technical points of view, and as regards the latter the information has been brought up to date by including notices of Webster's improvements in the Deville process, Messrs. Cowles Brothers' electrolytic method of producing aluminium alloys, and the Castner process of reducing sodium from caustic soda at a low temperature, which, in conjunction with Webster's processes, seems likely to render the production of cheap aluminium commercially possible.

The author has contributed to the appendix a series of experiments made by himself on the formation and reduction of aluminium sulphide, which are of interest, although the results, in the reduction experiments at any rate, appear to have been mainly negative. Iron, tin, copper, and antimony were employed as reducing agents, but only with the first two metals was any reduction effected. The concluding paragraph, therefore, reads rather oddly:—"These processes have been covered by patents, but have never been made successful. It appears that if rightly managed they will give good results and produce aluminium alloys cheaply."

Questions on Physics. By Sydney Young, D.Sc., F.C.S., Lecturer on Chemistry, and Tutorial Lecturer on Physics in the University College, Bristol. (London: Rivingtons, 1887.)

ASSUMING that books consisting of a series of questions with their answers collected together at the end supply a legitimate want and do a real service in the cause of scientific education, Dr. Young's "Questions on Physics" is a valuable addition to those already existing. It is as free as it is possible to make such a book from the charge of encouraging "cram," as the questions are many of them not adapted to rule-of-thumb methods of solution. Many of them also are descriptive of some instrument or principle, in which case, of course, answers are not given. The author takes in succession mechanics, acoustics, heat, magnetism, electricity, and optics. After the answers he gives a series of tables which will be found useful. There are no questions on moment of inertia, or on the ballistic galvanometer: One sentence—the last part of question 155—may vex the student: "Calculate the focal length of a concave lens which gives a magnification of three diameters at a distance of three inches."

The book is intended for the intermediate examination in science and preliminary scientific examination of the London University.

Eminent Naturalists. By Thomas Greenwood, F.R.G.S. (London: Simpkin, Marshall, and Co., 1886.)

THIS is a little book (200 small 8vo pages) intended, as the preface says, to furnish "short yet comprehensive sketches of some leading naturalists." The sketches are certainly "short," but can only be said to be "comprehensive" in the sense that this term may be applied to an epitaph. It is difficult to understand what object such very sketchy biographical sketches can be supposed to serve. Moreover, in this case the subjects appear to have been selected at random; the result being that the portrait gallery, such as it is, presents a somewhat incongruous assemblage—to wit, Linnæus, Lubbock, Thomas Edward, Louis Agassiz, Cuvier, Buffon, Lyell, and Murchison. Whether this curious arrangement is intended to express the writer's idea of the order of merit of these men, or whether, like his choice of naturalists, it is purely haphazard, we are not informed. But surely, if a biographer goes back as far as Linnæus for his material, and carries down his survey to the present generation, even the most popular of popular readers might have expected him to supply a less deficient index of "eminent naturalists."

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

The Carnatic Rainfall.

IF I have rightly interpreted General Strachey's courteous criticism of my paper on the Carnatic rainfall, the gist of his objections may be summed up by saying that the method by which I endeavoured to estimate numerically the genuineness of the apparent cyclical variation of that rainfall, as a recurrent phenomenon, is logically invalid. This, I must frankly admit, is really the case; my error has been somewhat of the nature of a *petitio principii*, and is indefensible. I have reasoned upon a series of values directly obtained from the observations, as if they had been obtained deductively from some independent source, and had been found, on trial, to agree, within certain allowable limits, with the results of the observations. This procedure, as General Strachey has shown, is manifestly illogical; and the inferred "high probability that the apparent undecennial fluctuation of the Carnatic rainfall is no chance phenomenon," in so far as this conclusion depends on the above erroneous reasoning, necessarily falls to the ground. But only in so far. The validity of the data afforded by the registers remains, of course, unaffected; and these data, as they stand, seem to me to furnish evidence of so pronounced a character that it is at least improbable that the apparent fluctuation is fortuitous. The considerations on which I base this opinion are:—

(1) That each series of eleven years, taken separately, shows a dominant fluctuation of that period, and these fluctuations show much accordance, both in their ranges and in the epochs of their critical phases. Simple inspection of the tabulated annual means is sufficient to convince one that there is no regular fluctuation of anything like the same magnitude, differing much from the eleven-year period.

(2) The range of the fluctuation as deduced by the harmonic formula (restricted to two periodical terms), is four times as great as the mean deviation of the recorded amounts from the corresponding computed values. And this fact fulfils a condition which, in a less rigorous sense, General Strachey suggested, I believe,¹ as a test in his discussion of the Madras rainfall registers, communicated to the Royal Society in May 1877, and the failure of which he rightly assigned as a reason for doubting the reality of the supposed cyclical fluctuation of the Madras rainfall.

