

the same as that which produces the corresponding series  $A_1, A_2, A_3, \&c.$ , in cadmium, and the same for the corresponding sets in the other metals of this chemical group. In other words, we are led to suspect that, not only is the atom a complex composed of an association of different ions, but that the atoms of those substances which lie in the same chemical group are perhaps built up from the same kind of ions, or at least from ions which possess the same  $e/m$ , and that the differences which exist in the materials thus constituted arises more from the manner of association of the ions in the atom than from differences in the fundamental character of the ions which build up the atoms; or it may be, indeed, that all ions are fundamentally the same, and that differences in the value of  $e/m$ , or in the character of the vibrations emitted by them, or in the spectral lines produced by them, may really arise from the manner in which they are associated together in building up the atom.

This may be an unjustified speculation, but there can be no doubt as to the fascination which inquiry of this kind has always exerted, and must continue to exert, over the human mind. It is the speculation of the ignorant as well as of the philosophic and trained scientific mind, and even though it should never be proved to rest on any substantial basis of fact, it will continue to cast its charm over every investigator of nature.

It is ever the desire of the human mind to see all the phenomena of nature bound by one connecting chain, and the forging of this chain can be realised only gradually and after great labour in the laboratories of science. From time to time, the hope has been entertained that metals may be transmuted, and that one form may be converted into another; and although this hope has been more generally nurtured by avarice and by ignorance rather than by knowledge, yet it is true that we never have had any sufficient reason for totally abandoning that hope, and even though it may never be realised that in practice we shall be able to convert one substance into another, even though the philosopher's stone be for ever beyond our grasp, yet when the recent developments of science, especially in the region of spectrum analysis, are carefully considered, we have, I think, reasonable hope that the time is fast approaching when intimate relations, if not identities, will be seen to exist between forms of matter which have heretofore been considered as quite distinct. Important spectroscopic information pointing in this same direction has been gleaned through a long series of observations by Sir Norman Lockyer on the spectra of the fixed stars, and on the different spectra yielded by the same substance at different temperatures. These observations lend some support to the idea, so long entertained merely as a speculation, that all the various kinds of matter, all the various so-called chemical elements, may be built up in some way of the same fundamental substance; and it is probable that this protyle theory will, in one form or another, continue to haunt the domains of scientific thought, and remain a useful and important factor in our progress, for all time to come.

Even though it may be that a knowledge of the ultimate constitution of matter must for ever remain a sealed book to our inquiries, yet, framed as we are, we must for ever prosecute the extension of our knowledge in every direction; and in pursuing knowledge it frequently happens that vast acquisitions are made through channels which at first seem most unlikely to lead us any further. It has frequently happened that small and obscure effects, obtained after much labour and difficulty, have led to results of the highest importance, while very pronounced and striking effects which have forced themselves on the attention of the observer have

proved comparatively barren. It was by a determined effort of this kind, founded on a correct appreciation of the importance of small outstanding differences—so small as to be despised or passed over by all other observers—that Lord Rayleigh discovered a new gas in our atmosphere, added argon to our list of elements, and initiated the attack which led to the brilliant capture by Prof. Ramsay of several new terrestrial substances.

Viewed from this standpoint, I hope I am to some extent justified in occupying your attention this evening with the consideration of the action of magnetism on light, for although the effect produced is small and not easy to observe, yet it is likely to prove an important instrument of research in the study of matter, and it is not inappropriate that a public account of what has been already achieved should be given in this Institution, in which the inquiry was first begun by Faraday, and in which his spirit still lives.

