

greater part of the constellation Orion, and of which the brightest part corresponds, in position, with Herschel's region No. 27. Of this region Dr. Roberts remarked "sky clear, stars very few in number, large areas void of stars, no nebulosity," yet the photograph shows a distinct nebulosity in this region, and photographs obtained by two independent observers, with three different photographic telescopes, on several different occasions, confirm Herschel's observations.

Both Dr. Roberts's results and Prof. Barnard's comments thereon appear in No. 1, vol. xvii. of the *Astrophysical Journal*.

A NEW STAR CATALOGUE.—Volume viii. of the *Annalen* of the Leyden Observatory, edited by Dr. H. G. van de Sande Bakhuyzen, is a new catalogue of 10,239 stars situated in the zone $29^{\circ} 50'$ to $35^{\circ} 10'$ north latitude, and having magnitudes of 9.5 or brighter.

The observations have been made and reduced at Leyden, in accordance with the programme of the Astronomischen Gesellschaft, during the years 1870-1876 and 1880-1898, by Messrs. W. Valentiner, E. F. van de Sande Bakhuyzen, E. Becker, J. H. Wilterdink and H. G. van de Sande Bakhuyzen, and the observations of the former period have been already published in vols. iv. and v. of the *Annalen*.

The catalogue gives the position for 1875, the magnitude, the precessional and secular variation in each coordinate, the epoch and the B.D. number (where there is one) for each star, and, in additional tables, these positions are compared with those given in the Bessel, Argelander, Struve and other catalogues for the same objects.

RECENT SCIENCE IN AUSTRIA.

Chemistry.

A PERUSAL of the *Sitzungsberichte* of the Vienna Academy of Sciences indicates that a great deal of valuable chemical research work is being carried out by Austrian investigators. In the concluding section of vol. cx., J. Klimont gives an account of experiments on the composition of oleum cacao which indicate that this substance can no longer be regarded as a mixture of tristearin, tripalmitin and triolein, but that it is essentially a mixed glyceride containing the radicles of these three acids united to one and the same glycerin radicle. Other mixed glycerides containing oleic acid and fatty acids of smaller molecular weight are also present in the fat.

The action of acetylene as cathodic depolarising agent in the electrolysis of acid and alkaline solutions has been investigated by Dr. Billitzer, who finds that this substance readily acts as depolariser with a kathode of platinum, and that the products of its action are ethylene and ethane. Within certain limits of potential, it is possible to obtain a quantitative yield of ethylene. If the potential is gradually increased, mixtures of ethylene and ethane are produced at the kathode, and later hydrogen also makes its appearance. In sulphuric acid solution and with a mercury kathode, small quantities of alcohol are also formed from the acetylene.

The nature of that physiologically most important substance, chitin, has been further investigated by Drs. Fränkel and Kelly. The view advanced by Schmiedeberg that chitin is an α -acetyl-acetoacetic acid compound of chitosamine of the formula $C_{18}H_{30}N_2O_{12}$ can no longer be regarded as correct in the light of this more recent work. This conception of the nature of chitin was largely based on the production of chitosamine and acetic acid by boiling with strong hydrochloric acid, but the authors' experiments indicate that its constitution cannot possibly be of such a simple character.

In vol. cxi., Dr. von Cordier describes a peculiar reaction exhibited by iron and steel. If iron containing carbon and nitrogen is treated with dilute acid and excess of ammonia added to the solution, a distinct odour of carbamine is observable. The author's experiments indicate that the reaction is only obtained if both these elements are contained in the same sample of iron. A mixture of two samples, one containing carbon but no nitrogen, the other nitrogen but no carbon, does not evolve any isonitrile. Investigation of the small quantity of gas given off shows that it is ethylcarbamine.

