

convey, through reading-lessons, some of the more attractive elementary facts of science; and, if we may judge from the degree of success attained in "Sea-side and Way-side," the volumes are likely to be cordially welcomed in many primary schools in England as well as in the United States. The author has taken, as the subjects of her lessons, crabs, wasps, bees, spiders, and shell-fish; and she has contrived to put into the simplest and most direct language a great deal of really useful and entertaining information. Almost all children find something to interest them in what they are told about the habits of animals, and it is not improbable that these bright and pleasant lessons will implant in a good many young minds the seeds of an enduring love of natural history.

Reminiscences of Foreign Travel. By Robert Crawford. (London: Longmans, Green, and Co., 1888).

MR. CRAWFORD is already favourably known as the author of "Across the Pampas and the Andes." The present volume will maintain his reputation as a traveller who knows how to observe what is most significant in the countries he visits, and who possesses the faculty of reproducing his impressions in a lively and attractive narrative. His reminiscences relate to Canada, Austria, Germany, Sardinia, Egypt, Algeria, and various other lands; and in every chapter he records something that most readers will find fresh and interesting. The most instructive sections of the book are, upon the whole, those relating to Canada and Algeria.

LETTERS TO THE EDITOR.

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Dr. Giglioli and Lepidosiren.

DR. GIGLIOLI asserts, in his interesting letter published in the last issue of NATURE (p. 102), that the Lepidosiren whose capture he records is "the fifth specimen known." Reference to his earlier remarks (NATURE, vol. xxxv. p. 343), concerning that which he regards as "the fourth known" specimen, shows that while he has acknowledged the examples of Natterer and Castlenau, he has apparently overlooked that of Bibron and H. Milne-Edwards, recorded in 1840. Readers of NATURE interested in this wonderful creature, now apparently verging on extinction, will find a *résumé* of all that is topographically important concerning the last-named and the three previously recorded specimens in the *Zoolog. Jahrb.* for 1887 (pp. 575 to 583). For this welcome communication, to which a full bibliography is appended, we are indebted to Dr. G. Baur, of Yale College Museum, U.S.A. It forms one of the series of historical miscellanea with which he has enriched our recent literature; and, if the conclusions at which he (in common with Brühl) arrives are sound, Dr. Giglioli's "fifth" specimen will be in reality a sixth.

Zoologists in general will unite in congratulating Drs. Rodriguez and Giglioli upon their recent acquisition; and while hoping for a repetition of the same, they will eagerly await the results of the promised "future study." G. B. HOWES.

South Kensington, June 2.

"A Text-book of Biology."

WILL you allow me to point out that the reviewer, in your issue of May 17 (p. 52), apparently misunderstands the object of my "Text-book of Biology"? The work is not meant to supplant lectures, but to aid them, by reducing for the student the wearisome labour of note-taking, and by enabling the teacher to enlarge where necessary, and to treat the subject from other points of view, running meanwhile less risk of addressing an audience of mere scribbling-machines.

The review also implies that a previously published work

covers the same ground as the present book. This, however, is not the case, as my book deals with the *Botany* as well as with the *Zoology* of the course.

I cannot but think that the reviewer is led by his enthusiasm into the common mistake of demanding that the ordinary "pass" man shall follow the same course as the specialist. I suppose that the University of London prescribes at the Intermediate Pass stage a portion, not too small, of Biology, which shall form part of a general course of science adapted to the average student, and to the time at his disposal; perhaps your reviewer will kindly explain, less vaguely, what other system he would propose to substitute?

J. R. AINSWORTH DAVIS.

Aberystwyth, May 24.

Resistance of Square Bars to Torsion.

THE attention of writers on Applied Mechanics should be called to the error continuously repeated in about thirty editions of the late Prof. Rankine's different works which have appeared during the last thirty years. The error is still reproduced in quite recent works of other writers: Prof. Ewing's article, "Steam-Engine," in the *Encyclopædia Britannica*; Prof. Unwin's "Elements of Machine Design"; Prof. Alexander's "Elementary Applied Mechanics"; &c.

It is stated that the moment of resistance of a square bar to torsion appears from Saint-Venant's investigations to be—

$$0.281 fl^3,$$

where f = maximum intensity of stress, and l = side of the square. This formula is also quoted at discussions of Institutions of Engineers and accepted without dissent. It is easily seen to be wrong, because the moment of torsion of a round bar of equal area is only

$$0.282 fl^3.$$

The error is reproduced in the text of Prof. Cotterill's "Applied Mechanics," but is corrected in an appendix, where the author says Rankine gives the formula without further explanation. The explanation is that on the old theory the torsional moment of inertia was—

$$I = \frac{h^4}{6},$$

which had to be multiplied by the maximum intensity of stress and divided by the corresponding radial distance—namely, from the centre to the middle of the side, giving the moment of resistance

$$= \frac{fl^3}{3}$$

on the old theory. (Rankine was aware that the maximum stress does not occur at the angles, as in Coulomb's method.)

Now, in Saint-Venant's "Mémoire," the torsional rigidity of a square bar is proved to be the fraction

$$0.843$$

of the fallacious result of the old theory. Rankine accordingly wrote

$$0.843 \times \frac{fl^3}{3} = 0.281 fl^3$$

as the true moment of torsion.

But the torsional rigidity determines the amount of twist, and not the maximum stress. A few pages farther on, Saint-Venant gives the correct formula, equivalent to

$$0.208 fl^3.$$

It seems strange that the talented author of the expressive distinctions *strain* and *stress* should himself have taken the formula for the strain instead of that for the stress. The reason is, that up to that date (Todhunter's "History of Elasticity") the strain and stress were supposed to be proportional to each other.

Abstracts of Saint-Venant's researches are given in Sir William Thomson's article "Elasticity," in the *Encyclopædia Britannica*, Thomson and Tait's "Natural Philosophy," and Minchin's "Statics." Strange that in all of these the method is given which determines the *strain* to be 0.843 of the old fallacy, while nothing is said about what is of more importance in Applied Mechanics, the maximum *stress*, nor the *moment of resistance to torsion*, as given above.

Perhaps this hint may be attended to in future editions.

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