The Krishnan Effect.

In a series of papers published in the *Proceedings of the Indian Academy of Sciences* (1934–38), Dr. R. S. Krishnan working in Sir C. V. Raman's laboratory at Bangalore has demonstrated the existence of a new effect referred to by Prof. Gans in a paper in the *Physikalische Zeitschrift* (1936), **37**, 19, as the " Krishnan Effect "—relating to the state of polarisation of the light transversely scattered by certain liquid and solid media. If the incident beam of unpolarised light passing horizontally through the medium be regarded as made up of two beams of equal intensity and unrelated in phase, one with vibrations vertical and the other with vibrations horizontal, the light scattered in a direction normal to the incident beam can be supposed to be made up of four components V_v, H_v, V_h and H_h, the first two arising out of the vertical component and the last two arising out of the horizontal component of the incident beam. The first important observation of Dr. Krishnan which is general in its application is that $H_v = V_h$, whatever be the nature of the scattering medium. This he has called as the *reciprocity relation*. The second fact experimentally observed by Dr. Krishnan is that the depolarisation factor $\rho_h = V_h / H_h$ is less than unity in a large variety of material media, such as critical solution mixtures of liquids very near the critical solution temperature, colloids and optical glasses. In pure liquids it is known that $P_h = 1$ and the above observation signifies that in cases where ρ_h is less than one, the scattering units are no longer small compared with the wave-length of the incident light. Soon after the publication of his results on molecular clustering in binary liquid mixtures, Prof. Gans put forward a theoretical explanation of the observed anomalous depolarisation (*i.e.*, $\rho_h < 1$). He finds that the Krishnan effect requires the existence of optically anisotropic clusters which are strongly non-spherical in shape. In a later paper (*Phys. Zeit.*, 1937, **38**, 625) however he has questioned the validity of the reciprocity theorem.

Recently in the *Proceedings of the Royal Society*, 1938, **166**, 425, Dr. Hans Mueller has theoretically discussed Dr. Krishnan's investigations and has completely confirmed the validity of his conclusions from very general theoretical considerations. He has derived the reciprocity relation and has shown that the objections raised by Prof. Gans are not valid. Based on Dr. Krishnan's work he has also put forward the theory for the structure of optical glasses. The theoretical considerations of Dr. Mueller upholds the view put forward by Sir C. V. Raman in *Nature*, 1922, **199**, 138, that the intense scattering of light in optical glasses is molecular in origin and is an inherent property of the amorphous state of matter. It is remarkable to find that the magnitudes of the Krishnan effect observed in optical glasses follows very closely the order predicted by Dr. Mueller in his paper.

The new method of experimental observations of the scattered light developed by Dr. Krishnan and the principal results emerging therefrom described above have opened out a wide vista of applications in the study of colloidal systems and the amorphous state of matter. Dr. W. Lotmar has made a general survey of these investigations in the current number of the *Helvetica Chemica Acta*, 1938, **21**, 792.

SCIENCE NOTES.

George Ellery Hale (1868–1938).—Dr. George Ellery Hale, who died on February 21, was by common consent the " greatest builder of modern astronomy ". When he was only 22 years old, he established with his father's financial aid, the Kenwood Astrophysical Observatory, where he invented the spectroheliograph. In 1892, with the munificence of Charles T. Yerkes, he was enabled to found the Yerkes Observatory with its 40-inch telescope which is still the world's largest refractor.

In 1904 the Mount Wilson Observatory was established through the efforts of Dr. Hale. The Observatory, perched on the mile-high peak, was essentially meant for solar observations. In 1914, Dr. Hale obtained from John D. Hooker, a sum of $ 45,000 for a 100-inch telescope disc and with the help of the Carnegie Foundation, the giant telescope was completed and mounted in the Observatory. Dr. Hale retired in 1923 owing to failing health but pursued his researches in his private observatory at Pasadena. Here he invented the spectrohelioscope. In April 1928, he published in *Harpers's Magazine*, an article, wherein he indicated the need for, and the practicability of, a 200- or even a 300-inch telescope for astronomical research. The 200-inch telescope is now in the process of being built and it is hoped that by 1940 the instrument will be completed and mounted in the new Observatory on Mt. Palomar, as a monument to the memory of George Ellery Hale.

