PHOTOGRAPHY AT THE CRYSTAL PALACE.

PHOTOGRAPHY as a practical art of interest to others than a few investigators dates from 1839, when the Daguerreotype was introduced. Its development and applications were well illustrated at the Great Exhibition of 1851, but since that time there have been very few attempts, and none altogether successful, to show its further progress. The Royal Photographic Society has held more than forty annual exhibitions, but as each of these has dealt with its current year only, the Council of the Society considered it desirable to arrange an exhibition that should demonstrate, not only the last year's advances, but the present position of photography and its applications as well as the history of its development.

The exhibition that was opened last week by the Prince of Wales is the result of the Society's endeavours. It must be regarded as eminently satisfactory, for it is not possible to call to mind many individuals or firms intimately connected with photography that have not contributed characteristic and interesting exhibits. The large areas of the north and south naves of the Crystal Palace, and of many of the courts, are well filled. The catalogue, which is published by the Society, will form an important historical work of reference, because of the numerous descriptive notes, references to original literature, dates, and examples of work that it contains. It is particularly fortunate that such an exhibition as this should have been inaugurated now rather than ten or twenty years later, as those of the older generation who are best able to speak of some of the older processes that are obsolete, and the introduction of the methods of to-day, are fast disappearing from our midst. There are, for example, but few left who are skilled enough in the Daguerreotype process to work it with a fair average of certainty, but Messrs. Negretti and Zambra have arranged a studio for taking Daguerreotypes of any who may desire it while the exhibition remains open. This is an opportunity that in all probability will never occur again.

The exhibition is divided into seven sections, namely: (1) the historical collection, (2) pictorial photography, (3) apparatus and material, (4) scientific and industrial applications, (5) photography in colours, (6) photography as a science, and (7) general technical photography. The Society's collection of portraits of eminent workers in connection with photography has been largely reinforced by loans from private individuals, and the series includes the elder and the younger Niepce, Fox Talbot, five of Daguerre, Andrew Ross, Sir David Brewster, Baron Pollock, Sir John Herschell, Mungo Ponton, W. B. Woodbury, F. von Vöigtlander, Dr. Draper, and many others; and in the catalogue there is a short biographical notice of each. Among the works of the elder Niepce there are exhibited the first camera photograph, taken in 1824, and some of the specimens that he submitted to the Royal Society in 1827. The Daguerreotype process is well represented. Daguerre's history and description of the process, dated 1839, and a translation of it into English published in the same year, are on view. The collection of Daguerreotypes and apparatus for producing them dates from 1842. Fox Talbot's callotype process, which was also made public in 1839, is even better represented; but space forbids further reference to these, and the various collodion and gelatine processes. The first methods and the developments of carbon printing are fully illustrated, including the gum-bichromate process, which, after being nearly forgotten, has lately been reintroduced and extolled.

After the examples of early work in the production of photo-etched plates and photo-typographic blocks, there follows the optical section. This is certainly the most complete collection of lenses ever got together. Examples of nearly ninety different kinds are shown, ranging from the early form of single lens by Chevalier and the first lens made in England for portraiture (in 1841, by Andrew Ross) to the stigmatics of Dallmeyer and Zeiss' planars. Sectional drawings of nearly fifty different kinds of lenses are given in the catalogue, and also a print from a photograph taken for the purpose with Sutton's panoramic water lens and his camera carrying curved plates.

