THE HUXLEY LABORATORY FOR
BIOLOGICAL RESEARCH,
AND THE MARSHALL SCHOLARSHIP.

SCIENTIFIC friends and former pupils of Prof. Huxley will alike be gratified to learn that an appropriate method has been devised for establishing a permanent memorial of his great services to the institution with which his name has been so long identified. The late Sir Warrington Smyth, whose loss we had to deplore rather more than a year ago, was the last surviving member of the original staff of the School of Mines, as founded by Sir Henry de la Beche in 1851. Prof. Huxley, who, as long ago as 1854, succeeded Edward Forbes in the Chair of Natural History, continues to hold the post of Honorary Dean of the Royal College of Science, with which the School of Mines is now incorporated; and although, since 1885, compelled by ill-health to discontinue the work of lecturing, he is still, we are happy to say, able to take a kindly interest in, and to exercise a general supervision over, the biological studies carried on in the school.

How much the Central Institution for training teachers in science, which is now located at South Kensington, owes to the organizing faculty and unremitting labours of Prof. Huxley, only those who have been associated with him in the work can form any just estimate. During the first twenty years of its existence all attempts at practical teaching in the School of Mines were restricted to the subjects of chemistry and metallurgy, the space available in the Jermyn Street buildings only permitting of the existence of very small and inconvenient laboratories in connection with those two branches of science.

Soon after the first establishment of the school, larger and more convenient premises for carrying on the chemical instruction had to be obtained in Oxford Street; and in 1872, on the unanimous recommendation of the Council, the teaching of chemistry, physics, and biology, was transferred to the building at South Kensington, which had been originally designed as a School of Naval Architecture. At subsequent dates, as the inadequacy of the Jermyn Street buildings to accommodate both the school and the Geological Survey made itself more strongly felt, the divisions of geology, mineralogy, metallurgy, applied mechanics, and mining, were successively removed to the same place.

No sooner did Prof. Huxley find an opportunity afforded to him, than he energetically devoted himself to the realization of a long-cherished scheme for establishing a system of practical laboratory-instruction in biology, including both its zoological and its botanical aspects. The ground was broken by a short vacation course, in which an attempt was made to supply such practical instruction to persons engaged in teaching; this course was given in the summer of 1871, and in the following year the same system of laboratory-instruction in biology was introduced into the ordinary School of Mines curriculum. In establishing at South Kensington the biological laboratory which has become the model of so many similar institutions at home and abroad, Prof. Huxley sought and obtained the advice and co-operation of many of his fellow-workers in science, among whom may be specially mentioned Profs. Michael Foster, Thiselton Dyer, Ray Lankester, and Rutherford, with Dr. Martin and Dr. Vines. In carrying on and further developing the work, he has had the assistance of Profs. Jeffrey Parker and F. O. Bower, in the zoological and botanical departments respectively, and, in succession to them, of Mr. G. B. Howes and Dr. D. H. Scott.

From the period of the first foundation of the School of Mines, the importance had been kept in mind of combining original research with the work of teaching. No one at the present day needs to be reminded of the numerous important investigations which have been

prosecuted by Prof. Huxley, both at Jermyn Street and South Kensington. Memoirs of the highest value on various branches of comparative anatomy and palæontology have been interspersed with notable contributions to geology, to anthropology, and to botany; and from time to time excursions have been made still farther afield (predatory excursions they were regarded by some), into realms of thought more remote from the ordinary domain of the zoologist. But in all these varied avocations the interests of the teaching work were never forgotten; and it was made evident that the teacher, while carrying on investigations himself, was ever ready to suggest, stimulate, and supervise the investigations of others.

When, in 1885, ill-health compelled Prof. Huxley to relinquish his daily occupations in the school, it was found that, during the more than thirty years' occupancy of his post, he had accumulated a most valuable library of research, composed of treatises and journals dealing with every branch of biological science. This library he generously determined to present to the institution, the interests of which he had so long and earnestly laboured to promote. The Council of the School, in accepting this valuable gift, recommended that the room where these books were kept, and in which Prof. Huxley had so long carried on his work, should be entirely set apart for biological research; and the proposal at once met with the sanction of the Lords of the Committee of Council on Education.

