

has, therefore, not elapsed sufficient time to develop a body of teachers sufficiently large and sufficiently well-informed to meet the wants of the new era. In so far as the evil arises from this cause, it may safely be left alone, as it is certain to cure itself in the long run. Worse than this, however, is the fact that the place of science in education has not yet been sufficiently, or at all generally, recognized; that there is no appreciation of the necessity of a special teacher of science in every large school; and that there is, therefore, little encouragement for our young men in devoting themselves to the study of science. This, however, is also likely to cure itself in time; and the supply is certain ultimately to equal the demand. Worst of all is the lamentable but undoubted fact that those who would teach science in many cases do not recognize that the one essential qualification of a teacher in science is direct, personal, and practical acquaintance with the facts to be taught. Book-knowledge may do well enough for some branches of education, but it is an utter failure in science so far as concerns teaching. And, the more elementary the scientific knowledge to be imparted, the more urgent the necessity that the teacher should not be speaking simply at second-hand. When this fact is once recognized, we shall hear less of the difficulty of obtaining an adequate supply of science-teachers qualified for their work; and it can hardly escape recognition in any reform of our higher institutes of learning. There is, therefore, reason to hope that this first difficulty, by which the establishment of science, as a branch of general education, is assailed, will be removed in the regular course of events.

In the second place, we have to confront the difficulty to which I have already alluded, that science-teaching is valueless unless conducted upon a practical basis, and that it cannot, therefore, be easily carried out in schools. The first part of this proposition I shall not dilate upon, as all scientific authorities are entirely in agreement about it. No one, whose opinion upon the subject is worth anything, doubts that the value of science-teaching lies in its being strictly practical to begin with. Not only must the teacher be practically acquainted with his subject, but the pupil must have the facts of the science presented to him in a tangible form. He must learn from objects, and not merely from books; and he must be encouraged to collect his facts for himself. At first sight it appears very difficult to carry this out; and our schools, as at present constituted, are certainly little adapted for the development of this idea in practice. There is, however, no reason in the nature of things why this should be so. The objects and apparatus absolutely essential for teaching any given branch of science are not numerous, and could readily be obtained, at little cost, by any large school. As regards some of the sciences, such as Geology, Natural History, or Botany, the objects necessary for practical teaching are, to a large extent, directly accessible to both the teacher and his pupils. There is no reason why every large school should not acquire for itself a good local museum, embracing the natural objects, organic and inorganic, of the surrounding district. Such a museum would be largely recruited from the collections made by pupils themselves, who would thus be stimulated to independent observation, and who would, unconsciously and without effort, acquire knowledge which could but painfully and imperfectly be gained from books. Such a museum, also, would supply the teacher with many of the objects necessary for class-demonstration; and, it is not too much to say, would be of considerable practical value to the professional scientific observer. That this idea is not chimerical has been proved by the practical experience of such well-known English schools as Rugby and Marlborough, and I do not despair of seeing it more or less completely realized in this country. In the meanwhile I can but insist that the teaching of science merely out of books, if not absolutely injurious or worthless, is no fair test of the value of science as an educational agent; whilst I do not see any insuperable difficulty in the way of teaching at any rate some of the natural sciences in schools in a thoroughly practical manner.

I could have wished to say more upon this subject, but I must conclude with a few brief remarks upon the third difficulty to which I have alluded—the difficulty, namely, of obtaining good text-books on science—to which I would add a few words on the comparative advantages presented by the different sciences as regards school teaching. The difficulty of obtaining good text-books arises from two causes, one peculiar to our educational system, the other universal and confined to no particular country. The latter is simply the fact that many very unreliable and inaccurate text-books of science are in existence, owing to the common but most erroneous idea that anyone can write an elementary text-book on any subject of science. The truth is that it requires a profound, and above all a practical knowledge of the subject to enable a writer to produce a good text-book for beginners on any branch of science. This may sound paradoxical, but it is undeniably true.

