The Photographic Plate.

THE third Hurter and Driffield memorial lecture was delivered in the theatre of the Royal Society of Arts, before the Royal Photographic Society, on May 9, by Prof. The. Svedberg of Upsala, who took for his subject "The Interpretation of Light Sensitivity in Photography." After a short general discussion of light sensitiveness from a purely photochemical point of view, particularly with regard to Einstein's law of the photo-chemical equivalent, the lecturer distinguished between *plate*-sensitiveness, *grain*-sensitiveness, and sensitiveness of the *silver-halide material* of the grain. The first is the sensitiveness that concerns the practical photographer, but the third, together with some purely physical circumstances, determines the quality of the plate, and is that to which the emulsion maker should devote most of his attention. It has been recognised only quite recently that there is a sensitiveness of the haloid which is independent of the physical properties of the film and of the size of the grains or particles.

From a statistical point of view, and with single emulsions, that is emulsions prepared at once and unmixed with other emulsions, there is a certain relationship between sensitiveness and the size of the particle, the larger grains being more sensitive than the smaller. But though the probability for a grain to become developable is greater in the case of a large grain than in the case of a smaller one, yet taking any two individual grains one cannot tell whether, on exposure, the larger or the smaller will be the first to become developable. This is accounted for by the fact that development sets in at discrete points in the halide grain and progresses from these points until the whole of the grain is converted into metallic silver. One such starting-point is sufficient to render the grain completely developable.

These centres of action are located and counted by stopping development at a very early stage, and superposing a photograph of them on a photograph of the same particles taken in a deep red light before the exposure. A statistical study of the distribution of these centres gives the interesting result that within each size-class of halide grains they are distributed according to the laws of chance. The lecturer adds, "Whether the developable centres are pre-existent in the grains in the form of especially light-sensitive points, or whether their number and position in a grain is entirely determined by the light only—eventually by the haphazard distribution of the light quanta—we are so far not able to tell."

For various size-classes of grains in the same emulsion, the average number of centres increases with the size of the grain. This leads to the assumption that as a rule all the grains of a single (unmixed) emulsion are built up of the same silver halide material of the same light sensitiveness, the larger grains being more sensitive than the smaller ones merely because of the greater probability that a larger grain may contain one, or more than one, developable centre. The average number of centres is found to be proportional to the surface area of the grains.

By the use of X-rays, which are so little absorbed that the grain is exposed to their action through its whole mass, the available centres are found to be on the surface of the grain, so that the sensitiveness of a grain is determined entirely by its surface layer. By finding the number of centres per unit area of grain surface it is possible to find the sensitiveness of the silver halide material of an emulsion, independently of the size of its grains, and this has been done for three different emulsions, demonstrating clearly the great differences in sensitiveness to light of the haloid bromide material in different emulsions. Such estimations are likely to be of value to the emulsion maker in his endeavour to prepare emulsions of new and desirable properties.

The lecturer concluded his discourse by pointing out many questions that still remain to be answered in order to perfect our knowledge of the photographic plate and its sensitiveness to light. C. J.

Agricultural Research at Aberystwyth.

THE new agricultural buildings and the Welsh plant-breeding station of the Agricultural Department, University College of Wales, Aberystwyth, were formally opened on May 20 by the Minister of Agriculture, the Rt. Hon. Sir Arthur Griffith Boscawen, Bart.

The Welsh plant-breeding station owes its origin to the foresight of Sir Laurence Philipps, Bart., of Llanstephan House, Boughrood, Radnorshire, who generously provided an endowment of 10,000*l.* for the purpose, and who further assists the station with an annual donation of 1000*l.* to its funds for a period of ten years. In 1920 the station was recognised by the Ministry of Agriculture as a research institution entitled to grants-in-aid from the Development Fund, and by virtue of a capital grant and annual grants-in-aid, in addition to Sir Laurence Philipps's generous endowment, it has been possible to equip the station in a thorough and up-to-date manner.

The work in connection with the new agricultural buildings and the plant-breeding station was started in 1919. The buildings are now completed and consist of commodious and well-equipped laboratories for research in agricultural botany and agricultural chemistry, as well as lecture rooms, and a library. The laboratories of the plant-breeding station are also arranged for in the buildings and have been specially equipped in a manner suitable for the researches which are in progress. The buildings occupy the site of the old foundry near the station—practically all the laboratories and lecture rooms being, in fact, part of the original building—the alterations having been skilfully made by Mr. Bassett. In addition to the self-contained building which is now solely occupied by the Agricultural Department, Nantcellan Farm, Clarach, has been acquired for the use of the teaching department, and Frongoch Farm for the Welsh plant-breeding station. The former is situated in the Clarach Valley about three miles from Aberystwyth. It comprises about 142 acres of pasture and arable land together with about 28 acres of woodland. The main object of the farm is to furnish facilities for giving demonstrations to students and for carrying on experiments and research. It is considered eminently suitable for the purpose for which it was obtained. The latter is a farm of 92 acres and is used entirely for experimental purposes in connection with the Welsh plant-breeding station. In addition, the plant-breeding station has about 5 acres of garden ground situated a few minutes' walk from the laboratories. At the gardens the equipment consists of a large span greenhouse and an up-to-date pot culture station, together with cages and other essentials.

The formal opening marked a great advance in the facilities afforded in Central Wales for both the student and for research in the problems influencing productivity in the Principality. The investigations

conducted at the Welsh plant-breeding station are primarily intended to be of service to agriculturists in Wales, and are therefore bound to be of equal value to farmers generally in elevated areas in regions of high rainfall.

