of zigzags which yield without entanglement to the very rapid motion of the rocket—the strain on the cord being only due to its inertia. As then the force required to set it in motion is proportional to the weight of cord moved multiplied by its velocity, and this weight is also proportional to its weight per unit of length multiplied by the velocity, the strain or tension, $T = MV^2$ or $V = \sqrt{\frac{T}{M}}$; the relation which we have already seen is necessary to the production of a stationary wave. Accordingly, we find that the rope, instead of at once following the flight of the rocket, rises almost perpendicularly from the box, and only passes into its low trajectory at a distance of six or eight feet, with a sharp irregular curve, which remains comparatively steady during the whole flight of the rocket. This curve is no doubt first produced in the first portion of the rope, which is "faked down" on the ground outside the box; but it would be impossible to see its formation, because of the smoke of the discharge, even if the motion were not too rapid.

One rather curious result of the above-mentioned conditions is, that however erratic the flight of the rocket may be, the rope will continue to follow through the whole track, as if the air were a solid which the rocket had pierced.

Another result is, that no lateral vibrations can be propagated along a rocket line—a fortunate condition with regard to steadiness of flight. HENRY R. PROCTER

Clementhorpe, North Shields, Jan. 26

Ocean Currents

PROF. EVERETT has evidently misapprehended what I said in my letter to NATURE, January 11. Nine foot-pounds would, of course, generate in a pound of matter a velocity equal to that acquired by the pound falling through a space of nine feet. And in reference to the deflecting power of rotation, what I meant was not the amount of deflection in a given space passed over, but the positive amount, say in feet, in a given time.

Edinburgh, Jan. 27 JAMES CROLL

ON TEACHING GEOLOGY AND BOTANY AS PARTS OF A LIBERAL EDUCATION

ON Monday, Jan. 22, one of a series of lectures on Educational questions was given at the rooms of the Society of Arts by Mr. J. M. Wilson, of Rugby. The following may be taken as an abstract of the lecture :—

Two points have to be considered : (1) When, if at all, these Natural History Sciences ought to be introduced into schools ; (2) What they should include, and how they should be arranged for teaching purposes.

The problem before schoolmasters is to adjust the rival claims of the subjects which press for admission into the school course, all of which may urge something in their favour. These subjects have increased in number and extent so that the question of re-arrangement is pressing. For the solution at present is to admit a little of all, or nearly all ; and the effect of this is to distract. A wide education levels up, but also levels down, and weakens, by eliminating the close study of detail, and the drudgery that is essential in valuable work. It is that conflict between the old theory of *promise* and the new theory of *performance* ; and schools are in great danger of giving less faculty than they did formerly, though they give increased knowledge.

To meet the requirements some *stratification* of studies must be effected, so that not so many shall be followed at once. Greek and Chemistry and Physics (except Mechanics), should be excluded from the elementary course, which should include Latin, French, Arithmetic, and Natural History. Then bifurcation should begin ; the one branch leading to Greek and a mainly literary education, the other to Science; both continuing Latin and English, and French and History. The recognition of the bifurcation, both by the Universities and by the great schools, is urgently needed. Without it Science must be dwarfed or excluded, and literature also suffer from the distraction which is already felt at schools. The programme of the reformers in education ought to include the abolition of Greek as a compulsory subject at the Universities.

By Natural History is meant what Huxley has introduced to us under the word "Erdkunde." The earth, its relation to sun and moon, the phenomena of day and night, and seasons ; the changes going on, the activities of the earth, rain, and rivers, and sea, and earthquakes, and slow changes of level, and their geological effects, and something also of geology proper. The teaching should be based on the familiar knowledge of the boys, and should extend and systematise it, and without being too dogmatical, should be practical where possible. A little botany, enough to teach the objects and the interests of the science, and the principles of structure and classification, and something of geographical distribution, may well be included in the natural history of this elementary stage in education. The object of the master should be to discover and train scientific ability, as well as to give scientific information, and for this purpose these studies have great advantages. The bearing of the experience gained at Rugby on these questions was also given.

THE SURVIVAL OF THE FITTEST

LAST summer a discussion took place in your pages on the expression, "Survival of the Fittest," and on the principle it formulates. Though, as being responsible for this expression, there seemed occasion for me to say something to dissipate the errors respecting it, I refrained from doing so, for the reason that the rectification of misstatements and misinterpretations is an endless work, which it is almost useless to commence.

In your last number, however, the question has cropped up afresh in a manner which demands from me some notice. A Professor is tacitly assumed to be an authority in his own department; and a statement made by him respecting the views of a writer on a matter coming within this department, will naturally be accepted as trustworthy. Hence it becomes needful to correct serious mistakes thus originating.

In your abstract of Prof. E. D. Cope's paper, read before the American Association for the Advancement of Science, I find the following sentences :—

"This law has been epitomised by Spencer as the 'Preservation of the Fittest.' This neat expression, no doubt, covers the case, but it leaves the origin of the fittest entirely untouched."

There are here two misstatements, the one direct and the other indirect, which I must deal with separately.

So far as I can remember, I have nowhere used the phrase, "Preservation of the Fittest." It is one which I have studiously avoided ; and it belongs to a class of phrases for the avoidance of which I have deliberately given reasons in "First Principles," sec. 58. It is there pointed out that such expressions as "Conservation of Force," or "Conservation of Energy," are objectionable, because "conservation" implies a conserver, and an act of conserving—implies, therefore, that Energy would disappear unless it was taken care of ; and this is an implication wholly at variance with the doctrine enunciated. Here I have similarly to point out that the expression "Preservation of the Fittest" is objectionable, because in like manner it supposes an act of preserving—a process beyond, and external to, the physical processes we commonly distinguish as natural ; and this is a supposition quite alien to the idea to be conveyed. One of the chief reasons I had for venturing to substitute another formula for the formula of Mr. Darwin, was that "Natural Selection" carries a decidedly teleological suggestion, which the hypothesis to be formulated does not in reality contain ; and a good deal of the ad-