observed to about one hour after the first after-glow had disappeared below the horizon. The exact moment of this disappearance has been more difficult to determine than in the earlier observations where darkness followed; as recently the heavens and the earth have been reilluminated just as the natural night would have begun.

T. STORY-MASKELYNE

Salthrop, January 13

As the "halo" exactly opposite the sun, reported by Mr. T. W. Backhouse in *NATURE*, January 10 (p. 251) may prove to be of considerable importance, I beg to add my observations of it on the 12th. I had noticed a mass of ruddy colour under the given conditions, previously, but had not detected its strange nature. The sunset on the 11th was very fine. The 12th, until after sunset, was cloudless, except for the hazy masses which seem to precede every sunrise, and, more especially, sunset, at present. Our sunshine record is an unbroken scorch from 9.15 a.m. to 2.52 p.m. (sun seen clear of horizon at 8.26, and touched at 4.0); I doubt if, previously, we have recorded even five hours in early January. At 7.45 a.m. on the 12th (sun rose at 8.22) the cloud-glow had turned to silvery green below, and rose from 15° to 30° in the south-east. At 7.47 the rose reached 60° , but was fainter. I first noticed the "halo" at 7.52. It was then so well defined that, calling a lady's attention by asking what she saw there, she spoke of it as "a broad rainbow." Position, by compass, 30° north of west. It was a semicircle situated 10° above the horizon, standing on the dark gray arch of dawn, Jupiter being on a line with the base of the left end of the rosy arch. The inner arc of this measured 10° , and the outer 24° in radius, but it spread out to 30° at the base. The centre was of the same blue as the sky to the right and left of the rosy semicircle, above the gray. The base, sinking faster than Jupiter, spread out so that, at 8 o'clock, the arch having now broken above, its outline was rather like a railway chair. The base now reached from west-north-west to north-north-west by north. After sunset there were signs of a similar phenomenon, but clouds prevented certainty.

Is not fifty miles an underestimate for the altitudes of the light-reflecting material? If Mr. Symons is nearer the mark in his suggestion (100 to 200 miles), then more than half of the eastward velocity of the original erupted dust is accounted for by retardation, due to matter having velocity belonging to an earth radius of 4000 miles, revolving in a circle of 4100 to 4200 miles radius. Would it need an eruptive force of more than two to four miles per second (six to twelve times greater than a cannon ball) to attain such altitudes? The constant uprush would minimise the air-resistance enormously.

York, January 14

J. EDMUND CLARK

P.S.—January 15.—This morning, at 7.47, the "halo" began to form, but was not nearly as perfect as on the 12th. The arch (upper part only) was *rayed*, as if it were the opposite point of sight for rays from the sun. All over before 8, or fully twenty minutes before sunrise.—J. E. C.

WITH reference to Herr Wetterhan's inquiry as to the absence of the sky-glow in a clear sky at other places than Freiburg on the morning of January 11, I find that at San Remo, in Northern Italy, where I spent the week ending on that day, a similar falling off of effect occurred at the same time. The sunrise was "very fine, but nothing to compare with the sunset of yesterday," and "the filmy streaks were very thin, and stretched this morning from south-west by south to north-east by north." Nevertheless there was the strange bluish-white glare above the eastern horizon, casting shadows, and a thin pink film up to about 75° at 28 min. before sunrise. The sunset glow of this day and of the day before was magnificent, the procession of colours beginning about 15 min. after sunset, and lasting a full hour. I see that your Constantinople correspondent also mentions the sunset of the 11th as a remarkably fine one. The air on the 10th, not the 11th, as at Freiburg, was wonderfully transparent at San Remo, the whole range of Corsican mountains, over eighty miles distant, standing out sharply for 15 min. before and after sunrise, and the sun himself bursting forth in great splendour from below the sea line.

London, January 19

F. A. R. RUSSELL

Unconscious Bias in Walking

SOME ten or twelve years ago I made some experiments upon the subject of Mr. Larden's letter in *NATURE* (Jan. 17, p. 262),

namely, unconscious bias in walking. The experiments were not numerous, but they left no doubt in my mind as to the cause of divergence from a straight path. My notes were sent, at my father's suggestion, to the late Mr. Douglas Spalding, who was about to undertake experiments on the curious power which animals have of finding their way. I rather think he made some trials with pigs, but I believe he never published anything on the subject. In stating my results I am compelled therefore to rely on memory only.

I began with walking myself, and getting various friends to walk, with eyes shut in a grass field. We all walked with amazing crookedness in paths which were not far removed from circles. I myself and Mr. Galton on the first trial described circles of not more than fifty yards in diameter, although we thought we were going straight, and afterwards I was generally unable to impose a sufficiently strong conscious bias in one direction to annul the unconscious bias in the other. I believe we all diverged to the right excepting one of us who was strongly left-handed.

