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INSIGHT INTO THE OCULAR MORPHOLOGY OF FOUR TROPICAL LIZARDS (SCINCIDAE) WITH SPECIAL FOCUS ON THE FOVEA

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BACKGROUND

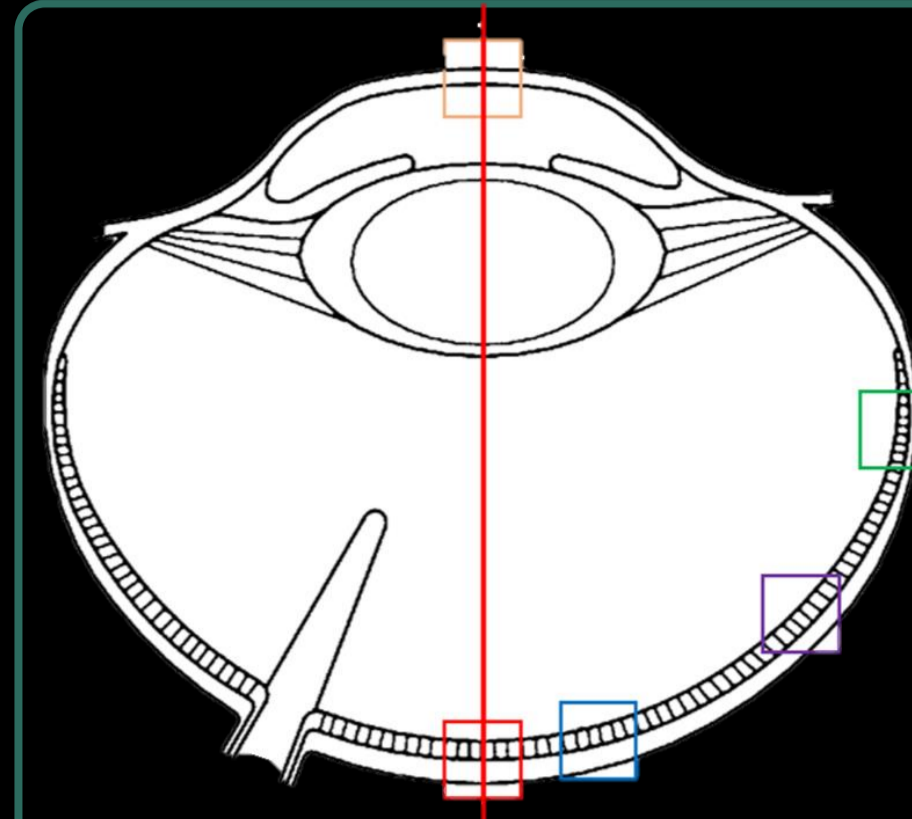
The Scincidae are one of the most diverse families of Squamates (lizards and snakes), including more than 1500 species. They inhabit numerous habitats in which they occupy various niches. Most of them live underground, but there are also arboreal and even semi-aquatic species. Despite this diversity, little is known about the vision of skinks, compared to other groups such as Chameleons or Anoles. The eyes of skinks are generally described as lacking a fovea, a small depression in the retina allowing a high visual acuity. To our knowledge, no species from tropical forests had been studied.

What are the characteristics of the visual system in tropical skinks?

