

Ross in regard to his discoveries in connection with deadly tropical diseases. Science was everything to industry, and man found that money profits could be made by taking advantage of the advances of science. He was an optimist about industry, but he could not be an optimist when he looked round and saw members of his profession who had laboured for nothing, scarcely even the thanks of the public, certainly without those rewards for which those engaged in industry rightly and properly looked. He referred also to the fact that the headmasters of the public schools generally were clergymen, and deprecated the lack of provision made in those schools for scientific instruction.

Sir William Byrne (Home Office), in proposing the toast of "The British Science Guild," said that he agreed with the statement in the annual report of the guild, that Government Departments used the services of scientific men without remuneration. The charge was irrefutable. Virtue might be its own reward, but science rarely was. He sympathised with them, and promised that so far as he was concerned he would do his best to alter this state of things.

FLUIDS WITH VISIBLE MOLECULES.

PROF. JEAN PERRIN (of the University of Paris) in his recent course of lectures at King's College, London, dealt with aggregates of suspended particles regarded as fluids consisting of visible microscopic molecules. The Brownian movement of such particles appears to be due to molecular agitation, suggesting that particles in suspension function as enormous molecules. If this is so, the laws of gases extended by Van't Hoff to solutions apply also to dilute emulsions consisting of uniform grains, and from a knowledge of the osmotic pressure of this "gas of visible molecules," one can calculate, using Avogadro's law, the ratio of the masses of the grains to those of the molecule of any gas, an indefinite vertical column of emulsion in equilibrium having the properties of a miniature atmosphere.

Suitable emulsions are prepared by isolating uniform particles of precipitated resin by fractional centrifugalisation. Such emulsions obey the laws of gases and give the correct value for Avogadro's number N , whatever the size of the particles.

Since dilute emulsions obey the laws of gases concentrated emulsions should behave analogously to compressed fluids, and the equation $(P+a/V^2)(V-b)=RT$, be applicable, where V represents the volume of the emulsion, b is four times the volume of the grains present, and a a constant which in Van der Waals's equation corresponds to cohesion. Experiment, while verifying the prediction, shows the interesting peculiarity that in the case of emulsions the cohesion constant is negative, the grains repelling one another appreciably. This result allows the experimental determination of the thickness of the double layer of electrification by contact, and throws light on the properties of colloidal solutions.

The Brownian activity of a grain is defined as E^2/t , where E^2 is the mean square of the displacement in the time t . An emulsion should diffuse as a solution of visible molecules with a speed proportional to the speed of the molecules which compose it. It can be shown that the speed of diffusion D is $1/6 E^2/t$, and since in the steady state as many molecules pass upward through any level by diffusion as pass downward through the level by gravitation, Einstein's equation holds, viz. :—

$$F^2 = 6D = \frac{RT}{N} \frac{1}{\pi r^2 z}$$

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where r is the radius of the grains and z the viscosity of the intergranular fluid. Thus both by measuring the rate of diffusion and by measuring the displacement Avogadro's constant has been determined.

Emulsions were prepared of such a nature that those grains touching one side of the retaining vessel became attached and the emulsion progressively weaker by diffusion, the variation with time in the number of grains captured giving a measure of the rate of diffusion.

By selecting relatively large spherules it was found possible to measure their rate of rotation, and thus verify Einstein's formula for the Brownian movement of rotation.

These theories also apply to grains suspended in a gas except that Stokes's law is no longer applicable, but by applying an electric field to the charged particles Townsend's equation for the diffusion of ions relates the charge on the granule with Avogadro's number and the activity of its Brownian movement.

$$Ne = \frac{RT}{D} \frac{u}{H} = 6RT \frac{t}{E^2 H}$$

The values of N , the number of molecules in a cubic centimetre of a gas under standard conditions, deduced by these various methods, exhibit a remarkable concordance. Prof. Perrin concluded his lectures with a critical comparison of the results of his measurements of N with the values which have been deduced from determinations of the charge of an electron, from counting alpha particles, and from the theory of radiation.

CONTRIBUTIONS TO VERTEBRATE PALÆONTOLOGY.

THE skull of a remarkable new generic type of horned dinosaur (*Styracosaurus albertensis*), from the Cretaceous of the Red Deer River, Alberta, is described and figured by Mr. L. M. Lambe in the *Ottawa Naturalist* for December, 1913 (vol. xxvii., pp. 109-16, plates x.-xii.). It was found by the well-known collector Mr. C. H. Sternberg, last summer. The skull is long, depressed, and wedge-shaped, with a single nasal horn of somewhat unusual shape; but its chief peculiarities are the large size of the supra-temporal fossæ, and the production of the hind border of the great occipital flange into four pairs of spines, of which the three innermost on each side are very long. Although the Alberta horned dinosaur may be generically identical with an imperfectly known species from the Cretaceous of Montana, referred by Cope to the genus *Monoclonius*, under the name of *M. sphenocerus*, it is considered that the two are specifically distinct.

According to an article by Mr. C. Schuchert on the dinosaurs of German East Africa, published in the *American Journal of Science* for 1913 (vol. xxxv., pp. 33-8), the largest representative of the genus first described as *Gigantosaurus*, but now known, on account of the preoccupation of the original name, as *Tornieria*, is believed to have been about twice the length of *Diplodocus*, or at least 150 ft. The neck appears to have exceeded that of the American species by a length of about 15 ft. It is hoped to set up a skeleton of this gigantic reptile in the Berlin Museum.

At the conclusion of a note on the relationship between the Permian reptiles of South Africa and those of Russia, published in the *Journal of Geology* for November and December, 1913 (vol. xxi., pp. 728-30), Dr. R. Broom expresses the opinion that the dicynodonts of the Durna valley represent the Ciste-