specimens illustrate:—(1) The rate of growth of the oyster. (2) Natural varieties of the shells. (3) Modifications of a variety bred under new conditions.

Prof. T. McKenny Hughes, F.R.S., exhibited abnormal and normal forms of oyster shells. The collection included oyster shells, showing the great variety of abnormal forms produced by accidental change in the position of the shells during growth, and also a selection of oyster shells, showing that among recent shells of *O. edulis* most of the forms occur which are considered of specific value in fossils.

The Joint Eclipse Committee exhibited the following photographs taken during the recent Eclipse Expeditions to West Africa and Brazil. (1) Photographs of the corona, taken in West Africa. (2) Photographs of the spectra of the corona and prominences, taken in West Africa. (3) Photographs of the corona, taken in Brazil. (4) Photographs of the spectra of the corona, and prominences, taken with the objective prism in Brazil. (5) Photographs of the stations.

Mr. W. H. Preece, F.R.S., exhibited submarine borers and specimens of submarine cables damaged by them. The *Xylophaga* and *Limnoria terebrans* have proved serious and expensive depredators in tropical seas, but while twenty years ago limnoria was practically unknown in our English waters, it has now gradually spread all around our coasts, and cables have to be served with brass tape to be protected from its attacks. Some stones pierced by *Saxicava rugosa* were also shown. They came from the Plymouth Breakwater. Several specimens of damaged cables from different parts of the world were exhibited.

The Zoological Society of London exhibited (1) a series of living Canadian walking-stick insects (*Diapheromera femorata*), hatched from eggs laid in the Society's insect-house in 1892. The "Walking-sticks" are orthopterous insects of the family Phasmodæ, so-called from their resemblance to sticks. They are strictly herbivorous, and closely imitate the plants upon which they feed, changing colour as the foliage turns in autumn. In North America the present species is said to do great injury to the oaks. These specimens are fed on hazel-leaves. (2) Living specimens of the Hornet Clearwing Moth of the Osier (*Sesia bembiciformis*), reared from pupæ in the Society's Insect-house. This moth affords one of the best known examples of "mimicry." Although belonging to quite a different order of insects, it resembles a hornet so closely as to deceive a casual observer, especially when it is on the wing.

Col. Swinhoe exhibited some species of butterflies, illustrating protective mimicry. Mimetic forms of the nymphalid genus *Hypolimnas* in India, Malaya and Africa, showing the various phases of development of mimicry in two widespread species of the same genus; also mimetic resemblances to different protected species in the females of *Euripus halitherses*, &c.

Prof. H. G. Seeley, F.R.S., exhibited fossil skulls from the Karoo Rocks of Cape Colony. These specimens were brought from Cape Colony by the exhibitor in 1889. They include examples of the chief types of fossil reptiles included in the Anomodont and Theriodont groups, preferable to the genera *Dicynodon* and *Tapinocephalus*.

Mr. Edward Whympers exhibited the Corry "protected" aneroid, a new form of aneroid, specially designed for use in mountain-travel, or for aeronauts. This form of mountain aneroid is designed to avoid the inaccuracies which result from continued exposure to low atmospheric pressure. It is enclosed in a perfectly air-tight outer case, and the internal atmosphere is kept at about a normal pressure at all times, except when an observation is to be taken, and then the cock is opened, and communication with the external atmosphere is established. After taking a reading, the pressure is restored to the normal by means of a small force pump. The conditions thus correspond to those which originally obtained, when the aneroid was graduated under the air-pump receiver.

Mr. J. W. Swan exhibited specimens of electrolytic copper, deposited bright. A series of electrolytic copper deposits, showing the great change produced in the character of the deposited metal by the addition of a minute quantity of colloid matter to an acid solution of sulphate of copper. The deposits produced from the solution containing the colloid are not only bright instead of being dull, but they are also very much harder and more elastic than ordinary electrolytic copper.

Prof. Henriçi, F.R.S., exhibited (1) A harmonic analyser, constructed by G. Coradi, Zürich, according to instructions by Prof. Henriçi and Mr. Sharpe. The instrument gives, on going once over a curve, the first five terms of the expansion in

Fourier's series, and on going twice more over the curve, it gives five additional terms. The constant term is not given. (2) A calculating machine by Prof. Sellinger, constructed by Ott, Munich. This instrument is constructed on altogether new principles. The "carrying" is done continuously without jerks. It works very rapidly and smoothly.

In addition, Prof. J. Norman Lockyer, F.R.S., gave a lecture on the localities and instruments used during the eclipse of April 16, 1893, in West Africa and Brazil, with photographs showing some of the results obtained.

Mr. W. M. Conway also used the electric lantern to show photographic lantern slides, illustrating the scenery of the Baltoro Glacier in the Karakoram Mountains, Kashmir, India. The photographs were taken during Mr. Conway's climbing and survey expedition in 1892. Some of them were taken from the summit of the Pioneer Peak (22,500 ft.); the remainder represent the great mountains K2, Gasherbrum, Masherbrum, the Golden Throne, and others, probably the highest group of mountains in the world.

