contact processes, so far as the production of acids which are not very concentrated is concerned. For the manufacture of the strongest acids, however, numbers are given which indicate that the contact process is considerably superior to the older process from the commercial point of view. The other articles on the subject deal with more recent alterations which have been made in the lead chamber process, the theory and practice of sulphuric acid manufacture and the treatment of platinum residues.

THE additions to the Zoological Society's Gardens during the past week include a Side-striped Jackal (*Canis lateralis*), a Young Leopard (*Felis pardus*), a Spotted Hyæna (*Hyaena crocuta*), a Harnessed Antelope (*Tragelaphus scriptus*), a Nagor Antelope (*Cervicapra redunca*), a Marabou Stork (*Leptoptilus crumeniferus*), a White-necked Crow (*Corvus scapulatus*), a Spur-winged Goose (*Plectropterus gambensis*), two Red-backed Pelicans (*Pelecanus rufescens*) from Gambia, West Africa, presented by Captian Sir George C. Denton, K.C.M.G.; a Striped Hyæna (*Hyaena striata*) from Gambia, West Africa, presented by Captain MacCarthy Morrogh; a Black-eared Marmoset (*Hapale penicillata*) from South-east Brazil, presented by Mrs. Armyn Thornton; a Yellow-fronted Amazon (*Chrysotis ochrocephala*) from Guiana, presented by Miss Ellen Cull; a Red-winged Parrakeet (*Ptistes erythropterus*) from Australia, presented by Miss E. P. France; a Pale-headed Parrakeet (*Platycercus pallidiceps*) from Australia, presented by Mr. Thomas Morson; a West African Python (*Python sebae*) from West Africa, presented by the Rev. H. Ross Phillips; two European Tree Frogs (*Hyla arborea*), European, presented by Mrs. Sidney Wolton; a Thar (*Hemitragus jemlaica*), a Yak (*Poephagus grunniens*) born in the Gardens.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN AUGUST:—

August 1. 15h. 25m. to 19h. 8m. Transit of Jupiter's Sat. III.
4. 11h. 34m. to 16h. 29m. Transit of Jupiter's Sat. IV.
5. 5h. Jupiter in opposition to the sun.
8. 12h. 38m. Minimum of Algol (β Persei).
10. 8h. 29m. to 9h. 32m. Moon occults 8 Libræ (mag. 5·3).
10. 8h. 41m. to 9h. 35m. Moon occults α Libræ (mag. 3·0).
11. 9h. 27m. Minimum of Algol (β Persei).
11–12. Maximum of the Perseid meteoric shower.
15. Venus. Illuminated portion of disc = 0·886. Mars = 0·965.
18. 17h. 1m. to 17h. 22m. Moon occults c^1 Capricorni (mag. 5·2).
28. Saturn. Outer minor axis of outer ring = 16″·48.
30. 4h. 37m. to 8h. 20m. Transit of Jupiter's Sat. III.
31. 11h. 10m. Minimum of Algol (β Persei).

A NEW ALGOL VARIABLE.—Prof. Pickering announces the discovery of a new Algol variable (+43°·4101) by Mrs. Fleming, at the Harvard College Observatory.

Two plates, taken with the 8-inch Draper telescope on March 7, 1900, and April 3, 1902, respectively, were being examined in order to discover, if possible, a trace of the image of Comet 1902 *a* on the latter plate. This search was unsuccessful in its immediate object, but Mrs. Fleming noticed that the image of a faint star, the position of which for 1900 was R.A. = 21h. 55·2m., Dec. = +43° 52′, showed a variation in magnitude during the interval between the taking of these two plates, and on examining more plates it was found that generally the light was bright and constant, thus showing the star to be of the Algol type.

The period is about 31·4 days, and the star retains its maximum brightness (photographic magnitude = 8·9) for twenty-eight days and then decreases to minimum by the following steps:—9·0 m. at 1·05 d. before minimum, 9·5 at 0·94 d., 10·0 at 0·84 d., 10·5 at 0·71 d., 11·0 at 0·58 d., and 11·5 at 0·43 d. The light then remains constant at 11·6 m. for more than half a day. The times of increase are apparently the same as those of decrease, but this is not conclusively indicated. (*Astrophysical Journal*, No. 5, vol. xv.)

SPECTROSCOPY OF THE SOLAR ECLIPSE OF MAY 18, 1901.—In No. 5, vol. xv. of the *Astrophysical Journal*, Mr. W. J. Humphreys gives an account of the United States Naval Observatory Eclipse Expedition to Sumatra last year, and a reduction of the spectrograms obtained.

Excellent photographs of the corona were obtained, the cœlostat used having a mirror at either end of its heavy polar axis, one supplying the light to the coronagraph, the other to the spectroscope.

The concave grating used was of 30 feet focal length and had a diffracting surface 8 inches long and 5 inches wide; the whole of this area was not used, however. To obtain good uniform focus heavy celluloid films were used, and these were 2½ inches wide and 36 inches long.

