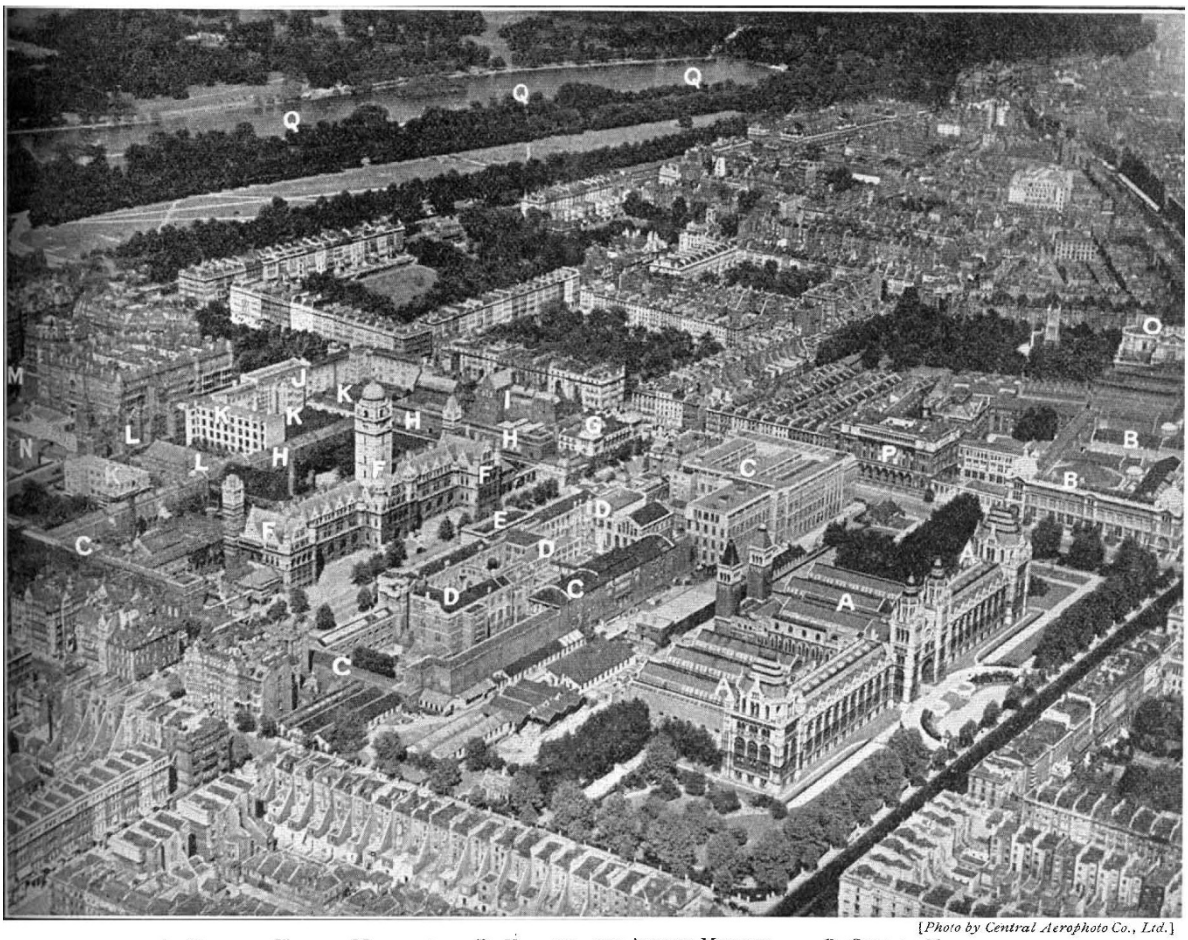
Science and Education at South Kensington.[1]

By T. LL. HUMBERSTONE.

