rufous (or chestnut), but one is fawn-coloured and has dark "patches at the fetlocks." Doubtless dun may contain bay, brown, and black, but on one occasion I obtained a striped dun by crossing a black Shetland pony with a striped bay Arab—an Arab which mated with a yellow-dun Connemara mare produced a pure black. These may only be exceptions that prove the rule.

J. C. EWART.

Tests for Colour-Blindness.

I AM surprised to see in the review of my book in NATURE of September 1 the statement:—

"We do not see that Dr. Edridge-Green has furnished us with any increased security, or indeed that any better security is needed, than is obtained from Holmgren's test when this is employed in the precise manner directed by its originator."

In this issue of my book I have devoted nearly nine pages to the detailed condemnation of the Holmgren test, and this portion remains as it was in the 1891 edition. The statements there have been confirmed by numerous observers, amongst whom are some of the ablest scientific men the world contains. In fact, at the recent International Physiological Congress I did not meet with a single man who was satisfied with the Holmgren test.

I will only refer to the statements of Prof. Nagel, who has done so much in connection with colour-blindness.

I pointed out that normal-sighted persons were rejected by this test, and this is abundantly evident by the number of men rejected by the Board of Trade who get through on appeal.

Prof. Nagel in 1898 found thirty-nine cases (2·75 per cent.!) in 1420 examinations in which typical dichromic (red-green blind) mistakes were made with the Holmgren test, and yet when examined by other and more trustworthy methods, as, for instance, the spectroscope, were found not to be dichromics.

I stated that the test green was not the best colour for a first test. Nagel says the same thing. In the reports of the Board of Trade it will be seen that many have passed the green test and failed with the rose test. It may be noted that the Board of Trade have never at any time used the test in strict accordance with Holmgren's instructions, because they have used all three test skeins, whereas Holmgren stated that when the green test had been passed the person might be regarded as normal sighted. Nagel points out the varieties and number of colour-blind persons who are passed by the Holmgren test, and gives the reasons, which are similar to mine.

F. W. EDRIDGE-GREEN.

The Institute of Physiology, University College, London, October 7.

IN 1890 or 1891 the Royal Society appointed a very strong committee, of which Lord Rayleigh was chairman, and it included, among other "able scientific men," Lord Kelvin, Sir George Stokes, Sir William Abney, and Prof. Michael Foster, to report on the general subject of colour-vision and on the tests proper to be used in connection with it. Dr. Edridge-Green gave evidence before this committee, stated fully his objections to Holmgren's test, and displayed the methods which he recommended in lieu thereof. His book was published before he gave evidence; and, as his original objections to the Holmgren test are reprinted *verbatim* in the 1909 edition, it is fair to suppose that no fresh evidence in support of them has been obtained during the intervening time. Besides hearing many witnesses, the committee carried out an extended series of practical investigations, and on April 28, 1892, it unanimously recommended the Holmgren test for adoption by railway companies, ship-owners, and the Board of Trade. The committee pointed out that variations in the amount of deficiency in colour-perception are numerous, and, "when small, are often difficult to classify." No one claims for the Holmgren test that it affords a sufficient basis for a minute classification, but it does afford the surest and most convenient means of excluding from certain industries the small number of persons who could not engage in them without danger to the community.

THE REVIEWER.

Water Vapour on Mars.

THE statement attributed to Director Campbell on p. 317 of NATURE for September 8, to the effect that the nights in September, 1909, on which his spectrograms of Mars were taken, "were as perfect for the purpose as could be wished," is open to question. Though the sky may have been clear and the surface humidity low, this does not prove that the aqueous vapour in the upper air was small in amount. September is the month when the total vapour-content of the atmosphere is a maximum, and February is the month when the vapour-content is a minimum, in north temperate latitudes. This is well shown in the curves of energy in the infra-red solar spectrum for February 19, 1903, and September 14, 1903, in the article on "The Absorption of Water Vapour in the Infra-red Solar Spectrum," by F. E. Fowle, jun. (Smithsonian Miscellaneous Collections, quarterly issue, vol ii., part i., p. 1, 1904, Plate i.). The ratio of the intensities of the bands of aqueous absorption {(Mars+earth)/earth} will be greatest when the total absorbent column of the earth's atmosphere contains least water, that is, other things being equal, the ratio may be expected to be smallest in September and largest in February. Director Campbell has chosen the worst month, and Dr. Slipher, who observed in January and February, the best months for making the experiment.

The statement that "with a nearly evanescent α band, the more water vapour one attributes to the terrestrial atmosphere the less remains attributable to that of Mars" is, of course, true, and because the water vapour of Mars is not great in amount it is not desirable to attempt to observe it at a time when the feeble Martian absorption band is swamped in a more powerful terrestrial band.

The depths of the aqueous absorption bands in Mr. Fowle's figure (*loc. cit.*) is many times greater in September than in February; but this does not express the degree of unfavourableness of the September observation adequately, for it is increasingly difficult to detect an increment of absorption due to the addition of a constant amount of vapour, as the total absorption grows greater, and this for the reason that many of the absorption lines have reached a maximum intensity already, so that any further increase of the depth of the absorbent only affects the feebler lines. It should be understood that, with the low power employed, the band is not resolved into its separate lines in the Martian spectrum.

Through the favour of Dr. Percival Lowell I have been permitted to measure the spectra of Mars and the moon photographed by Dr. Slipher at the Lowell Observatory in January and February, 1908. The seasonal gain from lower temperature and diminished moisture in the upper air in winter at Flagstaff is more than an equivalent for any gain in this respect to be obtained by even a double altitude in summer. I have made quantitative measures of the absolute intensity of the little α band in both spectra. The ratio, α(Mars)/α(moon), obtained from six different plates on as many nights, varies from night to night as changes in the terrestrial atmospheric humidity may determine, but all of the plates unite in telling the same story, and show that little α is stronger in the spectrum of Mars.

One of Dr. Slipher's plates, which is, unfortunately, not the best one photographically, although it is better in this respect than any of Director Campbell's, was taken under almost ideal conditions, the air at the surface having a dew point of −14·8° C., and the exposure on Mars being equally divided on either side of the lunar exposure with both bodies at the same altitude (40°). The result is conclusive, and shows that the Martian band on this occasion was two and one-half times as intense as the telluric one. Still larger ratios were obtained from other plates.

Similar consistent measures have also been made of the oxygen band, great B, showing that it is in like manner stronger in the spectrum of Mars, although the measurement is a difficult one, because the earth's atmosphere is much denser than that of Mars, and the further small addition of absorbent has but little effect.

FRANK W. VERY.

Westwood Astrophysical Observatory, Westwood, Massachusetts, October 1.