The answer is, of course, that there is not one. Government exacts multiple marks of vaccination, but in Gloucester it is clear that there was a better case for the single than for the multiple marks. Government exacts re-vaccination in the services, but here there is a large number of re-vaccinated cases, and twice Von Swieten's fatality in them.

Then, again, it is clear that the eruption has, as of old, everything to do with the fatality, and nothing can be clearer in the Gloucester cases. Unless, therefore, you have taken the precaution of giving reference to the register of vaccinations, you are in the fix of having almost certainly got wrong with your classification. Is there any test of this? There most certainly is. For in the variety of the disease, in which there is not so much damage to the skin as discoloration of it, where the poison is damaging the whole system, and internally more than externally, we have still the vaccination marks, if they are noted. I gave before the Commissioners all these cases that I had been able to trace in a large number of reports. And here is the fatality of these "malignant" cases.

	Per cent. died.
Vaccinated malignant cases	83·5
Unvaccinated cases	90
The first line divides thus—	
Vaccinated, no evidence	82
Doubtfully vaccinated	81
Indifferent vaccination marks	84
Good vaccination marks	85

It is very clear, therefore, that there is not the slightest influence in vaccination, good, bad, or indifferent, to abate the fatality of these cases. In some of the hospitals the whole of the vaccinated in this class died, without any recoveries. But that way of returning the cases is only followed occasionally, so that there is no possibility of taking all the hospital experience. There is however, no reason to suppose that it would show any different results. All these cases, with the almost unvarying total fatality, show that there is high time for a reference of every possible case returned as unvaccinated to the vaccination officer for his verification, and for information as to whether there had been the payment for successful vaccination. Till that is done, we have the right to say that there is not the slightest gain accruing from vaccination in the cures of the small-pox, and that there is all reason for declaring the present classification by skin marks in this eruptive disease unscientific and erroneous. ALEX. WHEELER.

Darlington, April 17.

[In deference to the wishes of Mr. Wheeler we print the enclosed letter, after which our columns must be closed to the subject unless something very important is brought forward. Of course, as Mr. Wheeler says, he has completely departed from the original controversy; and it is necessary to call attention to the fact that no amount of statistical jugglery, or reference to assumed historical data, can be held sufficient to refute the unquestioned fact that in Gloucester the unvaccinated children were attacked with small-pox and died in overwhelming disproportion to the vaccinated. Epidemics, as we know, cannot be compared with one another as regards their severity, but the incidence of attack in the same epidemic may always be taken as being fairly comparable throughout.—ED. NATURE.]

RÖNTGEN RAYS AND ORDINARY LIGHT.

ACCORDING to the theory of the Röntgen rays suggested by Sir G. Stokes,[1] and recently developed by Prof J. J. Thomson,[2] their origin is to be sought in impacts of the charged atoms constituting the kathode-stream, whereby pulses of disturbance are generated in the ether. This theory has certainly much to recommend it; but I cannot see that it carries with it some of the consequences which have been deduced as to the distinction between Röntgen rays and ordinary luminous and non-luminous radiation. The conclusion of the authors above mentioned,[3] "that the Röntgen rays are not waves of very short wave-length, but impulses," surprises me. From the fact of their being highly condensed impulses, I should conclude on the contrary that they *are* waves of short wave-length. If short waves are inadmissible, longer waves are still more inadmissible. What then becomes of Fourier's theorem and its assertion that *any* disturbance may be analysed into regular waves?

Is it contended that previous to resolution (whether merely theoretical, or practically effected by the spectroscope) the vibrations of ordinary (*e.g.* white) light are regular, and thus distinguished from disturbances made up of impulses? This view was certainly supported in the past by high authorities, but it has been shown to be untenable by Gouy,[1] Schuster,[2] and the present writer.[3] A curve representative of white light, if it were drawn upon paper, would show no sequences of similar waves.

In the second of the papers referred to, I endeavoured to show in detail that white light might be supposed to have the very constitution now ascribed to the Röntgen radiation, except that of course the impulses would have to be less condensed. The peculiar behaviour of the Röntgen radiation with respect to diffraction and refraction would thus be attributable merely to the extreme shortness of the waves composing it. RAYLEIGH.

April 18.

1 *Manchester Memoirs*, vol. xli. No. 15, 1897.
2 *Phil. Mag.*, vol. xlv. p. 172, 1898.
3 See also Prof. S. P. Thompson's "Light Visible and Invisible" (London, 1897), p. 273.

THE BAKERIAN LECTURE.[4]

THE purpose of the lecture was to show that certain metals and certain organic bodies can act on a photographic plate in such a manner that, on treating it exactly as if it had been acted on by light, a picture is developed. When carrying on some experiments with photographic plates, a piece of perforated zinc was found not to act as a screen and give a picture of the holes, but to give a picture of the metallic part; and further, it was found that a bright piece of zinc, when coated with copal varnish, with the object of stopping any emanation of vapour from it, became more, not less, active; these were the accidental observations which gave rise to the present investigation. With regard to the action of the organic bodies: their activity is greater than that of the metals, and the experiments with them are more easily carried out, hence it was advisable to investigate to a considerable extent their action before undertaking the more intricate and, probably, more important action of the metals.

Printing ink is one of the many substances which will, both when in contact and when at a distance, act on a photographic plate, and it was shown that remarkably clear pictures can be obtained of ordinary printing and of lithographic pictures. Printing ink varies in composition, and if the ordinary newspaper's, for instance, be used, the density of the pictures obtained will vary considerably. The varnish known as picture copal is also an active substance producing a dark picture. The active constituent of the printing ink was proved to be boiled oil, and in the varnish to be turpentine; and these bodies alone can be used in place of the more complicated substance above named. If then boiled or drying oil was active, it was natural to try linseed oil in its ordinary state, and this proved also to be active; different specimens, however, of so-called pure oil vary very considerably in the amount of their activity. Passing from linseed oil to other vegetable oils, they were found also to be active, but apparently none so active as the linseed oil. Then, with regard to turpentine, a body belonging to a very different class of organic substances, it was found that bodies analogous to it—all the terpines,

1 *Journal de Physique*, 1886, p. 354.
2 *Phil. Mag.*, vol. xxxvii. p. 509, 1894.
3 Enc. Brit., Art. "Wave Theory," 1888; *Phil. Mag.*, vol. xxvii. p. 462, 1889.
4 Delivered before the Royal Society, March 24, by Dr. W. J. Russell, V.P.R S.