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Abstract: While the domestic cat has served as a mammalian model to study retinal circuitry from photoreceptors to ganglion cells, data on the visual capacities of large and endangered Felid species are sparse. We have gathered eyes from 7 felid species, cheetah (Acinonyx jubatus), lion (Panthera leo), tiger (Panthera tigris), jaguar (Panthera onca), Siberian manul (Felis manul), Eurasian lynx (Felis lynx) and domestic cats (Felis catus) to compare their retinal cone photoreceptor topography and discuss its correlation to specific lifestyles and habitats.
ADAPTIVE DESIGN IN RETINAL CONE TOPOGRAPHIES OF THE DOMESTIC CAT, CHEETAH AND OTHER FELIDS

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Poster Abstract
While the domestic cat has served as a mammalian model to study retinal circuitry from photoreceptors to ganglion cells, data on the visual capacities of large and endangered Felid species are sparse, We have gathered eyes from 7 felid species, cheetah (Acinonyx jubatus), lion (Panthera leo), tiger (Panthera tigris), jaguar (Panthera onca), Siberian manul (Felis manul), Eurasian lynx (Felis lynx) and domestic cats (Felis catus) to compare their retinal cone photoreceptor topography and discuss its correlation to specific lifestyles and habitats.

We have studied eyes obtained during autopsy of animals delivered to veterinary pathology from Austrian animal parks and zoos. Spectral cone subpopulations were identified and mapped using antisera JH 492 for M-opsin, JH 455 and sc-14363 (Santa Cruz) for S-opsin.

All species studied have two cone subtypes and central areas are located in the superior temporal quadrant surrounded by largely circular gradients. In the domestic cat, as reported previously (Linberg et al. 2001), densities of ca. 26000 cones/mm² are present, largely consisting of M-cones. The cat S-cones have a flatter topography increasing from superior (10%) to the center of the inferior hemisphere (18 %). While the lion has a similar pattern, the cheetah - despite of sharing the lion’s habitat - deviates strongly in many parameters: A prominent visual streak is present with vertical /horizontal cone ratios of ca. 0.7. In spite of smaller eye diameter the cheetah has by far the highest cone numbers (9.5 Mio M-cones + 1.5 Mio S-cones, as compared e.g. to 5.5 + 1.5 Mio in tiger). Cheetah maximum density values reach 41000 M- + 6000 S-cones/mm², as compared to 17000 M/ 1300 S/mm² found for the lynx. Cheetah overall S-cone proportion is 14% as compared to 8% in tiger and 10% in lion.

The cheetah’s visual organization is unique among felids confirming the species’ specialized adaptation as a diurnal open-terrain speed hunter leading. Its features are rather convergent with other open terrain species such as wolf (Peichl, 1992) and antelopes (Schiviz, 2006; see poster in this meeting). Other differences tend to correlate with species size (dorso-ventral asymmetry), and open-closed habitat. These variations indicate that prototypically, felids share a concentric visual system optimized for binocular target detection in structured environments. However, as exemplified by the cheetah, selective effects from visuo-motor specialization may drastically reshape general phylogenetical layouts (Ahnelt et al, 2006).
References


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