A LARGE part of the area shown in the accompanying photograph was at one time Brompton Park, a fine estate famous for its snipe-shooting and for its mild and salubrious air. In 1675 the park became a market-garden, the first of its kind in England. A short distance eastwards was Knightsbridge, an outlying hamlet of London, the scene of frequent skirmishes during the Civil War. Cromwell's association with the district—there is a tradition that he lived near what is now Queen's Gate—is preserved in the name Cromwell Road. Knightsbridge and Brompton maintained their sequestered character until comparatively recent times. It is recorded that until the middle of the nineteenth century, which must be well within the memory of the oldest inhabitant, people started from Hyde Park Corner at regular intervals in bands for mutual protection, and a bell was rung to warn pedestrians when the party was about to set out. Thus the effective history of the district for our purpose begins in 1851, when the great International Exhibition was opened in Hyde Park. Its initiation and success were largely due to the Prince Consort, and appropriately, therefore, the estate, which was purchased for the modest sum of 150,000*l.* from the profits of the Exhibition, is dominated on the northern and higher side by the Albert Memorial in Kensington Gardens and by the Royal Albert Hall. Would it be possible to find, in the whole educational history of the country, an example of money spent to greater advantage for the promotion of science and art? Sites have been provided for a splendid group of educational and public buildings and in addition a considerable annual income is received which is devoted to scientific purposes. The Exhibition of 1851 justified the hopes of its founders. It was to be for the nineteenth century



[*Photo by Central Aerophoto Co., Ltd.*]

A=NATURAL HISTORY MUSEUM. B=VICTORIA AND ALBERT MUSEUM. C=SCIENCE MUSEUM.
D=ROYAL COLLEGE OF SCIENCE (NEW BUILDING). E=SCIENCE LIBRARY. F=IMPERIAL INSTITUTE AND UNIVERSITY OF LONDON.
G=ROYAL SCHOOL OF ART NEEDLEWORK. H=INDIA MUSEUM. I=CITY AND GUILDS ENGINEERING COLLEGE.
J=ROYAL SCHOOL OF MINES. K=IMPERIAL COLLEGE. L=ROYAL COLLEGE OF MUSIC. M=ROYAL ALBERT HALL.
N=ROYAL COLLEGE OF SCIENCE (BOTANY) AND IMPERIAL COLLEGE UNION. O=BROMPTON ORATORY.
P=ROYAL COLLEGE OF SCIENCE (OLD BUILDING). Q=SERPENTINE IN HYDE PARK.

[1] It is fitting that NATURE should take advantage of the method of obtaining "bird's-eye" views by means of aerial photography. Arrangements have been made for a short series of articles dealing with certain London areas of scientific interest illustrated by such photographs. The first of these, on South Kensington, is here printed. This will be followed by an article on Bloomsbury by the same contributor.

what the tournament had been in mediæval times—a challenge to every land, "not to the brightest dames and bravest lances as of yore," but to its best produce and happiest device "for the promotion of universal happiness and brotherhood." Happy days! Never perhaps was the spirit of the English people more buoyant, hopeful, confident. This was due in part to a growing appreciation of the benefits which science would confer on humanity.

The Albert Hall was designed to carry out the Prince Consort's expressed ideas as forming "a central point of union where men of science and art could meet, where the results of their labours could be communicated and discussed, and where deputies from affiliated societies could occasionally confer with the metropolitan authorities." Public response to the appeal for the Prince Consort's memorial was less generous than was expected. The memorial in Kensington Gardens, which cost 130,000*l.* and took twenty years to complete, absorbed all the free-will offerings, including 50,000*l.* from Parliament, and it was therefore necessary to establish the Albert Hall on a commercial basis with the financial assistance of the 1851 Exhibition Commissioners, and even of the builders. A capital sum of 200,000*l.* was raised and seats were retailed (with a generous tenure of 999 years) for 100*l.* each. The foundation-stone was laid by Queen Victoria in 1867 and the Hall was opened in 1871. Those who, in view of the uses to which the Hall is occasionally put, may feel doubt as to the high ideals of its founders should read the inscription on the frieze, which asserts: "This Hall was erected for the advancement of the arts and sciences and for the works of industry of all nations, in fulfilment of the intentions of Albert, Prince Consort."