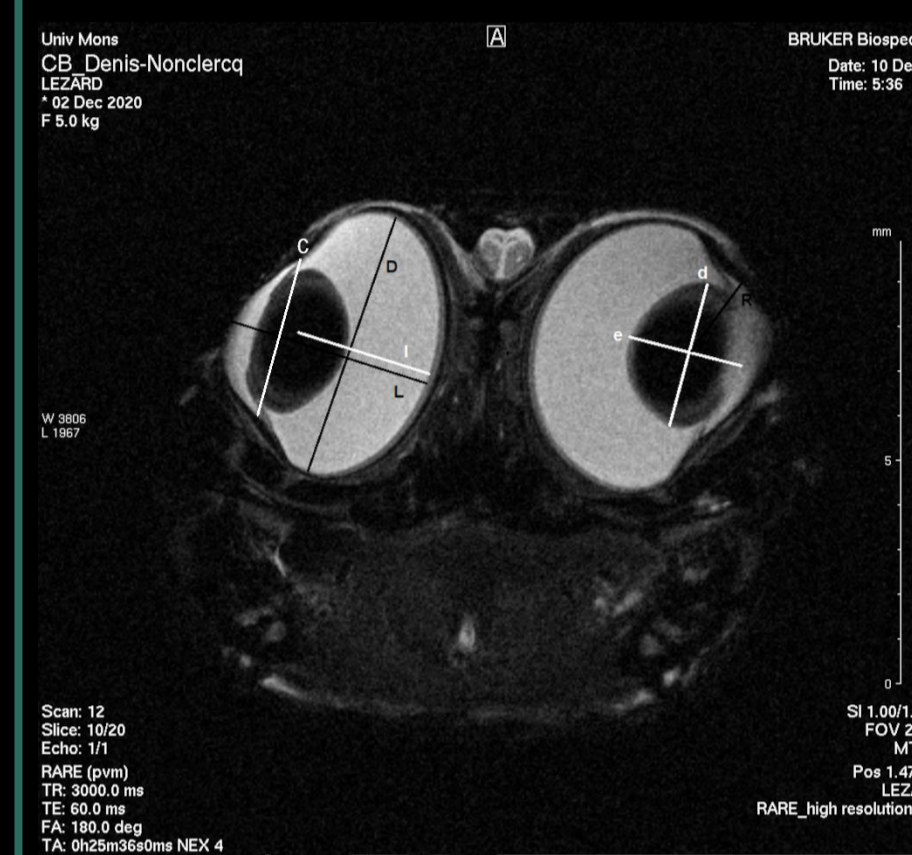


Fig.1 : Model species used in this study : A) *Tribolonotus gracilis*, B) *Mochlus fernandi*, C) *Tiliqua scincoides* and D) *Tiliqua gigas*

HOW TO STUDY THEM?

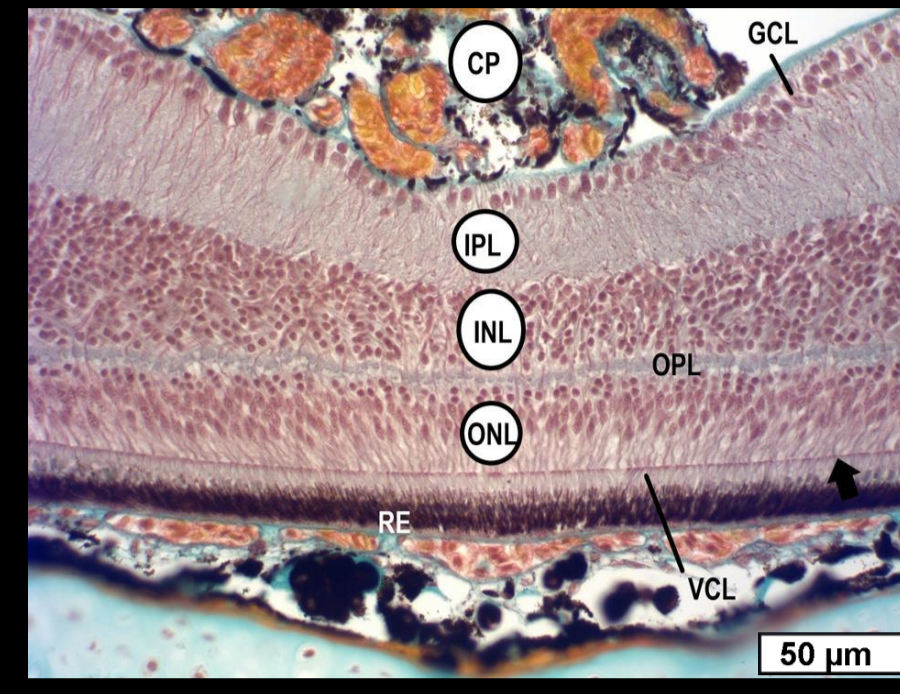
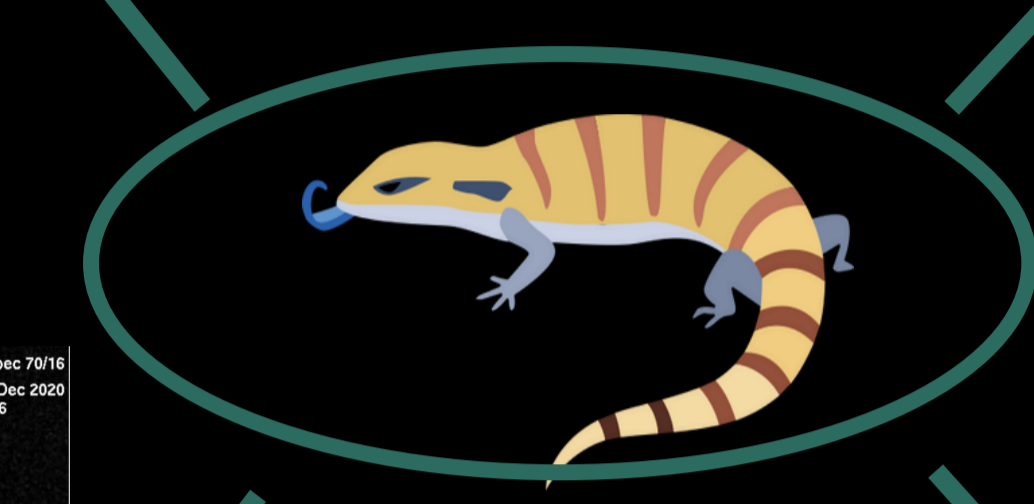


