meteorological observations. The weather tables now published in the daily papers are of comparatively little value to the general public, owing to their want of arrangement. A weather-table, to be of any great practical value in the northern hemisphere, should contain—first, a record of observations made at points south of the place for which the table is designed, and if possible on or near the equator and the 30th to the 32nd parallel; next, a record of observations made at western points within the limit of what I have ventured to call the storm area; next, a record of observations at northern stations about latitude 60°; and next, at eastern stations within the storm area. This statement is not to be understood as implying that all storms begin at the equator or at any one point of the compass, or that they are in all cases confined within one section of the atmosphere, or move in one direction.

Fourth:—It is very important to obtain correct and copious data regarding the atmospheric currents between (say) 5,000 feet and five miles above the level of the sea, and especially at various points on and near the equator, and at about 30° to 32° North and South latitudes. Within these limits the rain-bearing currents of the atmosphere move. If self-registering meteorological instruments were placed permanently upon several of the leading mountain ranges of the world, and their records copied at stated intervals, we should obtain valuable data for determining the direction, velocity, and magnitude of the controlling atmospheric currents of the globe. More valuable still would be data obtained by the use of self-registering and self-regulating machines that would ascend to any desired height within the limit mentioned above, remain up for a time determined by clock-work, and then descend, bringing with them complete records of temperature, moisture, direction and velocity of currents, &c. Additional facts regarding the great atmospheric currents within the limits named are required to enable us to interpret correctly the oscillations of barometers near the surface of the sea. G.

New York

## Colour Blindness

I HOPE your readers will bear with a few more observations from me on the foregoing subject. It is an undoubted fact that modes of nervous action which have once coexisted tend to excite each other afterwards. This the phenomenon known as Association of Ideas sufficiently proves. It is to this cause that I should be disposed to attribute the phenomenon of accidental or complementary colours. I do not, of course, mean that this latter fact can be resolved into Association of ideas, but that it and association depend on the same organic law. It is probable that in addition to this, however, the mutual excitation of vibrations comes in. Judging from the determination of wave-lengths by diffraction, the ratio of the wave-length of any given ray to that of the complementary one is not very far from 2 to 3 or 3 to 2; and, as the colours excited do not seem to be exactly complementary, it is probable that the vibration referred to is that chiefly excited. For an accurate determination of this question we should require to determine the wave-lengths for each colour in the liquid which surrounds the eye, or rather, perhaps, in the retinal substance. Such are the two causes to which I should be disposed to ascribe the phenomenon of accidental colours. From the former it would follow that the more completely the eye had been accustomed to white light, the more likely the person would be to become colour-blind; and that colour-blindness might be remedied, or at least altered in character, by accustoming the eye to look at everything through coloured glasses.

There are, however, subjective causes which determine the eye to exhibit various colours in particular instances. Of these, jaundice, which makes the object appear yellow, is one. Derangement of the stomach, I believe, often invests objects in the dark with a blue tint. Colours of this description constantly mingle with our ordinary perceptions without being noticed, but when a finer distinction is needed it becomes necessary to avoid them. Thus, in some of the delicate optical experiments to which I referred in my last, the experimentalist must not operate after a long fast or a hearty meal, or after taking any alcoholic drink. He sometimes finds, also, that his two eyes differ in their appreciation of colours. Two instances of this subjective colouring recently came under my notice. In one case an old lady for some time saw everything red, which she attributed to looking very much at a red flower (which she greatly admired) in her sitting-room. She was advised to look a good deal at the green fields opposite her window, and soon recovered. In the other case a friend of mine, reading a note-book which he had marked with a blue pencil, was surprised to find that the marks appeared green. He showed me the book, and the marks were quite unaltered to my eye. He was reading hard, and somewhat nervous, but otherwise in good health. In most of the cases I have referred to, the subjective colouring was only temporary; but I have little doubt that there frequently exists a permanent subjective colouring which modifies all the phenomena of vision, and leads to effects, in some respects, similar to those of ordinary colour-blindness.

