

refrangible end of the spectrum, acting in this respect in a manner analogous to the hydrogen lines. It is found that the potassium curve is exactly similar to the hydrogen, having a horizontal asymptote which corresponds to the limit of the series. Not only is it similar to the hydrogen curve, but by making two displacements parallel to the coordinates it is found to be superimposable, and both curves may be represented by a generalisation of Balmer's formula, due to Rydberg, as follows:—

$$N = A - B/(m + \mu)^2,$$

where A, B and μ are constants, B having sensibly the same value as in Balmer's formula.

It is interesting to compare the curves for the various members of the alkaline metals among themselves, when it is seen that both for the "principal" and the "subordinate" series the limits approach the red end of the spectrum in the order of the atomic weights of the metals, as if the greater masses of the atoms caused the frequencies of the vibrations to become less; this same fact becomes obvious when we consider, similarly, the spectra of the other metals classified into their natural groups.

Prof. Fabry next describes the "satellites" which accompany most lines in the several spectra. For an example he takes the spectrum of mercury, which is composed of triplets forming two series, one the "diffuse" and the other the "sharp" ("first subordinate" and "second subordinate" respectively) series of Rydberg. In the "diffuse" series the first element of each group is composed of four lines, the second of three and the third of two, but in the "sharp" series the elements are apparently single lines; this is probably due, however, to the very close proximity of the satellites in the latter series, and in several cases MM. Fabry and Perot have shown that, with special apparatus having great resolving power, these lines are of a compound nature, and have come to the conclusion, which at least is probably the correct one, that all the elements of the secondary series are accompanied by satellites. All these satellites appear to share the common property of varying greatly under different conditions of emission (e.g. as temperature, pressure and nature of the electric discharge), and these two observers have shown that, whereas the silver line at λ 547.2, which is a satellite of the line at λ 546.6, appears in the spark spectrum in air, it completely disappears when the spark takes place *in vacuo*. Many metals (e.g. Fe, Ni, Mn) produce spectra so complex that, as yet, it has not been possible to classify them, but this may be done when a means of distinguishing analogous rays is discovered and brought into use.

This latter means may be found when the phenomena first observed by Zeeman, and known as the "Zeeman effect," have received a more complete study. This observer found that if the emission took place in a strong magnetic field, each line was split up into a series of lines symmetrically placed as regards the original line, but differently polarised. Taking the spectrum of mercury as an example, we see that the second subordinate series is made up of triplets, or, as shown above, three separate parallel series of lines, which one may call, in this explanation, "a," "b" and "c" respectively. In the magnetic field the members of the "a" series split up into nine separate lines, four on each side of the original line, some of which are polarised in the plane of the lines of force, the others in the perpendicular plane, but the corresponding line on each side is similarly polarised. In the "b" series we get lines which are similarly placed as regards the original line, and similarly polarised, but there are only three on each side, the second member on each side in the "a" group having disappeared. Similarly in the "c" series only two extraordinary lines are seen, one on each side of the original, corresponding to the extreme lines in the "a" series.

To the first workers in this field these lines appeared greatly entangled, but, thanks to the labours of Cornu, Michelson, Preston, and more especially Runge and Paschen, order has been evolved from the chaos, and the study of the "Zeeman effect" will, in the future, form a ready means of recognising and determining series, for it has already been proved that "the various lines which go to make up similar series behave in an identical manner

when the emission takes place in a magnetic field, and if one represents each line by its 'frequency,' the various members, in the same magnetic field, resolve themselves into groups which are strictly superimposable." It is also to be hoped, and even expected, that when the work of Humphreys and Mohler, and others, on the displacement of spectral lines under various conditions of pressure, comes to be further developed, similar laws as to the analogous behaviour of lines in their corresponding series will be evolved.

Prof. Fabry concludes his article with a discussion of the relations which exist between the absorption and emission of the same radiations, taking the example of the telluric absorption assigned to atmospheric oxygen in the solar spectrum as an example for discussion. He doubts the coincidence of these absorption bands with emission lines in the spectrum of the gas, although, as he points out, experimental means of proving their non-coincidence have yet to be devised.

CONGRESS OF THE SANITARY INSTITUTE.

THE annual congress of the Sanitary Institute was held at Bradford on July 7-11, under the presidency of the Earl of Stamford.

