

sibly, a full presentation of simple harmonic motion might be appropriate, since all waves, transverse or longitudinal, which result in sound are of that form of motion, but it could hardly be necessary to go into any considerable discussion of elasticity or the determination of elastic constants. It should be sufficient, it would seem, to point out that in accordance with Hooke's law all vibrations due to elasticity are simple harmonic motions. In America, at least, a student capable of reading a work like this intelligently would very probably be so far familiar with the principles of elasticity as to make chapter III. superfluous, and the like would be true regarding some other portions that are not obviously of an acoustic nature. Even if their connection with acoustics is ultimately fundamental, it is so remote as to suggest comparison with the works of a watch which have nothing to do with the case. Their presence, however, is not a serious fault if it secures better treatment of other parts that could not be omitted. It is a question whether simple harmonic motion in connection with sound is not overdone. It is true that elastic vibrations are simple harmonic motions, but so far as sound is concerned its reception by or transmission to the ear is always due to longitudinal vibration, and the intricate composition of transverse vibrations helps very little in interpreting the superposition or interference of longitudinal waves in the medium through which the sound is transmitted. Still, the phonograph and the telephone have of necessity forced the study of acoustics along the line of vibrating plates. It is interesting to note how the very delicate points in acoustics are best appreciated by seeing instead of hearing.

The last chapter, devoted to recorders and reproducers, is most interesting and important, although some of it goes pretty far afield for sound. A good instance is given of rhythm resulting from sound vibrations and, without being itself sound, transmitted electrically as rhythm and perceived by dipping fingers into a conducting liquid. This may illustrate the vibrations of a plate as a source of sound, but they are neither transmitted nor perceived as sound at all, there being no evidence of any

material vibration in the transmitting media or in the organ of perception. Of course this is very different from telephonic reproduction, where there is distinctly a sounding disk at the receiving as well as at the sending terminal. This chapter serves to show how greatly the domain of acoustics has widened since the earlier work of Donkin and Helmholtz, and it also points out how the theory of sound is connected with that of electricity through wave motion. The value of the chapter is heightened by the original work of the author upon electric oscillations.

We notice the introduction of the term sound-rays. Although this is unusual, the use of the term ray to designate a normal to a wave front is becoming so common in text-books as to justify it in connection with sound, even though the conception of a material ray of sound has never had any favor.

In enumerating several forms of sensitive flames the Govi-Barry flame, which is so easy to produce and so wide in its range of sensibility might well have been included.

A few errors have escaped the proof-reader, but probably not more than are to be expected in a first edition. Such are the omission of an exponent after equation (1) on page 225, and an uncompleted sentence at the top of page 371. But when the few points have been mentioned to which exception might be taken, there remain so many more to be commended that the balance is greatly in favor of the work. The admirable choice and distribution of experiments, the masterly character of the discussions, the ample scope of the work and its attractive typography and make-up, constitute it a welcome addition to the text-books of this division of physics.

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The Nature and Development of Plants, by CARLTON C. CURTIS, instructor in botany in Columbia University. Henry Holt & Company, publishers.

THOUGH published last year, the book has not yet received, in the way of review, the notice which it deserves. Though not purporting to be a text-book, it nevertheless is a book which may well serve the purpose in the

real sense of the word. In the first place are set forth in simple language and lucid style the fundamental facts of plant physiology and morphology. Although not elementary in its treatment, the book is one which the beginner may read with interest and profit. In the second place the general order in which the subjects are taken is the logical one from the teacher's standpoint.

In Part I. the author discusses the structures and functions of typical plant organs as found in the leaf, root, stem, flower, etc. Though the order of subjects in the first part is not the most advantageous, from the reviewer's standpoint, the relations of structure and function and the relation of the work of one organ to that of another is made clear, and one is acquainted with the business of a vegetable organism, and the nature of plant life, before taking up the study of the structure and relationships of the groups which form the substance of Part II.

In the second part we are introduced to the principal divisions of the vegetable kingdom in ascending order, typical examples being discussed with sufficient fullness and clearness to set forth the salient features of their kind. Due emphasis is laid upon phylogeny and discussions of points of biological interest are plentiful. One feature of the book which adds to its interest, and which will commend it to many readers, is the repeated reference to the practical application of botanical knowledge and the relation of certain plants to economic operations.

One is pleased to observe the excellent character of the illustrations. It is a relief to see illustrations that illustrate, after some of the wretched sketches and meaningless figures that characterize several of the recent text-books of botany.

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India Rubber and its Manufacture, with Chapters on Gutta-percha and Balata. By HUBERT L. TERRY. 8vo, pp. v + 291, illustrated. New York, Van Nostrand Company. 1907. \$2.00.

One may fairly say that, next to mining, the growing of rubber has of recent years been increasingly regarded as a golden path to material ease. In common with mining, the project has its risks and drawbacks, and the only safe guide to intelligent investment in both is knowledge. This the general public does not have, but many individuals desire specific information, either for the reason observed, or for the sake of general enlightenment. With regard to rubber and its manufacture, Terry's book fairly meets this need; it is for such that it has been written. Though dealing with a distinctly technical field, the author has succeeded in making a very readable book, and this is due not a little to his pleasing style, occasional prolixity to the contrary notwithstanding.

One experiences a slight feeling of disappointment in reading the first two chapters, those dealing with the history of the matter and with the botanical origin of crude rubber. It would have been justifiable to have dealt with these topics with greater liberality, and the addition of treatment at greater length of the cultural aspects of the industry would have heightened the value of the book in a marked degree. It seems to the reviewer a fair criticism that the chapter on India-rubber Plantations is a trifle pessimistic. Mr. Terry's attitude is safe, because negative. A more just statement of the legitimate attempts which are being made in Mexico to cultivate rubber trees (*Castilloa*) would have had greater merit. Sharp practises do great damage to infant industries. So much more therefore do these demand proper representation at the hands of the critic.

To be commended in this connection is the effort to point out the need for adequate conservation of the natural forests of rubber-producing trees, a problem to which our modern forestry methods have not yet reached. Science will be needed in meeting this aspect of the industry quite as much as any other. Already her face has been turned toward plantation culture, with no little success, but the inevitable struggle of man with nature has already discovered a quite handsome array of