

plants which have the capacity of association, and which, to speak metaphorically, are able to use changed conditions as signals for serviceable movements. Without selection we cannot conceive the forging of the chain of inherited habit which binds plants to the performance of adaptive movements.

It is true that we cannot say in what the association consists, and it will doubtless be said that our point of view only differs from that of Klebs in substituting "stimulus" for conditions." The difference is essential, for we take into account natural selection as a universal condition under which all organisms subsist.

We must be content to differ from Dr. Klebs, who goes so far as to say (p. 162) that the adaptation (Zweckmässigkeit) of organisms is in no way (gar nicht) a scientific problem. We are none the less ready to welcome his researches, of which we proceed to give some account.

Among the results obtained by Klebs some of the most interesting are the experiments in which, by appropriate culture conditions, he converts an inflorescence into an ordinary vegetative shoot. For instance, by making a cutting of the flowering shoot of *Veronica chamaedrys* and growing the plants in damp air, he converts an organ of limited growth into one of unlimited growth, with leaves differing in size, character of hair and phyllotaxy from those of the inflorescence, and resembling the ordinary vegetative shoot.

Another interesting series of observations is on *Glechoma hederacea*, which, if grown in a greenhouse and watered with nutritive solution, never flowers, whereas parts of the same individual plant, grown in small pots in summer and kept cool in winter, flower in the following summer. By special treatment he even compelled flowers to appear on the runners, whereas normally only the upright shoots bear flowers. *Ajuga reptans* bears runners in the axils of its rosette-leaves; these form in the autumn new terminal rosettes, the central shoots of which flower in the following spring. This is the normal state of things, but Klebs converted a flowering shoot into a runner by darkness and damp heat, and also produced other curious anomalies of development. In another experiment on the same type he introduced a runner into the lower end of a cylinder of water, when its normally horizontal growth was changed and it grew straight up until it reached the air, where it once more became horizontal. Klebs devotes a section of his book to a discussion of the facts of regeneration for which we are largely indebted to Vöchting. Klebs points out that we do not even know why the severance of a part from its parent should lead to a regenerative outgrowth of roots and shoots; he goes on to demonstrate by experiments that in *Salix vitellina* a branch, without being severed from its parent, can be forced to make roots by submergence in water. He uses this fact as an argument against the adaptive explanation of the behaviour of cuttings. It proves, of course, that some of the phenomena are producible without severance, but the facts of severance remain; two different stimuli may produce the same result, as in the well-known experiment of Pfeffer in which the root-

hairs of the gemmæ of *Marchantia* develop on the physically lower side and also on the side in contact with a solid body.

Another section of the book deals with the length of life of plants and the cognate facts on resting periods in vegetable growth. He shows that *Parietaria* can be kept in constant flower for two years. That in annuals there is no inherent limit to their development, as he proved by making a series of cuttings of the growing shoots. Again, he compelled the winter buds of *Gratiola* to germinate (contrary to their habit) without a resting period, by cultivating the plant under water and placing it in a greenhouse in autumn. These may serve as examples of the experimental work in which Dr. Klebs is engaged. It is evidently a research which tests to the full his ingenuity and determination, and it is one in which all naturalists will wish him the success he deserves.

The book concludes with a section on "Variation and Mutation," which will be useful to old-fashioned evolutionists in showing the trend of certain younger schools of thought.

FRANCIS DARWIN.

#### NITROGEN AND ITS COMPOUNDS.

*Der Stickstoff und seine wichtigsten Verbindungen.*

By Dr. Leopold Spiegel. Pp. xii+912. (Braunschweig: Vieweg und Sohn, 1903.) Price 20 marks.

THE large and ever-increasing amount of work turned out by research chemists in all branches and departments of the science, and the dispersal of the results of investigations throughout a sufficiently extended array of publishing media, awaken the demand for some means by which the wealth of newly-acquired knowledge may be made easily accessible; and the editor or author who undertakes the very tedious but important task of collecting from the different sources and arranging in a summarised form all, or even the most important, facts which have been established, performs a service to his science for which he does not always receive due credit.

The importance of the compounds of nitrogen for the study of valency and the formation of complex compounds, the important position which they occupy in investigations into the laws of stereochemistry, and, in the case of the carbon compounds, the determining influence of the nitrogen atom on the character of the molecule, have led the author to the compilation of a volume which brings together all the most important known facts with regard to the chemical and physicochemical relationships of this element and its compounds. No separation is made of the organic from the inorganic compounds, but the latter are treated much more fully than the former. With regard to the organic compounds of nitrogen, the author has wisely refrained from a duplication of "Beilstein," and has contented himself with pointing out the more important characteristics, and with giving in tabular form the chief representatives of the different groups.