At intervals throughout the evening Mr. W. Bayley Marshall exhibited the lantern stereoscope (invented by Mr. John Anderton). The images of a pair of stereoscopic transparencies having been superposed on a 10-foot screen, the beams of light from the two lanterns were polarised in planes at right angles to each other. The picture was viewed through a pair of analysers, similar to a small opera glass, and a true stereoscopic effect was obtained.

THERMOMETER SOUNDINGS IN THE HIGH ATMOSPHERE.

THE project, which was suggested by Le Verrier in 1874, of sending small balloons into the upper atmosphere with registering apparatus has been executed recently by M. Hermite in Paris, with remarkable success. No fewer than thirteen small balloons, constructed with paper and varnished with petroleum, were liberated during the last four months of 1892, and penetrated to an altitude of 9000 metres. A paper balloon of 60 cubic metres capacity was sent up on December 7, but exploded at a small distance from the earth. It was therefore resolved to build a balloon of 113 cubic metres capacity in gold-beaters' skin. The launching of this balloon took place on March 21 last, at Vaugirard, with the help of the Aerophytic Union of France, of which I have the honour to be the president. The balloon was filled with 113 cubic metres of coal-gas. Its weight with netting was about fourteen kilograms. It carried in a small basket a Richard registering apparatus for temperature and pressure, and about seven hundred postal-cards, to be liberated by the combustion of a cotton string specially prepared for the purpose. This part of the operation utterly failed. Although the fire was put to both extremities of the string, it was extinguished before all the cards had been sent down, and out of four hundred which were precipitated, no more than five or six were recovered. Thus, the hope of determining the path by dropping such objects from an immense height had proved futile. But the recovery of the balloon at 190 km. from Paris was very easy, and the registering apparatus was returned to its owner in excellent working order. The diagram, which had been traced on the revolving cylinder, has been submitted to a close inspection, of which the results have been published in the *Comptes Rendus* and *l'Aéro-philie*, a new periodical devoted to the study of aeronautics.

The registering of the pressure had been continued down to 95 mm. of mercury, which answers to something less than 17,000 metres, if Laplace's formula is valid even for this altitude. A temperature had been registered of $-51^{\circ}\text{C.} = 60^{\circ}\text{below zero Fahr.}$ at a level of about 14,000 metres, according to the same formula. The temperature on the ground being $+17^{\circ}$, a diminution of 67°C. was thus found, which is about a degree for each 210 metres. The atmosphere being supposed to extend up to 180,000 metres, it is easy to see that these numbers are an indication that the cold of the upper regions is much greater than supposed according to Fourier's theory, which asserts that the greatest degree of cold observed at the surface of the earth, viz. 58° registered by Black in Northern America is about equal to the temperature of celestial space.

This remarkable observation is not however to remain long isolated, as Commander Renard, of Meudon, has built a set of

registering apparatus, which were exhibited recently at the anniversary meeting of the *Société de Physique*, and will be sent up very shortly with a 113 c.m. balloon inflated with pure hydrogen. So a new departure may be said to have been taken for the scientific exploration of the air at an altitude where no human being can penetrate. The series of prizes proposed by M. Hodgkins for 1893 and 1894, and the creation of the Hodgkins medal by the Smithsonian Institution, certainly add new interest to these experiments.

M. Janssen intends to establish an apparatus for making pure hydrogen in the Meudon Observatory in order to help M. Hermite to send his sounding balloons to a higher level if possible. He will, moreover, try to measure by direct observation the altitude of the balloons sent, as long as they remain visible from his Observatory.

This last scheme was adopted by Le Verrier, who says in the *Bulletin de l'Association Scientifique de France* for October 1874: "La hauteur du ballon est toujours déduite de la mesure du baromètre et du thermomètre, au moyen d'hypothèses sur la repartition de la pression atmosphérique. Il s'agit d'écarter ces causes d'incertitude, et de mesurer directement par des opérations trigonométriques la hauteur même du ballon; ce qui permettra de vérifier les lois admises ou de les modifier. Les opérations trigonométriques à terre seront faites par les astronomes de l'Observatoire sur le charge de cette partie des dépenses. La direction de l'aérostat fourni par l'Observatoire est confiée à M. W. de Fonvielle." The protracted illness of the illustrious astronomer and his subsequent death, prevented the series of ascents from being tried as contemplated.

The experiments already tried by M. Hermite, namely, on March 3, prove that the balloon will remain long visible from an Observatory, if the ascent is executed on a clear and calm day with a considerable ascending force, which gold-beater's skin can support without being torn by the friction.

The ascent of March 21, when ordinary gas was employed, took place with such velocity that the balloon was seen always nearing the zenith, independently of the diverging direction of the air, the mean recorded velocity having been eight metres per second from the time of starting to the time of maximum, which was reached in three-quarters of an hour, according to the automatic barometer.

The inflating pipe (*appendice*) which the balloon carried with it, was 30 cm. diameter and 90 cm. long, and air took the place vacated by the retreating gas, when the balloon descended. Consequently it was found quite full when discovered, just the same as when the balloon was liberated. The only difference was that the gas had been expelled and replaced by air.

