Be this as it may, the idea of Daniel Bernoulli has been developed into a beautiful theory—the kinetic theory of gases—a theory which has shed a sudden clearness, an unexpected light, on matters which seemed to be veiled in the deepest obscurity. The molecules, as already stated, are invisible. Nevertheless, attempts have been made to penetrate this invisible world by the force of scientific reasoning, and by an effort which does honour to the human mind, even if it be destined to remain barren. The illustrious authors of the kinetic theory of gases have sought to determine, not only the velocities of the gaseous molecules, and the prodigious number of their collisions during a unit of time, but likewise their distances, their absolute dimensions, and their number in a given volume. And here we arrive at results which bewilder the imagination, but which, in this lecture, I must not attempt to unfold.

Permit me only to add that these great labours mark a resting place in our course, and are, perhaps, an approach towards the solution of the eternal problem of the constitution of matter—a problem which dates from the earliest ages of civilisation, and though discussed by all the great thinkers of ancient, as well as of modern, times, still remains unsolved. May we not hope that in our own time this problem has been more clearly stated and more earnestly attacked, and that the labours of the nineteenth century have advanced the human mind in these arduous paths, more than those of a Lucretius, or even of a Descartes and a Newton. From this point of view, the discoveries of modern chemistry, so well expressed and summarised by the immortal conception of Dalton, will mark an epoch in the progress of the human mind; and to one of the most important among these discoveries—that of the liquefaction of the gases—grateful posterity will for ever join the glorious name of FARADAY.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

BIOLOGISTS will be pleased with the frank recognition of Dr. Foster's services contained in the statute proposed by the Council of the Senate at Cambridge for the new Professorship of Physiology to be founded by Trinity College. It is to be permanently recorded that Dr. Foster's lectures have always been open to the entire University, and that he "has successfully promoted" the study of physiology. Thus the continued self-denying effort and enthusiasm which have in eight years developed a school of over seventy students, and which have called forth the original talents of a score of ardent young investigators, will find still fuller scope. We understand that Dr. Foster resolutely declined to sanction any arrangement by Trinity College to secure for him the first tenure of the professorship, preferring to leave the University perfectly unfettered in its choice. But the Council of the Senate, which is a thoroughly representative body, chooses to signify the inseparable connection of the work with Dr. Foster's name by the very wording of the statute. The professor is to be elected by a board consisting of the Vice-Chancellor, of four members nominated by the Council, and four nominated by the Board of Natural Science Studies. One of each four must be neither resident in the University nor officially connected with it.

THE Cambridge mechanical workshops, organised by Prof. Stuart, bid fair to become of importance to research in the country generally, as well as in Cambridge. Prof. Stuart, on his own responsibility, has completely fitted up the workshops with all machinery necessary for the construction of philosophical apparatus. He has engaged a number of the most competent workmen as teachers, and to construct apparatus required by professors and investigators who are often deterred from researches because of lack of appliances or time to make what they want. Classes are formed for the regular instruction of university men in the use of tools and the construction of machines, and these are attended at present by a dozen students, several of whom intend to become engineers.

MR. A. C. HADDON, of Christ's College, has been nominated by the Board of Natural Sciences Studies, Cambridge, to study at the Zoological Station at Naples during the ensuing season.

DR. GREENFIELD, of St. Thomas's Hospital, has been appointed by the Senate of the University of London to succeed Dr. Burdon Sanderson as Professor of Comparative Pathology at the Brown Institution.

THE subscriptions already received or promised for the extension of the buildings of University College, London, amount to upwards of 14,000*l.*

BY the will of the late Mr. Charles Randolph, engineer, 60,000*l.* has been left to the building fund of Glasgow University.

THE third annual report of the Johns Hopkins University, Baltimore, issued by President Gilman, is of the highest interest, and shows that the attempt to establish a purely philosophical university has been eminently successful. Our readers are no doubt familiar with the principles on which this institution has been based. It was not sought to add one more to the many colleges already existing in the United States, but to found a genuine university in which those who had the inclination and the capabilities would have every facility for carrying their elementary or collegiate studies into the region of research in the various departments of human knowledge. The method of work has been carefully planned; the best men obtainable have been got to superintend the work of the students, who are admitted only on showing that they are really able and willing to pursue the courses which have been arranged. It is a many-sided and active centre of the highest learning, and cannot but have an invigorating result on science in all its departments in the United States. We would recommend those of our readers interested in the higher education to procure a copy of this report, which deserves a more detailed notice than we have space for.

THE Budget for Public Instruction will be deposited this week in the Bureau of the French Chamber of Deputies. A large increase is asked for in favour of public instruction. The credit granted will exceed two millions sterling. In 1823 it was only two thousand pounds, consequently in a little more than half a century it has been multiplied a thousand-fold. M. Bardoux will propose the creation in each department of a high school for popular education according to the models which have proved so successful in Paris. The benefit of the organisation realised in the capital will be extended to the whole of France if the scheme of the active minister is adopted, as will most probably be the case.

AT Stockholm the "Free" University was opened on October 14 last. The funds collected for its foundation now reach the sum of 820,000 Swedish crowns. It is intended to establish a similar university at Gothenburg.