In a series of papers, Prof. Wegscheider discusses the question of the influence of constitution on the affinity constants of organic acids and gives the results of his experiments on the

partial esterification of unsymmetrical di- and poly-basic acids. Special attention is devoted to the alteration produced in the affinity constant by the substitution of hydrogen by ester groups such as SO_3CH_3 , CO_2CH_3 , $CO_2C_2H_5$ and by the carboxyl group. A considerable addition to our knowledge of this subject results from these investigations. The data obtained are utilised by the author to determine the configuration of the ester acids obtained by partial esterification of unsymmetrical polybasic acids.

Two other papers by Dr. Billitzer treat of the acid character of acetylene and the formation of carbon ions in aqueous solution. In the first of these, the solubility of acetylene in solutions of the alkalis has been studied. By suitable elimination of the physical action of the dissolved bases, it is shown that acetylene undoubtedly forms salts in the alkaline solutions and that it must be regarded as a very weak acid, its dissociation being about $1/40000$ th of that of carbonic acid. In the second paper, the presence of carbon ions in solutions of silver and copper acetylides is shown by electromotive measurements, and by electrolysis of these solutions under suitable conditions a small deposit of carbon has been obtained on the anode. By two independent methods, the electrolytic dissociation of acetylene has thus been demonstrated.

Physics.

In mathematics, attention should be directed to F. Mertenz's proof of Galois' fundamental theorem of the groups of an equation the coefficients of which belong to a given range of rationality. A construction for the six normals from any point to a conicoid, based on the methods of synthetic geometry alone, is given by Prof. August Adler.

In theoretical physics, perhaps the most extended mathematical investigations are those by Dr. Josef Grünwald dealing with the propagation of waves in uniaxial crystals when the initial disturbances are given. Dr. Grünwald finds for the vector potential a series of waves partly "ordinary," partly "extraordinary" and partly "intermediate" in character. A formula is discussed by G. Jaumann for the heat generated in the motion of a viscous liquid. The expression involves volume integrals of the squares of the curl, and divergence and a surface integral; in the case of an incompressible liquid, this result agrees with the known formulæ in which the only volume integral is that involving the square of the curl. The difficult subject of astronomical aberration and its relation to the ether is discussed by Dr. Egon v. Oppolzer, and in molecular physics, Prof. O. Tumlirz's paper on the "cohesion pressure" terms in Van der Waals's equation, H. Mache's discussion of the relative magnitudes of molecules in a liquid and its vapour, and Dr. G. Jäger's investigation of the law of partition of energy between the liquid and the vapour may be noticed.

In spectroscopy, Dr. Edward Haschek has been working at the relation between wave-length and quantitative composition, and while the conclusions are on the whole remarkably consistent, it appears that at present the method is unsuited generally for laboratory analysis. In collaboration with Prof. Exner, Dr. Haschek has drawn up a list of the spectral lines of europium, including 1193 spark and 527 arc lines. The element europium has also had its magnetic properties compared with gadolinium and samarium by Dr. Stefan Meyer, the preparations of Eu_2O_3 having been obtained from Demarcay.

The diathermanosity of water and certain solutions forms the subject of a paper by Otto Dechant, who finds that as the temperature increases the transparency for heat decreases according to a formula approximately linear. Alum solution is only 2 per cent. less diathermanous than water, but cobalt chloride is better, and its coefficient decreases more rapidly after 50° than between 11° and 50° .

That the freezing points of aqueous solutions are lowered by pressure to a greater extent than that of water is the conclusion of A. Lampa.

In terrestrial physics, a long series of tables relating to rainfall and *inter alia* its supposed connection with sun-spots is drawn up by J. Hann, and Prof. B. W. Stankewitsch describes magnetic measurements made with a "magnetic theodolite" in Pamir during his travels in 1900.

The series of papers on atmospheric electricity includes a comparison of brush electrodes and flame electrodes by Dr. Victor Conrad and a description of a self-registering atmospheric electrometer by Dr. Hans Bendsdorf.