Since the volume of the balloon remained quite constant during the whole of the operation, it would have been quite easy to determine the absolute distance from the observatory by measuring the apparent diameter with a micrometer. By taking simultaneously a reading of zenith distance and azimuth, it would have been quite easy, by a series of observations conducted from a single station, to ascertain the altitude of the balloon and every circumstance of its motion.

The principal object of M. Janssen will be to determine the absolute minimum of temperature at the maximum altitude, which can be done more or less precisely, and the direction or velocity of the winds blowing at different altitudes. Then the indications of the registering instruments can be submitted to the rational control which is necessary before coming to any definite conclusion.

It is interesting to notice that these preliminary results are in conformity with the Joule and Clausius theory, which asserts that celestial space is at the temperature of -273°C. , or even with the opinion that there is no limit to the refrigeration, as asserted by other natural philosophers.

Another question is raised by these experiments, when coupled with Dewar's and Cailletet's discoveries relating to the liquefaction or solidification of the elements of the air. If the temperature descends to such a degree it is necessary to admit that the air loses its gaseous condition and becomes changed into a series of minute crystals or drops, which follow the earth in its motion through space, and are constantly vapourised when falling in regions where the temperature is somewhat above their point of liquefaction or evaporation.

Such are some of the questions raised by this new exploration of elevated regions, rendered very easy by the unexpected facility with which balloons and instruments in working order are recovered. This has been rendered possible in France by the

interest taken in the matter by public schoolmasters, who have been notified of the experiments by the newspapers, and have found special instructions printed on a paper pasted to the basket. It is certain that similar results may be obtained in every civilised country in the world, and we trust this new method will develop and improve so that unquestionable facts will be discovered with regard to the mysterious cosmical frontiers of our globe.

W. DE FONVIELLE.

DISINFECTANTS AND MICRO-ORGANISMS.

SOME important results have recently been obtained by Heider, who has been experimenting with disinfectants at higher temperatures and testing the effect produced upon their bactericidal properties. The author's first contributions in this direction were published in 1891. In Heider's original communication, "Ueber die Wirksamkeit von Desinfektionsmitteln bei höherer Temperatur" (*Centralblatt für Bakteriologie*, vol. ix. 1891, p. 221), temperatures of 55° and 75°C. were employed, and the spores of anthrax were selected for investigation. Although these spores, it was ascertained, survived an immersion during 36 days in a 5 per cent. solution of carbolic acid kept at the ordinary temperature of the room, they were destroyed in from one to two hours in a similar solution at 55°C. Weaker solutions of this acid (1 per cent. and 3 per cent.), even when maintained at the higher temperature for seven and eight hours, produced no effect upon the anthrax spores. On the temperature being raised to 75°C. , however, three minutes' exposure to a 5 per cent. solution of carbolic acid, fifteen minutes to a 3 per cent. solution, from two to two and a half hours to a 1 per cent. solution sufficed to annihilate these spores. Other materials were also investigated at these high temperatures, and equally satisfactory results obtained. Heider has brought together all his researches on this interesting subject in an elaborate memoir, "Ueber die Wirksamkeit der Desinfektionsmittel bei erhöhter Temperatur," which has been published in the *Archiv für Hygiene*, vol. xv. p. 341. It is pointed out how great an effect upon the powers of resistance possessed by micro organisms may be exercised by the nature of their surroundings, and that it may be taken that they are, as a rule, more refractory in their normal environment than when purposely introduced into various materials. This has been shown by Versin, in respect to the tubercle bacillus, which succumbs more readily to certain temperatures when exposed in artificial cultures than in sputum. Heider also found that particular culture media had a remarkable effect in this respect upon bacteria, that, for example, those grown in sugar broth (3 per cent. cane sugar) proved far more capable of resisting exposure to a high temperature than those introduced into ordinary broth. In conclusion, it having been distinctly proved that the bactericidal action of the majority of disinfecting materials is markedly increased when they are employed at a higher temperature, the author recommends that in all those cases where the destruction of spores is required, instead of applying these materials in cold solutions, they should be employed hot, or even boiling. The advantages derived by so doing are not alone the greater security obtained and saving of time, but economy in the cost of material, inasmuch as effectual sterilisation may be accomplished by the use of less concentrated solutions.

THE NEW FLORA AND THE OLD IN AUSTRALIA.

A VERY interesting paper on the effect which settlement in Australia has produced upon indigenous vegetation, by Mr. A. G. Hamilton, appears in the new number (vol. xxvi.) of the "Journal and Proceedings of the Royal Society of New South Wales." Mr. Hamilton traces with great care the results which have sprung from the direct action of man. He then deals with the alteration of the flora by the introduction of a new fauna, and the modification of it by the destruction of the native fauna. Finally, he considers the introduction of a new flora, and the consequent modification of the indigenous flora through competition.

The following is the portion of the paper relating to the effects due to a new flora:—