will be added to the museum of oceanography recently founded by the Prince at Monaco.

WE have received the first number of *Finland*, an "English journal devoted to the cause of the Finnish people."

Science of June 16 publishes a translation of a criticism of the plans for an International Catalogue of Scientific Literature, contributed to the *Zoologische Anzeiger* by Prof. J. Victor Carus.

A MEETING of the Anatomical Society of Great Britain and Ireland will be held in the Anatomical Schools, New Museums, Cambridge, on Saturday, July 8, commencing at 2 p.m.

MESSRS. J. AND A. CHURCHILL announce that they will shortly publish the following scientific works: A text-book of physics by Prof. Andrew Gray, F.R.S.; the book will be issued in three parts, the first to appear being that on dynamics and properties of matter. A work on medical electricity for the use of students and practitioners, by Dr. W. S. Hedley. A handbook on chemistry and physics, for students preparing for the first examination of the Conjoint Board, by Messrs. Corbin and Stewart.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus*, ♀) from India, presented by Mrs. L. Smallcombe; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mr. J. H. Johnston; a Diana Monkey (*Cercopithecus diana*, ♀) from West Africa, presented by Mr. T. N. Loy; a —— Deer (*Cariacus*, sp. inc. ♂) from Tobago, presented by Captain J. Leslie Burr, R.N.; a Stone Curlew (*Aedicnemus scolopax*), European, presented by Mr. D. T. Campbell; six Cormorants (*Phalacrocorax carbo*, juv.) from Scotland, presented by Mr. Percy Leigh Pemberton; a Yellow-crowned Penguin (*Eudyptes antipodum*), a Thick-billed Penguin (*Eudyptes pachyrhynchus*) from New Zealand, a Rock-hopper Penguin (*Eudyptes chrysocome*) from the Falkland Islands; two Elephantine Tortoises (*Testudo elephantina*) from the Aldabra Islands, a Reticulated Python (*Python reticulatus*) from the East Indies, deposited; a Red Deer (*Cervus elaphus*, ♂), born in the Gardens; two Coscoroba Swans (*Coscoroba candida*) from Antarctic America, purchased.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN JULY:—

July 2. 9h. 16m. to 11h. 14m. Transit of Jupiter's Sat. III.
3. 12h. 40m. to 13h. 30m. Occultation of the star D.M. + 21°, 539 (mag. 5·7) by the moon.
3. 14h. 57m. to 15h. 43m. Occultation of the star 32 Tauri (mag. 5·7) by the moon.
5. 15h. Conjunction of Venus and the moon (♀ 1° 0′ south).
6. 10h. Conjunction of Venus and Neptune (♀ 0° 46′ north).
13. 9h. 51m. Minimum of Algol (β Persei).
15. Venus. Illuminated portion of disc 0·955, Mars 0·931.
19. 8h. 6m. to 9h. 17m. Occultation of B.A.C. 5709 (mag. 6·3) by the moon.
19. 8h. 9m. to 9h. 24m. Occultation of 26 Ophiuchi (mag. 6·1) by the moon.
19. 14h. Conjunction of Saturn and the moon (♄ 2° 26′ north).
20. 7h. 39m. to 8h. 41m. Occultation of 7 Sagittarii (mag. 5·4) by the moon.
20. 8h. 4m. to 9h. 15m. Occultation of 9 Sagittarii (mag. 5·7) by the moon.
21. 23h. Mercury at greatest elongation (26° 59′ east).
24. 9h. 26m. Jupiter's Sat. IV. in conjunction with north pole of planet.
28. Tempel's comet (1873 II.) in perihelion.

TEMPEL'S COMET 1899 *c* (1873 II.)—The following ephemeris is contributed to the *Astr. Nach.* (Bd. 149, No. 3574), by M. L. Schulhof.

Ephemeris for 12h. Paris Mean Time.

1899.	R.A. h. m. s.	Decl. ° ′ ″	Br.
June 29	20 13 33·4	− 8 35 52	2·525
30	14 51·3	8 56 1	
July 1	16 8·8	9 16 56	
2	17 25·9	9 38 37	
3	18 42·5	10 1 5	2·770
4	19 58·6	10 24 18	
5	21 14·4	10 48 17	
6	20 22 29·7	− 11 13 0	

FIFTH SATELLITE OF JUPITER.—In *Bulletin* No. 10 of the Yerkes Observatory (*Astrophysical Journal*, vol. ix., p. 358), Prof. G. E. Hale gives the measures of Jupiter's fifth satellite which have recently been made by Prof. E. E. Barnard with the 40-inch refractor. The observations were made on five nights during March and April 1898, and on four nights during April and May 1899. The constants determined are as follows:—

Times of east elongation, G.M.T.	d. h. m.	East elongation distance. ″
1898 March	2 18 57·80	
1898 March	6 18 36·11	48·14
1898 April	5 ...	48·12
1899 April	25 19 5·26	48·34
1899 May	1 18 32·72	48·29

The different values of the elongation distance are due to the revolution of the line of apsides, which, as Tisserand showed, takes place in a period of five months. The consistency of the measures with the instrument are shown by the plotted curve of the 131 observations of May 1, none of which depart more than 0″·4 of arc from the mean.

