inches, each measurement is open to an error of from 1˙3 to 2˙0 per cent.

The product of these three is found, and is supposed proportional to the cranial capacity. That this is most imperfectly so in individuals is manifest ; but the author hopes that in the average of a large number of cases the effect of the extreme variability of shape of the head may be obliterated. He therefore tabulates the products, using the first decimal place, *i.e.* up to four significant figures. Since the original measurements only included two figures, the last two of the four must be inaccurate. The product is open to an error of 3 or 4 or even up to 6 per cent. Since the probable error is from 3 to 6 per cent., which is nearly the same size as the difference between the "honour" man's and "poll" man's heads, and also the difference supposed to be due to growth, I therefore hold that there is no evidence for any of the author's conclusions.

I have recently had a better opportunity of judging the value of the statistics, for two of my friends, who have been several times measured, have kindly shown me the results.

	Width.	Length.	Height.	Product.
X., June 1888	5˙8	7˙7	5˙6	250˙1
,, Nov. ,,	5˙9	7˙8	5˙2	239˙3
,, Dec. ,,	5˙9	7˙7	5˙5	249˙9
,, Jan. 1889	5˙8	7˙6	5˙4	238˙0
,, March ,,	5˙8	7˙6	5˙4	238˙0
,, May ,,	5 8	7˙7	5˙3	236˙7
,, June ,,	5˙8	7˙8	5˙5	248˙8
Y., Jan. 1888	5˙9	7˙5	5˙6	247˙8
,, March ,,	6˙0	7˙4	5˙4	239˙8
,, Aug. ,,	6˙0	7˙6	5˙5	250˙8

From the above table it will be seen that (1) in the measurements of the same individual taken at different times the width may vary 0˙1 inch ; (2) the length may vary 0˙2 inch ; (3) the height may vary 0˙4 inch ; (4) the above variations are not due to head growth, for they are as often negative as positive.

As anyone would expect who had seen the instrument used, the height measurement is most unsatisfactory. The error of 0˙4 inch is not an isolated case. Yesterday another friend of mine, who was measured for the second time, found that his height of head had apparently decreased 0˙5 inch.

The products are seen to vary in the first case from 236˙7 to 250˙1, nearly 6 per cent. So far are the figures capable of affording good evidence of head growth of either individual, they are so inaccurate as not to make certain whether X. or Y. had the bigger head. It is quite evident that numbers, each open to an error of 5 or 6 per cent., cannot, when combined into averages, teach us anything about differences as minute as 3 per cent.

Trinity College, Cambridge, July 16.   F. M. T.

THE errors made in measuring the height of the head are certainly much larger in the instance given by "F. M. T." than they should be ; still they do not seem to me large enough to throw doubt on the truth of the general conclusions to which he refers. (1) As regards the difference between the means of the "products" in the high honour and the poll men. Those means are 224 and 237, and they depend on 258 and 361 observations respectively, which numbers are much the same as 16^2 and 19^2. Therefore the probable error in the determination of each of these means will be equal to the probable error of a single "product" divided by 16 in the one case and by 19 in the other. I have as yet no data to determine the probable error of a single "product," due to faults of measurement alone, other than those given by "F. M. T.," which suggest, though in the rudest way, that it is about 4 units. Accepting this for the moment as a basis, the probable error of the means of the two sets of "products" would be 4 divided by 16 and by 19, equal, say, to $\frac{1}{4}$ and $\frac{1}{5}$ respectively. Now, the chance of an error exceeding 4 or 5 times the probable error is not worth regarding ; therefore safety, so far as regards the effects of inaccuracy of measurement, is practically to be found in each mean value beyond a range of about 1 unit. In the differences between the mean measures, safety will be found beyond the range $\sqrt{2}$, say

$1\frac{1}{2}$ units. But the two means 224 and 237 differ by as much as 7 units. It should, however, be remarked that the seven observations fall into two well-marked groups, each of which is very consistent within itself, but which differ from one another by 10 units. This raises strong suspicion of some peculiarity in the shape of the head, which caused doubt as to the exact line of maximum height, and that one line was followed in three of the measurements and another line in the remaining four. (2) As regards the differences between the high honour and the poll men at different ages, the observations at each stage are, of course, much less numerous than in the sum of all of them, still they range in all cases but two between 25 (or 5^2) and 102 (or say 10^2). Each person must judge for himself, from the diagram that accompanied my little paper, how far the run of those differences confirms my conclusions. I think they do well enough to give "an approximately true" idea of what we should find if we had the opportunity of discussing a much larger number of observations, and this was all that I claimed.

The remarks of "F. M. T." lead to two useful deductions. One is the desirability of checking, as soon as may be, the conclusions already reached, by discussing the observations that have since accumulated. The other is to improve, if possible, the method of measuring the height of head. The existing plan was adopted, after consultation with many competent persons, and many trials, as the best then available for making this very difficult measurement. I have, however, never ventured to introduce its use in my laboratory at South Kensington.

FRANCIS GALTON.

Intermittent Sensations.

IN a short notice in NATURE of May 23 (p. 86), calling attention to the intermittence of the intensity of some sensations, and more particularly to the experience of M. Couetoux as reported in the *Revue Scientifique*, the writer very properly remarks, that these sensorial fluctuations deserve more thorough study. It may interest him, therefore, to learn that the interrupted sensibility of the retina can be easily demonstrated, to anyone possessed of binocular vision.

Some years ago, on converging the eyes, so as to fuse the images of two squares, each square being composed of parallel lines 1 mm. broad with an equal interval between them, and the lines in one square being perpendicular to those of the others, I was astonished to find that instead of squares, which ought to have resulted from the perfect fusion of the two images, the field was occupied by a series of zig-zags, composed of portions of straight lines of each square, passing across the field sometimes from right to left, sometimes the contrary way, and too complex and transitory to admit of analysis.

Since your notice, while experimenting with my students with a stereoscope, we have obtained the same result in every case. But, in order to determine the rate of intermittence, the attention was fixed on a small mark made in the centre of one of the squares.

This mark was found, on an average of a number of experiments by different individuals, to be visible, with its accompanying lines, for from 6 to 8 seconds, and then completely extinguished ; and the lines of the other square, appearing for an equal interval of time, thus completed the cycle of activity and rest in from 12 to 16 seconds.

On covering the eye not directed to the mark, this point was never entirely lost sight of, but went through a series of changes of brightness and degradation of the sensorial impression, corresponding in time with those of the previous experiment.

These experiments seem to show that the impression is not equally intense, at the same instant, over the surface of each retina, but occupies successive areas, in somewhat irregular patches, which appear to be supplemented by the other retina in binocular vision It is probably due to this that the imperfect images of objects formed on the retina are corrected, and our perceptions made more accurate than they would be if our sensations were not intermittent. THOMAS REID.

11 Elmbank Street, Glasgow.

The Aurora.

THE aurora in the Unites States is rarely seen at a single station for two nights in succession, but is usually reported from different stations for about four days at each manifestation. Recurrence at intervals of nearly twenty-six days is common.