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The American Museum of Natural History. The Sixty-Ninth Report of the Museum for the year 1937, gives a succinct account of the activities of what, by reason of its collection and scientific staff, may be considered the largest organization of its kind in the world. This great educational institution has an ' Exhibition area of 23 acres, collections on exhibition and available for study valued at over $ 30,000,000 and a force of approximately 451, who are paid in round figures $ 1,000,000 a year in salaries to carry on the work '. The scientific and educational work comprise expeditions, purchase of collections, preparation of exhibits, changing old exhibits and developing new ones, publication and research by the scientific staff. In an introductory note to the Report, President Fredrick Trubee Davison draws attention to the serious financial condition

of the Museum. In the year 1936, a $ 10,000,000 Ten Year Development programme was announced, which was definitely organised in the year 1937. The response by hundreds of friends of the Museum was most gratifying. In order that the American Museum of Natural History may foster its functions, ' it must not stand still. It certainly must not retrogress. It must go forward '.

In spite of the declining income and resulting curtailment in many of its most important activities in scientific research, the amount of original work turned out by the staff of the Museum is impressive both in regard to quality and volume.

It would hardly be possible to do any justice to the numerous activities of the Museum in a brief note. Among the recent exhibits, mention must be made of the Haydon Planetorium, now in its third year of operation, which 'holds a unique place among educational institutions of our great city, for here the science of Astronomy is made a fascinating study to even the youngest visitors. And apart from its educational value, it continues to present a form of entertainment that gives the visitor a never-to-be-forgotten experience of insipration and beauty '. In the section devoted to exhibits in ' minerology ' a number of interesting additions were made. Mention may be made of a large rock crystal sphere mounted on a tall pedestal, beneath which is placed a device consisting of rotating discs of coloured glass, throwing a cycle of colour combination through the quartz sphere which acts as a ' cosmic colour mixer '. The effect of the introduction of the ' crystalight ' has been to double the attendance in the Morgan Hall, in which this exhibit has been housed. New exhibits were also added to the section in Vertebrate Palæontology, Geology, Living Invertebrates, Entomology, Ichthyology, Herpetology, Ornithology, Mammalogy, Anthropology, Comparative and Human Anatomy and Experimental Biology. In the last-named section the Theodore Roosevelt Memorial Hall has been transformed into one of the most interesting exhibits in the Musuem. " Hardly a day goes by without some visitor to the Museum wanting to know why certain animals behave in particular ways. The mechanisms regulating the behaviour of animals and men are fairly well known ; but no museum has until now attempted to show that various mechanisms in the form of a well-rounded exhibit. The chief reason for this is that behaviour is dynamic, requiring exhibits with parts which move when the visitor presses a button.' Exhibits of this type can fascinate the public while telling a serious scientific story. There are other dynamic exhibits telling the story of the animal mind. With the help of a group of artists, sculptors, and technicians, a series of exhibits have been built up showing the ' world as seen through the eyes of a dog, hen, trout, snapping turtle and house-fly '.

The contrast is obvious between such wide museum activities and what is possible in the understaffed and inadequately financed musuems to which we have grown accustomed in India. The need for a permanent Expert Committee to deal with the situation is urgent.

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Mysore Geological Department.—In the first few pages of the latest *Records of the Mysore Geological Department* (Vol. XXXVI, 1937) recently published, Mr. B. Rama Rao, Director, gives a general report of the work of the Department during the year 1936–37, under several headings such as Administrative, Mining and marketing of minerals, Geological survey, Mineral-surveying and prospecting, Engineering and water-supply questions, etc., and in all these sections the work done by the officers of the Department is of a kind which will be highly appreciated both by the Government and the general public. In addition to the investigation of special problems connected with the useful aspects of geology on the economic and engineering side, about which a number of short reports have been published, the *Record* includes a notable contribution on the purely scientific side—a paper on—"The Cordierite Hypersthene granulites and their associated schistose rocks from Bidaloti, Mysore State " by Messrs. B. Rama Rao and T. P. Krishna Char. In the Bidaloti area, which is less than a square mile in extent, occurs a complex and highly metamorphosed suite of rocks comprising such interesting members as hornblende granulites, pyroxene granulites, cordierite hypersthene granulites, sillimanite quartzites, etc. The complicated geology of this area has been thoroughly worked out and the rocks examined in detail. Of these, the most interesting are the cordierite hypersthene granulites ; and from a complete study of their mineralogical, chemical and field characters, the authors have come to the conclusion that these rocks were originally true sediments, their present condition being due to repeated cycles of metamorphism by different igneous intrusions, which have also materially affected their chemical composition. It will be remembered that it was from these cordierite hypersthene granulites that a new orthopyroxene was recently described by Mr. B. Rama Rao in collaboration with Prof. L. Rama Rau of the Central College.

