LETTERS TO THE EDITOR.

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Science at Oxford and Cambridge.

I HAVE read with great interest Prof. Perry's article on "Oxford and Science" and his letter in NATURE of January 21, and assuming as I do that his remarks apply equally to Cambridge, I know that he has in no way overstated his case. There are one or two effects of the present system which I feel that he has scarcely brought out sufficiently strongly, and on which I lay the more stress, as I consider that they are harmful in more ways than one.

I well know the asphyxiating atmosphere of which he speaks, and I compare it to that of a septic tank the contents of which are reduced in time to the form of an innocuous but useless effluent. Had they been spread out over the country at large they would have been of value in raising up a fertile growth of scientific progress.

The university professor is generally in a position to disregard the apathy of his university, and to pursue researches for their own sake. In the case of the enthusiastic student who is desirous of embarking on a career of teaching combined with research, the effects of the present system are far more deadly, especially if he belongs to a small college where the mediæval atmosphere is usually most concentrated.

In the present day it is generally impossible, and if possible it is always highly inexpedient, that a man should devote his energies to research, pure and simple, without taking some part in the educational work which is being carried on all around him. But the man who, after taking a brilliant degree *in arts or science*, seeks to associate himself with the teaching and examining work of his college or university, frequently finds himself baulked at every step by the opposition of a hostile but influential *clique*, although he is being continually urged by his friends to remain at the university in the hope that he may ultimately obtain that recognition which is freely conferred on men of less originality. Although the dons of his college will not raise a finger to help him, they do everything in their power to dissuade him from engaging in such outside work as a man without teaching experience has a reasonable prospect of obtaining in these days of competition. When a good professorship falls vacant, they write testimonials belauding his original work, of which they know nothing, but his candidature breaks down as soon as questions are asked about his teaching experience.

[A striking contrast to this spirit is seen in the excellent work done by certain well organised departments, such as the Cavendish Laboratory and a few enlightened colleges.]

What I have attempted to describe is not the experience of a single individual; from the number of cases that have come before my notice I feel sure that it must be a common experience.

I now pass to the other side of the question. When a vacancy occurs in a university college, it frequently happens that there is one candidate whose brilliant distinctions place him far above his rivals, and whose appointment would *in all probability* greatly conduce to the success and welfare of the department of which he would have charge. The electors would gladly appoint him if *any* definite evidence could be adduced as to his capability of discharging the duties required of him, but failing such evidence they are obliged, after a long and protracted discussion, to choose the second candidate on their list.

I know men who have broken through the barrier, both from Oxford and from Cambridge. I am glad to have such men as colleagues, for I know that they are doing splendid work in raising up a high standard of university education throughout Greater Britain.

Our university colleges have not been afraid to establish scholar assistantships in departments in which the work is too heavy for the existing staff. Why should not the same procedure be adopted at Oxford and Cambridge? This would often enable the colleges to give their best graduates a good send-off into the world, and it would relieve the present teaching staffs of much burdensome routine work. We might even have college tutors waxing enthusiastic over scientific research!

G. H. BRYAN.

The Radiation from an Electron moving in an Elliptic, or any other Orbit.

I HAVE been looking for a tolerably simple way of expressing the radiation at a distance from an electron, to avoid the work involved in reducing the general formulæ (NATURE, November 6, 13, 1902) in special cases. The result is

$$\mathbf{E}=\frac{\mu Q}{4\pi r}\ddot{\mathbf{s}}\sin\gamma, \qquad (1)$$

subject to

$$R=v(t-t_1). \qquad (2)$$

Here understand that Q is the charge moving in the path defined by the vector $\mathbf{s}$ from the origin at the moment t_1, and $\mathbf{E}$ is the electric force at the corresponding moment t at the point P at the end of the vector $\mathbf{r}$ from the origin, at distance R from Q, and γ is the angle between $\mathbf{r}$ and $\ddot{\mathbf{s}}$. That is, the electric force is the tangential part of the vector $\ddot{\mathbf{s}}\mu Q/4\pi r$, or the part perpendicular to $\mathbf{r}$. The magnetic force is perpendicular to $\mathbf{E}$, given by $E=\mu vH$. It is assumed that s/R is very small, but no assumption has been made about u/v, so the waves are fully dopplerised. The dot indicates time-differentiation at P.

Example. Elliptic orbit. Let

$$\mathbf{s}=\frac{1}{n}\left(\mathbf{i}u_2\cos nt_1+\mathbf{j}u_1\sin nt_1\right). \qquad (3)$$

Then Q describes an ellipse in the plane x,y, axes u_2/n and u_1/n, where $n/2\pi$ is the frequency. It is the spring or pendulum kind of elliptic motion. Describe a spherical surface with centre at the centre of the ellipse, and project $\mathbf{s}$ upon the surface, and insert the result in (1). Then we get

$$E_\theta=\frac{\mu Q}{4\pi rn}\cos\theta\frac{d^2}{dt^2}\left(u_2\cos\phi\cos nt_1+u_1\sin\phi\sin nt_1\right), \quad (4)$$

$$E_\phi=\frac{\mu Q}{4\pi rn}\frac{d^2}{dt^2}\left(u_2\sin\varphi\cos nt_1-u_1\cos\phi\sin nt_1\right), \quad (5)$$

expressing the θ and ϕ components of $\mathbf{E}$ at the point r,θ,ϕ, if θ is measured from the z axis, and φ from the plane z,x.

Yet one thing more. The connection between t and t_1 is

$$nt_1=n\left(t-\frac{r}{v}\right)+\frac{\sin\theta}{v}\left(u_2\cos\varphi\cos nt_1+u_1\sin\phi\sin nt_1\right), \quad (6)$$

which gives

$$\dot{t}_1=\left\{1-\frac{\sin\theta}{v}\left(u_1\sin\phi\cos nt_1-u_2\cos\phi\sin nt\right)\right\}^{-1}, \quad (7)$$

which is required when (4) (5) are differentiated. This process introduces the factor $\dot{t}_1^3$, and so, at high speeds, converts the radiation into periodic pulses, as in the case of a circular orbit (NATURE, January 28, p. 293). Put $u_1=u_2=u$ in the present formulæ to reduce to the circular. The analysis to simply periodic vibrations may be done in a similar way. If the motion in the elliptic orbit is of the planetary kind, the equation (3) is replaced by a much less manageable one. Electrons can conceivably vibrate in both these ways, according as the centre of force is condensed positive electricity, or is the centre of diffused positive electricity.

This is not the place for detailed proofs, but I can indicate one way of representing the matter which has some interest apart from the speciality of orbital motion. Given that Q is moving anyhow, it may be shown that my general formula for $\mathbf{E}$ may be converted to

$$\mathbf{E}=\frac{\mu Q}{4\pi}\ddot{\mathbf{R}}_1+\frac{\mu Qv}{4\pi R^2}\left(\dot{\mathbf{R}}-3\mathrm{R}\mathbf{R}_1+v\mathbf{R}_1\right) \qquad (8$$

This gives $\mathbf{E}$ at P, at distance R from Q, and $\mathbf{R}_1$ is the unit vector $\mathbf{R}/R$. The centre varies as we shift P, because Q is moving. It is always to be understood