COPIES of two booklets, which have been published privately by Mr. F. W. Armstrong, of the Blue School, Wells, Somerset, have been received. They deal respectively with elementary inductive chemistry and inductive physics.

A NEW catalogue of physical and electrical instruments, balances, &c., has been issued by Messrs. W. G. Pye and Co., of the "Granta" Works, Cambridge. The excellent illustrations, drawn to a larger scale than is usual in similar publications, should greatly assist customers ordering instruments from a distance, since with the accompanying concise explanations little room is left for misapprehension.

OUR ASTRONOMICAL COLUMN.

THE VARIABLE ASTEROID 1905 Q.Y.—From a telegram from Dr. Palisa to the Kiel Centralstelle, it appears that the asteroid which, on the supposition that it was a newly discovered one, was designated 1905 Q.Y., is identical with that known previously as (167) Urda. The identity is confirmed by Prof. Berberich, who writes that on August 28 the magnitude of Urda was from 0·5m. to 1·0m. brighter than shown by the value given in the Jahrbuch (*Astronomische Nachrichten,* No. 4046).

NOVA AQUILÆ No. 2.—From a note in No. 4046 of the *Astronomische Nachrichten,* we learn that the position first given for Nova Aquilæ was 1m. wrong in R.A. It should have read R.A. $=284^{\circ}\ 17'$ ($=$18h. 57m. 8s.) instead of $284^{\circ}\ 2'$ as given, the mistake occurring in the first telegram received at Kiel.

Observing this object on September 5, Prof. Hartwig determined the position, referred to the equinox of 1905·0, as R.A. $=284^{\circ}\ 16'\ 16''$ ($=$18h. 57m. 5·06s.), dec. $=-4^{\circ}\ 34'\ 50''$, and found the magnitude to be 10.

FRENCH OBSERVATIONS OF THE TOTAL SOLAR ECLIPSE.—No. 10 (September 4) of the *Comptes rendus* contains the brief reports received from various French eclipse expeditions by the Académie des Sciences.

Prof. Janssen, M. Bigourdan, and MM. Stephan and Trépied, observing at Alcosebre, Sfax, and Guelma respectively, report satisfactory meteorological conditions and successful observations. At the last named place M. Bourget obtained fourteen negatives of the corona, using coloured screens. The parties at Cistierna, Burgos, and Tortosa were less fortunate, clouds interfering with, or totally preventing, observations. The measures of the ionisation of the electric field were, however, carried out throughout the eclipse by the observers at Tortosa. Similar observations were carried out, entirely according to programme and under perfect conditions, at Philippeville, and M. Nordmann, from a preliminary examination of the curves obtained, expects that some very interesting results will accrue when these are finally compared with those obtained on previous occasions. M. Salet, from the same station, reports that the polarisation of the corona was well observed, the deviation of the plane of feeble polarisation being 3°. Ten coronal radiations were photographed with a "Nicol" in front of the slit, and fifteen ultra-violet coronal radiations were photographed with the spectroscope.

From the eclipse station at Alcalá de Chisbert (Spain) M. M. Moye writes that the eclipse was observed under good conditions, and that the corona was very brilliant, the longest streamers occurring in the south and the north-east. The green line was very apparent. Shadow bands were well observed both before and after, but were invisible during totality.

Observations of the partial phase were made in Paris, where the times of the contacts and of the occultations of spots were recorded by several observers. Unfavourable meteorological conditions prevented the actinometric observations, which it was proposed to carry out at Trappes, Bordeaux, and the Pic du Midi, from being made, but a series of good observations was obtained at Bagnères.

EYE-ESTIMATES OF THE TRANSITS OF JUPITER'S SPOTS.—In order to determine whether his own eye-estimates of the transits of Jupiter's spots were subject to any error similar to that suspected by Schmidt, the Rev. T. E. R. Phillips has analysed his observations, which number about 140, and cover the period of seven apparitions. As a result he has arrived at the conclusion that at the beginning of each apparition, when the planet's hour-angle is east, he observes the transit a little too early. Similarly, at the end of each apparition, when the hour-angle is west, the transits are recorded a little too late. The explanation of this error is that it is due to the varying slant of the belts as the planet is removed from the meridian, and the consequent failure of the eye to determine correctly the position of the line which bisects the disc and is normal to the planet's equator. If this explanation is correct, the error should be of the opposite sense in the two hemispheres, but the evanescent character of the spots in the northern hemisphere has prevented Mr. Phillips from making this test. Again, if the cause suggested is the true one, this error should disappear if care be taken to keep the line joining the eyes parallel to the belts.

