Rods do not signal blueness at mesopic light levels

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It has long been assumed that rods elicit the sensation of blue at low levels of luminance. (e.g. Trezona, 1970, Vision Research, 10, 317-332). Here three observers (24, 34 and 36 yr), all of whom were heterozygous for a novel S-opsin mutation (I190T), were tested with the Cambridge Colour Test (Regan et al., 1994, Vision Research, 34, 1279-1299) at different levels of retinal illuminance. Their results were compared with those of a group of healthy normal trichromatic females (all younger than 40 yr). The trivector test, which measures sensitivity along the protan, deutan and tritan confusion axes, was presented on a calibrated CRT monitor controlled by a computer graphics system. The vector length was extended to maximum achievable for the monitor along the tritan axis (0.1650 units in CIE *u'*, *v'* space). Observers were tested monocularly with their preferred eye. They viewed the monitor through an artificial pupil of 2.8 mm from a distance of 3.1 m, where the gap in the Landolt-C subtended 1 deg. Cone-plateau thresholds were obtained after bleaching with a tungsten-halogen lamp covered by a large diffuser (33 000 Td) for 1 min, followed by a 4 min waiting period before testing for 3 min. Dark-adapted thresholds were obtained after dark adaptation for 30 minutes. Thresholds were measured at least twice at two different retinal illuminance ranges: 16-118 Td and 1.6-12 Td. The lowest illuminance level was obtained by adding a 1.0 ND filter in front of the eye. The performance of observers with the I190T mutation was significantly different from that of normal trichromats along the tritan vector at all conditions tested: they behaved as mild tritans at 16-118 Td, but as tritanopes at 1.6-12 Td, for both cone-plateau and dark-adapted conditions. The results imply that S-cones, and not rods, are responsible for signalling blueness at low mesopic light levels.

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