The chief aim of the station is to investigate problems connected with herbage plants with the view of producing improved strains of such important plants as red clover, lucerne, the rye grasses, cocksfoot, and all other grasses suitable for inclusion in mixtures for temporary and long-duration pastures. Researches on these lines are now well advanced, interesting reports having been issued from the station on the work so far conducted. The oat crop is also receiving detailed attention; the possibility of extending the practice of growing winter oats is being explored, and endeavour is being made to produce hardier, earlier, and stiffer-strawed varieties suitable to Welsh conditions. It should be stated that the potato, barley, and root crops are not being studied at the station.

Welsh agriculturists must not expect to see the full benefits from Sir Laurence Philipps's foresight and the developments that have followed from the foundation of the station until after the lapse of a number of years—for plant-breeding is a slow and laborious business based on the gradual building up of strains each of which can only be the outcome of prolonged investigation.

The Royal Observatory, Greenwich.

THE report of the Astronomer Royal presented at the annual visitation of the Royal Observatory, Greenwich, on June 3, deals with the year ended on May 10. The observations for the seven-year star catalogue, 1915–1921, have been concluded, practically all the stars having been observed at least seven times; they include all stars in the Backlund-Hough list north of declination −28°. The determination of their proper motions is now in progress. The working catalogue in use since January last includes all the stars brighter than the eighth magnitude (with some fainter ones in sparse regions) between North Decl. 32° and 64°. It will be remembered that the zones from N. 24° to N. 32° and from N. 64° to N. 90° were covered in recent Greenwich catalogues. The epoch 1925 is adopted for all catalogues about the present time, in accordance with a resolution of the Astronomical Union.

A change has been made in the method of determining azimuth error of the transit-circle. Formerly it depended upon observations of the nine standard polars within 3½° of the pole; a list has now been made of 70 stars the polar distances of which lie between 13° and 45°, most of them bright enough to be observed in daylight; as many of these as practicable are observed daily at both culminations, using the travelling-wire micrometer, thus greatly reducing the personality that was present in the previous method of hand-tapping used for the close polars. The latter stars will still be observed for place; their positions will no longer depend solely on double transits of Polaris, which were only obtainable for restricted periods of the year. The clock-star list has been modified by removing two very low stars and inserting eleven new ones to fill gaps.

The moon was observed on 126 nights; the average correction required to the Nautical Almanac value of the longitude is 13·38″. After the end of 1922 Brown's tables will be used in the Almanac, and there will be a discontinuity in the errors.

Eighteen consecutive divisions of the transit circle, covering an arc of 1½°, have been obliterated from some unknown cause in recent years; new divisions have recently been cut with a small steel scriber that was screwed to the bracket holding the pointer. The new divisions are very sharp, and the errors of graduation are very small.

The distribution of temperature in the neighbourhood of the instrument has been studied; thermometers are now read outside both the north and the south walls of the observing room; they frequently show differences of some degrees, depending apparently on the direction of the wind; it is therefore somewhat difficult to know what temperature should be employed when computing refraction.

The recently published volumes dealing with the results of the observations made with the Cookson floating telescope between 1911 and 1918, and with the observations and orbits of the double stars observed with the 28-inch refractor since 1892, have already been noticed in NATURE. The latter observations are being continued, 253 pairs having been measured during the year, of which 56 had separations less than 0·5″.

The Thompson equatorial has been used, as before, for the photographic determination of stellar parallaxes. In all, 896 plates have been measured during the year, and the parallaxes of 48 stars deduced, with a mean probable error of 0·009″; altogether 142 parallaxes have now been determined with this instrument.

The 30-inch reflector has been used for a photographic determination of the wave-lengths of maximum photographic intensity in stars of different colours. A grating of steel wire, 1·42 mm. in diameter, was used to produce diffraction images, the effective wave-length being found from the separation of images; the results, which were communicated to the Royal Astronomical Society, indicate that the graph connecting wave-length with spectral type is distinctly non-linear. An extension of this work, suggested by Prof. T. R. Merton, is now being commenced. A 7-inch prism has been borrowed from the joint permanent Eclipse Committee; this will be mounted in front of the 6-inch Franklin-Adams lens, for which an aluminium camera has been made; a coarse wire-grating will be placed in front of the prism.

The astrographic equatorial was used to complete the magnitude determination of stars in the Harvard polar sequence. The results, which are in good accord with those obtained at Mt. Wilson, were published in the Mon. Not. R.A.S. of last November. The instrument has now been taken to Christmas Island for the eclipse of next September. The latest report stated that the mounting had been set up, except part of the driving clock. It has been arranged to take photographs of the Kapteyn areas in zones 15° N., 15° S., and 30° S. in order to connect the northern and southern magnitude scales.

Sunspot activity declined considerably during the year; there were, however, some prominent groups, of which the largest two crossed the central meridian on 1921, May 14, and 1922, March 2.

The mean values of the magnetic elements for 1921 and the three previous years were as follows:

	Dec. W.	Hor. Force. (C.G.S. Units.)	Vert. Force. (C.G.S. Units.)	Dip.
1918	14° 27·8′	0·18464	0·43247	66° 52·8′
1919	18·2′	0·18454	0·43242	53·3′
1920	8·6′	0·18456	0·43192	51·8′
1921	13° 57·6′	0·18449	0·43183*	52·0*

* Denotes that these values are provisional.