In No. 361 of the *Observatory* Mr. Phillips gives the details of his observations during each opposition since 1898, and a diagram which shows the effect of the error referred to above on the observed drift in longitude of the Great Red Spot "Hollow." The hope is expressed that this may lead other observers to elucidate the matter further from their own experiences.

THE SOLAR ACTIVITY, JANUARY–JUNE.—No. 7, vol. xxxiv., of the *Memorie della Società degli Spettroscopisti Italiani* contains Prof. Mascari's usual summary of the solar observations made at the Catania Observatory during the first six months of the current year. A comparison of the "frequencies" observed with those recorded for the latter semestre of 1904 shows that the solar activity was much greater during the later period, but the increase was much more marked during the first quarter of this year than during the second. The daily frequencies of spots, faculæ, and prominences during the six months under discussion were 7·18, 7·12, and 3·29 respectively.

Two plates which accompany this publication show, diagrammatically, the sizes and positions of the prominences observed on the sun's limb at the observatories of Catania, Kalocsa, Odessa, Rome, and Zurich during the last quarter of 1902 and the first two months of 1903.

INSTITUTION OF MINING ENGINEERS.

THE sixteenth annual general meeting of the Institution of Mining Engineers was held at Manchester on September 13, 14, 15, and 16 under the presidency of Sir Lees Knowles, M.P. The report of the council contained an expression of deep regret at the loss sustained by the death of the president, Sir Lowthian Bell. The Institution of Mining Engineers is a federation of seven local mining societies—the Manchester Geological and Mining Society; the Midland Counties Institution of Engineers; the Midland Institute of Mining, Civil and Mechanical Engineers; the Mining Institute of Scotland; the North of England Institute of Mining and Mechanical Engineers; the North Staffordshire Institute of Mining and Mechanical Engineers; and the South Staffordshire and East Worcestershire Institute of Mining Engineers. Since the formation of the institution in 1889, the membership has increased from 1239 to 2901 in 1905.

The first paper read was on the leading features of the Lancashire coalfield by Mr. Joseph Dickinson, formerly H.M. Chief Inspector of Mines. This paper gave a concise summary of the recent developments of the geological investigation of the coalfield. Electric power distribution was dealt with in a paper by Mr. R. L. Gamlen, in which he showed the advantages possessed by the power companies as providers of power. Mr. B. H. Thwaite submitted a paper on colliery explosions in which he suggested, as a method of dealing with explosions, the installation of a series of pipes conveying a supply of oxygen and a pneumatic method of coal-dust removal. The former proposal met with much adverse criticism in the discussion. Mr. Sydney F. Walker read a paper on earth in collieries, in which he pointed out some of the difficulties in carrying out the special rules drawn up by the departmental committee for the installation and use of electricity in mines. If earth was to be admitted into the system, the only method of carrying out the wishes of the committee was to use an uninsulated return completely enclosing the live conductor. The last paper read was by Mr. John T. Stobbs on the value of fossil Mollusca in Coal-measure stratigraphy. He expressed the opinion that Mollusca afforded the best means of correlating Coal-measures, and considered that their neglect was due to inadequate collections in public museums, and to the fact that teachers failed to impress upon students the utility of the Mollusca as zonal indices. The Coal-measures were, he thought, comparatively neglected by the geologist, the knowledge of the Ordovician, Silurian, and Chalk systems being much more exact than that of the 3000 feet of Coal-measures. The remaining days of the meeting were devoted to excursions to Chanters Colliery, to New Moss Colliery, to the Manchester Museum, to the works of the British Westinghouse Company and the Manchester Ship Canal, to Pendleton Colliery, and to other places of interest.

THE BRITISH ASSOCIATION.

SECTION K

BOTANY.

OPENING ADDRESS[1] BY HAROLD WAGER, F.R.S., H.M.I., PRESIDENT OF THE SECTION.

ON SOME PROBLEMS OF CELL STRUCTURE AND PHYSIOLOGY.

Introduction.

WHEN Robert Hooke, in the early part of the seventeenth century, discovered, with the aid of his improved compound microscope, the cell structure of plants, he little thought that our ultimate knowledge of the physical and chemical processes in the living organism, of its growth and reproduction, of the problems of heredity and of the factors underlying the origin of life itself, would be in the main dependent upon a clear understanding of the structure and physiology of the cell.