That the second of these considerations is valid has been established in my former communication. The computed range of the fluctuation was shown to be 14 inches, and the mean annual deviation of the observed from the computed values ± 3.5 inches. To render the first more obvious, I have computed the harmonic constants, separately, from each of the two undecennial series, and therefrom the annual values in each case. The constants are:—

$$\begin{array}{l} \text{1st Cycle.} \\ u' = 7.23 \quad \dots \quad u'' = 0.66 \quad \left| \quad \begin{array}{l} \text{2nd Cycle.} \\ u' = 4.22 \quad \dots \quad u'' = 5.44 \end{array} \right. \\ U' = 190^\circ 16' \quad \dots \quad U'' = 322^\circ 10' \quad \left| \quad \begin{array}{l} U' = 233^\circ 59' \quad \dots \quad U'' = 240^\circ 14' \end{array} \right. \end{array}$$

and the computed annual values—

1st Cycle.			Inches.	2nd Cycle.			Inches.
1864	...	...	- 1.70	1875	...	...	- 8.14
1865	...	...	- 4.62	1876	...	...	- 8.63
1866	...	...	- 6.35	1877	...	...	- 2.61
1867	...	...	- 6.62	1878	...	...	+ 3.46
1868	...	...	- 4.99	1879	...	...	+ 3.69
1869	...	...	- 1.39	1880	...	...	+ 0.07
1870	...	...	+ 3.18	1881	...	...	- 1.46
1871	...	...	+ 6.79	1882	...	...	+ 2.11
1872	...	...	+ 7.23	1883	...	...	+ 6.71
1873	...	...	+ 5.81	1884	...	...	+ 5.97
1874	...	...	+ 2.12	1885	...	...	- 1.04

¹ I quote from memory, not having the Proc. Roy. Soc. at hand.

the average annual rainfall being, as before stated, about 35 inches.

These figures have, in themselves, as General Strachey truly observes, no physical signification, but they show that there is a very pronounced harmonic element, with a period of eleven years, underlying the observed quantities, and that in some of its most salient features it seems to be recurrent. Physical considerations only come in when, and in so far as, its features can be correlated with those of the solar variations; a point already noticed in my former paper, and on which I need say nothing further. But of course it is the supposed connexion of the two classes of phenomena that constitutes the chief interest of the subject under discussion.

HENRY F. BLANFORD.

Folkestone, July 25.

The Progress of the Scottish Universities.

YOUR issue of July 14 (p. 252) set forth in vivid graph the rap'd increase in size of the Scottish Universities. But as we must not forget that in progress, advance of type or improvement in quality is more important than increase of quantity, it behoves us to test the qualitative change of the Scottish Universities, and to make sure that they are not of the nature of malignant tumours—rapidly-growing masses with tissues of an embryonic type.

The test is not hard to find in the case of organisms with a unction so definite as the Universities. Increased efficiency

FIG. 1.—Efficiency.

and decreased cost must be the tests, and the results are startling, as shown by the accompanying graphs of the official returns.

The first shows the efficiency in the Arts Faculty in Glasgow, the Medical Faculty in Edinburgh, and for two points the whole of Scotland as tested by the fraction $\frac{\text{Professors}}{\text{Students}}$.

The second shows the quantity, in seconds, of Professor of Anatomy which the students can have for £1 in Edinburgh.

The result is an entire reversal of the usual optimistic picture of progress by growth in quantity, and as I am both hopeful and

FIG. 2.—Cost.

anxious for the advance in quality of the Universities in which I have spent many years, I hope you will allow me to call attention to its urgency.

M.A. ET MEDICUS.

Floating Eggs.

THE floating eggs which a correspondent in NATURE of July 14 (p. 245) describes and refers to *Orthogoriscus*, are apparently those of the angler or frog-fish (*Lophius piscatorius*), which are known to naturalists. They are laid, as Agassiz states (Proc. Amer. Acad. Arts and Sci., vol. xvii. part iii. p. 280), "embedded in an immense ribbon-shaped band, from 2 to 3 feet broad, and from 25 to 30 feet long." The ova of *Orthogoriscus* do not appear to have been yet obtained, and Mr. Green's description accords essentially with the features presented by the eggs of *Lophius*, though no colour is mentioned, whereas the eggs of the frog-fish are of a light violet-gray tint, and when the dark pigment develops in the young embryos the band assumes a blackish hue resembling crape. Examples, I may add, have been obtained on the west coast of Scotland; but, though *Lophius* is extremely abundant at St. Andrews, and on the east coast generally, the ova have not been procured here, as yet.

EDWARD E. PRINCE.

St. Andrews Marine Laboratory, Scotland, July 16.

Expression of the Emotions.

IN reading the very interesting letter of "J. M. H." (NATURE, July 14, p. 244), I was much struck with the similarity of purpose and singularity of expression in the robin and in a cat of mine, of which can equally be said, it "invented a note by which it called me to feed it. It was quite peculiar—hushed, short, and muttered, as it were." This note is also used on other occasions,