

of "traces" upon masses, and the authority of Berthollet was not sufficient to save them from neglect. In this eventful year for science, 1803, the latter published his essay on chemical statics, in which he stated, as a fundamental proposition, that in comparing the action of bodies on each other, which depends "upon their affinities and mutual proportions, the mass of each has to be considered" (English edition, by M. Farrell, M.D., 1804, p. 5). His views were successfully contested by Proust, but, as Lothar Meyer says, the influence on chemistry of the rejection of Berthollet's views was remarkable:—"All phenomena which could not be attributed to fixed atomic proportions were set aside as not truly chemical, and were neglected. Thus chemists forsook the bridge by which Berthollet had sought to unite the sister sciences, physics and chemistry." Fortunately, however, in this country there was one chemist who had followed up the line of work indicated by the early metallurgists, for in 1803, the same year as that in which both Berthollet's essay and Dalton's atomic theory were published, Charles Hatchett (Phil. Trans., vol. xciii. p. 43, 1803) communicated to the Royal Society the results of a research which he had conducted, with the assistance of Cavendish, in order to ascertain "the chemical effects produced on gold by different metallic substances when employed in certain" (often very small) "proportions as alloys."

Allusion was then made to the evidence of the passage of metals into allotropic states, and it was shown that, although the importance of the isomeric and allotropic states was abundantly recognized in organic chemistry, it had been much neglected in the case of metals. Special attention was then devoted to the works of Joule and Lyon Playfair, who showed, in 1846, that metals in different allotropic states possessed different atomic volumes, and the lecturer then proceeded to the consideration of the work of Matthiessen, who, in 1860, was led to the view that in certain cases when metals were alloyed they passed into allotropic states, probably the most important generalization which has as yet been made in connection with the molecular constitution of alloys.

Instances of allotropy in pure metals were then shown to the audience, such, for example, as Bolley's lead, which oxidizes readily in air; Schützenberger's copper; Fritsche's tin, which fell to powder when exposed to an exceptionally cold winter; Gore's antimony; Graham's palladium; and allotropic nickel. It was further shown that metals could be obtained in chemically active states under the following conditions:—Joule proved that when iron is released from its amalgam by distilling away the mercury the metallic iron takes fire on exposure to air, and is therefore clearly different from ordinary iron, and is, in fact, an allotropic form of iron. Moissan (*Comptes rendus*, vol. lxxxviii. p. 180, 1879) has shown that similar effects are produced in the case of chromium and manganese, cobalt, and nickel, when released from their amalgams with mercury.

Evidence is not wanting of allotropy in metals released from solid alloys, as well as from fluid amalgams with mercury. Certain alloys may be viewed as solidified solutions, and when such bodies are treated with a suitable solvent, usually an acid, it often happens that one constituent metal is dissolved, and the other released in an insoluble form. Reference was then made to a new alloy of potassium and gold, containing about 10 per cent. of the precious metal. If a fragment of this alloy be thrown upon water, the potassium takes fire, decomposes the water, and the gold is released as a black powder: there is a form of this black or dark-brown gold which appears to be an allotropic modification of gold, as it combines with water to form auric hydride. If this dark gold be heated to dull redness, it readily assumes the ordinary golden colour. The Japanese use this gold, released from gold-copper alloys, in a remarkable way, for they produce, by the aid of certain pickling solutions, a beautiful patina on copper which contains only 2 per cent. of gold, while

even a trace of the latter metal is sufficient to alter the tint of the patina.

With regard to theoretical views as to molecular change in metals, special care was given to a description of the work of Prof. W. Spring, of Liège, who had furnished much evidence in support of the view that polymerization of metals—that is, the rearrangement of atoms in their molecules—could take place even in *solid* alloys of lead and tin.

With reference to the passage of metals into allotropic states under slight external influences, it was stated that Debray (*Comptes rendus*, vol. xc p. 1195, 1880) has given a case of an alloy in which a simple elevation of temperature induces allotropic change in the constituent metals. It is prepared as follows: 95 parts of zinc are alloyed by fusion with 5 parts of rhodium, and the alloy is treated with hydrochloric acid, which dissolves away the bulk of the zinc, leaving a rich rhodium-zinc alloy, containing about 80 per cent. of rhodium. When this alloy is heated *in vacuo* to a temperature of 400° C., a slight explosion takes place, but no gas is evolved, and the alloy is then insoluble in *aqua regia*, which dissolved it readily before the elevation of temperature caused it to change its state. We are thus presented (as the experiment shown to the audience proved) with another undoubted case of isomerism in alloys, the unstable, soluble modification of the alloy being capable of passing into the insoluble form by a comparatively slight elevation of temperature.