SCIENTIFIC SERIALS

The American Journal of Science and Arts, October.—Besides two valuable papers by Professors Mayer and Draper, reproduced in our columns, we have here an account of the curious artificial mounds of North-Eastern Iowa, by Mr. McGee. They consist of tumuli, smaller conical mounds, embankments, and animal mounds, and from numerous measurements the builders seem to have used a unit which either was, or grew out of, the pace or yard. A slow southerly migration of the mound-builders is supposed to explain the evident increase in geometrical knowledge attested by various works found in passing across the United States from north to south.—Prof. Young furnishes details of observations of the Princeton Eclipse Expedition.—The flour-mill explosion at Minneapolis in May was probably due to the running dry of a set of stones which ground middlings, one of six sets discharging into a spout which communicated with a dust-house. Mr. Peckham studies the case, pointing out that there is greater danger with middlings, because it is dryer, and is ground at a higher temperature, and finer. The dry stones may heat the last part of the grist remaining, sufficiently to make it like tinder, so that it readily ignites on receiving a spark from the stones. The practical problem is how to prevent or detect dry stones, especially those for middlings.—Mr. Becker indicates the *rationale* of correction for vacuum in chemical analysis.—Prof. Smith writes on the composition of the new meteoric mineral, Daubreelite, and its frequent, if not universal, occurrence in meteoric irons.—Prof. Watson gives a more careful determination (than previously) of the intra-Mercurial planets.

Annalen der Physik und Chemie.—No. 9, 1878.—The excitation of electricity on contact of solid and gaseous bodies, forms the subject of an opening paper by Herr Beetz, who thinks the case is either one of differences of tension, produced by different conducting liquids, or of change of metals by gases which have ceased to be in the gaseous state, either through occlusion in the metals, or condensation on their surface.—From experiments on production of

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galvanic currents by streaming of liquids through tubes, Herr Dorn infers that the motion of the liquid in itself produces no considerable part of the electromotive force observed; the influence of the tube wall, on the other hand, is undoubted.—Herr Wiedemann shows that an examination of magnetic behaviour of iron oxide salts is well adapted for determining with accuracy, even quantitatively, their dissociation in solutions at different temperatures, the conditions of their fixation by acids, and their exchange with other salts.—In the first portion of an inquiry into the divergences of some gases from Boyle's law at 0° and 100°, Herr Winkelmann gives an interpolation formula, expressing this divergence in the case of ethylene.—A new proposition in the theory of diffraction proved by Herr Frölich, is, that with small angles of diffraction, the kinetic energy of the incident light for an aperture of any shape is equal to the kinetic energy of the diffracted light.—Some experiments on the nature of the phases and change composition in telephonic transmission are described by Herr Hermann.—There are also notes on the relation between refraction equivalent and wave length, and on excitation of electricity by pressure and friction.

Journal of the Franklin Institute, October.—This contains a short account by Prof. Henry Draper, of his eclipse observations at Rawlins, Wyoming Territory, together with a photograph of the corona, showing the unequal distribution of its matter in the plane of the ecliptic and ray-like forms towards the poles of the sun.—Mr. Bell furnishes an account of the now historic "Camel" locomotive engine of Ross Winans, built in June, 1848. It first practically demonstrated the superiority of the eight-wheel connected engine for heavy traffic; it had also an inclined firebox, and other features of novelty.—The new system of electric lighting by Profs. Thomson and Houston, is described, consisting in causing one or both the carbon electrodes to vibrate to and from each other, so that the effect of the light produced is continuous. This allows of a feebler current being used.—Mr. Isherwood analyses some Scotch experiments on economic vaporisation of water and expansion of steam.

