganyika. Reports are also included from the standing Cocoa Research, Soils and Stored Products Sub-Committees.

The Colonial Insecticides, Fungicides and Herbicides Committee appointed two new sub-committees during the year, one to consider problems relating to herbicides and arboricides (including defoliant) and the other to deal with defoliant. Arrangements have been made with the Imperial College of Science and Technology, London, and the Agricultural Research Council for fundamental work on insecticides to be conducted at the Imperial College Field Station, Silwood Park, and at Rothamsted Experimental Station. Preliminary work on a number of the newer insecticides has been agreed on, and the establishment of a Colonial Insecticides Research Unit in West Africa is recommended. A study of the behaviour of mosquitoes in huts treated with DDT and BHC has commenced, and also of the effect of partial defoliation of the bush in tsetse concentration areas on tsetse control and the disinfection of trains against tsetse. The work of the Colonial Insecticides Research Team, Porton, on aqueous suspensions of insecticides, the formation and properties of DDT crystals, the toxicity of compound 497, 'Chlordan' and 'Toxaphene', and the fumigant action of insecticides, and that of the Colonial Insecticides Research Unit, East Africa, on tsetse, mosquitoes and malaria, and malaria eradication in Mauritius are reviewed in some detail.

The third annual report of the Colonial Economic Research Committee records that arrangements for research projects into the national income of Nigeria, the problems arising from the dependence of certain Colonial territories upon imported foods and on transport economics in relation to economic development, with special reference to Nigeria, are well under way; difficulty in securing suitable research workers has continued to be a principal hindrance to progress. Other schemes in progress at the end of the year were Dr. J. Greaves's inquiry into Colonial monetary systems, and an investigation by Mr. P. T. Bauer of the organization of trade in West Africa.

## FIFTIETH ANNIVERSARY OF THE NOBEL FOUNDATION

ON December 10, the Nobel Foundation celebrated its fiftieth anniversary. Alfred Nobel, a man of great vision and unique generosity, and most keenly interested in the welfare of mankind, wished his discovery of dynamite, the most potent explosive of his time, and the huge estate collected through its manufacture, to benefit peace and progress. To achieve this he directed that his estate after his death should constitute a fund, the interest of which would be distributed annually in the form of prizes to those who, during the preceding year, shall have conferred the greatest benefit on mankind. The interest was to be divided into five equal parts, and apportioned as follows: one part to the person who shall have made the most important discovery or invention within the field of physics; one part to the person who shall have made the most important chemical discovery or improvement; one part to the person who shall have made the most important discovery within the