The great number of revolutions made by the satellite since its discovery in 1892 render possible an accurate calculation of its period. Using the elongations of September 10, 1892, March 6, 1898, April 25, 1899, and May 1, 1899, the resulting periodic time is found to be

11h. 57m. 22·647s.

OXFORD UNIVERSITY OBSERVATORY.—The twenty-fourth annual report of the Savilian Professor contains an account of the work accomplished from June 1, 1898, to May 31, 1899, and a survey of the condition of the instrumental equipment. The large dome, erected in 1875, has become so defective that plans for a new one have been prepared, the estimated cost being 440*l.* In consequence of disadvantages resulting from the unprotected state of the observatory, the need of a residence is strongly urged. During the year the observatory has been greatly enriched by the acquisition of the library of the late Mr. George Knott. Among the numerous presents received, special mention is made of a long series of early nautical almanacs, extending from 1767 to 1843, kindly given by Mr. Robert Gordon.

The De la Rue astrographic telescope is in good order, 258 plates for the catalogue having been taken during the year. The De la Rue reflector and the Barclay transit circle are both in good order. With the latter an unknown, variable change of collimation error has been traced to the looseness of the object-glass in its cell, this being finally eliminated by cotton wool packing.

No time has been found to proceed further with the photographic transit circle. The four micrometers for measuring the catalogue plates are in general use, one being in charge of Mr. T. J. Moore, of Doncaster, who has measured 61,186 stars with it.

The staple work of the observatory staff has been the measurement and reduction of the plates for the astrographic catalogue, and about half of this is now done, 586 plates out of the 1180 allotted to the observatory having been measured, and 525 completely reduced. In the region of the Milky Way the times of exposure for the plates have been reduced to 3 min., 1 min. and 20 secs., the number of stars even with the smaller exposure being still over 300.

Considerable interest attaches to the investigation undertaken to determine the possible distortion present in a large photographic doublet. Positives from plates taken with the 24-inch Bruce doublet at Arequipa have been lent by Prof. Pickering, and the results of their examination prove that it is possible to get large fields sensibly free from optical distortion. This has a most important bearing on the carrying out of the "chart" work, as it is at present necessary to expose for one hour to obtain a region 2° × 2°, whereas the new form of lens would give a much larger region in the same time. For this reason, Prof. Turner has indefinitely postponed the taking of the "chart" plates for the Astrographic Survey.

CAMBRIDGE OBSERVATORY.—Embodied in the *Cambridge University Reporter* for June 16, is the annual report of the Cambridge Observatory from 1898 May 26 to 1899 May 25. With the meridian circle, 2241 observations of 1420 stars have been taken, most of these being repetitions of previous observations for the catalogue.

One hundred and seventy-six observations have been made of the Harrow occultation stars; and, at the request of Dr. Gill, observations of heliometer comparison stars were commenced in March and are still in progress.

In addition, there have been other measurements of standard stars, bringing up the total number of meridian observations to 3616.

The new bent equatorial, to be called the "Sheepshanks equatorial" (see illustrated description in *Monthly Notices*, R.A.S., 1899 January, vol. lix. p. 152) was completed about September 1898, and its adjustment was undertaken by Mr. Hinks. It was soon found that the objective tube had a large flexure, and a new tube is being made. The first trial photographs were unsatisfactory, the disturbing cause being thought to be the air currents in the tube, which is partly open near the joint.

The Newall telescope has been employed on 96 nights during the year, in connection with the Bruce spectroscope, in taking photographs of stellar spectra for determining their velocity in the line of sight; 150 photographs have been obtained, giving material for determining the velocity of 60 stars. Thirty of these are included in the Potsdam list of 51 stars observed from 1888–1891. Preparations are in hand for converting the spectroscope into a powerful 4-prism instrument for detailed examination of a few of the brightest stars. Special series of stellar spectra have been taken to assist in the reduction of the eclipse photographs obtained in India in 1898. For this purpose also attempts have been made to separate scandium salts from the mineral gadolinite.

PICTURES PRODUCED ON PHOTOGRAPHIC PLATES IN THE DARK.[1]

I THINK I may fairly assume that every one in this theatre has had their photograph taken, and consequently must have some idea of the nature of the process employed. I have, therefore, only to add, with regard to what is not visible in the process of taking the picture, that the photographic plate is a piece of glass or such like body, coated on one side by an adhesive paste which is acted on by light, and acted on in a very remarkable manner. No visible change is produced, and the picture might remain latent for years, but place this acted on plate in a solution, of, say pyrogallol, and the picture appears. The subsequent treatment of the plate with sodium hyposulphite is for another purpose, simply to prevent the continuance of the action when the plate is brought into the light. Now, what I purpose demonstrating to you to-night is that there are other ways of producing pictures on photographic plates than by acting on them by light, and that by these other means a latent picture is formed, which is rendered visible in precisely the same way as the light pictures are.