I then got eight village schoolboys, from ten to twelve years of age, and offered a shilling to the boy who should walk straightest blindfold. Before the contest, however, I dusted some sawdust on the ground, and after making each of the boys walk over it, measured their strides from right to left and left to right. They were also made to hop, and the foot on which they hopped was noted; they were then made to jump over a stick, and the foot from which they sprang was entered; lastly, they were instructed to throw a stone, and the hand with which they threw was noted. Each of these tests was applied twice over.

I think they were all right-handed in throwing a stone, but I believe that two of them exhibited some mark of being partly left-handed. The six who were totally right-handed strode longer from left to right than from right to left, hopped on the left leg, and rose in jumping from that leg. One boy pursued the opposite course, and the last walked irregularly, but with no average difference between his strides. When told to hop, he hopped on one leg, and in the repetition on the other, and I could not clearly make up my mind which leg he used most in jumping. When I took them into the field, I made the boys successively take a good look at a stick at about forty yards distance, and then blindfolded them, and started them to walk, guiding them straight for the first three or four paces. The result was that the left-legged boys all diverged to the right, the right-legged boys diverged to the left, and the one who would not reveal himself won the prize. The trial was repeated a second time with closely similar results, although the prize-winner did not walk nearly so straight on a second trial.

I also measured the strides of myself and of some of my friends, and found the same connection between divergence and comparative length of stride. My own step from left to right is about a quarter of an inch longer than from right to left, and I am strongly right-handed.

Comment on these experiments seems needless, and they entirely confirm Mr. Larden in his view.

It seems to be generally held that right-leggedness is commoner than the reverse; this I maintain to be incorrect. I believe that nine out of ten strongly right-handed persons are left-legged. Every active effort with the right hand is almost necessarily accompanied by an effort with the left leg, and a right-handed man is almost compelled to use his left leg more than the other. I believe that Sir Charles Bell considered that men were generally right-legged, and sought to derive the custom of mounting a horse from the left side from the fact that the right leg is stronger than the other. I suggest as almost certain that we mount on that side because the long sword is necessarily worn on the left, and would get between our legs if we went to the off-side of the horse. Some of your readers may perhaps be able to tell us whether the Chinese do not wear their short swords on the right and mount their horses from the right.

I will not hazard a conjecture as to why the rule of the road in Great Britain, and inside of the towns of Florence and of Salzburg (?), is different from that adopted by the rest of the world. For an armed horseman the English rule is, I presume, more advantageous, both for attack and defence.

January 20

G. H. DARWIN

THE question whether a man will walk to the right or left in a mist, in darkness, or if blindfolded, has led to no little controversy and dispute. Almost every conceivable reason has had its advocates for the fact that some men persistently turn to the

left, and others to the right, when walking without the aid of sight. I am familiar with some ambidextrous men, and about the same number of left-handed men, but I cannot recall a single instance of a left-legged man, and think they must be somewhat rare. In the present question it might, perhaps, be well to put aside peculiarities of the arms—as occupation and education enter very largely into the method of their use—and confine observations to the legs alone. Mr. Larden has, I think, very nearly arrived at the solution of the problem with his definition of right or left strong-legged men circling to the right or left respectively. I take exception, however, to his referring the peculiarity to the *strength* of the limb, and think the following suggestion may afford help in the matter, being founded upon observations, and providing a reason for circling in walking in either right- or left-legged men:—It has been frequently remarked of late years that short-leggedness on one side or the other is of common occurrence—the cause is doubtless attributable to a retardation in the growth of the limb caused by one or more of the many illnesses to which we are subject in the earlier years of our life. Excepting when the retardation in the growth of the limb is considerable, it produces no inconvenience, and the possessor of a limb shorter than its fellow by some tenths of an inch may never be aware of the deficiency. To apply this fact to the question (it is another matter why the left leg is more frequently the short one), Mr. Larden's strong leg should correspond to my long leg. The long leg makes a longer step in proportion to the difference in its length over its fellow. If the right be the longer leg, as is oftener the case, the walker will circle to the left, and *vice versa*. In my experiments I fixed a drawing-pin into the sole of each boot, selected a hard, level, untrodden piece of sand on the seashore, about 250 yards in length, and used a measuring-tape which would take ten or twenty paces in one measurement for obtaining the difference in length of the paces; the drawing-pins afford a definite and precise mark in the sand. To insure a good and regular start I always allowed my man a few yards start with his eyes open and fixed on the distant mark. He then, without stopping, put over his head and face a cardboard cylinder open at the top. This allows the eyes to be open, whilst effectually preventing any lateral vision. I think this, small detail as it is, important, as a bandage tied round the head across the eyes is sometimes unpleasant and often confusing.

