

refuses to flow, and remains aggregated in oil-drops over the surface. When the glass in the proximity of one of these drops is heated, the oil is seen to creep away from the heated part, leaving behind it no trace of oil on the surface.

3. On "Tait's Property of the Retina."

By George Forbes, Esq.

Professor Tait having asked me to communicate to the Society some experiments I have made from time to time on the property of the retina discovered by him, and communicated to this Society, 15th January 1872, I prepared the following notes. It will be remembered that he pointed out that when the eye has been rested for a long time the first impression of light gives a red colour. Professor Crum Brown stated at the same meeting, that after Professor Tait had told him of the appearance he had himself observed a like phenomenon. Awaking one morning at grey dawn, and opening his eyes suddenly, he saw a glare of red on the window, and was so struck by it that he hastily rose to discover what house was on fire.

The circumstances under which Professor Tait made the observation were as follows:—He was suffering from sleepless nights owing to the illness arising from re-vaccination. He found that at each time of awaking, a portion of the wall feebly illuminated by a gas-flame appeared to have a crimson hue, and acquired its true white colour only after a few seconds of time.

I have very little to tell the Society, except to corroborate the evidence of Professor Tait, and to describe a method of observation that removes the necessity for re-vaccination or even sleepless nights. I have reproduced the appearance, I suppose, thirty times during the past winter. I lower the gas until there is only a small blue flame. This may be done before going to bed, and the experiment made in the morning, provided the window is darkened by shutters. In the morning, on suddenly turning up the gas, either the gas-flame assumes the crimson flush, or if there be a globe of ground glass on the gas, that globe assumes the hue. If the gas be quickly lowered again, a short rest is sufficient before repeating the experiment. It is never necessary (in my case) to

be in the dark for more than an hour or so. But when the time of darkness is short, the crimson flush is seen only for a small fraction of a second. It is not necessary to have just awoken from sleep, though certainly this seems to favour the appearance, making it more extended and more lasting. The colour of this appearance is the same as that crimson flush which is often seen when the eyelids are closed and a light is shining on them. This struck both Professor Tait and myself, and led him to test whether it was due to the same cause, viz., the passage of light through the blood-vessels.

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I had proceeded thus far, and had moreover duly apologised to the Society for offering them a communication with so little novelty in it, when accident, or rather an inexcusable drowsiness, led me to perform some experiments that I look upon as of far greater importance, in that they give an extension to the property of the retina observed by Tait, in a direction quite unlooked for.

When travelling in the train from Edinburgh to London lately, I had my eyes closed, and frequently saw that crimson flush which is so often seen under such circumstances, and to which I have already alluded. This has been stated by Professor Tait and myself to be of the same hue as that observed by him in the cases mentioned in his note. It has always been attributed without any doubt to the passage of the light through the blood-vessels of the eyelid. But I soon noticed a remarkable fact, viz., that if the light of the sky remained of the same brightness, in other words, if the sun were not flitting behind clouds, this crimson flush gave place to a dingy orange or even yellowish brown colour. The brilliant crimson flush was in these circumstances seldom visible on closing the eyelids, and it invariably gave way to this dingy colour. On continuing to repeat this experiment, no doubt remained on my mind of the fact. Being now convinced that the appearance of white light passing through the blood-vessels of the eyelid is of this orange colour, I was at a loss to account for the crimson flush that is so often seen. I soon noticed, however, that when the eyes were closed, this brilliant colour never made its appearance, except at such moments as when the sun burst out from behind a cloud, thus brightening the field of view. I then

covered my closed eyes with my hand, so as to cause complete darkness. If I now removed my hand, the eyelids still being closed the crimson flush made its appearance; the darkness having been continued for a considerable time. I soon found that if the closed eyes were first directed to a white handkerchief, and then to the bright sky, the crimson flush made its appearance. At this stage the true explanation of the phenomenon began to appear. It was that the colour of white light that has passed through the eyelid is dingy orange or yellowish brown, and that the crimson flush is due to Tait's property of the retina, namely, that *when the eye is suddenly illuminated, or when the illumination is suddenly increased, the retina first acquires the power of recognising the deep red; but the other colours usually follow so rapidly as to prevent this fact from being recognised.* I hope that Professor Tait will allow me to make this slight addition to his statement, as originally made.

According to this theory, the reason why this flush is only sometimes seen is, that peculiarly favourable circumstances are necessary for observing it. These are (1), a very long rest to the eye, (as this is how Professor Tait and Professor Crum Brown saw it); or (2), a very sudden illumination of the retina (this is the experiment of the gas-flame described in the first part of this communication); or (3), an exposure to a very feeble light after the eye has been in the dark for a short time (this is what I have just described). To prove still further that this, and not the transmission of light through blood, is the true explanation of the crimson flush as usually seen, I tried the following experiment:—A piece of common whitey-brown paper, four folds thick, was placed in front of one eye (the other being quite darkened). This shaded eye was kept dark for a short time, then keeping it closed to the skin to prevent stray light from entering, the head was raised, and the eye opened pointing to the sky. The crimson flush was unprecedentedly vivid, but soon yielded to the yellow colour of the paper employed. Lastly, six folds of plain white glazed writing paper were placed in front of the eye in the same manner. A longer duration of darkness was necessary than in the last case, but then the crimson flush was well shown, the colour then changed to orange, and it was some time before it assumed its natural white colour.

These experiments, then, prove that the transmission of light through the blood-vessels is not necessary for the production of the crimson flush, and that a long rest be given to the eye to perceive the phenomenon described by Professor Tait, and that the former depends upon the latter effect.

In the experiments last described the whole of the retina was affected. There is still one point that requires explanation. How is it that either a very powerful or a very feeble light is the most potent, either a gas flame or diffuse light that has passed through several folds of paper? At first this seems to militate against the identity of the two phenomena, but a little consideration explains difficulty. First, if the light be very bright, *e.g.*, a gas flame, the red will certainly have a greater tendency to appear, but it seems *a priori* likely that the other colours will also soon become apparent. Thus we should expect with a powerful flame to see a very intense redness, lasting a very short time. Second, if the light be very feeble, *e.g.*, diffuse light passing through paper. Here it is not likely that we should get so brilliant a red, but it is certainly very probable that it will be much longer before the other colours become sensible, since they are so feeble. We should expect then, in this case, to have a less powerful red lasting a longer time, but with the gas flame a strikingly brilliant flush, lasting a very short time. Again, with a medium light the green and blue colours would be added rapidly, and the crimson flush would not be powerful enough to be conspicuous in that short time. I may say that in every point this agrees exactly with the appearances as they are really seen.

4. A Theory of Volcanic Eruptions. By Daniel Vaughan.

From researches which have much engaged my attention for nearly twenty years, I am convinced that silica performs a very important part, not only in the formation of the earth's crust, but also in leading to violent subterranean movements. The low specific gravity of silicic acid, and of the rocks in which it predominates, would (if much of the internal earth were fluid) give rise to certain results, which I traced in an essay published in 1856, and also in a paper which was brought before the British Association for the Advancement of Science in 1861. In the latter, I have given