Six films were exposed, and the reductions of the spectra are set out in tabular form, 330 lines between λ 3118 and λ 5204 having been measured. Neglecting those due to hydrogen and helium, the lines are chiefly those belonging to the Mendeléeff series which terminates with the Fe, Ni, and Co groups.

Incidentally observing the shadow bands, Mr. Humphreys found that they were stationary at first, but another observer noted that afterwards they widened out and then attained an increasing velocity.

Mr. Humphreys concludes his report with some useful suggestions which might be profitably considered by future eclipse observers.

REPORT OF THE CAPE OBSERVATORY FOR 1901.—Sir David Gill, in this report, announces the completion and official inauguration of the 24-inch "Victoria" telescope presented to the observatory by Dr. Frank McClean.

The transit circle has been completed and effectively mounted, the house being of a semi-cylindrical form, of which the two halves may be drawn aside at right angles to the axis when observations are to be taken. Owing to the loose nature of the upper rocks, the standard azimuth marks have had to be placed on the surface of the solid rock at the bottom of shafts some 30 feet deep, from which the marks are reflected to the instrument. The heliometer has been cleaned and repaired, and observations of the oppositions of Mars, Jupiter and Saturn have been made. Some thirty observations of the distances and position angles of Jupiter's satellites have also been completed.

The equatorials have been used for observing the phenomena attending ninety-seven separate occultations, to observe Giacobini's comet and the great comet of 1901, and to seek, without success however, for Encke's comet. Thirteen previously unrecorded double stars have been detected by Mr. Innes, the most interesting of them being τ_2 Lupi, h 4625 (chief star) and C.G.A. 2861. The 7-inch equatorial has been used for the revision of the C.P.D., and incidentally the unsuspected variability of the following stars has been detected:—C.P.D. −51°·2275, anonymous, Cor. D.M. −22°·14789, the ranges of variability being from 8·6 m., 9·8 m. and 9·4 m. to invisibility respectively. The character of the second star is not completely known yet, but it is suggested that it may be a Nova, R.A. = 11h. 14m. 14s., Dec. = 61° 10′ S. (1875).

The geodetic work has been actively prosecuted throughout the year, the geodetic arc of meridian having now been carried to the Zambesi, and an effective service of time signals has been distributed throughout the Colony.

WORK AT THE ATHENS OBSERVATORY.[1]

YEARS ago, under the vigorous direction of the late Prof. Schmidt, the Athens Observatory acquired a distinction that was denied to some kindred institutions more favoured with instrumental equipment and substantial endowment. Since that time evil days have fallen on the National Observatory of Greece and its record of useful work has been broken; but it is now a pleasant task to record that a period of renewed activity appears likely to make itself felt in the future conduct of this ancient centre of scientific work. The third volume of the

1 "Annales de l'Observatoire National d'Athènes." Publiées par Démétrius Eginitis, Directeur de l'Observatoire. Tome iii. Pp. 376. (Athènes: Imprimerie Royale Raftanis-Papageorgiou, 1901.)

"Annales," which has just appeared, devoted mainly to meteorological and climatic inquiries, is perhaps of a modest character viewed from a scientific standpoint; but it shows that the present director, M. Eginitis, is alive to the importance of creating a broader scientific interest throughout the country, which may be productive of greater energy and lead to the establishment of a well-supported institution. If this be the intention of the director, the means he has employed are excellent. For M. Eginitis has endeavoured to interest a number of the better instructed class, such as civil engineers, professors of mathematics in the colleges and schoolmasters, in meteorological and seismological inquiries, and has induced the Government to provide a simple instrumental equipment at stations where it could be properly employed. The result is that he has distributed throughout Greece and the Ionian Isles a number of centres whence climatic observations are regularly forwarded to the central observatory at Athens and there reduced.

The results for the years 1894-9 are printed in this volume, and we regard the fact that the dormant energies of a large number of people are interested, and the habit of continuous observation encouraged, as of greater importance than the actual observations collected. The public is being trained to expect a certain amount of scientific work from the Government officials, and demands for a further advance will be made and will be granted, when urged by competent observers backed by a growing scientific opinion. We would urge M. Eginitis steadily to pursue the methods which he has introduced, and which cannot but be productive of a lasting and beneficial result.

Two memoirs from the director accompany the volume, one a discussion of the observations of meteors made at the observatory, the other on the distribution of earthquakes throughout the day and year as recorded at the Grecian stations. In 1899, M. Eginitis reports 567 earthquake shocks, of which 271 occurred in the spring against 62 in the summer months, and this peculiarity is in general agreement with a more extended inquiry embracing the period 1893-8. With regard to the relative position of the earth and moon, in which the latter might be presumed to have some slight effect in displacing the arrangement of internal rocks as the consequence of a tidal flow, M. Eginitis finds that there is no noticeable connection between the frequency of seismic disturbance and the position of the moon in its orbit. A description of the effects experienced on the occasion of the earthquake at Triphylie on January 22, 1899, concludes this section.

