

### Early Science at Oxford.

**March 30, 1686.** Dr. Plot communicated coal from Amrath in Pembrokeshire, which being spit on gave an Ink for writing, as was found true by experiment before ye Society.

**March 31, 1685.** Mr. President was pleased to give the Society a more full account of his extracting the Root of a Number of 53 places in the darke, by the help of Memory.

Upon occasion of a Discourse at a meeting of the Philosophicall Society at Oxford (March 24, 1684-5) concerning the advantage, which those may have (as to Memory, & the application thereof) who want their sight, Dr. Wallis confirmed it by this consideration, that even we, that have our eye-sight, can yet with more advantage apply our Memory (in matters of intent consideration) by night, in the dark, when all things are quiet, than by day, when sights and noises are apt to divert our thoughts: And gave instance in his application of his own memory, by night, (in performing Arithmetically operations in great numbers) better, than by day he could have done: and, even by day, we may better do it with our eyes shut, than open.

Having had the curiosity heretofore to try, how far ye strength of Memory would suffice me to performe some Arithmetical Operations (as Multiplication, Division, Extraction of Roots &c) without the assistance of Pen, & Ink, or ought equivalent thereunto; And finding it to succeed well for instance in extracting the Square Root from numbers of 8, 10, 12, or more places: I proceeded to try it (with successe) in numbers of 20, 30, or 40 places. On December ye 22d, 1669, I had (by night, in the darke) extracted the Square Root of 3 (with cyphers adjoyn'd) continued to ye twentieth place of Decimall Fractions. I did that same night (by darke, in bed, without any other assistance, than my memory) propose to my self (at all adventures) this Number of 53 places

2,4681, 3579, 1012, 1411, 1315, 1618, 2017, 1921,  
2224, 2628, 3023, 2527, 2931,

and found its Square Root of 27 places to be

157, 1030, 1687, 1482, 8058, 1715, 2171 feré.

These numbers (having fixed them in my Memory; by repeating the same operation a night or two after) when a friend made me another visit, March 11th following, I did dictate to him from my memory (having not before committed them to writing) for him to write down and examine: And did afterwards write them down myself.

**April 3, 1688.** Mr. Walker shewed the Society some drop Microscopes, and the manner of making them.

Mr. Charlet acquainted the Society of a Cock with three legs, and two anus's at William Greenhill's Esqr. at Abbots Langley near St. Albans.

Several formed Stones were shewed the Society viz. *Cornua Ammonis*, *Mytiloides*, *Solenites*, *Conchites*; several Stones called St. Cuthbert-beads, and other stones exactly of the figure of a Cocks Spur, which, as Dr. Plot related, are only the pointes of those Stones called St. Cuthbert-beads, most of which were found in the Quarries on the side of Wotton-under-hedg-Hill in Glocestershire, as also a great hollow mass of Iron Oar, brought from St. Vincents Rocks near Bristol, which in the concave was beset with hexangular crystals; as also some masses of Lead Oar. Oar found on Lye-Down near Bristoll, from which it is said they extract Silver in a Cup alle standing under the aforesaid Down.

Upon the sight of which the President acquainted the Society that at Stanton-Prior *Cornua Ammonis* were the natural stones of ye place.

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### Societies and Academies.

LONDON.

**Royal Society, March 19.**—Sir William Hardy and Ida Bircumshaw: Boundary lubrication: plane surfaces and the limitations of Amontons' law (Bakerian Lecture). When the slider has a plane face the coefficient of friction is a function of the load, decreasing as the load increases, until a point is reached beyond which the coefficient is independent of the load. When it has a spherical face, the coefficient is always independent of the load. The coefficient is a measure of the efficiency of the lubricating layer with respect to one variable—the load. Recollecting that the pressure between the bearing surfaces must be very great when the slider has a spherical face, the above results show that with low pressure the efficiency of the lubricant increases as the pressure increases until a limit is reached, beyond which Amontons' law holds. It is probable that, during the first period, when Amontons' law does not hold, the slider is floating on a layer of lubricant the thickness of which is a function of the pressure, whilst in the second period, where Amontons' law holds, all lubricant which can be squeezed out has been squeezed out, and a layer of constant molecular composition has been reached. In the first period friction is adjusted to the load by variations in the thickness of the layer of lubricant, and in the second period by the elastic forces between the atoms.