Electric discharges form the subject of papers by J. Nabl, in

connection with the gases at the electrodes of the Wehnelt interrupter, and by Dr. Ernest Lecher, in connection with the effect of electrification of the field on the discharge. The electric conductivity of powders is treated by Franz Streinitz.

Speaking generally, the physical papers show a considerable amount of steady, plodding work in the elaboration of existing theories and the tabulation of statistical results rather than any very striking innovations in the direction of new theories.

Zoology.

The systematic position of the armoured dinosaurs from the upper Cretaceous of the Gosau district, originally described, on the evidence of extremely imperfect material, under the names of *Struthiosaurus*, *Crataomus* and *Anoplosaurus*, has recently occupied the attention of Herr F. B. Nopessa, jun. (*Sitzungsberichte*, vol. cxi. p. 93, 1902). The author follows some previous observers in regarding the first and second of these presumed generic types as identical, as also in considering the third to be inseparable from the Huxleyan *Acanthopholis*. Consequently, the two genera *Struthiosaurus* and *Acanthopholis* have alone to be considered.

The suggestion of the late Prof. Marsh that these European forms are members of the same family (*Ceratopsidae*) as the horned dinosaurs of the topmost Cretaceous of North America is discountenanced by Herr Nopessa. Rather, he thinks, they typify a family by themselves—the *Acanthopholididae*—in many respects intermediate between the comparatively generalised *Stegosauridae* and the highly specialised *Ceratopsidae*. From the horned dinosaurs, the members of the intermediate family are readily distinguished by the absence of bony horn-cores on the skull and also of a frill-like neck-shield. They are further characterised by the non-fusion of the cervical vertebrae, the relatively large fore-limbs and the long and powerful tail. As regards the large size of the fore-limb, they are connected with the *Stegosauridae* by the Wealden *Polacanthus*. Taken as a whole, their organisation tends to confirm the view that among the armoured dinosaurs the early bipedal, or partially bipedal, forms are the more primitive, and the quadrupedal types (*Ceratopsidae*) the more specialised.

In the same communication, Herr Nopessa describes a chambered vertebra of one of the gigantic saurapodous dinosaurs from the Cretaceous of Neuquen, Patagonia. The reptile to which this vertebra belonged is regarded as generically distinct from *Titanosaurus* and *Argyrosaurus*, both of which have been recorded by Mr. Lydekker from the formation in question, but no further attempt is made to determine its systematic position. The saurapodous dinosaurs are now known in the southern hemisphere from both Madagascar and Patagonia.

Mollusca, both recent and fossil, have come in for a considerable share of attention in the issues of the *Sitzungsberichte* recently to hand. In vol. cx. p. 315, Herr R. Hoernes describes new cerithia, belonging to the group typified by *Clava bidentata*, from the Tertiary of Oisnitz, in Central Styria, with remarks on the distribution of that group in the Mediterranean and Sarmatian horizons. The paper is illustrated by a beautifully executed plate. In the succeeding volume (p. 5), Dr. C. Gorjanović-Kramberger treats of the Tertiary cockles of the genus *Limnocardium* in Croatia, more especially those pertaining to the subgenus *Budmania*. Some doubt has been thrown on the right of the latter group to distinction, but, from the hinge and other characters, the author justifies its separation from the more typical form. Finally, in the same volume (p. 123), Dr. R. Sturany discusses our present knowledge of the land molluscs of Asia Minor, describing a few new forms.

Botany.