The Huxley Laboratory for Biological Research is now arranged to accommodate two students, who will undertake investigations in connection with some branch of zoology, botany, or palæontology, the work being carried on under the supervision of the professors and assistant professors of the school. With a valuable library and all necessary appliances for work supplied to them, it may be hoped that the *genius loci* will not be without its influence upon these research students, and that a long series of important observations may be made, which will constitute an enduring and a worthy memorial of Prof. Huxley's connexion with the school.

It happens, very opportunely, that something in the way of a small endowment has already been provided to aid this scheme of biological research. As long ago as 1882, Miss Sarah Marshall, of Warwick Gardens, Kensington, wrote to Prof. Huxley, informing him of her intention to bequeath the sum of £1000, and her scientific books and instruments, to the Department of Science and Art, with a view to the establishment of a prize or scholarship in biology, in memory of her father, the late Mr. Marshall of the Bank of England. By the recent death of Miss Marshall, this bequest has now passed into the hands of the Lords of the Committee of Council on Education, and, by the advice of the Council of the Royal College of Science, it has been decided that the interest of the legacy shall be annually paid as a scholarship to a meritorious student, to aid him in carrying on some biological investigation in the Huxley Laboratory. We can only hope that this modest attempt at the endowment of research may be attended with success; and that this success may be so conspicuous as to encourage others to imitate the example of Miss Marshall, so that bequests of a similar character may be made in connexion with this and other institutions where scientific researches can be carried on.

ON VAN DER WAALS'S TREATMENT OF
LAPLACE'S PRESSURE IN THE VIRIAL
EQUATION: IN ANSWER TO LORD RAY-
LEIGH.

MY DEAR LORD RAYLEIGH,—From the heading of your first letter, and from the wide scope of the passage you quoted from my paper, I imagined that you intended to raise the whole question of Van der Waals's

treatment of Laplace's pressure. Otherwise I should not, in my answer, have referred to his δ or to the unfortunate results of comparing his formula with experiment. I should, in fact, have contented myself with the acknowledgment that you had given an accurate account of the contents of a portion of Van der Waals's earlier chapters, which I had carelessly missed on the first hasty perusal; and that these contents justified the expression $3Kv/2$ as the virial of Laplace's pressure. But to this I should certainly have added that, even had I been fully cognizant of that portion of the pamphlet when I wrote my paper, I should probably not have modified (at least to any serious extent) the passage you quoted.

For (1) that passage contains the distinct statement that, from the static point of view, reasons "satisfactory on the whole" were given by Van der Waals for regarding Laplace's pressure as proportional to the square of the density. And it would have been illogical on my part to object, except on the ground of insufficient generality, to the equation

$$\left(\phi + \frac{a}{v^2}\right)v = \frac{1}{3}\Sigma(mu^2),$$

though I might have regarded the mode of its establishment as obscure or even doubtful.

In fact, the equation which is one of the main features of my own paper, viz. :—

$$\phi v + \frac{A}{v+a} = \frac{1}{3}\Sigma(mu^2) \cdot \left(1 + \frac{e}{v+a}\right),$$

includes it as the particular case when

$$e = 0, \quad a = 0.$$

What I objected to was a totally different thing:—viz. the above equation manipulated by the introduction of the factor $(v - \delta)/v$ in the left-hand member.

Again (2) the equation

$$\phi(v - \beta) = \frac{1}{3}\Sigma(mu^2)$$

is obtained in my paper (§ 64), and is there spoken of as "perfectly legitimate," but *only* on the distinct condition that

$$\beta\Sigma(mu^2)/3v,$$

where β is four times the sum of the volumes of the particles (§ 30), "*be small in comparison with the other terms in the [virial] equation.*" As one of these terms is the quantity $\Sigma(mu^2)/3$ itself, this implies that for the truth of the equation β/v must be a small fraction; and it is most certainly not so at the critical point of carbonic acid, which furnished the first and one of the most important cases for the application of the virial method. In fact the equation above, when correctly obtained, comes originally in the form (in which it ought to be preserved)