**Linnean Society, February 5.**—G. P. Bidder: Growth and death. A water-borne organism may grow indefinitely, but swiftly moving land-animals must maintain a relation between their weight and the cross-sectional area of their bones and muscles. Men and plaice before puberty alike show additions to their weight in approximately geometrical progression for equal intervals of time; alike after sexual maturity they show an approximately arithmetical progression. In the plaice the annual increment remains to a great age positive. In man the arithmetical progression shows a difference with negative sign, and from 28 (the age of greatest reproductive fertility) onwards there appears to be a constant net loss of protein material, amounting annually to  $(0.8 \pm 0.15)$  per cent. of its weight at 28. The mechanism of the adult body is set after sexual maturity to a certain annual balance of profit and loss: for water-borne animals this may be a positive increment and life may be eternal; for terrestrial animals the length of life depends on the nearness to equality of profit and loss. A positive annual increment, however small, will eventually bring about death from gigantism; it is not improbable that this has been, and possibly is now, the form of death in some quadrupeds. A negative annual increment, however small, determines a date at which all capital resources will disappear. We die, therefore, as an alternative to becoming giants.

**Faraday Society, February 16.**—A. J. Allmand and V. S. Puri: The effect of superposed alternating current on the anodic solution of gold in hydrochloric acid. The only well-known case in which a superposed alternating current is used in technical electrolysis is furnished by the Wohlwill modified gold refining process. Pure gold anodes in hydrochloric acid solution were employed, using direct current alone, and also the same with alternating current superposed. Anode potentials have been measured throughout.—C. H. Desch and Eileen M. Vellan: The electrolytic deposition of cadmium and other metals on aluminium. Where lightness is of importance, as

in aeronautical work, the deposit should be thin, and the choice of metals is further limited by the tendency of many deposits to detach themselves. Preliminary experiments having shown that cadmium was better in these respects than copper or nickel, an investigation into the best conditions of deposition was undertaken. Other methods of protection are on the whole more useful, but comparison with other metallic coatings shows a great superiority in favour of cadmium, even under the severe test of exposure to a salt spray. The deposit has a pleasing appearance and a good colour.—W. M. Thornton and J. A. Harle: The electrolytic corrosion of ferrous metals. The most direct way of subjecting a metal to the influence of active moist gas is by electrolysis. Since rust is almost entirely oxide, it is only necessary to make the specimen the anode of a cell containing slightly acidulated water in order to obtain conditions of exposure to moist oxygen which are perfectly under control. Not only have pure metals definite rates of corrosion according to Faraday's laws, but also every ferrous alloy examined has a specific rate of electrolytic corrosion by which it can be identified with certainty. This may prove a basis for a systematic comparison of the behaviour of ferrous alloys under all conditions of exposure which result in oxidation.—S. Glasstone: Overvoltage and surface forces at the lead cathode. The addition of ethyl or methyl alcohol, or acetic acid, to aqueous solutions with various hydrogen ion concentrations lowers the surface tension and also the overvoltage. Substances like iso-amyl alcohol, which are sparingly soluble in water and lower its surface tension considerably, cause the overvoltage of a lead cathode first to increase and then to decrease as increasing amounts are added. A complete theory of overvoltage must take into account the surface forces involved in bubble formation.—M. Shikata: The electrolysis of nitrobenzene with the mercury-dropping cathode. Part I. The reduction potential of nitrobenzene. Nernst's formula, modified by the adsorption isotherm, was verified in acid and alkaline solutions. An abnormal reduction potential in alkaline solution was found and "neutral salt actions" were observed. The reduction due to the simple deposition of hydriions, and to the ionic splitting of water in neutral solutions, was distinguished by the current-voltage curves. Part II. The influence of the cathodic potential on the adsorption of nitrobenzene. A maximum reduction current followed by a minimum, due to certain potentials, were observed in the reduction of nitrobenzene. The formation of a maximum reduction current was explained by the desorption due to the applied polarisation potential of the mercury drops. Observed influences of neutral salts upon the R.P. and on adsorption were explained by the "salting-out" action. The method is applicable to quantitative and qualitative micro-analysis.—J. R. H. Coutts: The law of distribution of particles in colloidal suspensions: a note on the specific volume of a gamboge suspension. Measurements of the specific volume of a dilute gamboge suspension, to an accuracy of about 1 in 60,000, verified the assumption made by Porter and Hedges, namely, that no significant contraction or expansion takes place in the formation of such a suspension.—W. W. Barkas: On the distribution of particles in colloidal suspensions. The results of measurements made in centrifuged solutions of gamboge, silver and copper, of the sizes of particles given by the formula of Porter and Hedges as compared with the sizes given by the law of centrifuging developed by E. Talbot Paris, are discussed. The same values of the radius are given for copper by the two methods; for silver the radius from the distribution