#### THE DOVER MEETING OF THE BRITISH ASSOCIATION.

THE meeting of the British Association in Dover on September 13 this year promises, on account of its international character, to be a memorable one in the history of the Association. Dover was selected, though it is a smaller town than is usually chosen for these meetings, on account of its nearness to the French coast, in order that an interchange of visits should take place between the British Association and its French counterpart, which meets this year at Boulogne. The French Government has taken a great interest in the arrangements for the meeting, rightly judging that the meeting cannot but promote friendship and good will between the two nations. A good illustration of the truth that science has no nationality will be found in the fact that one of the evening lectures in Dover will be delivered in French by Prof. Chas. Richet, of Paris, on "La vibration Nerveuse." This will take place on Friday, September 15, at 8.30 p.m. It is extremely probable that Prof. Fleming will find some way of imparting an international character to his lecture on the "Centenary of the Electric Current," to be delivered on Monday, September 18.

The preliminary arrangements for the meeting are well in hand. The usual handbook is being prepared under the editorship of Dr. Sebastian Evans, brother of the ex-President of the Association, and will deal with Dover both in its ancient and modern aspect. The historical part of the subject has been undertaken by the Rev. S. P. H. Statham, Chaplain to the Forces, who has recently written a history of the castle, town, and port of Dover. The geology of the district is in the able hands of Prof. Boyd Dawkins; the botany in those of Mr. Sydney Webb. Dr. Parsons undertakes the climate, health and meteorology of Dover; whilst the harbour and cross-Channel traffic is described by Mr. A. T. Walmisley, C.E., the Harbour Board Engineer. This portion of the handbook should be extremely interesting in view of the national harbour which has been undertaken by the Government after more than fifty years' delay, and which will turn Dover into one of our most important naval ports.

For a town of its size Dover possesses an unusually large number of rooms suitable for public meetings, so little difficulty has been experienced in providing for the Sections. The Town Hall, with its annexe, the ancient Maison Dieu, will serve for the President's address and the soirées. The School of Art, in which five of the Sections assemble, adjoins and communicates with the Town Hall. The reception rooms and offices have an ideal *locale* in the buildings and grounds of the Dover College. This institution was founded some thirty

years ago in what remains of the Dover Priory, established about 1130. The magnificent Norman refectory will serve as the reception room and ticket office. The College is only about three minutes' walk from the Priory Station (L.C.D. Railway), and about as far from the Town Hall. Two of the Sections (anthropology and geography) will meet in a part of the town somewhat more remote from the reception room.

There will be no lack of entertainment of a public character. The General Commanding the South Eastern District (Sir Leslie Rundle) will give a garden party at the Castle; the Council, head-master and assistant-masters of Dover College will give another in the College grounds. The Mayor (Sir William Crundall) will give a *conversazione*, and will also give a reception one afternoon at the Dover Athletic Grounds, when there will be an exhibition and contest of motor cars from all parts of Europe and America.

The smoking concert, which was so successful a feature of the Bristol meeting last year, will be repeated. There will also be a military tattoo by torchlight on the sea front one evening, with music by the massed bands of the garrison.

The visit of the French Association is to take place on Saturday, September 16. The members will arrive early, and, after a light repast at the Lord Warden Hotel, will assemble at the Town Hall, when addresses of welcome will be given. An adjournment will then be made to the various Sections, which will meet on Saturday this year, though that day is generally an "off-day." In many Sections the presidents will reserve their presidential addresses for this occasion, so as to give the French guests a chance of being present. There will be a luncheon afterwards in a marquee in the College grounds. In the afternoon, parties will visit the Castle and other objects of interest in Dover. There may be opportunity for a visit to Canterbury.

On Sunday there will be special services in most of the churches and chapels of Dover, whilst those who care to go further afield can take advantage of the arrangements made by Dean Farrar, of Canterbury, one of the vice-presidents of the Association this year, for there will be special services in the Cathedral, with well-known preachers, and an organ recital in the afternoon. The Canterbury Museum, which owes much to the munificence of its Hon. Curator, Mr. Bennett Goldney, a most useful member of the Dover Local Committee, will be open to members of the Association on Sunday afternoon.