VIBRATIONS OF BRIDGES.

THE last volume issued by the Earthquake Investigation Committee of Japan published in a foreign language is "On the Deflection and Vibration of Railway Bridges"—a subject which, although not seismological, is an excellent illustration of investigations which seismologists have been tempted to pursue.

The author, Dr. F. Omori, experimented on twelve railway bridge girders, the spans of which varied between 20 and 200 feet. The instruments used to record the bridge vibrations were a pair of seismographs such as are used for recording horizontal motion, and a horizontal lever seismograph for vertical motion. This latter instrument is here called a *deflectometer*. The quantities measured were the *deflection* of girders, or the total amount of bending caused by the passage of rolling stock, and the vertical transverse and longitudinal *vibrations*, which latter are almost *nil* when the speed of a passing train is either very slow or at a maximum, when the speed has a certain value. The incentive to this work was a question respecting the stability of the Rokugo-*gawa* Bridge, which was the first large bridge built in Japan. It was put up in 1875, a time when the rolling stock was somewhat lighter than that now in use. Oddly enough, the vibrations and deflections of this same bridge, and also others, were investigated in 1895 with apparatus similar to that now employed, and had Dr. Omori known this, it is possible that he would have compared the apparent state of the bridge at that date with what it was found to be five years later.

An account of this earlier work, with reference to that of others, as, for example, the seismometric measurements made by Prof. J. A. Ewing on the new Tay Bridge, will be found in *Engineering*, January 24, 1896.

The mechanical time marker used to determine the speed at which the record-receiving surface was moved, which is a determination of great importance when estimating vibrational periodicities, is apparently very similar to a contrivance largely used in seismometry in 1882 (see *Trans.* Seis. Soc., vol. iv. p. 97, Fig. 8).

A point not touched upon is a comparison between values given to displacements as measured by seismographs and as determined by the direct methods employed by engineers. Previous investigators have done a little in this direction, but before the confidence of the practical man can be obtained it is clearly necessary that this work should be extended. The results which, however, have been arrived at respecting the strength and rigidity of various types of iron girders by this neglected method of investigation appear to be worthy of consideration by the builders of bridges. In the *Erdbebenwarte* of last year there are three notices of Dr. Omori's important and carefully conducted investigations, which are now followed by the advertisement of an instrument maker who is prepared to supply engineers with apparatus designed for this particular class of work. J. M.

REPORT ON UNIVERSITY COLLEGES.

A REPORT upon the work of university colleges has been issued as a Blue-book and contains much information as to the provision for higher education in various parts of the country. An annual grant of 25,000*l.* is made by the Government in aid of certain university colleges, and the character and quality of the work done, with special reference to the difference between work of an elementary character and that of a more advanced nature, is tested by occasional inspection.

A visit of inspection was held in 1896 by Mr. T. H. Warren and Prof. G. D. Liveing, and another was made last year by Dr. H. G. Woods and Dr. Alex. Hill. The colleges visited were:—University College, London, King's College, London, Bedford College for Women (University of London), the Owens College, Manchester, University College, Liverpool, Yorkshire College, Leeds, the University of Birmingham, University College, Bristol, Durham College of Science, Newcastle-on-Tyne, University College, Nottingham, Firth College, Sheffield, University College, Dundee, Reading College, the Royal Albert Memorial College, Exeter, and Hartley College, Southampton. As has already been announced, the Reading College and the Hartley College, Southampton, have only recently been added to the list of university colleges, of which there are now fifteen which participate in the Government grant.

The present report is almost entirely made up of descriptions of the buildings and laboratories of each of the colleges, main lists of work, organisation, and position of various departments of arts and sciences. Preceding this is a general statement by Drs. Wood and Hill, and following it a report by Mr. H. Higgs upon the financial position of the colleges. A few of the points touched upon by Drs. Wood and Hill are mentioned below.

Plan of Buildings.—Anyone who makes the round of the university colleges is certain to develop in his own mind an ideal scheme of college buildings. Our own observations have led us to the conclusion that it is a mistake for a college to invest a large portion of its capital in buildings which cannot readily be adapted and extended to meet changing needs. We could cite cases in which much money has been spent upon the material fabric of a laboratory, whereas the want of funds to provide an adequate modern equipment seriously reduces the effectiveness of its work. The demands of science are constantly changing. It is therefore desirable that funds should be so husbanded as to allow of the provision of new apparatus and appliances of all kinds as they are called for. In this connection we feel that it is not too much to say that we have seen no single college in which adequate funds were available for departmental expenditure. A few departments of particular colleges which have been housed and equipped by private munificence are notable exceptions, but in the large majority of cases the funds assigned to departmental libraries, apparatus, lecture illustrations, &c., are altogether insufficient.

Statistics of Progress.—The general result of our observations and inquiries is to show that very remarkable progress has been made by the university colleges during the last five years. The great, we might almost say immense, growth is proved by the following statistics:—(1) The total amount of the benefactions