is higher, and for gamboge lower than from the centrifuge. The radius given from the distribution of uncentrifuged solutions is in similar agreement with that given from the rate of fall of the cloud particles by Stokes's Law. If the solution under examination could be effectively shielded from changes in temperature, the determination of the distribution would give an accurate measure of the mean size of the particles in a solution, provided their density was known. Over a considerable range of concentrations, the level at which the distribution is sensibly uniform is quickly reached and the limiting concentration is directly proportional to the number of particles present in the solution.

**Royal Statistical Society, February 17.**—E. S. Russell and T. Edser: The fishery statistics of England and Wales. The number of fishermen engaged in the sea industry is about 40,000, and all the waters of the continental slope, from the Barents Sea down to the Atlantic coast of Morocco, are visited by English trawlers in their search for fish, and to the north-westward the waters round Iceland and Faroe are regularly frequented. The value in 1923 of the catch of bottom-living or demersal fish, the great bulk of which is brought in by steam trawlers, was 12,500,000*l.* To this must be added the value of a catch of pelagic or surface-living fish caught mainly by drift nets, which amounted in 1923 to 1,500,000*l.* The principal pelagic fish is the herring, of which more than 3,000,000 cwt. was landed in 1923. Statistics of real value date back to 1886, and marked improvements were made in 1903 and 1906. It is now possible to allot catches to rectangular areas of 1° of longitude by 1° of latitude, and the catch per 100 hours' fishing can be worked out for steam trawlers and certain other classes of vessels. An international system of groups of these rectangular areas has been evolved and is accepted by the nations adhering to the International Council for the Exploration of the Sea.

**Royal Meteorological Society, February 18.**—Miss L. D. Sawyer: The effect of pressure distribution upon London's sunshine in winter. The results were based on an analysis of the pressure types during the five winters ending 1921-22, and the amount of sunshine recorded in different parts of London each day. Near the centre of a depression the average sunshine is less than 0.5 h. per day, and near the centre of an anticyclone the figures are equally poor except with E.S.E. breezes. If the pressure centre is at least two or three hundred miles away, the average with anticyclonic conditions is about two and a half times as great as with cyclonic, while a "neutral distribution" (neither cyclonic nor anticyclonic) is almost as sunny. Records show that Hampstead and Greenwich are both almost as sunny as South Farnborough when the air reaches them before passing over London, but Hampstead loses more than an hour a day with S.E. winds and Greenwich as much or more with N.W. winds.—S. Chapman: On the changes of temperature in the lower atmosphere, by eddy conduction and otherwise. For a number of years hourly observations of the temperature of the air have been made on the Eiffel Tower, at the base, the top, and two intermediate heights, *i.e.* of the change of temperature in the lowest stratum of the atmosphere, 300 metres, or nearly 1000 ft. thick. Eddy conduction is not the predominant cause of the temperature changes, and the effect of the remaining (major) cause, probably radiation, is far from being constant with respect to height. The temperature changes wrought by conduction are greatest at midday and small at night; those produced by radiation are greatest soon after dawn (when the air is being heated rapidly) and

in the late afternoon (when the air is cooling).—N. K. Johnson and O. F. T. Roberts: The measurement of the lapse rate by an optical method. Theoretical expressions have been deduced by various authors connecting the apparent vertical displacement of a horizontal ray with the length of the ray path and the vertical gradient of temperature in the atmosphere. The results of the observations confirm the theory within the limits of accuracy of the measurements. With certain limitations, the optical method affords a practical means of determining the vertical gradient of temperature.

