Eye and vision in the subterranean rodent cururo (*Spalacopus cyanus*, octodontidae)

Leo Peichl, Andres E. Chavez, Adrian Ocampo, Wilson Mena, Francisco Bozinovic, Adrian G. Palacios

Abstract

Subterranean mammals are generally considered to have reduced eyes and apparent blindness as a convergent adaptation to their lightless microhabitat. However, there are substantial interspecific differences. We have studied the prospect of vision in the Chilean subterranean rodent cururo (*Spalacopus cyanus*, Octodontidae) by analyzing the optical properties of the eye, the presence and distribution of rod and cone photoreceptors, and their spectral sensitivities. Cururo eye size is normal for rodents of similar body size, the cornea and lens are transparent from red to near-UV light, and the retina is well-structured. Electroretinography reveals three spectral mechanisms: a rod with peak sensitivity (λ_{max}) at about 500 nm, a cone with λ_{max} at about 505 nm (green-sensitive L-cone), and a cone with λ_{max} near 365 nm (UV-sensitive S-cone). This suggests dichromatic color vision. Immunocytochemistry with opsin-specific antibodies confirms the presence of rods, L-cones, and S-cones. Cururo rod density is much lower than that of nocturnal surface-dwelling rodents, and the cones form an unexpectedly high 10% proportion of the photoreceptors. Of these, S-cones constitute a regionally varying proportion from 2% in dorsal to 20% in ventral retina. The high cone proportion suggests adaptation to visual demands during the sporadic short phases of diurnal surface activity, rather than to the lightless subterranean environment. Our measurements on fresh cururo urine reveal a high UV reflectance, suggesting that scent marks may be visible to the UV-sensitive cones. The present results challenge the general view of convergent adaptive eye reduction and blindness in subterranean mammals.