- Cell countings in four regions of the retina : Foveal (Central) – Parafoveal (Pericentral) – Extrafoveal (Outer) – Peripheral

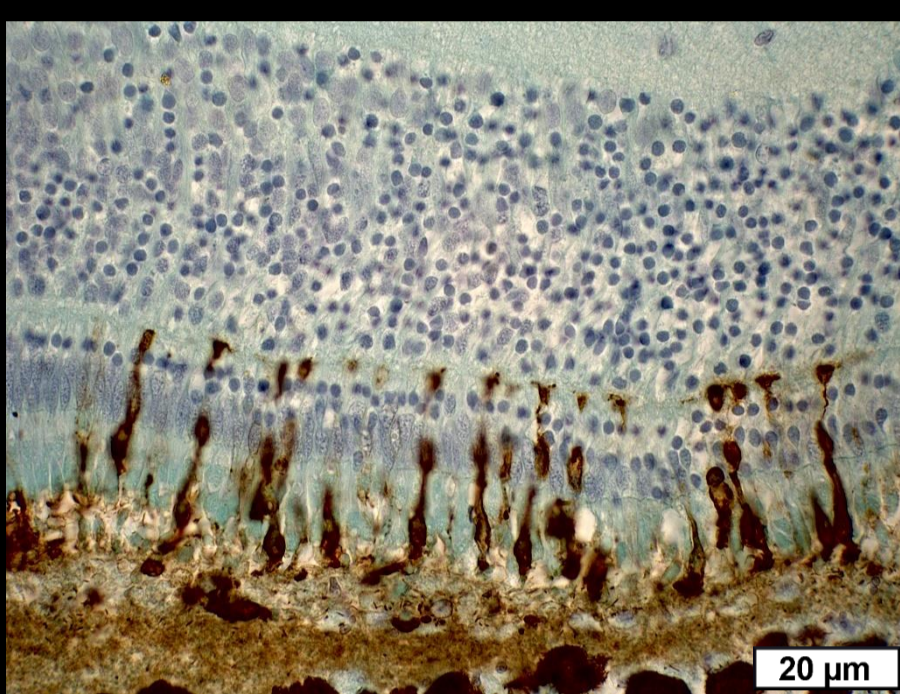


- Measurements of the ocular properties by NMR *in vivo*

N = 4



- 3 layers of interest :
 - ONL : Outer nuclear layer (photoreceptors)
 - INL : Inner nuclear layer (Bipolar cells)
 - GCL : Ganglion cells layer



- Detection and counting of two types of opsins (RH1 & LWS) by immunohistochemistry