**Geological Society, February 20.**—J. W. Evans: Regions of tension, evidenced by joints, slip-faults, and dykes (Anniversary Address). The different causes of local tension were given, including torsion; but although the latter was found by Daubrée to give systems of fractures at right angles to one another, these might also be produced in any area with maximum and minimum directions of tension. Western Europe is largely characterised by tension towards the south-west, but north-westward tension prevailed in north-western Ireland and north-western Scotland. The south-westward tension appears to represent a slow drift towards the Atlantic "deep" in the Bay of Biscay running north-westwards from Cap Breton, and the north-westward tension seems to represent a drift towards the "deep" trending north-eastwards between Rockall and Ireland. These "deeps" themselves are to be attributed, not to "foundering," but to a drift of the "sial" masses of the Central Atlantic banks to the south-west and north-west respectively.

## EDINBURGH.

**Royal Society, February 9.**—W. L. Calderwood: The relation of sea growth to the spawning frequency in *Salmo salar*. From the systematic study of scales of salmon and the calculation of age lengths, the growth of fish which return from the sea to spawn in early life is contrasted with the growth of those which remain for several successive years to feed and grow to a large size without spawning. The first and frequently the second year's growth in the sea determines which habit is followed.—F. J. Cole: A monograph of the general morphology of the myxinoïd fishes based on a study of Myxine. Part VI. Blood vascular and lymphatic systems of Myxine. The anatomical relations of the two systems and the circulation of the blood from one to the other is described. An extensive true lymphatic system is present as apart from the so-called veno-lymphatics which belong strictly to the venous system. A fourth (cardinal) heart is described. The liver is an hepatopancreas, the pancreatic tubules being associated with the branches of the portal vein in the liver parenchyma.—Sir Thomas Muir: Theory of compound determinants from 1900 to 1920.

## MANCHESTER.

**Literary and Philosophical Society, February 3.**—W. L. Bragg: (1) Model illustrating the formation of crystals. When a solution of a salt is evaporated, positively and negatively charged ions, which are at first distributed in the solutions, pack themselves into a regular pattern. A series of electro-magnets hung by long wires represent these ions. They can be charged with opposite polarities by passing an electric current through them. At first they swing about freely in all directions, then as the attractive force increases they group themselves into pairs (molecules), and these pairs pack together to form

a regular crystalline body in two dimensions. A slight variation of the experiment shows the difference between acids and bases and the formation of complex acid groups according to the theory of Kossel. (2) Exhibit of diffraction gratings constructed to illustrate the effect of crystals on X-rays. By ruling gratings in which the lines are complex, many of the diffraction effects observed in crystals may be simulated. The gratings are made by taking a contact print from a glass plate ruled with a number of fine lines such as is made for the half-tone printing process. Instead of taking one print, two or more are taken, the plate being moved a very small distance between each exposure, and the times of exposure varied. Thus each line in the grating has several components of different intensities just as each molecule in the crystal is composed of several atoms, all the components or atoms scattering the light or X-rays respectively. Very striking diffraction effects exactly like those got in X-ray analysis are obtained.—R. W. James and W. A. Wood: The structure of barium sulphate. Examination of the spacings of the different planes shows that the space-group is  $V_h^{16}$  and that the unit cell contains four molecules and has the dimensions  $a=8.852 \text{ \AA}$ ,  $b=5.430 \text{ \AA}$ ,  $c=7.132 \text{ \AA}$ . By examining the intensities of the different spectra it has been possible to place the atoms with some accuracy. The intensities of the spectra of lower order are consistent with the assumption that the  $\text{SO}_4$  group is a tetrahedral arrangement of oxygen atoms around a central sulphur atom, the distance sulphur to oxygen being about  $1.5 \text{ \AA}$ . The barium and sulphur atoms lie on the reflexion symmetry planes of the structure which are parallel to (010), and necessarily two of the oxygen atoms lie on these planes also.—E. C. S. Dickson: Experimental demonstration of the Magnus effect: principle of the Flettner rotor ship.

