

its symbiotic character in later ages. The particular kind of symbiosis occurring in Merlia was apparently extremely common and vigorous in the Palæozoic era, for encrusting, massive, laminate, and branching "Monticuliporas" abound, while Merlia is only a thin spreading crust.

I shall shortly publish a paper giving the evidence for the truth of the above statements.

R. KIRKPATRICK.

British Museum (Natural History).

#### Curie's Constant in the Ferromagnetic State.

IN a former letter to NATURE (August 25, 1910) I remarked upon the analogy which exists between the passage of a fluid from the liquid to the gaseous state, and the passage of a magnetic substance from the ferro- to the para-magnetic state, and that the equation of van der Waals which applies to the former represents the salient features of the latter.

In magnetism it is possible to suppress more or less completely the term representing the mutual attraction of the magnetic molecules by running an alternating current through the magnetic substance. The equation thus simplified represents very well the curves of magnetisation under these conditions at different temperatures, and allows the constant which corresponds to R in the fluid equation to be calculated. Observations on such magnetic isothermals when reduced by the method of least squares yield for this constant the mean value  $4.35 \times 10^{-6}$  for iron between air temperature and  $700^{\circ}$  C., and  $21.1 \times 10^{-6}$  for nickel between air temperature and  $300^{\circ}$  C. The reciprocal of this constant, according to this theory, is Curie's constant, and these numbers are in good agreement with determinations of the same constant by Curie, Weiss, and Bloch, from experiments made above the critical temperature.

This constant is therefore independent of the temperature, and may now be applied not only to the paramagnetic state above the critical temperature, but also to the ferromagnetic state below that temperature, and is of fundamental importance in the theory of magnetism.

J. R. ASHWORTH.

July 9.

#### The International Congress of Applied Chemistry.

I AM told that many chemists are hesitating about attending the eighth International Congress of Applied Chemistry (New York, September, 1912) because of the supposed enormous expense. I ask the hospitality of your columns for the purpose of correcting so utterly false an impression. The minimum expense for comfortable accommodation may be estimated as follows:—

(1) From Liverpool, August 21, by American Line ss. *Dominion* (only one class of cabin passengers), to Philadelphia, thence rail to New York; inclusive fares, single 10*l.*, return 20*l.*

(2) From Glasgow, August 23, Allan Line ss. *Numidian* (only one class of cabin passengers), to Boston, thence rail to New York; inclusive fares, single 9*l.*, return 18*l.*

(3) From Glasgow, August 24, Anchor Line ss. *California*, to New York; first cabin fares, single 14*l.*, return 28*l.*

The first two of these routes afford an opportunity to see Philadelphia and Boston, without additional expense.

Columbia University has offered to members and their families the free use of rooms in the residence halls, which will be available from August 31 to September 13. Until the end of July, rooms will be assigned, in order of application, to guests from

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abroad exclusively. Application should be made to the Secretary of the Congress, Dr. B. C. Hesse, 25 Broad Street, New York. The expenses in New York are limited, therefore, to the membership fee (1*l.*), the cost of excursions and entertainment (2*l.*), meals, which will be furnished at very low rates, and incidental expenses (say 5*l.*). The necessary expenses per person, including gratuities, &c., in the steamship (2*l.*), are therefore 28*l.* to 38*l.*, according to the ship selected.

The inaugural meeting of the congress in Washington, for those who desire to see the magnificent scientific institutions in that city, will involve additional expense of 5*l.*

Following the meetings of the congress, there will be two excursions. The "short trip," lasting eleven days, includes Philadelphia, Pittsburg, Niagara Falls, Detroit, Chicago, Cleveland, and Boston (2513 miles). The total expense of this trip will probably be less than 20*l.* Members desiring to join this excursion should notify Dr. Geo. D. Rosengarten, P.O. Box 1625, Philadelphia, Pa., immediately.

I shall be very glad to reply to inquiries, which may be sent to me at the address below.

ALEXANDER SMITH,

Professor of Chemistry in Columbia University, and member of the Executive Committee of the Congress.

34 St. Albans Road, Edinburgh, July 10.

#### CRYSTALLO-CHEMICAL ANALYSIS, A NEW METHOD OF CHEMICAL ANALYSIS.

AN important and possibly epoch-making memoir by Prof. E. von Fedorow, of St. Petersburg, is published in the last issue of the *Zeitschrift für Krystallographie*, entitled, "Die Praxis in der krystallochemischen Analyse und die Abfassung der Tabellen für dieselbe." It used frequently to be demanded by chemists of crystallographers, "Of what practical use is crystallography to us?" But the results of recent work have been so striking, and have gone so directly to the root of chemical constitution, that their cumulative effect has for ever rendered it perfectly obvious that crystallography is of fundamental importance to chemistry.