Some time ago the question was suggested to me whether a blind man (whose retina was not destroyed) could have a perception of extension by sight, or whether, in the uniform darkness which was supposed to surround him, he could distinguish extension at all? I tried the experiment by shutting my eyes, but finding that when the light was good a very perceptible amount made its way through the eyelids, I placed bandages over them in addition. I could never, however, obtain uniform darkness. Points over the field always appeared less dark than the surrounding ones, and the positions of these points were easily distinguishable. On making the experiment for the third or fourth time, I was rather surprised to see part of the visible surface covered by a faint blue. Subsequent observation confirmed this, and I now believe that it was only from habitual inattention to colours when the eye was shut (as well as the difference between colours on a dark and on a bright ground), that I failed to observe it on the first occasion. These colours are by no means confined to blue. In fact, I think I have seen every tint in the spectrum, and I never can close my eyes for three minutes without seeing some of them more or less distinctly. They generally only cover a patch which, however, is not fixed, and the colour first visible sometimes disappears altogether. I may, perhaps, add to this that I often see a collection of small, bright, round moving spots about the centre of the field of vision. These spots I can likewise see in the dusk with my eyes open. This affords a proof of subjective colours in my own eyes, but from their variability, I do not think my eyes have a predilection for any particular tint. I often see more than one of these colours at the same time. If the eye had a predisposition for any particular colour, it could probably be discovered in this way. The observations are worth repeating. A close attention to the sensations is required on account of their faintness.

I have mentioned the expedient of looking through coloured glasses. Professor Wartmann succeeded in this way in making colour-blind persons distinguish colours which they confounded with the naked eye—a fact quite explicable on my principles; but he found it impossible to predict what effect a glass of any given colour would produce. But might we not by repeated experiments hit upon the particular tint which would suit the eye of any particular patient? If, for example, we tried his eye with a solar spectrum, and interposed one or more coloured glasses of different tints, and in this tentative manner at last succeeded in making him see seven colours, each confined within the same limits that they are to the ordinary eye, it is pretty evident that these glasses would enable him to distinguish the colours of all objects in the daylight.

Not having read much on the subject, I cannot say how far these views are original. The subject is at least one which requires further investigation, and if I can induce some of the eminent contributors to your columns to take up the matter, my letters will not have been vain though the result may be to overthrow all that I have advocated. W. H. S. MONCK

Trinity College, Dublin

## The Effect of Tannin on Cotton

IN your last number you mention the fact that cotton fabrics are rendered more durable by treatment with tannin, as if it was a new discovery, and state that "it is believed the change cannot be great, since it has escaped the notice of practical tanners."

In our neighbourhood (the coast of Northumberland) the fishermen have, for many years past, been in the habit of tanning their nets and sails with oak-bark or catechu.

At the tanyard with which I am connected, we tan a large number yearly, including many cotton nets. Not only does it render them more durable, but in some cases, where wet nets have heated and become tender, their toughness has been restored by tanning. I cannot attempt to explain the chemical action which takes place, and, indeed, the still more important ones by which leather is produced are very imperfectly understood. HENRY R. PROCTER

North Shields, Sept. 26

### The Intended Engineering College

IN my letter on the above subject, I alluded to Mr. Mason's magnificent foundation of an educational institution in Birmingham, and by a queer inadvertence wrote the Christian name "Oliver"; and shall be much obliged if you will insert this correction of my mistake. It is Mr. *Josiah* Mason, the well-known pen manufacturer and founder of the orphanage and almshouses at Erdington, who is so liberally and judiciously enriching the Midland metropolis

W. MATTIEU WILLIAMS

### The Haze Accompanying Auroral Displays

I DOUBT if the haze, seen before and during Aurora, has received sufficient attention. The beautiful displays which we in Canada have so frequently seen of late, have been well adapted to lead us to inquire into their cause; and I think in making observations, the beauty of the luminous portion has led us to overlook other things which are equally important.

On the night of April 15, 1869, we had a grand exhibition of Aurora at Toronto. It spread itself all over the heavens, forming a glorious canopy, filling the south as well as the north.