## PARIS.

**Academy of Sciences, February 9.**—Charles Richet, M. Öxner, and J. Richard: Cooked food and raw food in feeding fish. An account of experiments carried out at the Oceanographic Institute of Monaco on *Cantharus griseus*. The fish fed on raw meat showed no differences from those fed on cooked meat up to the 50th day, but after that period the former steadily gained in weight on the latter.—H. Vincent: The pathogeny and conditions of maintenance of the coli bacillus. The blood of animals immunised against the *B. coli communis* is rich in the antibody, but the urine contains little or none. The immunity does not extend to the kidney or bladder.—G. Friedel: Remarks on a recent communication relating to the fatty acids. With reference to a recent note of M. Trillat, the author emphasises that the smectic state as defined by him is very different from the crystalline state, and the term cannot be applied to crystals.—Georges Giraud: The generalised problem of Dirichlet; Non-linear equations of  $m$  variables.—F. Defourneaux: Some applications of electrospherical polynomials to the theory of numbers.—Maurice Fréchet: Abstract spaces.—Vladimir de Belaevsky: The rupture of the Bouzey dam. The deformations of a reduced model ( $\frac{1}{\tau} \frac{1}{\sigma}$ ) of the Bouzey dam constructed in xylonite have been studied by an optical interference method. From the results of the measurement the conclusion is drawn that the bursting of the Bouzey dam in 1895 was produced by rending.—Henri Malet: The idea of the variation of mass, deduced from the formula of the addition of the velocities taken by itself.—Maurice Le Besnerais and Raoul Ferrier: The electrical constitution of the ether.—Marcus Brutzkus: The realisation of chemical reactions in compressors.—

**F. Croze** : The structure of the line spectrum of ionised oxygen.—**B. Szilard** : A new method of examining the interior of pearls. The pearls, immersed in thick cedar oil, are viewed directly by the microscope. Pearls formed on a nucleus of mother of pearl can be readily distinguished by this method from natural pearls.—**Nobuo Yamada** : Particles from polonium with a long path.—**Fred Vlès** and **Edmund Vellinger** : The physico-chemical properties of gelatin; the rotatory power. The results of measurements of diffusion, multi-rotation and rotatory powers of solutions of gelatin are given, the variable being the hydrogen ion concentration.—**Lespieau** : The glycol  $\text{CH} : \text{C} \cdot \text{CH}(\text{OH}) \cdot \text{CH}_2(\text{OH})$ . This glycol was obtained from the chlorhydrin  $\text{CH} : \text{C} \cdot \text{CH}(\text{OH})_2 \cdot \text{CHCl}$  as starting point,

through the ethylene oxide  $\text{CH} : \text{C} \cdot \overset{\text{O}}{\text{CH}_2} - \text{CH}_2$ . Its formula was established by its combination with phenyl isocyanate and by titration with bromine. It is remarkable as being the first true acetylene derivative failing to give a precipitate with ammoniacal cuprous chloride.—**Marcel Godchot** : Octohydro-phenazine.—**Charles Chéneveau**. The formation of natural dull amber. A transparent pine resin can be rendered opaque by treatment with water at 50°C.; under similar conditions peach and cherry gums do not turn opaque, but swell up and form a gel. During the tertiary period the influence of the temperature of the Baltic regions, then tropical, together with the effect of time, would be sufficient in the presence of water at atmospheric pressure to convert the transparent resin into opaque resin.—**L. Royer** : New observations on the orientation of ammonium iodide by muscovite mica.—**Ch. Lormand** : Analysis of the thermal waters of Chaudesaigues (Cantal).—**C. Dauzère** : The atmospheric vase and the sea of clouds. Observations made at the Pic du Midi.—**R. Kuhner** : The nature of the cystids in the Basidismycetes.—**A. Hée** and **R. Bonnet** : The influence of the dissolved oxygen content of the water on the respiration of submerged plants. For the four species of plants studied (*Myriophyllum epicatum*, *Elodea densa*, *Cabomba caroliniana*, *Elodea canadensis*) the intensity of the respiration was not sensibly modified by variations in the dissolved oxygen in the water between 3 cc. and 24 cc. of oxygen per litre.—**E. Michel-Durand** : Under what form do the tannins exist in Spirogyra? The tannins of these plants are almost completely extracted by acetone and amount to about 3 per cent. of the dry weight. The insoluble tannin compounds, normal in higher plants, are absent from Spirogyra.—**Henri Piéron** : The differential characteristics of the working of the retinal cones and rods.—**Jules Amar** : The stages of vital coagulation.—**Jean Roche** : The respiration of the tissues in avitaminosis and inanition. A recent theory, put forward independently by Hess and Abderhalden, attributes to the vitamins a rôle of primary importance in the mechanism of cellular oxidations. According to this theory, avitaminosis is an impoverishment of the cells in respiratory ferments. Experiments on tissue respiration described have given results in opposition to this theory.—**P. Fredet** and **René Fabre** : Study of the localisation in the organism of the alkyl derivatives of malonyl urea. In injections of diethylmalonyl urea (veronal) and allylisopropylmalonyl urea, it has been proved that these compounds fix themselves selectively on the nervous centres, brain and spinal column.—**Mme. Phisalix** : Autopsy of a reticulated python (*Python reticulatus*) measuring 5.75 metres in length.—**Robert Weill** : The nematocysts and spirocysts of the Coelenterata. Mode of working and differential characters.—**O. Duboscq** and **P. Grassé** : The parabasal apparatus of the Flagellæ and its signification.