As a natural result of his well-known geometrical work on the possible structures possessing the property of homogeneity, the essential property of a crystal, Prof. von Fedorow turned his attention to descriptive crystallography, and in a series of brilliant papers has shown how the correct mode of setting up a crystal for descriptive purposes may be arrived at and distinguished from among the several possible modes; he has also shown us how to convert the crystallographic elements for any other "setting" or incorrect arrangement into those of the correct one, the latter being the arrangement which brings the directions chosen as the crystal axes into close and concordant relationship with the true internal structural arrangement, that of the nodes or points of the space-lattice or point-system, according to which the molecules of the substance and their constituent atoms are built up. This correct setting is arrived at quite independently of the fortuitous and variable property of external "habit," and is based upon calculations of the "reticular density" (close-

ness of packing of the nodes or "points" of the space-lattice or point-system) along the planes of the principal faces. For the forms (sets of faces of equal symmetric value) of greatest reticular density are those of most fundamental importance to both the internal structure and the correct setting, and those which, given ideal conditions of development and equal chances of growth all round, grow most slowly and are consequently the best developed, a fact proved conclusively by Wulff. The setting, therefore, which corresponds to primary faces of maximum reticular density is regarded by Prof. von Fedorow as the only correct one on which comparisons should be made.

He has next prepared with consummate trouble a table of the elements and morphological constants of all the hitherto goniometrically measured crystalline substances, arranged in regular progressive order, and calculated on the lines just explained for the correct setting in each case. It will doubtless be with some astonishment that chemists will learn that no fewer than ten thousand crystalline substances of definite chemical constitution have been measured adequately enough to be included in this table. Prof. von Fedorow then proceeds to show that if a few measurable crystals of any one of these substances be subjected, by an observer trained in his method and to whom the name or formula of the substance is not given, to a short goniometrical investigation on the theodolite goniometer, occupying at most two or three hours and possibly only a few minutes, it is possible by a reference to the table of elements and constants to discover and recognise immediately the substance of which the crystal is composed. In other words, provided a chemical substance has once had its crystals measured by a trained crystallographer, it is possible to detect it at any time by merely making a few brief measurements so as to be able to calculate the elements—by a shortened process, partly graphical, which Prof. von Fedorow has perfected—and then searching the table for the substance there recorded as possessing these constants. The constants being arranged progressively in the table, and according to their systems of symmetry, the search occupies but a moment of time, the table being practically an index.

In order to test this new mode of chemical analysis, which has the great advantage that the substance is not destroyed or even injured in the process, the crystals remaining as perfect at its conclusion as they were before it was undertaken, Prof. von Fedorow invited the cooperation of a number of co-workers in crystallography in various countries of Europe and the United States, and the gratifying result has been that a considerable number of well-crystallised substances, which had been the subject of careful investigations, were sent to him in bottles marked with only a distinguishing number and no name or formula label. In all cases—except a very few in which the crystals had either deteriorated, or where the substances were not included in the ten thousand recorded in the table (owing mostly to too recent

publication of the results concerning them), or in which they were indistinguishable from an isomorphous substance owing to the faces not being sufficiently perfect to enable the measurements to be trustworthy to within a few minutes of arc—Prof. von Fedorow has identified them with the greatest facility.

Among these test substances were a number which had been sent out by the writer, and had been for the first time investigated by him, and in every one of these cases the substance (often an organic compound of some complexity) was identified by Prof. von Fedorow without hesitation. Several of these cases are described at length by Prof. von Fedorow in his memoir, and it is interesting that in nearly all of them, and also in some of the sulphates and double sulphates investigated by the writer and also examined as unknown substances by Prof. von Fedorow, faces not actually observed during the latter's brief examination for the purposes of identification, but found by him, on calculation, to be important faces with respect to the ideal development and setting, had been observed by the writer in his detailed investigation some years ago. Some of the crystals sent by the writer had, in fact, been measured no fewer than twenty-two years ago. They were dispatched, unlabelled except by numbers, with the aid of Mr. T. V. Barker, of Oxford, who had spent some months with Prof. von Fedorow in his laboratory at St. Petersburg, and had kindly undertaken to collect and send out the contribution of British crystallographers and chemists to this interesting test.

Even at so early a date in the development of this surprising method of crystallochemical analysis, Prof. von Fedorow undertakes that at least three out of every four analyses shall be successful, and when the table is further extended this proportion will be materially raised. Moreover, if an analysis is not successful, it is usually because no result can be arrived at, owing to malformation of the crystals; in no case is an inaccurate result obtained, except, perhaps, in the few cases of isomorphous compounds so closely equiangular that the degree of perfection of faces present is possibly inadequate to enable the observer to distinguish between them. But in these cases an optical determination of refractive index would amply suffice to effect the distinction. Also, of course, the method fails in its simple form in the cases of cubic crystals, in which the angles are always the same; but again an optical test is successful where that of symmetry, elements, and angles fails.