An interesting paper by Prof. Haberlandt gives an account of cultural experiments made with isolated plant cells. These were taken from the mesophyll tissue of the leaf of *Lanium purpureum*, and when placed in culture solutions were kept living for several weeks. Considerable increase in size was observed in some cases, and an appreciable increase in the thickness of the walls occurred, especially where the walls were concave. In the solutions containing only inorganic salts, the chlorophyll corpuscles soon turned yellowish, but kept their green colour when sugar was supplied. It would appear that the plastids pass on all the products of their assimilation and require to be constantly nourished, to prevent decomposition of the chlorophyll. With regard to the renewed growth of the cells when isolated, Prof. Haberlandt regards this as the continuation

of growth which is ordinarily arrested in the leaf to suit the requirements of the organism. Two peculiar effects of light are described by Dr. H. Molisch. A flagellate, *Chromophyton Rosanoffii*, shows a large chromatophore which takes up a position on the shaded side. If viewed from the direction in which light rays are impinging upon the organism, at certain angles the cells seem to sparkle. The effect is due to the light which is condensed by the cell on the chromatophore and thence reflected, and is similar to that described for the moss *Schistostega*. The second paper refers to the light which is emitted by the bacterium *Micrococcus phosphoreus* obtained during the decomposition of meat. The light is sufficiently strong to produce heliotropic curvature in many seedlings, and also in the sporangio-phores of *Phycomyces*.

The poisonous effects so well known in the case of leaves of *Primula obconica* are further elucidated by the investigations of Dr. A. Nestler. Besides various cultivated forms of *Primula obconica*, three species, *Primula sinensis*, *Primula Sieboldii* and *Primula cortusoides*, all belonging to the group *sinensis*, were found to produce similar effects, giving rise to throbbing and inflammation. The source of irritation was traced to the secretions of glandular hairs. These readily crystallise out, and by sublimation were obtained pure. The writer recommends the outward application of strong alcohol as a palliative.

THE FUTURE OF COAL GAS.¹

WHEN, in the early years of last century, coal gas became a commercial reality, the one end and aim of the manufacturer was to produce his gas, and such details as purity, illuminating and calorific value never troubled his mind. As time passed on, however, and competing companies vied with each other in their endeavours to secure customers, advantages had to be offered to coax consumers from the enemy's camp, and those who remember the battle of the two then existing City companies with another proposed rival in 1847-48-49, and the way in which the gas consumers in the City were at that time pestered and pamphletted by the supporters of the rival schemes, will realise that even in those days gas management was not a bed of roses. The outcome of the rivalry was the introduction in the early 'fifties of a standard of illuminating value, and a string of Parliamentary requirements which have ever since safeguarded the consumer and harried the gas manufacturer.

In 1850 a Bill was passed which enacted that a consumption of 5 cubic feet of gas per hour should be equal to the light of twelve wax candles of the size known as sixes, the burner employed being a brass Argand burner with fifteen holes. In 1860 another Act changed the illuminating power to twelve sperm candles, which meant an increase of some 16½ per cent. in the illuminating value of the gas, owing to the fact that the wax candles originally used were only equal in illuminating power to 10.3 sperm candles, as at present employed for testing purposes. In 1868 the illuminating power was again raised to fourteen candles, whilst, in 1876, the present sixteen-candle standard was reached.

The amount of light emitted, however, by the gas was still insufficient to satisfy the desires of the consumers, who, utterly ignoring the fact that the illumination to be derived from coal gas was quite as much dependent on the burners employed as it was upon the standard illuminating value, vented their dissatisfaction at the light emitted by small flat-flame burners by clamouring for a higher quality of gas; and even thirty years ago the great aim of the gas-consuming public was to obtain the highest candle power that could be squeezed out of the gas company, in order that they might gain something like decent illumination from the flat-flame burners then almost exclusively used, and which were, as a rule, so small as to destroy entirely the value of the gas. It was at this period that the anomaly became common of seeing a town supplied with gas of more than twenty-candle illuminating value swathed in semi-darkness, whilst another, using the much-abused thirteen- or fourteen-candle gas, supplied at a good pressure and burnt in decent-sized burners, was well illuminated.

It was at this time, also, that some of our most able chemists ranged themselves on the side of the votaries of

¹ Abstract of Cantor lectures delivered at the Society of Arts by Prof. V. B. Lewis.