these elements—of which "argon" may be one—should exhibit properties differing chiefly in degree from the alternate palladium and platinum triplets; while hydrogen would appear as the primary of both systems of elements.

Dr. Gladstone's letter, which appeared in your issue of February 21, admirably puts the reasons for preferring an atomic weight of about 20 for argon to the higher number which Lord Rayleigh and Prof. Ramsay are now disposed to assign to it; but Dr. Gladstone seems to think that there is room for only one element, whereas three are possible, as I pointed out at the Oxford meeting, for the reasons given in the foregoing.

It will be seen from the illustration that an element with an atomic weight between 36 and 39 would belong to a third system of elements. But the sole ground for concluding that the atomic weight of argon lies between these points, is the ratio of the specific heats as determined by Kundt and Warburg's method. Lord Rayleigh and Prof. Ramsay found this ratio to be nearly equal to that afforded by mercury gas, the molecule of which is monatomic and density only half its atomic weight; hence they conclude that the argon molecule is monatomic, and that its density of nearly 20 represents but half the atomic weight. Now, while any opinion on this point, coming from the distinguished discoverers of argon, is of the highest value, it seems possible to attach undue weight to the very slender evidence afforded by the specific heats, for mercury at present is the only one of the known cases of monatomic elementary molecules in which the ratio of the specific heats has been determined. But, even admitting that the energy of the mercury and the argon molecules is chiefly translational, it is still conceivable that the argon molecule includes two atomic vortices so closely interlinked as to have a common centre, and therefore to enable the molecule to simulate a monatomic character. Such a structure would be consistent with great stability and, consequently, with exceptional chemical indifference. J. EMERSON REYNOLDS.

Trinity College, Dublin, March 19.

Variation in *Caltha palustris*.

READING the notice of Mr. Burkill's paper on "Variations in Stamens and Carpels," in NATURE of February 7 (p. 359), I remembered the following notes on *Caltha palustris*, which my wife and I made at Corfe, Dorset, June 11, 1891.

C. palustris: heads in pairs on a dichotomously branching stalk; number of follicles in each head, counted in several specimens, as follows:—

7 follicles on one, 4 on the other, of a pair. 8—5, 5—7, 5—6, 6—6, 6—7, 7—5, 9—9, 10—8, 11—8, 9—6.

Thus there is great variation. One stalk is longer than the other, of a pair, and it is presumed that in every case the shorter one flowers first. It will be noticed that in the above eleven instances, only two had the same number of follicles on both stalks. Of the remaining nine, three had most follicles on the longer of the stalks, and six had most on the shorter. Those on the shorter stalk were larger than those on the longer, presumably because older.

A second memorandum gives the results of fifteen more counts, all taken at random, thus (L. = longer, S. = shorter stalk):—

L. with most follicles.		L. and S. equal.		S. with most follicles.
L. S.		L. S.		L. S.
5—4	...	8— 8	...	4— 6
				4— 8
9—8	...	5— 5	...	6— 7
9—7	...	10—10	...	8—10
		7— 7	...	9—10
		10—10	...	7— 8
				4— 5

It accordingly appears that the later-flowering, longer-stalked head produced more follicles in just half the number of cases counted (13 out of 26), and the shorter-stalked head had a majority in only 5 cases, the remainder being equal.

In a *Bidens* found at Barbadoes (West Indies), on July 6 of the same year, there were similarly two heads, a long-stalked and a short-stalked, the latter flowering first. It would be interesting to get statistics of the numbers of akenes in the heads in this. The species was not certainly determined, but it is of the section of *B. bipinnata*. T. D. A. COCKERELL.

New Mexico (U.S.A.), February 24.

DR. M. FOSTER ON THE TEACHING OF PHYSIOLOGY IN SCHOOLS.[1]

THE teaching of science in schools has, it seems to me, two uses. The first is what I may call the "awakening" use. Many minds who feel no interest in the ordinary subjects of school learning, to whom the ordinary lessons appear as so much dull mechanical work, are at once stirred to intellectual activity when the teaching of this or of that science is presented to them. The second use is the more distinctly "educational," training use.