WASHINGTON, D.C.

**National Academy of Sciences** (Proc. Vol. 10, No. 12, December).—**H. B. Wahlen** : The mobilities of the positive ions in helium. The mobility of the positive ion in air decreases if the ion is allowed to "age" before it enters the field in which its mobility is to be measured, due probably to the fact that ions consist of clusters of molecules and not of single charged molecules. A similar result was obtained in helium, but the mobility curves show two definite breaks, due possibly to the presence of two types of aged and two types of unaged ions.—**G. P. Baxter** and **H. W. Starkweather** : The density of oxygen. Little novelty of method is claimed. Three globes were used and weighed by direct comparison with similar exhausted sealed globes. Oxygen was prepared by : (1) electrolysis of dilute sulphuric acid; (2) electrolysis of aqueous sodium hydroxide; (3) heating potassium permanganate; (4) heating potassium chlorate and manganese dioxide. The average value for the density found from the three series of experiments considered most trustworthy is 1.42901 corrected to 0°C. and 760 mm. at sea-level, lat. 45°, and this is also the average for the whole set of 22 experiments, each of which consisted of three determinations. The value generally accepted hitherto is 1.42905. The new density gives the limiting value of the molal volume under standard conditions as 22.415 litres.—**C. T. Brues** : Observations on the fauna of thermal waters. The observations refer chiefly to the thermal springs of the Yellowstone National Park. Characteristic of the conditions are the high temperature, presence of unusual quantities of inorganic salts, deficiency of dissolved oxygen, and excess of carbon dioxide. Plants without chlorophyll exist in water at 70°-89°C., and green algæ at 60°-77°C.; animal life is found in water at 46°-52°C., but is scarce above 40°-42°C. The present fauna includes Protozoa, Arthropoda, Mollusca, and cold-blooded vertebrates, and is generally similar to a brackish-water fauna. This seems to be due to their both deriving from fresh-water organisms.—**W. E. Castle** : On the occurrence in rabbits of linkage in inheritance between albinism and brown pigmentation. A race of rabbits with brown pigmentation of the coat gave 25 per cent. pink-eyed and white-coated young with brown at the extremities (Himalayan albinism). Brown is recessive to black pigment and Himalayan albinism to brown. The two recessive characters are relatively loosely linked in inheritance. Previous cases of linkage in mammals show less than 20 per cent. of crossing over; here more than 40 per cent. occurs.—**E. Hille** : A general type of singular point.—**J. W. Alexander** : Topological invariants of manifolds.—**F. G. Benedict** and **Cornelia Golay Benedict** : (1) The neutral bath and its relation to body heat. Oxygen consumption was used as an index of the basal metabolism of four trained subjects, one woman and three men, first in the laboratory at 15°C. and afterwards in a bath of water at 33°-38°C. (neutral bath used as a sedative in psychiatric clinics). The oxygen consumption of the men showed an increase, while that of the woman was practically unchanged. The bath does not tend to lower the metabolism, and the heat production under these conditions is independent of the heat lost to the environment and therefore of the surface area.—(2) Body posture and minor muscular movements as affecting heat production. Oxygen consumption while standing was about 10 per cent. greater, and while sitting 2-3 per cent. greater, than while lying down. Movements such as raising one arm or crossing the legs at intervals of less than 1 min. also cause increases, and must therefore be proscribed while measuring basal metabolic rates.