To put the same truth in another form, it requires less knowledge of a subject to teach grown up men than it does to teach boys. Adults are much better able to supply any deficiencies that there may be in the teaching for themselves, than young people are, and the latter require the simplicity and directness of exposition which is never found apart from extensive and profound knowledge. Everyone who has been at any time engaged in the practical work of teaching, will admit this, and I need say no more about it. The fact, however, is not generally recognized, and hence two-thirds of the scientific text-books in existence are entirely unsuited for the purpose aimed at by their authors.

It follows from the above that the choice of good text-books in science is by no means an easy matter; and it may reasonably be doubted if the existing machinery is sufficient for the discrimination of the few good from the many bad. The text-books to be employed in the schools of this Province are selected by the Council of Public Instruction. Now, I do not wish to say a word in disparagement of this body, the duties of which are very onerous; but it cannot be overlooked that of the members of the Council by which the existing scientific text-books were chosen, no one possessed any special practical acquaintance with science, or could claim to be accepted anywhere as an authority on any department of scientific investigation. It so happens, therefore, that whilst science-teaching occupies a recognized place in the school system of this country, there is no adequate provision for the selection of suitable scientific school-books. And, as a matter of fact—indeed as an almost inevitable consequence of the constitution of the Council—the authorized text-books of science are in several instances of a very inferior character—a most serious evil, when it is considered that the science teaching in schools is almost exclusively from books. Hence, also, the singular omission of certain science subjects very well adapted for school teaching, and the introduction of others that might well be dispensed with.

Of all the departments of natural science which can be taught in schools, chemistry, probably, takes the first place, owing to the facility with which its fundamental facts can be practically brought before the learner. The amount of apparatus necessary for demonstrating the more elementary phenomena and laws of chemistry is not very large, and can readily be obtained by any of the larger schools. Dealing also, as it does, with inorganic or dead nature, it is free from the complexity which attends the biological sciences. For these reasons chemistry is, perhaps, the best subject which can be chosen with which to commence a course of scientific study; and it has the additional advantage of being most closely interwoven with many departments of practical life. I need only add that Roscoe's "Elementary Chemistry," the authorized text-book, is written by a master of his subject, and is everything that could be desired.

Botany can be readily taught in schools, provided the instruction is more or less confined to the summer months, and is of a strictly practical nature. There is not the smallest difficulty in obtaining actual examples of plants whereupon to demonstrate the more important facts of botanical science; and there is, therefore, absolutely no excuse for teaching this subject from books. Under any circumstances it is more than doubtful if any benefit is gained by extending botanical instruction in schools beyond the simpler facts of vegetable organography and physiology, along with, if possible, some acquaintance with the commoner wild plants of the country. Botany is so overlaid with technicalities that it does not seem advisable to go beyond this. The authorised text-book, Dr. Asa Grey's "How Plants Grow," is an undoubtedly good book, but has several disadvantages. The flora, which occupies one-half of the work, might profitably be omitted, and the work is not distinctively Canadian. At present no better text-book could perhaps be obtained, but I trust to see ere long an indigenous work on this subject by some native botanist, which will more fully meet our wants. The teaching of Natural History in schools is attended with considerable, but, I think, not insuperable, difficulties. Biology, or the science which treats of the laws and phenomena of animal and vegetable life, can be taught without much difficulty, but the teaching of systematic zoology is a far harder matter. Still, if only the practical method be adopted, zoology would prove a most useful branch of school education. If the teacher would simply teach to his pupils the peculiarities of all the common animals, domestic or wild, which he can get hold of, much would be gained. In this way a basis would be formed for the prosecution of deeper and higher studies in zoology. The pupil should study *types* instead of *groups*, and should study these practically; and there is really little difficulty in obtaining characteristic examples of the leading classes of the animal kingdom. When once this is understood, zoology can be taught with profit, and every large school can readily accumulate specimens of the comparatively few types of animal life required for this mode of instruction. In the meantime it is, perhaps, best