The activities of the Department during the year under review were many and varied ; and we have no doubt that under the enthusiastic guidance of its present Director the work of the Department will continue to expand both in its scope and its usefulness. GEO.

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The Third Report of the **Royal Institute of Science,** Bombay, covers a period of three years (1934–37) and constitutes an interesting and valuable document from several points of view. Of significant interest is the volume of original work carried out at the Institute by the members of Staff and their associates, although burdened with teaching and administrative duties. Professor Wheeler and his colleagues in the Department of Chemistry are responsible for about 65 per cent. of the output. Abstracts of the 94 lines of research in progress in the four Departments of Physics, Chemistry. Botany and Zoology are given in the Appendix, and these are helpful to workers in other parts of India in avoiding wasteful duplication. It should be a matter of pride for the Institute that only 3·6 per cent. of its post-graduate students for the period 1925–37

remain unemployed. Writing about "Future Progress", the Report adds: "A satisfactory volume of research output has been attained. *Improvement, however, is to be sought in the quality of the research work.* To do this it is essential to attract good students to stay on after they have gained the M.Sc. degree, and work for the PH.D. This has proved unexpectedly difficult; as will be seen from Appendix F, practically all the M.Sc. graduates obtained posts, and although a number of those with employment try to do part-time work for the PH.D. degree, experience has shown that progress with part-time work only, is slow and erratic. Post-M.Sc. scholarships do not completely solve the difficulty. It has been the experience of both the Institute and the University that students holding such scholarships will surrender them willingly and if necessary refund the money paid to them if they are offered a post. *A good deal of time and money is wasted on such students who leave with little notice in the middle of a piece of planned research. Students appear to enter for Ph.D. work merely to fill in their time until they obtain employment.* As employers come to realise the value of higher degrees and suitably reward the possessor of a PH.D. degree, the position will probably improve." This statement holds good in the case of other institutions as well. We wish other Universities and research institutes in the country issue their reports on this model. It may perhaps be worthwhile for the Inter-University Board to discuss this matter and arrive at some uniformity in issuing periodical reports of the various research centres in the country.

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The **Annual Report of the Imperial Dairy Expert,** for the year ending June 1937, embodies the first year's activities after the separation of the Office of the Dairy Expert from the Imperial Agricultural Research Institute, New Delhi, and made an independent unit under the direct control of the Government of India. During the period under report, there was a remarkable manifestation of public interest in the Dairy Industry as evidenced by the large number of requisitions received for help and advice in starting dairy farms, foundation herds for breeding pedigree stock, etc. The Appeal issued by H. E. the Viceroy of India for the improvement of the cattle-wealth of the country and the holding of the All-India Cattle Conference at Simla (May 1937), have served to focus public attention on this nation-building industry. During the year Dr. Wright visited India, at the invitation of the Imperial Council of Agricultural Research, to conduct a survey of the Dairy Industry in India and make recommendations for its proper development.

During the past few years the Dairy Industry has made great progress. In his introduction to the Report, the Imperial Dairy Expert has compared the state of the industry to-day with what it was two decades ago when "except for the work done in the Military Dairy Farm with the special object of meeting the demands of British Troops, the industry in general, was in a morbid condition". To-day, the condition is different; the public have begun to realise that the industry is of vital importance to the country and attempts are being made to develop the industry on scientific lines. The Imperial Dairy Expert received no less than 25 enquiries for information regarding the manufacture of products like casein, condensed milk, milk powder and ghee on a factory-scale. Enquiries were also received from butter manufacturers for special cultures for improving the quality of butter. There is also an increased demand for training in Dairying. All these are encouraging signs which go to show that the future of the Dairy Industry in India is assured.

