The following Communications were read:—

1. On the Diurnal Oscillations of the Barometer.

By Alexander Buchan, M.A.

2. The Phenomena of Single and Double Vision, as shown in the Stereoscope. By R. S. Wyld, Esq.

When we direct the axes of the two eyes to any definite object, its different parts affect *corresponding* parts of each retina, and the object appears *single*. When we squint, or do not look direct at the object, its images affect *non-corresponding* parts of the two retinæ, and the object appears double. The more widely the axes of the eyes are deflected from the object, the further asunder the double objects seem; and the less the axes are deflected the less distant from each other the double objects appear. Thus, when we hold the finger in front of the eyes while we look at a distant candle or gas jet, the flame appears single and the finger double. When we turn the eyes to the finger it appears single and the flame appears double.

The paper read to the Society in February 1871 was an attempt to prove that all the phenomena connected with single and double vision were explainable on the supposition that the nerve fibres of each retina decussate in a common cerebral sensorium, as for instance in the *corpus quadrigeminum*, which the optic nerves are known to enter; and that as, owing to the fineness of the texture, anatomists had hitherto been unable to determine the ultimate arrangement of the fibres in the brain, we were justified in making this suggestion.

Such a crossing of nerve fibres has in it nothing improbable, for there are many instances of such crossings, as for instance in the great and in the lesser commissures of the brain. There is also a similar crossing in the *medulla oblongata* of the motor nerves from the brain, before they descend the spinal cord; and there is a similar crossing of the sensory nerves where they enter the spinal cord. The supposition then of a decussation of the fibres of the optic nerve within the brain is in analogy with what we know to be of frequent occurrence in the body.

The facts which Mr Wyld now brings before the Society are these—

1st, When we enter two slips of white card-board, one at each side of the stereoscope, they affect *non-corresponding* parts of the retinae, as shown in the diagram exhibited, and they appear as *two objects*.

2d, When we push the slips forward till they appear to overlap, the overlapping ends appear as one object, because they affect the corresponding central points of the two retinae. If we make a mark similar in form and size on each slip, but do not approach the slips sufficiently near for the marks at once to coalesce, such marks are nevertheless frequently observed to glide closer and coalesce. This is owing to the natural tendency we have to direct the axes of the eyes to the objects examined. This causes the marks to affect corresponding points of the retinae, and the marks consequently coalesce visually and appear as one object.

3d, When the slips seem to overlap, the overlapping portion appears so greatly increased in brightness that the other parts have a tendency either to disappear altogether, or they appear and disappear at brief intervals, so long as we continue to look at the central bright portion. These dim or invisible outlying parts may, however, at any time be made to reappear by simply moving the card-board once or twice up and down, and thereby exciting the attention and the retina. They may also be made to appear by winking, by moving the eyes from side to side, or doing anything to stimulate the retinae.

4th, With regard, again, to the overlapping parts, it is to be observed, that though they appear at first sight to form, as it were, one single object, yet it is easy to see that this bright part is in reality a double picture containing the impression received from each eye; and so far as these impressions are not incompatible, but may be blended the one with the other, they go to form as it were a composite picture, as we know is the case with the figures on the usual stereoscopic slides, and as we may prove to be the case by making any distinctive marks on the slips of card-board, when these marks will appear distinctly visible, as if integral parts of the overlapping portion, though seen by the different eyes.

5th, Another important circumstance is this. When the slips are of different colours, as for instance one slip red and the other blue, or one blue and the other yellow, these colours, when caused to overlap in the stereoscope, do not produce the intermediate

colours of purple or green; on the contrary, as was stated in the paper alluded to, at one time the coloured slips appear alternately visible, at another time one half of each may be visible, and occasionally, spots, or it may be only minute specks, smaller even than the fifth part the diameter of a small pin head of the one colour, will be seen shining on the ground colour of the other card-board. These particular changes seem to depend greatly on the excited or the fatigued condition of the retinae at the time; for if we direct our attention to any conventional mark made on either of the slips presented, the excitement of the retina of the eye, caused by the act of observing the mark, immediately causes the slip on which the mark is made to become visible, and the mark appears surrounded with a patch of the colour of the slip on which it is placed.

Two circumstances then may be mentioned as certain: that in no instance do the two colours blend into an intermediate colour; and second, that we never observe the same portion of the bright overlapping portion to have at one and the same moment two different colours; parts or spots or minute specks may, as we have said, appear of the one colour, and other parts may appear of the other colour, but though the one coloured slip visually overlaps the other differently coloured slip, we never see any part at once to possess two different colours.

The conclusions to which these phenomena lead are certainly these—that there is a physical union in a cerebral lobe of the nerve impressions coming from the two eyes, and in no other way can we account for the two retinal images giving the mind the impression of but one object both in natural and stereoscopic vision when corresponding retinal fibres are excited, and of double objects when non-corresponding fibres are excited—and no other supposition will account for the increased brightness obtained by the use of two eyes than that suggested, namely, that the nerve impressions from both eyes are physically united in the sensorium.

Another conclusion to which we are led is, that though the corresponding retinal fibres are brought into juxtaposition in the sensory, yet they are not there joined or amalgamated the one with the other, seeing they do not produce the effect of an intermediate colour, but each fibre transmits to the sensory the distinctive colour and impression which it receives in the retina.

The reason why we never see any one part of the overlapping stereoscopic objects simultaneously exhibiting either two different colours, or an intermediate colour, is a matter more difficult to explain; perhaps the following may be considered sufficient explanation. If the *smallest visible point* is a point due to the impression produced by a *single nerve fibre* from one of the eyes, then, as on the supposition of a decussation of the fibres in the sensory alternate, exceedingly small specks of different colours may at any time appear intermixed, from the circumstance of the supposed *alternate juxta position* of the individual fibres from each retina in the sensory, so, if this supposition is correct, it is evidently impossible that we can ever have the impression of two different colours superimposed on the same point and at the same moment of time.

3. On the Products of the Oxidation of Dimethyl-Thetine, and its Derivatives. By Prof. Crum Brown and Dr E. A. Letts.

The difficulty experienced in determining the sulphur contained in the compounds of *dimethyl-thetine* (described in a former communication) by oxidation to sulphuric acid, induced the authors to study the effects of various oxidising agents on these compounds.

By acting on *nitrate of dimethyl-thetine* with *dilute* nitric acid, two bodies are produced. The one has acid properties, and forms a well-marked soluble salt with baryta. The other has neither acid nor basic properties. It crystallises in very beautiful needles from a hot solution in alcohol.

By acting on the base *dimethyl-thetine* with permanganate of potash solution, the same crystalline substance is produced, but the presence of the acid body could not be ascertained. The oxidation of *dimethyl-thetine* by permanganate of potash takes place in acid or alkaline solution and in the cold.

Chromic acid has no action whatever on *dimethyl-thetine* further than combining with it to form *chromate of dimethyl-thetine*—a yellow gummy substance which refuses to crystallise. The same body may be produced by acting on a solution of hydrobromate of dimethyl-thetine with chromate of silver.

Fuming nitric acid dissolves solid *hydrobromate of dimethyl-thetine* without rise of temperature, but with separation of bromine.