Passing a very fine loan collection of photographs, which includes many examples by deceased workers, particularly Mrs. Cameron, D. O. Hill, O. G. Rejlander, B. B. Turner, and Colonel Stuart Wortley, and also the whole section of present-day apparatus and materials for photographic and photo-mechanical processes, there follows the section of the scientific and industrial applications of photography. The importance of photographic methods of observation was never more fully realised than it is at present. From almost the earliest days of photography the "recording science" has been applied in scientific investigations with the result not only of greater accuracy, but of the discovery of many facts that could never have been known by the use of the eye alone. Astronomy was one of the first of the sciences to derive benefit from photography; and in the delineation of the forms and features of celestial bodies, as well as in the spectroscopic analysis of their constitution, photographic processes have now almost entirely replaced the old method of drawing by hand what it was thought the eye could see. In many other domains of science photography is daily becoming more important, and it must continue to do so, especially as the scientific investigation of photography itself progresses. This important and universal method of work does not yet receive the attention and encouragement that it deserves in our teaching colleges; but this is due doubtless to the fact that, although it has done so much, it is still in its infancy so far as years are concerned. At the next exhibition of this kind there will without doubt be a far richer harvest of results to show, though this section, as it is here represented, well indicates not merely the directions in which future work is possible, but the very fine results that have already been accomplished, some of which it is difficult to believe can ever be surpassed. The Royal Observatory, Greenwich, contributes many exhibits, including some 12 × 10 prints of photographs of the recent solar eclipse, taken with the Thompson coronograph. Numerous other astronomical photographs are shown by the Royal Astronomical Society, Colonel Waterhouse, Dr. Common and Dr. Gill. Messrs. R. and J. Beck show twelve of De La Rue's original negatives of the moon. Photography as applied to spectroscopy, geology (including forty-one specimens from the B.A. Geological Photographs Committee), meteorology, zoology, botany, and Röntgen-ray work is well illustrated. In connection with the last, six large stereoscopic "skiagrams," by Dr. Mackenzie Davidson, mounted in reflecting stereoscopes, are strikingly good. The Kew Observatory Committee of the Royal Society sends photographs of various photographic recording apparatus, lens-testing apparatus, and other examples.

The section illustrating military photographs is of especial interest just now. The examples date from the Crimean war, and include balloon apparatus and photographs, the pigeon-post film used in the siege of Paris in 1871, and various examples from the School of Military Engineering at Chatham. But probably what will strike photographers as the most wonderful exhibits in this section is the telephotographic work contributed by the Italian Minister of War. The magnifications are far greater than we have been accustomed to, ranging up to one hundred diameters. Photo-micrography forms a large section, and includes a "complete photo-micrographic apparatus" by Zeiss, an apparatus that would

probably be regarded as an extreme luxury by most microscopists.

Photography in colours, by all the current methods, is well illustrated, many examples being of historic interest. G. Lippmann, A. Lumière, L. Vidal and H. W. Vogel and several English exhibitors contribute to this section.

"Photography as a science" refers apparently to what might be called *pure* photography to distinguish it from *applied*. But the distinction is neither clear nor precise. This section includes apparatus for measuring the densities of photographs, including opacities and blacknesses, by Captain Abney, Hurter and Driffield, and Chapman Jones; besides sensitometers, actinometers, and similar apparatus. Many results of the various treatments of photographic plates are shown, such as the sensitising for various colours, and the getting of an image free from stain, &c., that it may be of definite opacity. E. Sanger Shepherd shows an ingenious form of slit for spectroscopes, that is stated to be specially suitable for photographic use.

The National Photographic Record Association, that has recently become established through the energy of Sir Benjamin Stone, is well represented. Sir Benjamin himself contributes twenty-one photographs relating to the Houses of Parliament, every one of which is of general interest. There are numerous other examples of technical work to which we cannot refer in even the most general terms, except to a case exhibited by the Bolt Court Technical School of the London County Council Technical Educational Board, which illustrates the working of some of the most important photo-mechanical processes arranged for educational purposes.

While there are some exhibits that claim attention because of their novelty, these are the exception; the chief interest centres round the old rather than the new, and the complete presentation of the capabilities of photography in its numerous applications at the present day. But those whose knowledge of photography is of the general kind, and those who have not followed up its developments during the last few years, will find more that is new, of both examples and processes, than they will be able to appreciate in a single visit. Such an exhibition has never before been organised, and it must obviously be impossible to arrange another of similar extent until after the lapse of several years. The exhibition will close on May 14.

MICRO-BIOLOGY AS APPLIED TO HYGIENE.