The Imperial Dairy Expert has, under his administrative control, the Imperial Dairy Institute, Bangalore, and the affiliated centres at Wellington and Anand. The Institute at Bangalore is the main centre of educational and scientific activities. The Milk Depot at Wellington is run purely as a commercial concern and the Research Creamery at Anand remains closed, pending the decision of the Government on Dr. Wright's Report.

The total number of students trained during the year is 55. In the laboratory, attention was devoted mainly to problems that have immediate application to the industry. Seven research papers were published during the year.

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We have been favoured with a mimeographed copy of **A Method for Preparing Palmyra Jaggery for Refining,** by Victor M. Hinchy of West Kensington, London, W.14. This subject is one of topical interest in view of the programme of prohibition which several of the provincial governments in the country have in view. Those interested in this topic may usefully get into touch with the author.

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Industrial Possibilities in the Tinnevelly District.—The Tinnevelly District Commercial Association has issued a 38 page brochure, dealing with some of the more important commercial possibilities offered by the agricultural, forest, marine and other natural resources of the District (*Some Possible Industrial Ventures in the Tinnevelly District,* by A. V. Varadaraja Iyengar, D.SC., A.I.C.). As is the case with other parts of this country, we have "poverty in the midst of plenty", an unfortunate circumstance which is largely due to the paucity of the Government and the public in utilising competent technical talent in exploiting the resources. The Tinnevelly District Commercial Association which has inspired the publication of this brochure, might also take up the responsibility of giving effect to such of the recommendations which may have the prospect of immediate success. This is a report which deserves the careful consideration of all those interested in the prosperity of the District.

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The Grading of Aggregates and Workability of Concrete.—In placing concrete, whether for roads or structures, a factor of the utmost importance is the control of the workability of the mix. To control the workability solely by variation of the water content may lead to a needless and uneconomic sacrifice of strength.

In a recent report (Road Research Technical Paper No. 5; H. M. Stationery Office, London),

it is shown that by adjusting the grading of the aggregates to fall within certain limits, it is possible for the engineer to obtain the best combination of workability and strength for his purpose.

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Forest Products Research Board for the Year 1937.—The work of the Forest Products Research Laboratory for the year 1937, is summarised in a recent report issued by H. M. Stationery Office. Descriptions of the investigations into the structure, seasoning and preservation of timbers, their working qualities, physical properties and chemical composition are also included in the Report. Among other important subjects discussed are laminated wood products and fibreboard packing cases. Typical examples are also given of the help afforded to industry and to the general public by the Research Board.

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Royal Institute of Science, Bombay.—Mr. D. V. Bal of the Zoology Department, has been awarded the Sir Mangaldas Nathubhoy Scholarship of the Bombay University for the study of Marine Biology in England.

The National Institute of Sciences, India, will hold a Symposium on " Recent Work on the Synthesis of Naturally Occurring Substances " at the Royal Institute of Science, Bombay, on the 26th and 27th September. The Vice-Chancellor will perform the formal opening. Prof. M. N. Saha is expected to attend.

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University of Mysore.—1. *Personnel* : (1) Miss M. C. Albuquerque, L.R.C.P., M.R.C.S., L.M., Lady Medical Officer, Vani Vilas Hospital, Bangalore, was appointed Principal, Medical School, Bangalore, *vice* Rajasevasakta Dr. B. K. Narayana Rao appointed as Senior Surgeon. (2) A Professorship for Applied Mathematics was sanctioned for the Central College and Dr. B. S. Madhava Rao was appointed to it.

2. *Meeting of the Academic Council.*—A meeting of the Academic Council was held on the 27th August 1938. Among the propositions that were passed, mention may be made of the following :

(1) Re-instituting French as a second language and making provision for Latin also as a second language for the Intermediate, B.A., and B.Sc. examinations. (2) Providing the following additional group of optional subjects for the I.Sc. examination and the B.Sc. Pass Degree examination : Economics, Geology, Chemistry. (3) Scheme regarding the course of studies in Politics for the B.A. Honours degree examination. (4) Reducing the minimum for compartmental pass in the Intermediate Examination.