Not far south from the Albert Hall is the most beautiful building on the estate, and possibly in the kingdom, the Imperial Institute. This magnificent pile is the permanent memorial of the completion of the first fifty years of Queen Victoria's beneficent reign. Initiated by the Prince of Wales with the co-operation of the Lord Mayor of London, contributions to the fund poured in from all parts of the Empire. By 1892 a capital sum of 413,000*l.* had been obtained, including 236,862*l.* in private donations from Great Britain and 101,550*l.* from India, and a public grant of 20,000*l.* from Canada. Queen Victoria laid the foundation-stone on July 4, 1887. On this occasion the Prince of Wales expressed the hope that the Institute would hereafter exhibit not only the material resources of the Empire, but be "an emblem of that Imperial unity of purpose and action which we believe has gathered strength and reality with every year of your Majesty's reign." Mr. T. E. Collcutt was the architect, and the style is Italian Renaissance, with rich and abundant ornamentation. The central tower, 280 feet high, contains the Alexandra Peal of ten bells, given by an Australian lady.

Alas! the founders of the Imperial Institute gave more thought to raising the necessary capital than to sordid considerations of current income and expenditure. A somewhat fanciful scheme for electing Fellows, who were given certain club facilities and the right to use letters after their names, came to an untimely end. Call a building a white elephant and close its doors may be accepted as a paraphrase of a well-known proverb. In serious financial difficulties, the Institute sought the protection and assistance of the Government, which adopted the familiar expedient of taking in lodgers. Thus it came about that the University of London, which during the whole course of its existence had flitted like an embarrassed shade from one set of Government lodgings to another, including Somerset House, Marlborough House, and Burlington Gardens, obtained possession in 1900 of the larger part of the Imperial Institute for administrative purposes. In the remaining part of the building, the Imperial Institute continues its work of investigation and propaganda. Let us hope that in the near future the University may find its Canaan in Bloomsbury and this monumental building may again be wholly used for the noble purposes, sealed and sanctified by the War, for which it was originally founded; thus may Queen Victoria's earnest prayer at its inauguration in 1893 be fulfilled that the Institute might "never cease to flourish as a lasting emblem of the unity and loyalty of the Empire."

Reverting to the history of the Commissioners' estate, we find that at an early stage a large piece of ground, 12 acres in extent, was sold to the Government for the purposes of the Science and Art Department and its colleges and museums. This Department, originally founded in 1853 as a branch of the Board of Trade, became a few years later a distinct department of the Privy Council. It was moved westward from its quarters in Marlborough House in 1857 and drew up a programme of educational and scientific work which made "South Kensington" famous throughout the civilised world. The mere catalogue of the institutions which the Department administered is sufficiently impressive, including the South Kensington (now the Victoria and Albert) Museum, the Science Museum, the Science Library, the Royal College of Science, the Royal School of Mines, and the Royal College of Art. The Royal College of Science and Royal School of Mines claim descent from the Government "School of Mines and of Science applied to the Arts," established in Jermyn Street in 1851, and from the Royal College of Chemistry, originally established in Oxford Street, which combined with the School of Mines in 1853. The various departments were transferred to South Kensington between 1872 and 1880 to the old building in Exhibition Road, an early and beautiful example of building in terra-cotta. In 1905 the new chemical and physical laboratories, designed by Sir Aston Webb, were opened in the Imperial Institute Road, and, at about the same time, the new Victoria and Albert Museum, built to the designs of the same architect. The work of the Science and Art Department as a separate department came to an end under the Board of Education Act of 1899. It must be admitted that its adventures into the domain of secondary education were less happily inspired, and that there was need for co-ordination between secondary and technical education. In its day and generation, however, the Department did a great work, from which the impartial historian of national education will not withhold grateful appreciation and the historian of the late War may trace some of the silver threads of victory.

South Kensington was not only closely associated with the early history of general scientific education, but it recapitulates that history. A permanent memorial there to the technical education movement of the 'seventies and 'eighties is the City and Guilds of London Institute for the Advancement of Technical Education. The Institute was formed in 1878 by the Livery Companies of the City of London, one of its principal objects being the establishment of the Central Technical College to supply higher technical education to productive industry. It was designed originally as the coping-stone of a system of technical schools, and particularly for the training of technical teachers. The foundation-stone of the College was laid by the Prince of Wales in 1881, and the building was completed three years later. Its work is now confined to engineering education, and it is one of the largest and best-equipped schools for this subject in the country.

