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#### On Teaching Natural Science in Schools.

#### By J. M. WILSON, M.A., F.G.S., F.R.A.S. (Concluded.)

The next training subject is unquestionably Experimental Physics. This term is used commonly to denote the sciences which can be studied experimentally, without an extensive knowledge of mathematics, and excludes Chemistry. Mechanics and Mechanism, Heat and Light, Electricity and Magnetism, Hydrostatics, Hydrodynamics, Pneumatics, and Acoustics are the principal branches of the subject. In selecting from them the subjects most fit for use at schools, and in choosing the order in which they should be taught, we must be guided by the prin-ciples already enunciated. We must proceed from the concrete to the abstract, from the familiar to the strange, from the science of masses to the science of molecules. Hence, Mechanics and Mechanism must come first. In a year most boys are able to learn the great principles of Statics and Dynamics, and the elements of Mechanism, such as the ordinary methods of converting one kind of motion into another. They become tolerably familiar with the ideas of motion, and space, and time, and form, in their exact numerical relations. Ignorance of arithmetic and the want of ideas in practical geometry are the main hindrances in their way; but even they are improved by the many illustrations of arithmetic and geometry that are afforded by Mechanics, and by the growth of exactness in all ideas of quantity and form as expressed by numbers. Arithmetic is too often the science of pounds, shillings, and pence alone; and by being so limited it loses in dignity, and in interest, and in clearness. In Mechanics, also, the motion of force is constantly present in its commonest and simplest forms; and in this respect also this branch of science serves as the best introduction to the later branches.

Hydrostatics and pneumatics, I do not doubt, are the best subjects to take next: the range of these subjects that could be taught at school is not great; and they may be learnt very thoroughly and exactly, and provide very good illustrations of the principles of the subjects that precede them. Hydrodynamics, Acoustics, and Geometrical optics will be only studied profitably beyond the bare elements by those who have special talent for mathematical or experimental investigation, and should, I think, be in general reserved for university teaching. Physical Optics unquestionably should be excluded from school teaching.

The next year's course should be Heat and the elements of Electricity. By the time boys have reached this stage they are far more able to acquire new subjects than in the previous stages, and are fit to enter on these branches of physics, if they have studied the earlier subjects intelligently. And of all subjects of experimental investigation, Heat (1) seems to me the best for work at schools. Three times I have taken classes in Heat, and with more satisfactory results than in any other subject. The phenomena of Heat are so universal and so familiar; it has so central a position among the physical sciences; its experimental methods are so perfect; it affords such a variety of illustrations of logical processes; that it seems unrivalled as a subject for training in science. And allowing for seventy lectures in the year it is clear that this year's course will allow of some time being given to Electricity. This may be made an enormous subject, but I apprehend that it will not be worth while to attempt its more difficult branches, but to reserve them for the University and for private study.

I will repeat, that a boy can learn, when he knows how to learn, far more than a master can teach; and it is at increasing the boy's power that the master must aim unweariedly. And by combining a voluntary and a compulsory system, giving opportunities for learning something of the higher branches, and insisting on a sound knowledge of the more elementary parts of Physics in which the teaching can be most stimulative and suggestive, all requirements will be met.

The methods of teaching Physics will be different in different hands; they will vary with the knowledge, the enthusiasm, the good sense, the good temper, the practical skill, and the object, of

(1) On this subject there is a very good text-book by Balfour Stewart.