SOCIETIES AND ACADEMIES

LONDON

Linnean Society, November 7.—Prof. Allman, F.R.S., president, in the chair.—Sir Joseph D. Hooker, C.B., presented to the Society, in the name of a committee of gentlemen, a portrait of the Rev. M. J. Berkeley. A great matted mass in sheet of a Chara (*Nitella* sp. ?) was exhibited by Dr. Thos. Boycott. It had been got from a dried-up pond in St. Leonard's Forest, Sussex, June, 1877; within its meshes many interesting microscopic forms were obtained.—Mr. Thos. Christy next called attention to living specimens of West African indian-rubber trees, the *Urostigma Vogelii*, and another undetermined species recently arrived. He likewise showed the fruit, flower, and leaf in spirit, with a dried ball of the gum of the commercially valuable *Landolphia florida*.—Dr. Maxwell Masters read an extract from a letter of Dr. Beccari describing a gigantic Aroid found by him in Sumatra, side by side with the *Rafflesia arnoldi*. The species has a large tuber 5 feet round, from which is pushed up a single leaf, with a long, stout petiole, the divided blade covering an area of 45 feet, or 15 metres.—Dr. R. C. A. Prior showed a specimen of *Colletia cruciata* in blossom, grown out of doors in Somersetshire by the Rev. W. Sotheby.—"Notes on Euphorbiaceæ," by Mr. G. Bentham, read in title, was a paper treating of the history, nomenclature, systematic arrangement, and the origin and geographical distribution of this remarkable order of plants. Among Dicotyledons, Euphorbiaceæ stands fourth in point of numbers, having above 3000 species and 200 genera. In investigating the origin of the order the geological record, unfortunately, is of no assistance. Their evident, generally tropical nature, is a striking feature, and, judging from various data, it is conjectured that their most ancient home was in the old world. Their affinities have repeatedly been discussed by botanists, but though there are individual genera which may exhibit some one character supposed to ally to other orders, yet no real connection has hitherto been pointed out. Their isolation is produced, not so much by any one special character, as by a special combination of several. As to position in the linear series, unless the order be broken up, practically it must remain among the Monochlamydeæ, in spite of occasional presence of corolla in some forms. The author has a most interesting chapter on nomenclature and synonymy, well worthy the study and serious attention of biologists generally.—Mr. Lewis A. Bernays, in a letter to the secretary, records the undoubted existence of *Carpesium cernuum*, in Queensland, and suggests its being indigenous there.—In a paper given in abstract, "Descriptions of New Hemiptera," by Dr. F. Buchanan White, the diagnosis of 2 new genera (*Helenus* and *Neovelia*) and 17 new species are entered. These mainly are the results of Prof. Trail's late exploration of the regions bordering the River Amazon.—Mr. Alfred W. Bennett read a communication, "Notes on Cleistogamic Flowers; chiefly of *Viola*, *Oxalis*, and *Impatiens*." According to him there are two kinds:—(1) Those which hardly differ from the perfect open flowers, other than the partial or entire suppression of the corolla, and the closing of the calyx (= homocleistogamic); and (2) those with a distinct modification in the flower to aid self-fertilization (= heterocleistogamic). He was at first disposed to regard those two kinds as having arisen, one by degradation, the other by a rudimentary form of the organ: but subsequent examination convinced him that both kinds owe their origin to degradation. In the extreme cleistogamic flowers a large number of organs have been correlatively modified. Most interesting phenomena occur in the mode of emission of the pollen tubes, these travelling through the air in a straight line from the anther vertically upwards in *Oxalis*, horizontally in others, and creep along the surface and even back of ovary in *Viola canina*. An unseen agency directs, for none wander with uncertainty; and this is all the more remarkable because, when not in proximity to the stigma, the pollen grains protrude their tubes in all possible directions.—The Rev. G. Henslow orally delivered the gist of a paper "On the Absorption of Dew and Rain by the Green Parts of Plants" (*vide Science Notes*).—The Rev. W. W. Fowler and Messrs. Wilfred Huddlestone and T. M. Shuttleworth were elected Fellows of the Society.

Chemical Society, November 7.—Dr. Gladstone, president, in the chair.—The following papers were read:—Contributions from the Laboratory of Tôkio, Japan. On the red colouring matter of the *Lithospermum erythrorhizon*, by M. Kuhara. The purple colouring matter was prepared from the root by extracting with alcohol, purifying by treatment with lead acetate, &c.; it forms a dark, resinous, uncrystallizable mass, with a metallic green reflection, soluble in alcohol, ether, benzol, almost insoluble in water; it resembles in some respects anchurin, the colouring matter from alkanet. A bromine and a chlorine compound were prepared.—A second report on some points in chemical dynamics, by C. R. A. Wright, and A. P. Luff. The authors have continued their previous research and have determined the temperature of initial action of carbonic oxide, hydrogen, and carbon on various oxides of iron, manganese, lead, cobalt, and nickel. They find that the general law holds good, that the temperature of the action of carbonic oxide lies below that of hydrogen, which again is below that of carbon; this rule appears to be a special case governed by the general law that *cæteris paribus* the greater algebraically is the heat evolution taking place during a reducing action on a metallic oxide, the lower is the temperature at which the action is first noticeable during a few minutes' action.—Note on the constitution of the olefine produced by the action of zinc upon ethylic iodide, by Dr. Frankland and Mr. Dobbin. The gas given off was passed through a cohol and sulphuric acid, and then absorbed by antimonic chloride; on heating with water and distilling a chloride was obtained, boiling at 83° C.; it was therefore ethylenic, and not ethylidenic chloride.—On the occurrence of certain nitrogen acids amongst the products of the combustion of coal gas and hydrogen flames, by L. T. Wright. The author proves that the origin of the nitrogen acids found in the condensed water procured by burning coal gas or hydrogen in the air is ammonia, either free or combined, no such acids being produced when the gases are carefully freed from ammonia.—On the action of bromine upon sulphur, by J. B. Hannay.—Researches on dyeing. Part I. Silk and rosanilin, by Dr. Mills and Mr. G. Thomson. The authors have investigated the nature of the transaction which occurs when a vat is exhausted of its tinctorial ingredients. The experiments consisted in immersing a constant area of white silk in a solution of a rosanilin salt at a constant temperature for varying times, and then determining the loss of strength of the rosanilin solution.—Comparison of the actions of hypochlorites and hypobromites on some nitrogen compounds, by H. J. H. Fenton. The compounds selected were, ammonium carbamate, guanidine, and biuret.—Notes on two new vegeto-alkaloids by

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