3. *Elections.*—(1) Mr. V. L. D'Souza, B.A., B.Com. (Lond.), Professor of Economics, Maharaja's College, Mysore, was elected to the University Council by and from the Academic Council *vice* Rajasevasakta Dr. B. K. Narayana Rao appointed as Senior Surgeon. (2) Sastravaidyapravina Dr. S. Subba Rao, B.A., M.B.C.M., etc., Retired Senior Surgeon, was elected as a member of the Mysore Medical Council *vice* Rajasevasakta Dr. B. K. Narayana Rao, by the Faculty of Medicine.

4. The Sri Krishnarajendra Silver Jubilee Lecture, 1938 (founded by Mr. V. Subrahmanya Iyer, B.A., Retired Registrar of the University) was delivered at Bangalore on the 27th August 1938, by Rao Bahadur Dr. A. Lakshmanaswami Mudaliar, M.D., F.C.O.G.

5. Government Orders were passed ordering the transfer of the degree class in the Maharani's College, Mysore, to Bangalore, with effect from 1939–40.

6. *Convocation.*—The 21st Annual Convocation of the University will be held at Mysore on Thursday, the 6th October 1938. Rev. C. F. Andrews has been invited to deliver the Convocation Address.

7. *Recognition of Examination.*—The B.T. Degree examination of this University is recognised by the University of Bombay as equivalent to its B.T. degree examination for purposes of admission into M.Ed. examination.

* * *

Lucknow University.—The following candidates are declared eligible to receive the Degree of D.Sc. :—(1) Mr. Shyam Sundar Lal Pradhan, M.Sc. The topic of his Thesis was " Morphological Studies on some Indian Coccinellids ". (2) Mr. Daya Shankar Surbahi, M.Sc. The topic of his Thesis was " The Anatomy of Indian Carp, *Labeo rohita* ".

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Mr. K. N. Kaul, Research Assistant to Prof. B. Sahni, appointed Demonstrator of Botany at the University of Lucknow. Mr. R. V. Sitholey, research student, selected as Research Assistant in place of Mr. K. N. Kaul. Mr. Bahadur Singh, research student in the same department, appointed Lecturer in Botany at the Balvant Rajput College, Agra. Mr. T. N. Srivastava, research student in Botany at Lucknow, appointed an Indian Forest Service probationer at Dehra Dun. Mr. N. P. Choudhury, another research student in the Department, appointed Demonstrator in Botany at the Agricultural College, Mandalay. Dr. S. C. Varma, Ph.D. (London), Demonstrator in Botany at Lucknow University, appointed Lecturer in Botany at the Agricultural College, Mandalay.

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We have pleasure in announcing that **Hon'ble Sir S. M.** Sulaiman, **Kt., M.A., LL.D., D.Sc., F.N.I.,** Delhi ; **Mr. E. F. G. Gilmore, B.Sc. (Hons.),** M.I.M.E., Director, Industrial Research Bureau, Calcutta ; **Dr. S. Siddiqui, D.Phil. Nat.,** Director, Research Institute, A. & U. Tibbi College, Delhi ; and **Khan Bahadur Dr. M. Afzal Husain, M.A., M.Sc., I.A.S.,** have accepted our invitation to join the Board of Editorial Co-operation.

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Announcements.

Federation of University Women in India.—The following Fellowships are available to members of the above Federation 1939–40 :—

1. International Senior Fellowship in Arts (£ 250).
2. International (A.A.U.W. Fellowship Crusade) Fellowship ($ 1500).
3. International Residential Fellowship at Crosby Hall (£ 100).

4. Helsinki Hospitality Fellowship.
5. Bursaries at Crosby Hall.
6. Research Fellowship, University of Sydney, Australia (1939–41) £200 per annum.

Further information regarding the above can be had from the Hon. Gen. Secretary, Federation of University Women in India, 31, Adder Road, Cumballa Hill, Bombay.

International Technical Commission of Pharmacopœial Experts.—At the recent session of the Health Organization of the League of Nations, a Commission was appointed to carry on the work of the Brussels Conference for the establishment of standards for potent medicines. The Committee consists of C. H. Hampshire, Chairman (London), H. Baggesgarad (Copenhagen,) V. E. Zunz (Brussels), M. Tiffeneau (Paris), R. Eder (Zurich), L. Van Itallie (Leyden), E. Fullerton Cook (Philadelphia), and a member of the Union of Soviet Socialist Republics.