AT the Congress of Hygiene and Demography recently held at Madrid, many matters of scientific interest and importance were introduced and discussed. Unfortunately the papers were not printed and distributed among the members, and as the majority were read in Spanish, the discussions were curtailed. The Section of Micro-biology as applied to Hygiene attracted the largest share of attention. Among the more important contributions was that of Dr. Behring, who announced that, as the result of experimental work with the toxin and antitoxin of tuberculosis, he had isolated a substance from the tubercle bacillus a hundred times more powerful than Koch's tuberculin, and had obtained, by passing the virus through the horse, an antitoxin which he believed to be an efficient cure for the disease. Experiments on a large scale are to be carried out at the Berlin Veterinary University. Dr. A. Calmette, of the Pasteur Institute of Lille, demonstrated in a highly successful manner the prophylactic effect on snake-bitten patients of serum of the blood of horses subjected to small doses of the venom. For this purpose a rabbit was injected with a large dose of a mixture of venom of the cobra, naja, and bothrops; this proved fatal in twenty minutes. Two rabbits were then injected with the protective serum, and in ten minutes each received a dose of the mixture equal in amount to that which killed the first rabbit. These rabbits appeared to suffer no ill-effects. Further experiments gave unquestionable evidence as to the prophylactic property of the serum, which is easily prepared and retains its protective power for an indefinite period. Great interest was evinced in the paper read by M. Nocard, of the Alfort Veterinary School, and delegate of the French Academy of Medicine, describing a method of cultivating the microbe of pleuro-pneumonia of cattle, the demonstration of which had baffled the efforts of bacteriologists for nearly half a century. This destructive disease of cattle is communicable only by cohabitation, and heretofore has not been communicated to animals of other than the bovine species. As long ago as 1850, Willems had established the fact that the virus existed in the liquid exuding from affected lungs, and laid down rules for a protective inoculation which has been regarded to a great extent efficacious. His method was to introduce into the subcutaneous connective tissue of the animal to be protected a drop of the serosity from an affected lung. The necessity for having an absolutely fresh lung from which to obtain the inoculating material renders Willem's method very inconvenient and often impracticable. It is hoped that the discovery of the specific microbe and the power of cultivating it for indefinite periods, independent of animals suffering from the disease, will afford the means of providing an effectual, protective vaccine at all times available when necessity for preventive inoculation may occur. Heretofore, failure to cultivate the virus has followed sowing in all ordinary media in air or *in vacuo*, and no method of staining has been successful in demonstrating the virus. Nocard and Roux have, however, applied with success the plan adopted by Metchnikoff on the toxin and antitoxin of cholera. Very thin-walled capsules of collodion, rendered sterile by heat, are filled with sterile bouillon, sown with a very small quantity of virulent matter from a fresh pleuropneumonia lung and hermetically sealed. The capsules are then inserted into the peritoneal cavity of a rabbit. The collodion wall proves an absolute barrier to the egress of the microbe and to the ingress of the cells of the animal, which ordinarily have a destructive effect on each other. The wall, however, is permeable to liquids and dissolved matters. Products of the microbe pass out, and sometimes prove fatal to the animal; while it is usually found that products of the animal body, favouring the growth of the microbe, pass inside the capsule, so that after a longer or shorter period, according to the nature of the microbe and the animal, a rich culture is found inside the capsule. The microbe of pleuropneumonia thus cultivated is exceedingly minute. When examined under a very high power (2000 diameters magnification) the culture shows innumerable refractile, motile specks, so fine that, even after staining, their form cannot be exactly determined. Experiments with cows indicate that subcutaneous inoculation of small quantities of these cultures afford protection from the disease. Another interesting fact in connection with these experiments, is the discovery that if collodion capsules filled with sterile bouillon be inserted into the peritoneal cavity of the rabbit or the cow, and remain there for fifteen to twenty days, they are found to contain a medium suitable for cultivation of the microbe *in vitro*. Beyond the definite results in relation to the special disease under consideration, facts elicited concerning the method of providing favourable culture media would appear to have a broad significance.

Among the most novel suggestions for the application of bacteriological science were those of Dr. E. Vallin, of the French Academy of Medicine, who drew attention to the existence of saltpetre on the walls of dwelling-houses, and its ill-effects on the health of the dwellers therein. Dr. Vallin states that the salt is produced by nitrifying