In his inaugural address Lord Stamford dealt with the history of hygiene, showing how closely the subject was allied to political, social and economic history. In describing broadly the various sanitary questions as they affected the home, factory, and the municipality, the president dealt with the important subject of school hygiene, and pointed out how essential it was that the training schools for teachers should form part of the coordinated system of national education. It should be one of the first requirements in the preparation of the teacher, and also of the inspectors who are appointed to visit the schools, that they should practically understand something of the nature of the child material upon which they are to work, the conditions under which the child can best develop by the teacher's guidance, and the proper use of the appliances provided in modern school buildings.

The sections and conferences to which the papers and discussions of the congress were allotted were presided over by well-known representatives of different sciences connected with hygiene. Prof. Clifford Allbutt, in his address on sanitary science and preventive medicine, brought forward for consideration the question if, within limits, the birth of fewer children under improved conditions may be better in the end than a more voluminous birth-rate of children of which some may be of lower vital capacity, and many less watchfully reared.

Mr. Fitzmaurice, of the London County Council, presided over the section of engineering and architecture, and in connection with some of the large engineering works in which he had been engaged he directed attention to the duty of providing for the medical and sanitary requirements of the large bodies of men temporarily collected for the purpose of carrying out the works, and showed that attention to these requirements was an economic advantage. In works like the Forth Bridge or others in the neighbourhood of large towns the difficulty could be overcome, but in works abroad, such as the Nile reservoir, the problem was a more difficult one, especially as smallpox and typhoid are endemic in the Nile valley, and a large outbreak of either in a camp where 15,000 persons were at times employed would have been disastrous; but by making careful provisions, health conditions were so well maintained that, during the five years the works were going on, there were only four deaths from smallpox and one from typhoid fever. He also dealt with the health aspects of cheap locomotion to the suburbs, and motor traffic.

Prof. Hunter Stewart, in addressing the section of chemistry, physics, and biology, discussed the spread of and immunity from Asiatic cholera, and referred to Great Britain as the most striking instance of acquired immunity. With a sea traffic from India greater than that of any other European Power, and in constant communication with the Mediterranean ports, with no quarantine and cordon regulations such as prevailed on the continent of Europe, this country has, since 1866, known cholera only in the sporadic

form, even though it was raging as an epidemic in France and Spain in 1884-1885. This immunity may be attributed to the great measures for sewage and refuse removal carried out in Britain, which had slowly resulted in such a purification of the soil as to make it unsuitable for conferring virulence on the micro-organism of cholera.

Among the subjects discussed in the sections were the notification of consumption, the several aspects of sewage disposal, construction of hospitals and public baths, and disinfection.

In addition to the sections, eight technical conferences were held dealing with the aspects of hygiene, particularly in reference to the different professions and various classes of the community.

In connection with the congress an exhibition of sanitary apparatus and appliances was arranged, containing exhibits brought by manufacturers from all parts of the country. The visits made to the various municipal undertakings and sanitary works in the neighbourhood served as a valuable object-lesson, illustrating many of the matters discussed in the meetings of the congress.

Among the exhibits at the exhibition, which were carefully examined by a board of expert judges, a special Rogers Field medal was awarded by the institute to the Northern Vacuum Cleaning Company for their apparatus for cleaning carpets, furniture, and house decorations without removing them from the house. The attendance of members and delegates numbered 1550.

E. WHITE WALLIS.

THE MUSEUMS ASSOCIATION.

THE fourteenth annual congress of the Museums Association was held in Aberdeen on July 13-16, and although the place of meeting was so far north, the attendance was exceptionally good, while the programme of business was one of the most varied and useful that has ever been brought before the Association. The president for this year is Dr. F. A. Bather, assistant keeper of geology, British Museum (Natural History), whose presidential address dealt chiefly with art museums. After defining generally the purport and breadth of museums, which he classified into three divisions, (a) investigation for the benefit of specialists; (b) instruction for the benefit of students; and (c) inspiration for the guidance of the general visitor, he entered into a critical survey of the Museum of Fine Art, specially condemning the present system of arranging pictures, and the lack of harmony between the architecture, decoration, and contents of an art gallery.

Mr. James Murray followed with a paper on the Aberdeen Art Gallery, which is about to be greatly extended; then came a paper by Mr. Alex. M. Rodger, "Method of Mounting Fish with Natural Surroundings," which can be commended to all curators who wish to make their museums attractive. Mr. W. P. Pycraft was rather severe on some of the methods of representing birds in a museum, and Mr. E. M. Holmes briefly described a method of preserving the natural colours of dried leaves and flowers for museum specimens, which had stood the test of many years' exposure, while a paper by Mr. H. Bolton treated of the "Re-shelving of Museum Cases." "On Good Form in Natural History Museums" was the title of a paper by Mr. F. Jeffrey Bell; another paper of the same character being "Neglect of Opportunities," by Mr. S. S. Buckman.