Previous to any auroral display, however, the atmosphere became thick and hazy; I was viewing the setting moon through a telescope, and though there were no clouds, I found the definition become extremely bad; I thought my breath must have got on the eye-piece, but soon found this was not the case. I then went outside, and on looking round, found the whole atmosphere full of haze. It had not the appearance of fog, but the whole air seemed thick and turbid, and shortly auroral columns commenced forming. This haze was visible for hours. Referring to this feature, Prof. Kingston says (*American Journal of Science*, July 1869, p. 65):—"Throughout the night, a generally diffused luminosity prevailed, such as is commonly seen with a full moon and hazy sky. This was evidently not occasioned by the moon, which was scarcely four days old, and was low in the horizon, but was part of the aurora itself, the brilliancy of whose more active features it greatly impaired." This haze is seldom seen spread in this way all around us; but it is usually seen as a bank in the north, and is surmounted by the auroral arch; stars can be seen through it, but it greatly dims their lustre. Prof. Loomis says:—"The slaty appearance of the sky, which is a common feature of great auroral exhibitions, arises from the condensation of the vapour of the air, and this condensed vapour probably exists in the form of minute spiculæ of ice or flakes of snow. Fine flakes of snow have been repeatedly observed to fall during the exhibition of auroras, and this snow only slightly impairs the transparency of the atmosphere without presenting the appearance of clouds. It produces a turbid appearance of the atmosphere, and causes that dark bank which in the United States rests on the northern horizon. This turbidness is more noticeable near the horizon than it is at great elevations, because near the horizon the line of vision traverses a greater extent of this hazy atmosphere. When the aurora covers the whole heavens, the entire atmosphere is filled with this haze, and a dark segment may be observed resting on the southern horizon."

Whilst approving of the professor's description, I must dissent from his explanation of the cause. This haziness is seen during our hot summer nights, as well as our cold ones; and I have seen it when snow-flakes would be out of the question in such a temperature. Many reasons leads me to regard this haze as cosmical, falling on our earth from without; but at present, I will call attention to the appearance only, reserving my explanation for a future time.

A. ELVINS

## NOTES

IT is with very great regret that we have to announce the death, at the age of fifty-two, of Dr. William Allen Miller, Professor of Chemistry in King's College, London, and treasurer and vice-president of the Royal Society. Professor Miller's writings have earned for him a position in the literature of chemistry, from which he will be very greatly missed.

WE understand that Professor Allman has resigned the Chair of Natural History in the University of Edinburgh. It has long been felt that the subjects of Geology and Mineralogy which have hitherto been taught from this Chair are of such vast and growing importance and extent, that they can no longer be properly included in it when a successor is appointed. It gives us the greatest pleasure to state that Sir Roderick Murchison, who has already done so much for the geology of his native country, has munificently come forward with the offer of 6,000*l.* towards the endowment of a separate Chair of Geology and Mineralogy, on the understanding that on this, as on former occasions, the Government will supplement the private grant by an equal sum. Here then we have an admirable occasion for the Government to show itself alive to the importance of fostering the cultivation of those sciences on which especially the future welfare of the country must largely depend.

THE new Faculty of Science in University College, London, was opened on Tuesday last, by an inaugural address by Prof. A. W. Williamson, F.R.S. The discourse was devoted to an exposition of the importance of scientific method, and of the value of a scientific training, as an introduction even to the life of an ordinary man of business.

IN addition to his discourse to the Social Science Congress at Newcastle, Dr. Lyon Playfair delivered, on Thursday evening last, the inaugural address on opening the session of the Birmingham and Midland Institute. The subject of the lecture was announced as "The Inosculation of the Arts and Sciences;" and in its course the lecturer discussed the intimate union between science and labour. It is not science which creates labour or the industries flowing from it. On the contrary, science is the progeny of the industrial arts on the one side, and on the other of the experiences and perceptions which gradually attach themselves to these arts, so that the evolution of science from the arts is the first circumstance of human progress, which, however, quickly receives development and impulse from the science thus evolved. Industrial labour, then, is one of the parents, and science the child; but, as often happens in the world, the son becomes richer than the father, and raises his position. Apologising for the apparently pedantic form of the word, Dr. Playfair said he proposed to treat of the "inosculation" of arts and sciences, their junction with open mouths, as when two arteries join and mingle their contents. It will be seen that science does not depend upon facts alone, but upon the increase of mental conceptions which can be brought to bear upon them; these conceptions increase as slowly as the common knowledge derived from experience—they both descend by inheritance from one generation to another, until science in its progress becomes a prevision of new knowledge by light reflected from the accumulated common knowledge of the past. In the progress of time common knowledge passes into scientific knowledge. The amazing changes which have taken place since 1838 are due to our better conceptions of forces and their mutual relations and conversions. Formerly heat, light, electricity, magnetism, and chemical affinities, were thought to be separate and independent existences, not even related to each other. Now we know that forces are convertible and interchangeable. This knowledge has already given great stimulus to their application, and will do so more in the future. Further, we know that