The Brussels Conference was the outgrowth of earlier efforts to establish an International Pharmacopœia. In 1902 a group of pharmacists from Brussels, in the name of the Belgian Government, issued invitations to practically all nations of the world to participate in a Conference for the purpose of establishing uniformity in the definition and strength of the more potent medicines in use throughout the world.

A second Conference was called for 1914, but was postponed because of the World War. The second Conference was finally assembled at Brussels in 1925, with representatives from more than 40 nations participating. Additional uniformity in standards and preparations was recommended and the Conference adjourned after passing recommendations that its work be taken over by the Health Organization of the League of Nations.

The establishment of a Pharmacopœial Secretaryship at the League, has been the basis for discussion for many years but the actual establishment of the programme has only now been completed. The Chairman of the Committee is the Secretary of the British Pharmacopœial Commission, which has recently published the First Supplement to the *British Pharmacopœia.*

The International Commission plans to compile a list of the more important medicines used throughout the world and invite the National Pharmacopœial Commissions in various countries to prepare model monographs, which, when finally approved, will be presented to the Pharmacopœial Commissions of the world with the hope that they may assist in bringing about greater uniformity in titles, definitions, descriptions, tests for identity and purity, and methods of assay.

It is hoped also that it will compile the pharmacopœial literature of the world for the use of all pharmacopœial commissions (*Ind. and Eng. Chem.*, News Edition, 1938, **16**, 376).

The attention of our readers is drawn to a review on **"Reports on Progress in Physics"** appearing elsewhere in this number. The volume is a comprehensive review, by leading physicists, of recent work in general and atomic physics, and can be purchased from the Manager, Physical Society, 1, Lowther Gardens, Exhibition Road, London S.W. 7 (Price 20*sh.* post free).

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We acknowledge with thanks, receipt of the following :—

" Agricultural College Magazine, Nagpur," Vol. 13, No. 4.
" Agricultural Gazette of New South Wales," Vol. 39, No. 8.
" Journal of Agricultural Research," Vol. 57, No. 1.
" Monthly Bulletin of Agricultural Science and Practice," Vol. 29, No. 7.
" Agricultural and Live-stock in India," Vol. 8, Part 4.
" The Philippine Agriculturist," Vol. 26, No. 3.
" Journal of the Royal Society of Arts," Vol. 86, Nos. 4470–74.
" Biochemical Journal," Vol. 32, No. 7.
" Journal of the Institute of Brewing," Vol. 43, No. 12 and Vol. 44, No. 1.
" Chemical Age," Vol. 39, Nos. 995–99.
" Journal of Chemical Physics," Vol. 6, No. 8.
" Journal of the Indian Chemical Society," Vol. 15, No. 6.
" Berichte der Deutschen Chemischen Gesselschaft," Vol. 71, No. 8.
" Journal de chemie physique," Vol. 35, No. 6.
" Russian Journal of General Chemistry," Vol. 8, Nos. 5 and 6.
" Experiment Station Record," Vol. 79, Nos. 1–2 and Index to Vol. 77.
" Indian Forester," Vol. 64, No. 9.
" Transactions of the Faraday Society," Vol. 34, No. 208.
" Forschungen und Fortschritte," Vol. 14, Nos. 22–24.
" Bulletin of the Health Organization, League of Nations," Vol. 7, No. 3.
" Medico-Surgical Suggestions," Vol. 7, No. 8.
" Calcutta Medical Journal," Vol. 34, No. 3.
" Mathematics Student," Vol. 5, No. 4.
" Review of Applied Mycology," Vol. 37, Nos. 4–7 and Index to Vol. 36.
" Nature," Vol. 142, Nos. 3587–90 and Index to Vol. 141.
" Journal of Nutrition," Vol. 16, Nos. 1–2.
" Proceedings of the Royal Society of Edinburgh," Vol. 57, Parts 1–4 and Vol. 58, Part 1.
" Research and Progress," Vol. 4, No. 5.
" Canadian Journal of Research," Vol. 16, Nos. 6 and 7.
" Sky," Vol. 2, No. 10.
" The Indian Trade Journal," Vol. 130, Nos. 1677–81.

Catalogues.

Wheldon and Wesleys, Ltd., London. (1) " Books on Microscopy," (2) " Natural History and Science ".

The Forest Research Institute, Dehra Dun — " Classified Catalogue," 1934.