The minds of the young being, happily, differently constituted, one mind is especially "awakened" by one branch of knowledge, another by another. One boy or girl dates the beginning of his or her intellectual activity from the day on which he or she had a first lesson in chemistry. Another starts in the same way with botany. And the number of those to whom physiology thus serves as "awakening" knowledge, is, it seems to me, sufficiently great to render it desirable, by the introduction of the teaching of physiology into schools, to afford adequate opportunities for its exercising this benefical effect.

It follows that, taught from this point of view, physiology should be taught as a new independent subject, not demanding any previous knowledge; it should be presented as a wholly new field into which the natural mind may wander at will without any restrictions as to being qualified for entrance. It also follows that the teaching must be of a most elementary kind, that as much of chemistry or physics as is necessary for the comprehension of the physiological matters should be taught with the physiology, and, as it were, as a part of it, the pupil being led into chemistry and physics by his interest in physiology, and not being compelled to learn the one for which he or she perhaps does not, at present at least, care before beginning the other.

The instruction given, however elementary it may be, should consist in part of demonstrations and practical exercises. I need not enumerate these in detail, but they must necessarily be limited in scope; the dissection of a rabbit or some other animal to show structure, some little microscopic work, such as the microscopic study of the blood and of a few tissues, the examination of the structure and working of the heart, the mechanics and elementary chemistry of breathing, and the like. But all these demonstrations, like the rest of the teaching, I may repeat, should teach so much of chemistry, of mechanics, &c., as is needed, as a part of the physiological lesson.

As an "awakening" study, I am in favour of physiology being very widely taught; but, as almost necessarily follows from the view on which I have been dwelling, it ought not to be made a compulsory study. Made compulsory, it would as an awakening study lose much of its virtues. I do not hide from myself the fact that the present gross ignorance which prevails among most men and women as to the most elementary facts concerning their own bodies is most undesirable, especially perhaps as regards women; but I am most decidedly of opinion that it is better to meet this evil by encouraging the study of physiology than by making it compulsory.

Physiology, as a distinctly educational study, as a training for the mind, is a very different matter; and it is, in my opinion, in this aspect unsuitable for schools. The training for the mind which physiology affords is one, I venture to think, of no small value, but is one

[1] A short time ago, on my consulting him on behalf of a committee appointed by the Headmasters' Association, to draft regulations for major scholarships' examinations, Prof. Michael Foster was good enough to give me this statement of his opinion on the teaching of physiology in schools—a subject of great importance, but of great difficulty, regarding which much misconception prevails: it appears to me to be so valuable, that I have sought for and obtained his permission to publish it.—HENRY E. ARMSTRONG.

which, especially compared with that afforded by some other sciences, is relatively slight when the knowledge is elementary, increasing rapidly as the study becomes advanced. Further, while I have just urged that elementary physiology as an awakening study may be and indeed should be taught by itself, independent of other kinds of knowledge, I can now urge equally strongly that a study of physiology, beyond the mere elements, is impossible without a previous adequate knowledge of chemistry and physics. Again, while the practical teaching of the rudiments of physiology can be carried out anywhere and by any one, the further study of physiology demands no inconsiderable laboratory accommodation, complicated apparatus, and experiments on animals. Lastly, if the study of physiology is to be real, the whole body must be dealt with, no parts being excluded for special reasons; and this means that the real study cannot be taken up until after puberty. For these reasons it seems to be undesirable to press the introduction of physiology into schools as an educational subject; all the more so, since not only both chemistry and physics are admirably adapted for this purpose, but also a not inconsiderable knowledge of both these sciences is needed for the proper study of physiology; and I imagine that by the time a boy or girl is thus prepared to study physiology, it is time that he or she should leave school.

While I am thus opposed to physiology being placed in a false position in the school curriculum, I feel myself all the more free to urge the very general introduction of an elementary study of the subject on account of its awakening value. I cannot define the amount of physiology which should thus be introduced more closely than by saying that the ground covered should be about that covered by my Primer. I would add that so far as is possible the pupils should *see* for themselves everything which is talked about in the lesson.