The return visit of the British Association to the French will take place on Thursday, September 21. The details are not finally settled, but there will be a *réunion* with addresses, a luncheon, the unveiling of a plaque to the poet Campbell, who lived at Boulogne for some time. A statue to the French man of science, Duchesne, will also be unveiled. It is intended to start from Boulogne on the five days' excursion through the most interesting towns of Northern France and Belgium. The civic authorities in each town have very cordially responded to the efforts of the French and the Belgian consuls in Dover, and have promised to do all in their power to make the five days' excursion a great success.

Amongst the scientific men from the Continent, the United States and Canada, who have already accepted the invitation of the Local Committee, may be mentioned Profs. Dwelshauvers-Dery, Fittig, Gobert, Julin, Kron-ecker, Calmette, Chappuis, Barker, Carl Barus, Surgeon-General Billings, Profs. Bovey, Campbell, Scott, Thurston, and Van Rijckevorsel.

From what has been stated, it will be evident that those members of the Association who visit Dover will have no cause to be dissatisfied with the programme before them.

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### THE VOLTA CENTENARY EXHIBITION AT COMO.

IN this age of electricity it is difficult to realise that only a hundred years have elapsed since the first electric current was produced by chemical means. The birthplace of Alessandro Volta has paid a fitting tribute to the pioneer of electrical science by holding an exhibition in commemoration of the discovery of the pile which bears the name of its inventor.

The Como Exhibition, which was opened on May 20, occupies a tract of land bordering on the Lake of Como, its natural surroundings harmonising well with the artistic arrangement of the buildings and exhibits. One section is devoted to electricity, another to the silk industries of Lombardy, while a small collection of pictures, church vestments, &c., forms a minor feature.

International Congresses of electricians and of telegraphists have been organised at Como. At the latter Congress, which was held on May 31, an inaugural address was given by Di San Giuliano, and a competition between professional telegraphists took place.

In the electric exhibits, applied electricity occupies, as might be expected, the most prominent place. All the machines in the exhibition, including the silk-spinning and weaving machinery, a lift to the top of one of the towers, and a high-pressure pump for supplying the fountains, are worked by electricity, each machine having a separate motor.

The principal source of power is a compound "Brünner" horizontal engine worked by steam supplied from two "Babcock and Wilson" boilers. The 150 horse-power thus supplied is transmitted to a steel shaft, where it can be increased up to 300 horse-power by a motor driven by a three-phase alternating current of 3600 volts, the generating plant for which consists of an engine of 100-150 horse-power by Wolf, of Magdeburg, and an alternator by Gadda and Co., of Milan. The main shaft can be connected with ten dynamos by different makers, varying from 24 to 300 horse-power, and as these cannot all be used simultaneously, a comparison of their efficiency is possible. Subsidiary electric power is supplied by three steam and two gas engines operating on dynamos, by Brioschi and other makers, and a fine series of accumulators is available for reinforcing the supply of power which, even without this help, is available up to 500 horse-power.

A large search-light exhibited by the Italian navy has been placed at Brunate, a station 1500 feet above sea-level, whence its rays can be flashed over Como and the surrounding district to a distance of many miles.

Technical instruction in electricity is well represented, while the purely physical side comprises exhibits of Röntgen ray apparatus, wireless telegraphy, electrostatic apparatus by A. Dall' Eco and other makers, and so forth.

One room in the exhibition buildings is set apart for the "Cimelii di Volta," under which head are comprised Volta's physical apparatus, original manuscripts of his papers, his letters, diplomas, and many of his personal effects. The greater part of these relics are exhibited by the Reale Istituto Lombardo, under whose auspices the collection was formed by public subscription in the years 1861 to 1864; for this collection, one of the rooms belonging to the Society at Milan has been specially set apart. Other relics, chiefly personal, are exhibited by Prof. Alessandro Volta and Prof. Zanino Volta. The University of Pavia exhibits several electroscopes, condensers, and similar electrostatic apparatus; and other exhibits are lent by the Como Museum.

The manuscripts include the following:—

(1) A letter to Volta from the French physicist Nollet, dated September 18, 1767.