In addition to representatives from the leading museums of Britain, there were some foreign representatives who read papers. Dr. Jens Thiis, director of the Nordenfjeldske Kunstindustri-museum, Trondhjem, explained the practical work connected with that museum; Dr. G. Johanson Karlin, of the Kulturhistoriske Museum, Lund, gave some good advice in his paper on the museum system; while Dr. O. Lehmann, of the Altona Museum, advocated the cultivation of the habit of drawing in natural history museums.

Other papers were contributed by Prof. T. D. A. Cockerell, of the New Mexico Normal University; Dr. Anton Fritsch, of the Bohemian Museum, Prag; Mr. B. H. Woodward, of the Perth Museum, Western Australia; and Prof. Wm. M. Ramsay, of Aberdeen, who treated of the archaic art of the north-east of Scotland, and the urgent necessity for the preservation of existing examples of it, while Prof. J. Arthur Thomson, in a convincing paper,

showed the need for a faunistic museum for the north of Scotland. All these papers, together with the discussions which they aroused, will be published in due course in the *Museums Journal*. The invitation of the City of Norwich to hold the conference in 1904 in that city was accepted, and Dr. S. F. Harmer, superintendent of the Museum of Zoology, Cambridge, was elected president, Mr. E. Howarth, of the Museum and Art Gallery, Sheffield, being re-elected secretary and editor.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE third reading of the London Education Bill was carried in the House of Commons on July 22, and the second reading passed the House of Lords on July 28. The measure will, therefore, doubtless soon be placed upon the Statute-book.

THE following awards have been made under the research scheme of the Carnegie Trust for the universities of Scotland, in addition to those announced last week:—*Research Scholarships*.—Pathological: Mr. C. T. Andrew, Mr. A. Matheson, Mr. M. Logan Taylor, Mr. S. A. K. Wilson. Economical: Mr. John Young.

MR. PHILIP J. HARTOG has been appointed academic registrar of the University of London in succession to Dr. H. Frank Heath, and Dr. E. R. Edwards secretary to the registrar of the board to promote the extension of university teaching, in succession to Mr. J. Travis Mills. The Drapers' Company has presented to the university the sum of 1000*l.* to be devoted to the assistance of Prof. Karl Pearson in his statistical researches at University College and in the higher work of his department.

THE Technical Instruction Committee of Leeds has decided to give support to the application of the Yorkshire College for the establishment of a university in Leeds, to be entitled Victoria University of Yorkshire, and, in the event of a Charter being granted, to give 4000*l.* per annum towards the university funds, in addition to the 1550*l.* granted from the "whisky" money. The finance committee also approved of the resolution. The *Gazette* of Friday last announces that a petition has been presented to the King in Council praying that a Charter be granted constituting an independent university in Sheffield.

AMONG many questions of educational interest considered in the report for 1902 of the council of the City and Guilds of London Institute is that of the relation between the amount of State aid for university and higher technical education and that of private munificence for the same purpose. The report states, "that State or public aid does not necessarily take the place of private and voluntary effort is shown by the experience of the United States of America. Notwithstanding the increasing revenue available there from the State land grants permanently assigned to education, the activity and munificence of private effort increases rather than diminishes, as shown by the large contributions which are continually being made to the principal universities and higher colleges. In the three months September to November of last year gifts to higher education, amounting in all to nearly five million dollars, equal to about one million sterling, have been publicly recorded." The report also shows that the executive committee of the institute has had under consideration the question of the length of the sessions of work of colleges providing systematic courses of higher instruction. It has been found that the number of weeks in the session at eight of the principal technical colleges in England varies from thirty-one to thirty-three, leaving between four and five months' vacation during the year. Vacations do not necessarily mean holidays, and in most colleges the work of advanced students continues into the vacations; nevertheless, the committee suggests that the length of the formal session might with advantage be increased.

TWENTY-EIGHT senior county scholarships and exhibitions have just been awarded by the London County Council Technical Education Board. The awards are made on the work and promise of the candidates, and most of the scholars will pursue their studies at universities or advanced