The choir invisible
Whose music is the gladness of the world.

We seem to do better in the natural sciences. In geology, zoology, botany, anthropology and psychology, there is probably more research work published here than in any other country except the German empire and the amount of research work published is the most tangible, and perhaps the most exact, measure of scientific activity. I have found that in the *Zeitschrift für Psychologie* there have been more articles in experimental psychology reviewed (selected as the more important articles) from America than from the German-speaking nations combined, and more than ten times as many as from Great Britain. We have also, according to the criterion of membership in foreign academies, the most eminent living psychologist.

The statement made by Professor Nichols and endorsed by Professor Willcox that "the men who have laid the foundations upon which civilization is built have nearly all been teachers and professors" appears to be more correct for Germany than for England. Darwin did not teach, and not one of the five scientific members of the Order of Merit—Hooker, Huggins, Lister, Rayleigh and Wallace—is a teacher. It is a remarkable fact that while Germany has excelled in the quantity of research work accomplished since the development of its universities, England has produced the greatest leaders. The elementary teaching required in our collegiate universities not only absorbs time and energy, but also tends to develop a superficial omniscience and a dogmatic attitude unfavorable to investigation. If we add to this the clerical, administrative and missionary work, which the university president crowds on the university professor, and the distracting need of earning enough money to support his family, there is perhaps reason to wonder that he accomplishes as much research work as he does accomplish.

Fortunately there has been within thirty years a great increase in this country in the number of positions permitting scientific work, and in the opportunities which these positions offer for research work. Many of our universities have admirable laboratories, and there is certainly a strong sentiment in favor of permitting the professors to use them. We are gradually obtaining university laboratories analogous to the astronomical observatories, where professors will only do so much teaching as is favorable to their investigations. At the same time there has been a notable development of scientific work outside the universities, under the national government, under states and municipalities, in technological work, and recently in the establishment of research institutions such as the Carnegie Institution of Washington and the Rockefeller Institute for Medical Research. The material foundation is already adequate and will be rapidly enlarged. What we need is more men with the ability and spirit which research work demands.

J. MCKEEN CATTELL

SCIENTIFIC BOOKS

Qualitative Analyse vom Standpunkte der Ionenlehre. Von Dr. WILHELM BÖTTGER, Privatdozent und Oberassistent am Phys.-Chem. Institut der Universität Leipzig. Zweite, Umgearbeitete und Stark Erweitete Auflage. Leipzig, Wilhelm Engelmann. 1908.

The first edition of this book was published in 1902. An English translation by Smeaton appeared in 1906, a book of 300 pages. This second German edition is a stately volume of 524 pages; it contains nearly double as much matter as its predecessor and is quite different in arrangement.

The fundamental general and ionic theory is in a division by itself, forming the first 116 pages of the book, and is illustrated by simple but ingenious and instructive experiments, thirty-five in number. These experiments alone would give the book permanent value, but it is worthy of study throughout.

In the chapter on systematic analysis, for example, a method is given, familiar in detail but new in application, for separating the cations of group III.; after treatment of the sulphides with dilute HCl, and filtering, the filtrate containing Al, Cr. Fe, Mn, Zn and

traces of Co and Ni, is heated to drive off H_2S, and cooled; it is then treated with an excess of KOH, oxidized with Br water or H_2O_2, and filtered. The residue may contain $Fe(OH)_3$, MnO_3H_2, and traces of $Cr(OH)_3$, $Co(OH)_3$, $Ni(OH)_3$. The filtrate may contain K_2CrO_4, AlO_3K_3 and ZnO_2K_2. The Cr is tested for by oxidizing an acidulated portion of the filtrate to perchromic acid by H_2O_2. Another portion of the filtrate is exactly acidulated with HCl, and precipitated by sodium acetate as aluminium basic acetate, thus securing the detection of very small amounts of Al. The filtrate from the oxyacetate contains the Zn which is precipitated as sulphide by H_2S. Iron and manganese are tested for by dissolving one portion of the residue in HCl, and adding KCNS, or $Fe(CN)_6K_4$, and by fusing another portion of the residue with $Na_2CO_3 + KNO_3$. The presence of traces of compounds of Cr, Co, Ni, not interfering with these tests. This method will be found simpler, shorter, and fully as accurate as the barium carbonate method, which is so generally recommended, when Cr, Mn and Fe are all present in the substance analyzed.

In the chapter on solutions the treatment of sulphides and chlorides insoluble in acids is noticeable.

In the chapter on preliminary treatment the introduction of the Hempel reduction methods is praiseworthy.

The phase-rule is entirely omitted; just why it is hard to see. One may say that beginners can not understand it, but this is not a book for beginners. However, as Dr. Böttger is chief assistant in the Leipsic laboratory, he must be credited with due consideration of the theories to be introduced or omitted.

Elementary physical chemistry throws such a flood of light on the problems of analysis that the opponents of its use for this purpose are fewer every year; although among the new manuals are some which practically differ from the older books only in adding the word "ion" to the name of the element, and freely using + and — signs; such books do not illuminate and make no converts.

The present book, it is true, is too large and too detailed for American college students, but any one who intends to write a laboratory manual—and who does not write one?—will do well to read Dr. Böttger's book carefully.

It would be well if the author should arrange with his American translator to publish an abbreviation of this book for college use, containing the theoretical part and experiments without change, but cutting down the remainder to a third of its present size. This is practicable, as much of the present material should be omitted for college use, and as Dr. Böttger's German is extremely diffuse. Such a book would be very valuable for college students in their second laboratory-year.

The book, as it is, should be studied by graduate students, and especially by teachers, who will find in its pages simple explanations of more than one puzzling phenomenon. It is to be hoped that the book will meet with the recognition which it merits.

E. Renouf

A Treatise on Chemistry. By H. E. Roscoe and C. Schorlemmer. Volume II.: The Metals. New Edition, completely revised by H. E. Roscoe and A. Harden. Pp. xii + 1436. New York, The Macmillan Company.

Sir Henry Roscoe is to be congratulated most heartily on the revision of the well-known "Treatise on Chemistry." It is seldom that an author lives to see such an extensive work useful through thirty years and at the end of that time appear entirely fresh with all of the most recent developments in theory and application. The book bears the strong personal impress of the author and is delightful reading on account of the intimate historical presentation of the various subjects. The scientific, practical and historical are so nicely interwoven as to make the book most readable and valuable.

The introduction of material on Werner's valence theory, the phase rule, radio-activity, Thomson's corpuscular theory and other recent developments has added much to the value of the book. In addition to these an account of recent work on alloys has been added, although the treatment is not entirely satisfac-