The whole matter is arranged under the following headings:—the element, halogen compounds of nitrogen, oxygen compounds of nitrogen, sulphur compounds of nitrogen, hydrogen compounds of

nitrogen, metal nitrides, phosphorus compounds of nitrogen, arsenic nitride, carbon compounds of nitrogen, silicon nitride, titanium compounds of nitrogen, zirconium nitride, boron compounds of nitrogen, nitrogen in closed rings, alkaloids, protein substances, analytical methods, addenda.

The treatment of the element and its important inorganic compounds, *e.g.* nitric acid and ammonia, seems very satisfactory, although, for instance, the action of hypobromite on ammonium chloride might well have been included in the list of methods of preparing nitrogen, instead of merely being referred to incidentally in another connection.

Apparently no attempt has been made to sift critically the large accumulation of material at the author's disposal, and the book therefore assumes the character of a dictionary. Nevertheless, several cases are to be found where a more connected treatment is given to the subject, as, *e.g.* in the description of the steps by which the formation of nitric acid in the soil was traced to a specific ferment, or in the account of the application of Werner's theories to the constitution of the metal ammonia compounds. Such accounts, although written in briefest outline, serve to direct attention to points of importance in theoretical chemistry. The account of the diazo-compounds one could wish fuller, and some reference might have been expected to Goldschmidt's important work on the dynamics of the diazo- and azo-compounds. In mentioning the transformation of ammonium thiocyanate (the melting point of which is 149°, not 159°) into thio-urea, also, the work of Waddell might have been referred to. Further, in the analytical portion of the book, although various methods are given for the estimation of nitrogen in organic compounds, no mention is made of the Frankland-Armstrong modification of Dumas's method, although it is probably the most convenient and accurate method of estimation.

In compiling the book, the chemical literature up to 1900 has been taken into account; and in an appendix additions and corrections are given bringing the work up to 1902. In spite of some omissions, the book will be readily welcomed as an important addition to the works of reference in chemistry, and the author deserves the thanks of his fellow-workers for the trouble he has taken in the compilation. A. F.

#### PROSPECTING.

*La Prospection des Mines et leur Mise en valeur.* By Maurice Lecomte-Denis. Pp. xv+551, with 320 figures. (Paris: Schleicher, 1903.)

WHEN an author is fortunate enough to have such a godfather for his book as M. Haton de la Goupillière, it may be taken for granted that the work contains much useful matter. The book is intended not so much for the old-time prospector, armed with pick, shovel, and pan, who wanders about in search of gold, as for the scientific mining engineer called upon to report upon a mineral deposit already discovered, and possibly already worked on a small scale. M. Lecomte-Denis tells the novice how to set

about his work, and how to draw up his report to his employers, and he points out useful precautions to be observed in purchasing mines and minerals. The motto for the chapter upon "salting," "*Défiance est mère de sûreté*," is well chosen; many of the common tricks of fraudulent mine-vendors are exposed by the author, who most wisely advises the inspecting engineer to err on the side of scepticism when making his examinations.

Next come two purely geological chapters upon the distinctive characters of the igneous and of the sedimentary rocks. It is doubtful whether it is wise to burden a book upon prospecting with more than three hundred figures of fossils. M. Lecomte-Denis points out, however, that the traveller cannot carry a geological library with him, and that it will probably be a convenience to him to possess a little palæontological information for immediate reference on the spot.

Six chapters are devoted to the study of the modes of occurrence of the most important useful minerals, viz., coal, petroleum, bitumen, and the ores of iron, copper, zinc, and lead. Many useful commercial data are appended. Similar information concerning phosphates, bauxite, and the ores of tin, mercury, &c., is promised in a later edition.

When a mineral deposit has been found, it is usually necessary to investigate its commercial value by certain preliminary workings. The manner of carrying these out and of making deductions from the results obtained is treated in a long and useful chapter. The author speaks wisely with regard to writing reports when he bids the engineer weigh his words very carefully, for extracts may be made, and words may be twisted, so as to convey a meaning very different from that which was intended. The greatest prudence is necessary on the part of inspecting engineers with the object of not raising his employer's hopes too high, nor, on the other hand, by an unnecessarily pessimistic tone, of preventing him from embarking upon an undertaking which may have many chances of success. What is required is complete frankness; let the capitalist know the grounds upon which the engineer bases his opinions. If the former is in doubt, he can then go to a consulting mining engineer and say, "Supposing these data to be true, what is your advice?"

The inspecting engineer should certainly make himself acquainted with the mining laws of the country in which the property upon which he is reporting is situated; and the brief remarks of M. Lecomte-Denis upon foreign mining jurisprudence may serve as a first step in the study. On the other hand, more space is devoted to an exposition of the mining laws of France than seems to be necessary.

The tables at the end of the book are similar to those found in the usual miners' pocket-books. Some palpable errors show that sufficient care was not taken in preparing them for the press, and consequently the reader may feel a little sceptical about their trustworthiness. On the whole the book is likely to prove useful to the mining engineer, for it deals with matters which are usually considered somewhat outside the scope of the ordinary text-books.