The industrial importance of the passage of metals and alloys into allotropic states, and the possibility of changing the mechanical properties of metals by apparently slight influences, were fully dealt with; and the lecture concluded with a detailed description of Prof. Austen's own experiments, which have since been printed in the Philosophical Transactions of the Royal Society, the results showing that very small amounts of metallic impurities exert an extraordinary effect on the tenacity and extensibility of gold, and that small as the amounts of these impurities are, their influence is rigidly controlled by the periodic law of Newlands and Mendelejeff, the deleterious action of a metallic impurity being in direct relation to its atomic volume. The audience was asked "to remember that the knowledge of the kind of facts which had been considered comes to us from very early times, for the influence produced on metals by small quantities of added matter had a remarkable effect on the development of chemistry, mainly by sustaining the belief of the early chemists in the possibility of ennobling a base metal so as to transmute it into gold. This was the object to which they devoted life and health, and laboured with fast and vigil. We inherit the results of their labours, and their prayers have been answered in a way they little anticipated, for, from an industrial point of view, if not from a scientific one, metals are 'transmuted' by traces of impurity. Possibly we are nearing an explanation of the causes which are at work, but the fact remains that iron may be changed from a plastic material, which in ornament can be fashioned into the most dainty lines of flow, into one of great endurance, to which, for the present at least, the defence of the country may be trusted, apparently because armour-plates and missiles owe their respective qualities to the fact that carbon, manganese, and chromium have small atomic volumes."

THE LEONID METEOR-SHOWER, 1888.

A T Bristol rain fell heavily between midday on November 12 and the same time on November 13, a 5-inch gauge registering an inch and eight-tenths, which is by far the greatest downpour of the year within twenty-four hours. In the afternoon of November 13 the clouds broke, and the weather showed a disposition to become more favourable. At night the sky was moderately clear

at times. I began to watch for the return of the Leonids at 15h. 30m., but there were many clouds until about 16h., when the firmament cleared and remained nearly cloudless until 18h. During the 2½ hours I counted 29 shooting-stars, and of these 17 were Leonids; so that the shower was pretty conspicuous. The radiant-point was at 149° + 22°, which is almost identical with the place assigned to it in previous years.

The display was noteworthy for the brilliancy of the individual meteors. I observed a large Leonid fireball at 16h. 56m., and I also saw two Leonids equal to Jupiter and one first magnitude at other times. Their paths were as follow:—

| | | | | | | | | | |
|-------------|-------|-----|----------|-----|------|-------|----|------|-------|
| Nov. 13 ... | h. m. | ... | ℓ | ... | 166 | + 34 | to | 172 | + 37½ |
| | 16 41 | ... | ℓ | ... | 125½ | - 22 | to | 121 | - 30½ |
| | 16 56 | ... | Fireball | ... | 252 | + 33½ | to | 257½ | + 31 |
| | 17 19 | ... | ℓ | ... | 175 | + 66½ | to | 210 | + 75½ |
| | 17 46 | ... | I | ... | | | | | |

All these left bright streaks enduring for several seconds. The fireball at 16h. 56m. was situated very low in the southern sky, and I should not have seen it but for its brilliant flashes, which lit up the whole sky with unusual vividness. It must have been a splendid object in the English Channel and at stations in the north-west parts of France. The fine meteor at 17h. 19m. appears to have been seen also by Mr. Backhouse, at Sunderland. At Bristol it was observed near ε Herculis, and very close on the north-east horizon; at Sunderland it was projected near Arcturus, about 15° above the east-by-north horizon, and the most remarkable feature of its display at Sunderland was the durability of the streak, which continued visible to the naked eye *nine minutes* after the flash which accompanied the outburst of the meteor. A comparison of the observations shows that this bolide at its disappearance was about 37 miles in vertical height above point in the North Sea near lat. 55¼° N., long. 3° E.

The recent shower appears to have been decidedly brighter than any other return of the same stream since 1879, when there occurred a very similar display to that which has just been witnessed. There was a large proportion of fine meteors from the Leonid radiant on November 13 of that year, and this seems a characteristic element of the shower.