97, Adelaide Road

THOS. HAWKSLEY

Diffusion of Scientific Memoirs

PROF. TAIT'S letter in your issue of December 27 (p. 196) raises two questions of interest to the Cambridge Philosophical Society. Prof. Tait states that during the last thirty years he has received very few of the publications of the Society. I cannot find from the records of the Society that Prof. Tait has ever expressed the wish to have the publications sent to him. The Cambridge Philosophical Society, like the Royal Society of London, the Royal Astronomical Society, and, I believe, other scientific societies, sends its publications to all Fellows who claim them within a reasonable time from the date of issue. Any Fellow requesting that *all publications* may in the future be sent to him receives them as they appear. The second point is the free distribution of copies. I find that at the present date the *Transactions* or *Proceedings* of the Society, or both, are sent either gratis or in exchange for other publications to the following number of centres:—

Home		Foreign	
London	16	Germany	22
Rest of England	16	France	9
Scotland	8	United States	12
Ireland	6	British Colonies	8
		Other foreign countries	23
Total	46	Total	74
Honorary Fellows	about 40		
Total number distributed	160		

Of this 160 about 40 have been added since the year 1869.

In Edinburgh at present there are three centres receiving the publications of the Society. I doubt very greatly if there are many societies which do as much as the Cambridge Philosophical Society towards spreading their publications.

R. T. GLAZEBROOK,

Secretary Cambridge Philosophical Society

Cambridge, January 19

Recent Low Temperatures in America

ON or about December 19 some very low temperatures are reported to have been registered in Manitoba. At Emerson, in lat. 49° , a cold of 46° below zero, and in Dakota (United States) -49° are recorded.

I do not presume to say that these temperatures are incorrectly given, but they must be received with some distrust, arising from possible, I may almost say probable, defect in the thermometers used.

These sources of error are two, and by no means uncommon. First, the construction of the instrument may be defective. Second, it is not unusual during the heat of summer for a portion of the spirit to become vaporised, and afterwards condensed in the upper end of the tube. If the spirit is colourless, and if the detached fluid extends down to the metal band which keeps the tube in its place, the error, which may amount to 8° or more, is not readily noticed, unless specially looked for. I had several examples of this error in thermometers used by me in Canada, and one not long ago at the house of an English gentleman, who had perfect faith in the correctness of his thermometer.

Of the errors arising from defective construction there were two notable examples among some twenty thermometers which were tested by freezing mercury at Great Bear Lake in the winter of 1848-49. Eighteen of these thermometers agreed very closely with each other, indicating $-36^{\circ}5$, or about 2° too high. Two others, beautifully finished, and made by a London maker of high repute, showed at the same time, and under similar circumstances, 57° below zero, or about 19° of error.

JOHN RAE

Meteors—Unpublished Notes of November 30, &c.

ON November 30, at 8.27 p.m., a large meteor passed from Dubhe, in the Plough, through the lower part of Auriga, exploding in sparkling reddish light; and at 9 another described nearly the same line, but without explosion. The latter left a very vivid bluish light in its path, which lasted about ten seconds. At 10.55 a very large meteor dropped right down from Psi Ursæ Majoris, and disappeared in a black cloud a few degrees above the horizon. At 11.10 one sped rapidly from Beta Ursæ Minoris through between Epsilon and Zeta (Mizar) Ursæ Majoris, and exploded in very brilliant white light. At 11.20 one proceeded from a point about 1° below Benetnasch, and disappeared in the right shoulder of Hercules without explosion. At 11.25 one blazed out from a point 2° above Etanin, and disappeared near Beta Cygni. At 11.30 a large and brilliant but a transient meteor went from Omicron Ursæ Majoris, and disappeared in the tail of the Dragon. At 11.35 one dashed out from a point about 1° above Pi Ursæ Majoris, and I thought that it would go through Merak, but just before it reached Merak it curved suddenly from it and exploded. About 12 a number of small ones were seen. December 1—Meteors seen at 0.13 a.m., 0.18, 1.12, 1.23, 1.45, 3.30, 3.40, 4, 4.23, 4.40, 4.55, 5.7, 5.10, 5.18. December 4—At 2.15 a.m., 2.20, 2.25, 2.28; and a number of meteors were observed between 5 and 6 p.m. December 5—A goodly number of meteors seen from 1 a.m. to 6, and from 8 p.m. to 10. December 6—1.12 a.m., 1.15, 1.22, 2.10, 2.30, 3.40, 5.21, 5.25. December 7—Three meteors seen. December 8, 9, 10, and 12—Only a few meteors were observed here; and from the unfavourable state of the weather, not a meteor could I manage to see since. I have ascertained the paths of all the above meteors, but to give them all would encroach too much on your space. I will supply particulars if required. On November 30 and December 1 last there was a brilliant display of meteors. A few Leonids, Leo Minorids, Taurids, and Geminids were seen. Six Andromedes made their appearance from December 4 to 8. On December 8 a beautiful bolide rushed through the clouds from south-west to south-east, at 6 p.m. Not a star in that part of the heavens could be seen at the time, but the moon shone dimly a little to the left of it. The point at which it appeared was a few degrees higher than the moon, and it disappeared a few degrees above the earth. It blazed in and out three different times on its way through the black clouds, and a little before the end of its journey it swelled out into a huge magnificent ball of red fire, and by its explosion it illumined the western heavens and earth with its bright crimson light. A few of the spectators were alarmed at the unusual apparition. No intonation. Left in its wake a red belt of fire. The light of