Sufficient will have been said to show that we have in this new mode of chemical analysis a most striking testimony to the value of crystallography to the chemist, and a further imperative reason why the crystals of every well-crystallised substance should not fail to be measured. It forms another stage in the development and the rapid march of this now highly important science. If any readers of NATURE should be further interested in the subject, they will find a remarkably correct account of it in English, written eighteen months ago from

advance information supplied by Mr. Barker, with Prof. von Fedorow's kind permission, in the writer's "Crystallography and Practical Crystal Measurement" (Macmillan and Co., Ltd., 1911), the account now definitely published in German requiring nothing to be corrected in that forecast.

A. E. H. TUTTON.

#### MALARIA IN INDIA.

THE fourth number of *Paludism* (Proceedings of the Committee for the Study of Malaria in India), published last March, begins with an interesting account of the proceedings of the second meeting of the general Malaria Committee held in Bombay on November 16-17, 1911. This meeting appears to have been of a very important nature. The president was the Hon. Surgeon-General Sir Charles Lukis, C.S.I., the new Director-General of the Indian Medical Service, and his introductory address is well worth the close attention of all sanitarians in tropical countries. After some preliminary remarks, he proceeded to say that he viewed with concern the tendency amongst malaria workers to divide into two camps, namely, those who advocate anti-mosquito measures, and those who pin their faith on quinine prophylaxis. He directed attention to a previous speech of his, in which he said that—

"whilst agreeing that quinine prophylaxis, properly carried out, was one of the most valuable weapons in the fight against malaria, and whilst admitting that in rural areas it might be the only weapon at the disposal of Government, I felt bound to express my opinion that, if they were to place sole reliance on this measure in Indian villages, they were doomed to disappointment. Quinine prophylaxis should go hand in hand with general sanitation and with the destruction of anopheles breeding grounds wherever this can be accomplished at reasonable expense, and it seems to me that recent observations justify us in thinking that this destruction is not likely to be as costly as has hitherto been supposed. Quinine has undoubtedly conferred inestimable benefits upon the individual; but it never has, and never will, be of equal value to the community as a whole, and you cannot get away from the fact that if there were no mosquitoes there could be no malaria. I fully realise that in some of the hyperendemic areas mosquito destruction may be a counsel of perfection, but even there much good may be done by reducing the numbers of the special species which acts as the carrier, and, I ask you, should we halt in our activity because we cannot attain to an ideal perfection? I recognise the fact that no one method will suffice as a general anti-malarial measure; I recognise the power of each in its proper place, but I hold strongly that wherever possible anti-mosquito measures must be carried out. I also recognise the importance of preliminary investigation, but it must not be carried to extremes; the time has come for definite action on well-considered and practical lines."

This official pronouncement will be looked upon with gratitude by all those who have been urging the wider policy in India for years past, and will, we hope, prove to be the starting point of a new era. The Director-General proceeded to give some

good advice on many other points; for instance, that actual operations may with advantage be carried out in conjunction with investigation (page 6), and that, indeed, in certain instances the former may be the only method of investigation—a point which has long required emphasising. He added that—

"if we wait until our experts have made a complete investigation of all the problems connected with the epidemiology and endemology of the disease, there is the danger that India will remain for many years practically untouched. We require then two classes of men—the scientific experts and the practical workers."

The other proceedings at the Conference showed that this advice is already being largely followed in India. The various provincial organisations for dealing with malaria are described, and several good articles and discussions are given. Both Sir David Semple and Major Robertson (the new Sanitary Commissioner for the Government of India) strongly supported the Director-General's remarks. Captain McKendrick, the Statistical Officer of the Indian Sanitary Department, furnished a very interesting paper on the pathometry of malaria according to the mathematical studies which were discussed by myself and Mr. A. J. Lotka in *NATURE* of October 5, 1911, and February 8, 1912, respectively. Captain McKendrick, who is a capable mathematician, has also added some interesting remarks on the subject, but these cannot be discussed except at some length. References were made to Major Christopher's very interesting researches in the Andaman Islands and to Dr. Bentley's Report on Malaria Prevention in Bombay; and Colonels Dyson and Adie, Majors Wilkinson, Glen Liston, and Robertson, and others added original information on details. I have only one fault to find, and that is that the printing and get-up of *Paludism* are so very much inferior to the excellence of the matter contained, a fact which may explain why the Director-General has been obliged to ask for more scientific contributions.

RONALD ROSS.

#### THE 250th ANNIVERSARY OF THE ROYAL SOCIETY.

THE celebrations in connection with the 250th anniversary of the Royal Society opened on Monday last with an evening reception of the delegates in the rooms of the Society. On Tuesday there was a commemorative service in Westminster Abbey at noon; a formal reception of the delegates and presentation of addresses in the library of the Royal Society in the afternoon, and a banquet in the Guildhall in the evening. Yesterday visits were paid to places of interest in London; a garden-party was given by the Duchess of Northumberland at Syon House and a conversation was held at Burlington House at night. To-day further visits are being paid to places of interest, and fellows of the Society and the delegates are being entertained by their Majesties