

¹⁴ *M. N.*, vol. 81, p. 104.

¹⁵ *Trans. R. S.*, vol. 221A, p. 239.

¹⁶ *M. N.*, vol. 80, p. 807.

¹⁷ *M. N.*, vol. 81, p. 89.

¹⁸ *M. N.*, vol. 85, p. 560.

¹⁹ A summary of his book, *The Surface of the Earth*.

THE REDDISH BLUE ARCS AND THE REDDISH BLUE GLOW
OF THE RETINA: SEEING YOUR OWN NERVE CURRENTS
THROUGH BIOLUMINESCENCE

BY CHRISTINE LADD-FRANKLIN

COLUMBIA UNIVERSITY

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A simple band of bright red light thrown upon a screen in a dark room gives rise to a very curious phenomenon—discovered in the first instance by Purkinje.¹ What you see on the screen is not only the red band but also, projecting out from it on both sides, big slightly reddish blue arcs. They are not of the color of the visual purple, which is a slightly bluish red. If one considers the shape and the angular size of these arcs, it is perfectly plain that what one sees, as an entoptic phenomenon, is certain fibres of the optic nerve which lie on the surface of the retina and which proceed to their exit point, the papilla. But why are they visible? The explanation that has been given of this phenomenon hitherto, by Gertz, by Tröland and by others, is that the nerve current by which one sees the red band gives rise to a secondary induced current in adjoining nerve fibres. Such a current as this, however, would not be provided with the right “place coefficients”—it would not enable one to see the stimulated fibres in the place where they lie. Let me put this hypothetical question: Suppose that one could lay open an optic nerve fibre all the way from the retina to the occipital lobe of the cortex, and suppose that one were to pinch it in half a dozen different places. The pinching of this nerve fibre would give one a light sensation (either chromatic or achromatic), but *where* would that sensation be seen to be?—not, certainly, in the half dozen different places in which the nerve fibre is pinched. The sensations would one and all seem to be in that direction in the external world which is in one-to-one correspondence with the rod or cone in the retina from which the fibre which is pinched has come. We have the same situation when the man who has had his leg amputated at the knee has a nerve fibre pinched—he feels a sensation of tickling (or something), but he feels it not in his knee but in the ball of his foot.² It is therefore plain that in the case of the

Blue Arcs of the Retina no possible nerve current evoked in adjoining fibres by the fibre which is conveying the red-light exertation would enable you to "see" those fibres, the actual place-coefficients attached to a sensation produced in this way would be entirely wrong.

There is another insuperable difficulty in resorting to any sort of a nerve-fibre stimulation as the cause of the reddish blue arcs. An after image of these blue arcs can be obtained; one gets a sensation which meets the requirements of the after image both in achromatic intensity and in chroma—it is of a slightly greenish yellow. But an after image does not occur after a stimulation of the visual mechanism by an electric current. This one would have been inclined instinctively to take as self-evident; but it has now been proved beyond question by the work of Lazareff, in which he finally demonstrates that nerve action is not (and cannot be) subject to fatigue.³

That nerve fibre when stimulated gives off some sort of an emanation which enables it to take its own photograph has now been proved by Nodan;⁴ and it is perfectly easy to suppose that this "emanation" may be of the nature of visible light or at least of a nature to produce visible light by means of fluorescence, which is known to occur in the retina.

Various details of this phenomenon—the blue glow, which has been entirely overlooked by most observers, the absence of the effect in the case of individuals who have myelinated fibres in this region of the retina, and other considerations—make it very certain that its real cause is a bioluminescence on the part of the stimulated nerve fibres. It would follow that all nerves when stimulated shine by their own light—a light which is invisible, of course, when the nerves are not non-myelinated. One has not discovered this before, because, although one devotes much time to studying the stimulated nerve fibre, one does not do it in an absolutely dark room.

¹ This rare work of Purkinje—so rare that Gertz reproduces what Purkinje says about this phenomenon, because so few of his readers will be able to see his book—has now been reproduced in Czecho-Slovakia. Purkinje, Johann Evangelista, *Opera Omnia*. Praha: C. Calve, 1919.

² To express this situation the psychologist has need of a new term. It is absurd to apply the phrase "local sign" to the case of the knee and the foot. "Sign" is a wrong term anyway, for there is every reason to think that we have here to do with an actual element of consciousness, and not at all with a *sign* simply. I propose "place-coefficients" as the proper term for this form of *attachment* to the pure sensation.

³ Lazareff, *Comptes rendus de l'Academie des Sciences*, 1925.

Katz, David: "Die Illusionen der Amputirten," *Beiheft zur Zts. f. angewandten Psychologie*, Leipzig, Barth, 1921.

⁴ Nodan, Alfred: *Ibid.*, 1923-1926.