As to "physiology being a proper subject to be included among subjects for scholarship examinations for young pupils," I am so impressed with the painful evils of the present scholarship system, that I am most loth to say anything that would in any way lead to an addition to that system. If the scholarship examination is to be a test of education, of intellectual training, it is obvious from what I have said above, that physiology cannot be put on the same level with chemistry and physics. At the same time, if such subjects as physiology or botany are excluded from scholarship examinations, no little injustice, it appears to me, is likely to be done in the following way. A lad, let us say, shows an early bent towards physiology, and acquires at school a very considerable knowledge of its rudiments. His future career depends on his gaining a certain scholarship. If in the examination for that scholarship his place depends solely on the way in which he has acquitted himself in chemistry and physics, in which his interest is of a secondary character—he regarding them merely as helps to physiology—the world may be robbed of an eminent physiologist. Hence I would say that if the evil of a scholarship examination must come, I would give an opportunity of an elementary knowledge of physiology being, in some way, rewarded.

NOTES.

PROF. RAMSAY has been good enough to forward to us the following translation of a passage in a letter he has recently received from Prof. Olszewski: "I have at last succeeded in determining the critical temperature and the boiling-point of hydrogen. I have found for the former $-233°$ and for the latter $-243°$. I have used the dynamical method, which I described in the *Philosophical Magazine*. A thermal couple proved of no use, and I was obliged to avail myself of a platinum-wire thermometer, measuring the temperatures by the alteration in resistance of the wire. I have obtained satisfactory results, and intend to publish an account of them in English."

MR. FREDERICK WEBB has presented the sum of £1000 to the Medical School of St. George's Hospital, to found an annual prize in bacteriology.

PROF. VICTOR HORSLEY, F.R.S., has been elected into the Athenæum Club, under the provisions of the rule which empowers the annual election by the committee of nine persons "of distinguished eminence in science, literature, the arts, or for public services."

WE are glad to learn that there is no foundation for the report of the death of Prof. H. Wild, of St. Petersburg, noted in these columns on February 28. The mistake arose owing to the announcement of the decease of a German investigator of the same name.

AT the meeting of the Royal Irish Academy, on March 16, the following were elected honorary members. In the section of Science: Dr. Karl Weierstrass and Prof. du Bois Reymond, and Prof. E. Suess. In the section of Polite Literature and Antiquities: Prof. A. Erman, Dr. E. Zeller, Lieut.-General H. L. F. Pitt-Rivers, and Mr. S. R. Gardiner.

AT the Paris Academy of Sciences last week, a bronze medal, engraved by Chaplain, was presented to M. Bertrand, in honour of his jubilee. The medal has on one side a likeness of M. Bertrand, and the reverse side bears the following sentiment: "To Joseph Bertrand, member of the French Academy, Perpetual Secretary of the Academy of Sciences, in honour of fifty years' devotion to science and education, from his pupils, admirers, and friends. March, 1844–1894."

THE Anniversary Dinner of the Fellows of the Chemical Society will be held at the Hôtel Métropole on Wednesday, March 27, when Dr. Henry E. Armstrong, President of the Society, will occupy the chair. The Right Hon. A. J. Balfour, M.P., James Bryce, M.P., the Presidents of some of the learned Societies, and several other distinguished guests have accepted invitations to the dinner.

A NUMBER of organisations for scientific research in the leading cities of the American sea-board, including Philadelphia, Princeton, New York, Brooklyn, and Boston, have combined to organise an expedition to the west coast of Greenland. The expedition will be fitted out at Newfoundland, and will sail next June. Elaborate preparations are under way to insure important results to science. Each of the Societies participating will send a representative, including several who went last year, such as Profs. Libley and Chamberlin. The Brooklyn Institute will send a representative, to be chosen hereafter.

THE death is announced of Mr. A. W. Beetham, at Dawlish, in his ninety-fifth year; he was elected a Fellow of the Royal Society in 1835. We also notice the death of Mr. J. C. Smith, president of the Institution of Civil Engineers of Ireland; of Dr. Hermann Grote, one of the most eminent experts in numismatics; of Mr. G. N. Lawrence, a leading American ornithologist; of General de Nasouty, founder and director of the Pic du Midi Observatory, which for twenty-one years has rendered great service to agriculturists in the French Pyrenees; and of Prof. Julien Brunhes, at Dijon.

THE Belgian Academy of Sciences offers a prize of 600 francs for the best essay on each of the following subjects:—(1) On the number of chromosomes before impregnation in an animal or a plant; (2) On the Quaternary Flora, especially that of peat-bogs; (3) Is there a nucleus in the Schizophyta? if so, what is its structure and its mode of division? The essay must contain a critical review of the publications existing on the subject. Each essay must be the result of original investigation.