

series of changes, in which the fish, Lepidosiren, perenni-branchiate, and triton, are all represented.

One would be inclined to infer from these metamorphoses, that, on tracing the Amphibia back in time, the story of their origin should be told, but, as a matter of fact, palæontological history tells a different story altogether. Abundant remains of frogs and toads are found in the Miocene deposits, some of which are of so fine a character that even the tadpoles are preserved; but these tertiary frogs and toads do not differ, in any important particulars, from those of the present day, and the same is true of the tritons and salamanders. Some of the latter attained a very great size, and one of them—a near ally of the great Japanese salamander of the present day—has had a very singular fate, having been described, about the middle of the last century, as a fossil man, by the German naturalist Scheuchzer, who named it "*Homo diluvii testis*," the man who saw the flood!

In the Wealden and Purbeck formations no Amphibia have as yet been discovered, but, from the Lower Lias to the Carboniferous they turn up again in remarkable numbers, and of great size, but differing from existing forms in some important peculiarities, and affording no help whatever to our inquiries as to the origin of the existing or of the tertiary frogs, toads, and salamanders. Under the throat, these gigantic Amphibia had a remarkable shield of three bony plates, as well as a series of plates along the belly. Their teeth were large and powerful, and presented an extremely complicated structure, whence the group has received its name of *Labyrinthodonta*.

Thus, in tracing back the existing Amphibia, we find a great break in the secondary period, and then come upon a distinct group, the *Labyrinthodonta*, from which the existing forms cannot possibly be deduced. These, again, have been traced no farther back than the carboniferous epoch.

(To be continued.)

PHYSICAL SCIENCE IN SCHOOLS

THE beginning of a discussion on any great subject elicits mainly differences of opinion; its end should be to establish agreement as to principles, and in great measure as to details. The first half of this dictum has been illustrated by the interesting letters in your columns on Physical Science in Schools; its entire confirmation as the correspondence proceeds will confer on education a benefit of the most timely kind.

The moment is a critical one for scientific teaching. Lord Salisbury's Bill will come to mean a revolution in the educational structure of the Universities; the Report of the Science Commission proposes to re-cast the teaching of the schools; public feeling, unexpressed as yet on other points, is distinct in wishing to see Science heartily recognised and systematically taught. If Science Teachers will agree as to what they want and press it vigorously, the game is in their hands.

I venture to lay down for consideration in NATURE certain propositions on this subject in the hope that they, or such others as may be preferred to them, may become the basis of the agreement we all desiderate:—

1. The business of a school is general education; the business of a University is special education.

2. The principal subjects taught at a school should be Literature, Mathematics, Science.

3. Each of these subjects should be studied in fixed relative proportions of time, from the very beginning of a school course until its close.

4. Scholarships offered for any one of these subjects to the exclusion of the others at the entrance on University life are mischievous in their effect on school teaching, and ought to change their character or be abolished.

5. Science should be taught to every boy in a school

for at least six hours in the week; holding a fair place in Entrance Examinations, being encumbered with no pecuniary charges unimposed on other subjects, and having a value in school-marks proportional to the time spent upon it.

Of these five theses, the first three and the fifth are in exact harmony with the recommendations of the Science Commission; the fourth follows necessarily from the others, as stigmatising a system whose continuance makes general school teaching impossible, and whose significance gains point from the curious admission of one of your correspondents as to the intellectual cost of a Balliol Scholarship.

The feasibility of teaching science to the youngest schoolboys, assumed in what I have said, demands a word of comment. The evidence on this point scattered through the Report of the Commission, and partly summarised in Report VI., pp. 6–9, is, if not overwhelming, so strong as to outweigh many-fold anything that has yet been said against it. I desire to advance with humility, but with great earnestness, my own experience, extending over fourteen years, in support of the view there laid down; and Mr. West's admirable letter in NATURE, vol. xiii., p. 48, represents, as I well know, the conclusions of many successful teachers. If grammatical analysis and arithmetical numeration are taught every day to boys of nine years old, why not the elements of science? It were well surely to inquire what parts of this vast subject and what treatment of them have been found suitable to younger minds; for the statement on the part of any individual that science cannot be taught to little boys means nothing more than that he himself has failed to teach it.

My object in writing is a practical one. I have stated the principles which seem to me to underlie all school science teaching worthy of the name, and I invoke a judgment upon them, possibly a reversal of them, at the hands of experienced teachers. If it be true, as we were lately told, that the head-masters are awaiting instruction from the public, let us prepare the public to educate their illustrious pupils. At any rate, let scientific men be ready to answer the appeal which will be made to them when the Report of the Science Commission comes before the House of Commons, with such unanimity as only abundant and unprejudiced discussion can generate. To let slip this opportunity will be to find, I fear, with the Jew of Malta, that "Occasion's bald behind."

W. TUCKWELL

I notice in your columns that a discussion has been conducted for some time past on that important subject, Physical Science in School Teaching. Permit me, as one possessing a deep practical interest in this matter, and also as a science teacher of some years' experience, to remark that in Scotland, generally, and in this great educational centre in particular, the chief obstacle which stands in the way of extended science teaching, is the simple apathy of educationalists to the claims of scientific instruction. It were well that, before disagreeing as to the exact mode of teaching, the claims of one science over another, and other points, science teachers should thoroughly agree as to the necessity for more openly enforcing their claims upon the notice of those who sit in high places in the world of educational management. I gladly welcomed an opportunity afforded me by the Edinburgh branch of the "Educational Institute of Scotland," in December last, to address the members of the Institute, consisting in the main of teachers of all subjects, on the "Place, Method, and Advantages of Biological Instruction in Ordinary Education." The substance of that address will shortly appear in *Fraser's Magazine*, and to that medium I would respectfully refer those of your readers who are interested in this question, for a *résumé* of a science teacher's work and method in the northern metropolis. I would fain hope that the argu-