Mr. Backhouse obtained observations at Sunderland which amply confirm those at Bristol during the apparition of 1888. He says the Leonids were "unusually numerous" on November 13. Between 16h. 48m. and 18h. 14m. he noticed about 14 of them, including one fireball, one equal to Jupiter, two equal to Sirius, and one equal to a first magnitude star. The streaks of the larger meteors belonging to this system are very pronounced in their aspect, and they sometimes brighten up considerably a few seconds after the nuclei have died away.

It is probable that this well-known group will become increasingly active every year until its maximum in 1899. Bristol, November 17. W. F. DENNING.

NOTES.

WE understand that Prof. Ray Lankester is a candidate for the post of Deputy-Professor of Human and Comparative Anatomy in the University of Oxford, which has just been created in consequence of the continued illness of Prof. Moseley.

PROF. GIARD's lectures at the Sorbonne begin to-day. He is to deal with the general proofs of the doctrine of evolution.

IT is expected that the meeting of the International Congress of Anthropology and Prehistoric Archaeology, at Paris, in 1889, will be a great success. The Congress was founded at Spezia in 1865, and held its first session at Neuchâtel in 1866. Many members have already announced their intention of being present at the Paris meeting.

AT the ordinary meeting of the Institution of Civil Engineers, on Tuesday, November 13, the President, Sir George B. Bruce, announced that Lord Armstrong, C.B., Past-President, in the belief that the Benevolent Fund attached to the Institution was not adequately supported by the general body of members, and that it needed support, had most generously offered to contribute any sum not exceeding £5000, provided the members among them would raise a similar amount.

AT a recent meeting of the Edinburgh International Exhibition Association, the joint Committee appointed by the Association and the executive to consider the best way of disposing of the Exhibition surplus submitted its report. The Committee, among various other proposals, recommended that £1000 should be given to the Scottish Meteorological Society in aid of the Ben Nevis Observatory, and £100 to the Royal Scottish Geographical Society.

A RESOLUTE effort is about to be made to secure for North London (comprising the boroughs of Finsbury, Hackney, Islington, and St. Pancras) four great technical institutes. The Central Executive Committee has issued a circular, pointing out the need for these institutions, and appealing for funds. It is supposed that if £200,000 can be raised by private subscriptions a like sum will be contributed by the Charity Commissioners.

THE next course of Christmas lectures adapted to a juvenile auditory will be given, at the Royal Institution, by Prof. Dewar, F.R.S., the subject being "Clouds and Cloudland." They will begin on December 27. During the recess the staircases leading from the gallery of the theatre have been considerably altered in order to facilitate more speedy egress.

WE have already called attention to the fact that an effort is being made to secure for Bedford College (for ladies), York Place, Baker Street, London, new chemical and physical laboratories. The College has been among the most successful of the institutions which send up graduates to the science degrees at the University of London; but its students have hitherto been severely handicapped by the inadequacy of the laboratory accommodation. The opportunity has occurred of securing fresh building-ground adjoining the College, and plans have been prepared for the proposed additional laboratories. The offer must be definitely made before Christmas, and the estimated expenditure will be at least £3000. The Council do not feel warranted in going forward unless they have at least a considerable portion of this sum promised, for which they are entirely dependent on voluntary contributions. Subscribers' names will be received by the lady-resident at the College. An application for assistance is also being made to the City Companies. Bedford College is the only institution exclusively for ladies which provides first-class practical instruction of this kind.

THE work of the United States Fish Commission during the past season seems to have been even more than usually successful. Stations capable of hatching four hundred million codfish-eggs have been established at Gloucester and Wood's Holl; and, according to *Science*, these stations will probably put at least one-fourth of that number of cod-fry into the Atlantic Ocean during the present season. It is expected, therefore, that cod-fish will soon be more plentiful on the coast of New England than they were years ago, and that a lost industry worth millions of dollars will be restored to that part of the United States.

THE Committee on Science and the Arts, of the Franklin Institute, of Pennsylvania, wishes to make known the fact that it is empowered to award, or to recommend the award of, certain medals for meritorious discoveries and inventions which tend to the progress of the arts and manufactures. These medals are:—(1) The Elliott Cresson Medal (gold), founded by the legacy