The substances which produce on a photographic plate these results, so strongly resembling those produced by light, are, some of them, metallic, while others are of vegetable origin. At first it seemed very remarkable that bodies so different in character should act in the same way on the photographic plate. The following metals—magnesium, cadmium, zinc, nickel, aluminium, lead, bismuth, tin, cobalt, antimony—are all capable of acting on a photographic plate. Magnesium most strongly, antimony but feebly, and other metals can also act in the same way, but only to a very slight extent. The action in general is much slower than that of light, but under favourable conditions a picture may be produced in two or three seconds.

[1] A lecture delivered at the Royal Institution on Friday, May 5, by Dr. W. J. Russell, V.P.R.S.

Zinc is nearly as active as magnesium or cadmium, and is the most convenient metal to experiment with. In its ordinary dull state it is entirely without the power of acting on a photographic plate, but scratch it or scrape it, and it is easy to prove that the bright metal is active. I would say that all the pictures which I have to show you, by means of the lantern, are produced by the direct action of the metal, or whatever the active body may be, on the photographic plate, and that they have not been intensified or touched up in any way. This first slide is the picture given by a piece of ordinary zinc which has been rubbed with some coarse sand paper, and you see the picture of every scratch. Here is a piece of dull zinc on which some circles have been turned. It was exposed to the photographic plate for four hours at a temperature of 55° C. In the other cases, which are on a larger scale, a zinc stencil was polished and laid upon a photographic plate, and you see where the zinc was in contact with the plate much action has occurred. In the other case a bright zinc plate was used, and a Japanese stencil interposed between it and the photographic plate, and a very strong and sharp picture is the result. The time required to produce these zinc pictures varies very much with the temperature. At ordinary temperature the exposure would have to be for about two days, but if the temperature was, say, 55° C., then half to three-quarters of an hour might be sufficient. Temperatures higher than this cannot be used except for very short times, as the photographic plate would be damaged. Contact between the zinc and photographic plate is not necessary, as the action readily takes place through considerable distances. Obviously, however, as you increase the distance between object and plate, so you decrease the sharpness of the picture, as is shown by the following pictures, which were taken respectively at a distance of 1 mm. and 3 mm. from the scratched zinc surface. The appearance of the surfaces of different metals varies, and the following slides show the surface of a plate of bismuth, a plate of lead, and one of aluminium. On the next slide are the pictures produced by similar pieces of pure nickel and cobalt, and it clearly shows how much more active in this way nickel is than cobalt. Many alloys, such as pewter, fusible metal, brass, &c., are active bodies, and in the case of brass the amount of action which occurs is determined by the amount of zinc present. Thus you will see that a brass with 30 per cent. of zinc produces hardly any action on the photographic plate, but when 50 per cent. of zinc is present there is a fairly dark picture, and when as much as 70 per cent. is present a still darker picture is produced. The second class of bodies which act in the same way on a photographic plate are organic substances, and belong essentially to the groups of bodies known as terpenes. In trying to stop the action of metallic zinc, which I thought at the time might arise from vapour given off by the metal, copal varnish was used, but in place of stopping the action it was found to increase it, and this increase of activity was traced to the turpentine contained in the varnish. In experimenting with liquids it is convenient to use small shallow circular glass vessels such as are made for bacteriological experiments, the plate resting on the top of the vessel, and the amount of liquid in the vessel determining the distance through which the action shall take place. The following slide, produced in this way, shows how dark a picture ordinary turpentine produces. All the terpenes are active bodies. Dipentine is remarkably so; in a very short time it gives a black picture, and if the action be continued, the dark picture passes away, and you then have a phenomenon corresponding to what photographers call reversal. The strong smelling bodies known as essential oils, such as oil of bergamot, oil of lavender, oil of peppermint, oil of lemons, &c., are all active bodies, and all are known to contain in varying quantities different terpenes; therefore ordinary scents are active bodies, and this is shown by the following pictures produced by eau de Cologne, by cinnamon, by coffee, and by tea. Certain wines also act in the same way, Sauterne gives a tolerably dark picture, but brandy only a faint one. Other oils than these essential ones are also active bodies; linseed oil is especially so; olive oil is active, but not nearly as much so as linseed oil; and mineral oils, such as paraffin oil, are without action on the photographic plate.

Interesting results are obtained with bodies which contain some of these active substances; for instance, wood will give its own picture, as is shown by the following slides: the first is a section of a young spruce tree, the next a piece of ordinary deal, and the third of an old piece of mahogany. Again, the