eral recognition, the one as a result of educational thought before the war, the other in connection with the wide upheaval of opinion that the war has caused.

In December, 1912, we published a draft scheme for the teaching of science upon a synthetic method—the term "synthetic," in this case, implying that science was to be taught as a whole in the more elementary stages, with the rudiments of the separate, specialized sciences blended together and taught in connection with one another as parts of a single realization. The sciences were in danger of becoming the monopoly of specialists; not a mere financial monopoly. but a monopoly of faculty and intelligence. In a civilization increasingly governed by science, it seemed to us of importance that citizens should have a general comprehension of science. More than this: specialists themselves go wrong if they never fully realize the broad foundations of their specialties. A narrow specialist is a bad specialist. The more important specialism in science was destined to become, the more essential we felt it to be that a wide general conception of science should be taught; not only that people might have some conception of the scientific principles upon which they were increasingly governed, but also that the specialists of the future might have a broader foundation for their work through a better realization of the dependence of one branch of science upon the others.

The war has taught us by force what we might not, perhaps, have learned so rapidly by the peaceful exercise of our wits: that in national endeavor all branches of activity must be subordinated to a conception of the whole. The present demand for more science comes of a recognition that, for all our special excellences, our general ignorance of causes had come near to destroying us. And with this recognition there comes a conception of science that goes beyond a synthesis of "the sciences." The scientific outlook, the scientific method, call for a place not only in science teaching, but in all teaching. This is not because we admire German scientific organization. As a matter of pure science, we detest German scientific organization because it is fundamentally unscientific, just as it is fundamentally inhuman. It favors prejudices, not truths. We want to put a right scientific organization in its place; we have seen the results of having no scientific organization at all, though we have battled against these evil results with extraordinarily rapid success.

The war is teaching us a new science of our own and a new humanism of our own. Both are in embryo, as far as education is concerned; much thought and discussion are still needed for the further evolution of a complete system. But one thing becomes increasingly clear. There is no war between our new science and our new humanism. The dying quarrel lies between prejudices rather than between principles. We need a science teaching that is complete and unified; but by now we are coming to realize that we also need a humanistic science, and a humanism that is scientific. Such a solution, if we take the pains to work it out, will be thoroughly in accord with the English genius.—*London Times Educational Supplement.*

SCIENTIFIC BOOKS

Bridge Engineering. By J. A. L. Waddell. John Wiley and Sons, New York, 1916. 2 Vols. 2177 pp.

Like most branches of science or of engineering, the field of structural engineering is abundantly supplied with text-books and treatises. However, as in a vocation there is always room at the top, so in the literature of a subject there is always room for a new work if it presents the subject from a fresh point of view, or if it contributes something new, or puts in a new light something which may be a matter of even common knowledge.

In engineering there is always opportunity for a contribution which will be of value if it embodies results of experience, even upon subjects of which the fundamental principles are well understood, for engineering deals with the applications of science, and, in those applications, conditions are so available that, as is well known, good judgment, common sense and

the ability to meet emergencies are more important requisites for success than deep or accurate scientific knowledge.

The author of the work under review is not only possessed of deep and accurate scientific knowledge, but has had an exceptionally wide and valuable experience as an engineer. The present work is not an ordinary text-book; indeed most of the subjects discussed in ordinary text-books are entirely omitted here. This work begins, broadly speaking, where the usual text-book leaves off, and concerns itself with an exhaustive discussion ranging from large questions down to details of design, and throughout it all the author draws upon his experience, and, in an easy conversational way which makes the book very readable, places here on record his opinions, his deductions, and his experiences regarding most of the important matters involved in the design of bridge structures.

The work is a large one, comprising two bulky volumes, with a total of over two thousand pages. Indeed, if any criticism is to be made of the work, it is that it is too bulky and includes some information which might well have been omitted, such for instance, as a glossary of terms covering 220 pages which might have been relegated to a technical dictionary rather than included in a treatise on bridge engineering. However, the book, as stated, is not a text-book, and will not be carried about by college students in their grips; it is a reference book for the office and for the consulting engineer, and for such it will be found of great value. The bridge engineer who desires to inform himself with reference to any type of structure, or to investigate any particular problem, will be apt to find in this work some clue which will guide him, if indeed he does not find the direct answer to his inquiry.

The book is rather uneven, it is true, in its treatment, devoting for instance, forty-eight pages to the subject of cantilever bridges, thirty pages to arches of all the various kinds, sixteen pages to suspension bridges, and seven pages to wooden bridges and trestles. However, the work does not pretend to be a complete treatise; it is supplementary to the usual text-books and the author has not thought it necessary or desirable, merely for the sake of completeness, to cover ground which is quite adequately treated in other works. This work is supplementary to such treatises and aims to give the profession the results of the experience and study of its author, and the opinions which he has been led to hold on the various matters of bridge design and construction. It will be found a very valuable work for the consulting engineer and the bridge specialist, while the engineering student will find an opportunity therein to pursue lines of inquiry upon which he may be engaged, and to learn the opinions of an eminent bridge engineer.

A characteristic of the work is the inclusion therein of a number of chapters relating to matters not generally touched upon in such works, such, for instance, as "Esthetics in Design," "Office Practise," "Bridge Failures and Their Lessons," "Responsibility of the Bridge Engineer," "Ethics of Bridge Engineering." A very interesting chapter is that on "Expedients in Design and Construction" in which instances are give of the exercise of the important quality of "gumption" which every successful engineer must possess in greater or less degree. The book will be found of value, not only for the technical information which it contains, but because it emphasizes the necessity for qualities, other than mere mathematical ability or an understanding of small technical details, for the successful structural engineer. It is a book which will tend to broaden the view and so increase the usefulness of the young engineer.

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SPECIAL ARTICLES

ON THE ELECTRIC ORGANS OF GYMNOTUS CARAPUS

IT was suggested to the writer by Professor U. Dahlgren, of Princeton University, that *Gymnotus carapus* might furnish material for the study of electric organs. Miss A. Lowrey[1]

[1] *Jour. Morph.*, Vol. 24, p. 693.