$$\phi v = \frac{1}{3}\Sigma(mu^2) \cdot \left(1 + \frac{\beta}{v}\right);$$

again a particular case of my own equation, viz. when

$$A = 0, \quad a = 0, \quad e = \beta.$$

Here the factor $1/v$ is (roughly) proportional to the number of collisions per particle per second, and it is in that capacity that it appears in the equation. As I said in my former letter, it is impossible (at least with Van der Waals's mode of interpreting $\Sigma(mu^2)$) to derive from this a cubic in v ; even when the term a/v^2 is introduced as a simple addition to ϕ :—unless, for the express purpose of obtaining the indispensable cubic, we write $v/(v - \beta)$ in place of $(v + \beta)/v$, on the right-hand side; which is, practically, what Van der Waals does. The true mode of getting a cubic here, if we keep to Van der Waals's interpretation of $\Sigma(mu^2)$, is to write $\beta/(v - \gamma)$ instead of β/v . This can, to a certain extent at least, be justified; the other method can not.

On the question of the introduction by Van der Waals of the factor $(v - \delta)/v$, whether or not it is applied alike to

ϕ and to K , I regret to find that our views must continue to differ. For it appears to me that when once the various terms of the virial equation have been correctly extracted from the expression $\Sigma(Rr)$, we have no right to modify any of them. There seems therefore to be no doubt whatever that the procedure in Van der Waals's sixth chapter is entirely wrong in principle:—except in so far as (in the German version) he borrows some correct expressions from Lorentz. The meanings of v and of ϕ , in the term ϕv of the virial equation, are (from the very beginning of the inquiry) definitely assigned as total volume and external pressure:—so that this term cannot in any way be altered. No more can the term $\Sigma(mu^2)/3$, or the ratio of these two terms. Van der Waals's argument seems (for his pamphlet is everywhere somewhat obscure) to be that (when there is no molecular force) *in consequence of the finite diameters of the particles the pressure, for a given amount of kinetic energy, will be greater than if these were mere points.* Perfectly true:—but we must seek the expression for this increase of pressure in the remaining parts of the term $\Sigma(Rr)$, and *not* artificially introduce it by diminishing the multiplier of ϕ in a term already definitely extracted. And further, if this procedure of Van der Waals were allowed to pass without protest in so far as the term ϕv is concerned, I think that we should logically be forced to treat the term Kv (not to the same but) to a very different factor:—for *here* the consideration of the finite volumes of the particles would appear to call for a *reduced* rather than an increased value of K ; and therefore analogy would require a multiplication of the term Kv by some such expression as $(v + \gamma)/v$, where γ is essentially *positive*.—Yours very truly,

P. G. TAIT.

Edinburgh, 17/10/91.

NOTES.

TO-DAY the Senate of Cambridge University will decide whether official inquiry shall be made as to the expediency of allowing alternatives for one of the two classical languages in the Previous Examination, either to all students or to any classes of students other than those already exempted. Everyone who devotes attention to questions connected with the higher education recognizes the importance of the issue, and the discussion of the subject has been followed with wide-spread interest.

THE ordinary general meeting of the Institution of Mechanical Engineers began yesterday evening, and will be continued this evening, at 25 Great George Street, Westminster. The papers to be read and discussed, as we have already stated, are by Mr. Samuel Boswell and Prof. W. C. Roberts-Austen, F.R.S.

THE Geologists' Association will hold a *conversazione* at University College, Gower Street, on Friday evening, November 6. Members are invited to send exhibits, and to let the secretary know the nature of the object or objects they propose to show.

AT the meeting of the Royal Horticultural Society in the Drill Hall, Westminster, on Tuesday, there was an interesting display of autumn foliage arranged for aesthetic effect. A lecture was delivered by Mr. H. J. Veitch, who urged that trees and shrubs in gardens and plantations should be selected, not only with a view to their summer beauty, but also with regard to their autumn hues; and he had many suggestions to offer as to the various ways in which these hues may be most effectively contrasted.

PROF. BOYS has arranged his apparatus for the repetition of the Cavendish experiment in the basement of the Clarendon Laboratory, Oxford. The experiment will be proceeded with immediately.

WE regret to have to record the death of Dr. Philip Herbert Carpenter, F.R.S., the fourth son of the late Dr. W. B. Car-