Hooke's researches did not, in fact, carry him very far, and we must turn to the nearly contemporaneous works of Malpighi and Grew on the anatomy of plants for the first clear indication of the important part which cells take in the constitution of the various tissues of plants. The account they give of them is extremely interesting in the light of our present knowledge. Grew, for example, in speaking of the structure of the root, compares the parenchyma to a sponge, "being a body porous, dilative, and pliable . . . a most exquisitely fine wrought sponge." The pores are spherical and consist of "an infinite mass of little cells or bladders. The sides of none of these are visibly pervious from one into another; but each is bounded within itself. . . . They are the receptacles of liquor, which is ever lucid, and . . . always more thin or watery." There is no indication either in Grew's or Malpighi's works that they understood the significance of this cell structure, and it was not until the beginning of the nineteenth century, after a lapse of some 150 years, that any insight into the real nature of the cell and its functions was obtained. But then began a period of activity—associated with the names of Turpin, Meyen, Robert Brown, Purkinje, J. Müller, Henle, Valentin, and Dutrochet—which culminated in the cell theory of Schleiden and Schwann that the common basis of all animal and plant tissues is the cell, and that it is upon this elementary vital unit that all growth and development depends.

The nucleus was discovered in 1831 by Robert Brown in various tissues of the Orchideæ and in some other families of the monocotyledons, as well as in some dicotyledons. He described it as a "single circular areola, generally somewhat more opaque than the membrane of the cell," and more or less granular. It is very distinct and regular in form, and its granular matter is held together by a coagulated pulp not visibly granular, or, which may be considered equally probable, by an enveloping membrane. Although Robert Brown was the first to recognise the importance of the nucleus, and to give it a name, it had been seen by previous observers, and he himself mentions that he had met with indications of its presence in the works of Meyen and Purkinje, chiefly in some figures of the epidermis; in a memoir by Brogniart on the structure of leaves, and that Mr. Bauer had particularly noticed it in the cells of the stigma of *Bletia tankervilliae,* but had associated it with the impregnation by pollen. There are some figures by Leeuwenhoek, published in 1719, to which Prof. L. C. Miall has directed my attention, of blood-corpuscles of a fish, human epidermal cells, and the connective tissue of a lamb, in which nuclei are shown, and they had been seen by Fontana (1781) in epithelial cells, and by Cavolini (1787) in some fishes' eggs.

[1] Slightly abridged.

To Schleiden and Schwann the cell was essentially a membranous vesicle enclosing a fluid sap and a solid nucleus. They thought that it arose in contact with the nucleus as a delicate transparent vesicle which gradually increased in size and became filled with the watery sap. As soon as it was completely formed, the nucleus, having done its work, was either absorbed or cast off as a "useless member," or in some cases was "found enclosed in the cell-wall, in which situation it passes through the entire vital process of the cell which it has formed." So far from being the most important organ of the cell, as we now consider it to be, they saw in the nucleus merely a centre of cell formation which is no longer required when the cell is formed. It was left for Hugo von Mohl to show that the mucus-like contents of the cell which he called protoplasm (1846) is the real living matter in which reside those activities which call into play the phenomena of life, and that the origin of nuclei by division from a nucleus already existing in the parent cell would possibly be found to occur very widely. Von Mohl, Nägeli, and Hofmeister all appear to have had some idea of the importance of the nucleus in cell division. Von Mohl says that the "process is preceded in almost all cases by a formation of as many nuclei as there are to be compartments in the mother-cell." Hofmeister's description of it is interesting: "The membrane of the nucleus dissolves, but its substance remains in the midst of the cell; a mass of granular mucilage accumulates around it: this parts, without being invested by a membrane, into two masses, and these afterwards become clothed with membranes and appear as two daughter-nuclei."

It is, however, mainly to the researches of the last thirty years that we owe our knowledge of the many complex cell-activities at work in living organisms, and we are still only just on the fringe of the great problems which cytology has to solve. Some of the most important of these are the origin and evolution of the nucleus, the meaning of the complex mode in which the nucleus divides, the origin and nature of the spindle figure and centrosomes, the part played by the chromosomes in the transmission of hereditary characteristics, the meaning of the phenomena accompanying fertilisation, the significance of the longitudinal division of the chromosomes and of their reduction in number in the sexual cells, and the evolution of the living substance. The satisfactory solution of these problems depends upon a clear understanding of the structure of protoplasm and its various differentiations. How far we have succeeded in obtaining this I will endeavour to show.

The Differentiation of Structure in the Cell.

The essential constituent of a cell is the protoplasm. This is differentiated into two constituents, the cytoplasm and the nucleus. It is usually held that this differentiation is an essential one, and that these two constituents are present in all cells; but, as we shall see later, there is some evidence that not only are there cells with very rudimentary nuclei, but cells in which no trace of a nuclear structure can be found at all.

In addition to this primary differentiation of the cell, secondary differentiations occur, resulting in the production of organs such as chloroplasts, chromoplasts, leucoplasts, pyrenoids, and pigment spots, which have special