The next important movement, which had for its object the development of teaching and research in applied science, culminated in 1907 in the establishment of the Imperial College of Science and Technology, to which a Royal Charter was granted. The Board of Education transferred to the new governing body of the Imperial College the control of the Royal College of Science and the Royal School of Mines; and the Central Technical College, renamed the City and Guilds (Engineering) College, was also brought into the scheme of common administration. Remarkable progress has since been made in developing the resources of the colleges for teaching and research. A new building has been erected for the Royal School of Mines, and an extension (provided by the Goldsmiths' Company) of the City and Guilds College and others for botany, plant physiology and pathology, and chemical technology, while the social needs of the students have been met by the provision of a special building for the Imperial College Union.

The foregoing list by no means exhausts the buildings at South Kensington. The Natural History Museum (a branch of the British Museum) is in grey terra-cotta, built to the designs of Alfred Waterhouse, and was finished in 1880. It is both a museum and a centre for natural history study and research. The Royal College of Music, a less austere enterprise, was built by Sir Arthur Blomfield and opened in 1894; and the Royal School of Art Needlework and the headquarters of the Royal Geographical Society in Kensington Gore must also be mentioned.

Some final reflections. First and most obvious, the available space at South Kensington is now practically exhausted. Almost the only science which has not been practised at South Kensington is town planning, and there can be no doubt that the area might have been planned more economically. Much still remains to be done in providing new departments of pure and applied science. Under no possible reorganisation of higher education in the metropolis can South Kensington cease to be a most important centre for education and research in science and art. It has great resources in traditions, in men, in materials; and if, like Oxford, it is already the home of some lost causes, it has a marvellous power of adapting itself to new conditions.

Dark Nebulæ.[1]

By Prof. H. N. RUSSELL, Mount Wilson Observatory.

IT is now generally believed that many of the dark markings in the Milky Way, and dark starless regions in the sky, are produced by the interposition of huge obscuring clouds between us and the more remote stars. A long list of such dark markings has been given by Barnard,[2] who has done more than any one else to point out their importance and probable nature. In some cases, as in the Pleiades, Orion, and Ophiuchus, these "regions of obscuration" merge into faintly luminous nebulosity in the vicinity of certain stars, in such a way that there can be no doubt that they lie near these stars in space.

It thus appears that the obscuring masses or dark nebulæ in Ophiuchus and Scorpius are at a distance of 100 to 150 parsecs, those in Taurus at probably about the same distance, and those in Orion some 200 parsecs from us, while the dimensions of the individual clouds are themselves measured in parsecs.

The occurrence of these three great regions of obscuration within a distance which is so small compared with that of the galactic clouds indicates that such objects are probably of great cosmical temperature.

These dark nebulæ usually appear to be quite opaque. In some cases the stars can be seen faintly through them, apparently without much change in colour; but in some examples[3] stars imbedded in dense luminous nebulosity are abnormally red.

Of the various forms in which matter may be distributed in space, by far the most efficient in producing obscuration is fine dust, since this has the greatest superficial area per unit of mass. In a cloud composed of spherical particles of radius r and density ρ, distributed at random so that the average quantity of matter per unit volume is d, the extinction of a beam of light in passing through this cloud will be e stellar magnitudes per unit of distance, where $e = 0{\cdot}814\ qd/\rho r$. The numerical factor is independent of the physical units which are employed. The factor q is introduced to take account of the complications which occur when the size of the particle becomes comparable with the wave-lengths of light.[4] For particles more than two or three wave-lengths in diameter q is sensibly equal to unity. For smaller particles it increases and is a maximum, 2·56, when the circumference of the particle is 1·12 times the wave-length. It then rapidly diminishes and becomes nearly equal to $14/3 \times (2\pi r/\lambda)$ for particles of less than half this diameter.[5] The ratio

[1] Communication to the National Academy of Sciences, Washington, on March 14. Reprinted from the Proceedings of the Academy, vol. 8, No. 5, May 1922.

[2] Barnard, E. E., *Astrophys. Journ., Chicago*, 49, 1919 (1-23).

[3] Seares, F. H., and Hubble, E. P., *ibid.*, 52, 1920 (8-22); *Mt. Wilson Contr.*, No. 187.

[4] Schwarzschild, K., "Sitzungsberichte der K. B. Akad. der Wiss.," *Math.-Phys. Kl., München*, 31, 1901 (293-338); Proudman, *Monthly Not., R.A.S., London*, 73, 1913 (535-539).

[5] Barnard, E. E., *Astrophys. Journ., Chicago*, 38, 1913 (496-501).