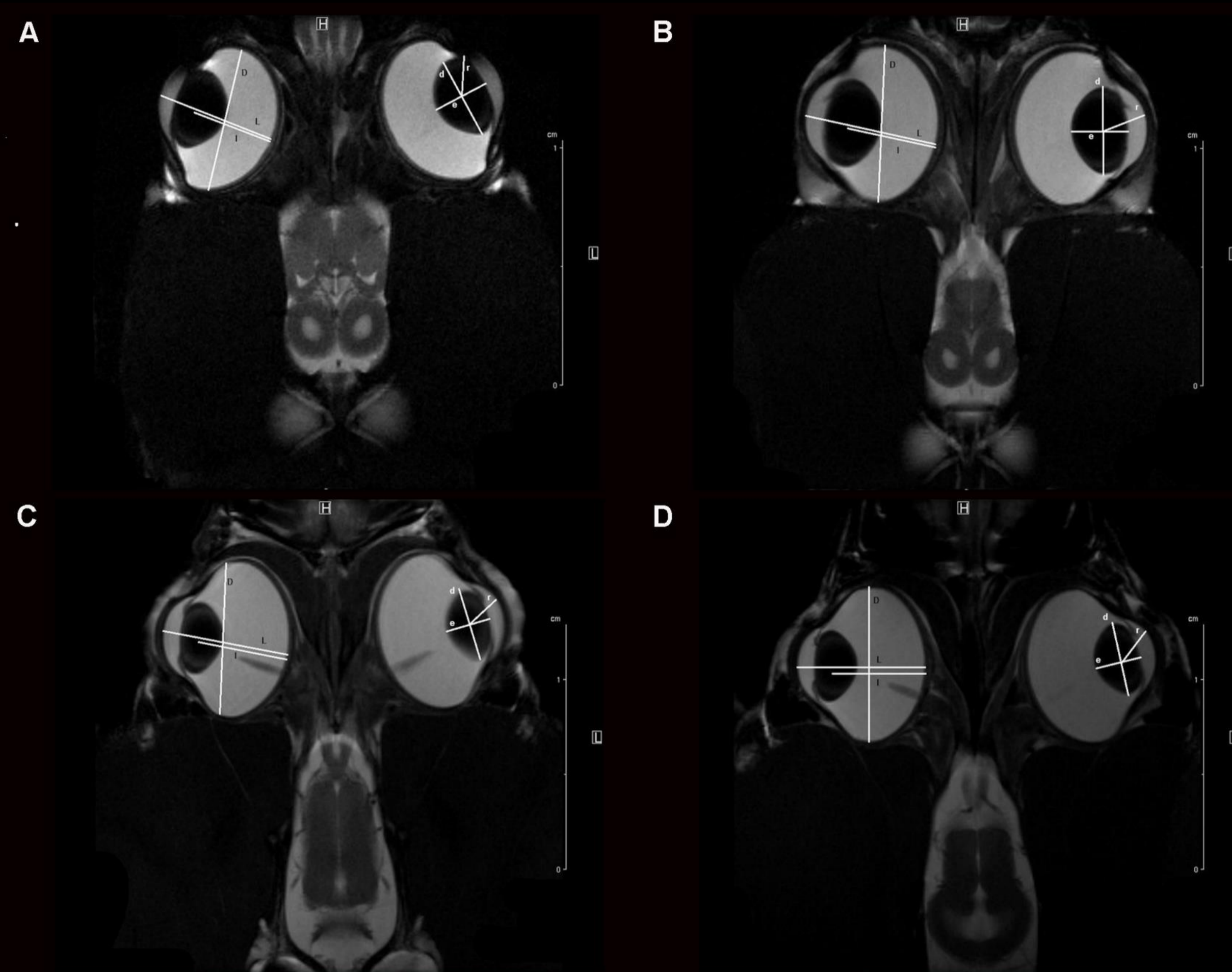


Fig.2: Coronal sections of the head. A) *Mochlus fernandi* B) *Tribolonotus gracilis* C) *Tiliqua gigas* and D) *Tiliqua scincoides*. The conus papillaris can be seen as a triangular projection from the optic nerve. D : Ocular globe maximal diameter, d : lens diameter, L : total axial length, l : length from nodal point to central retina , e : lens length (thickness), r corneal radius of curvature.

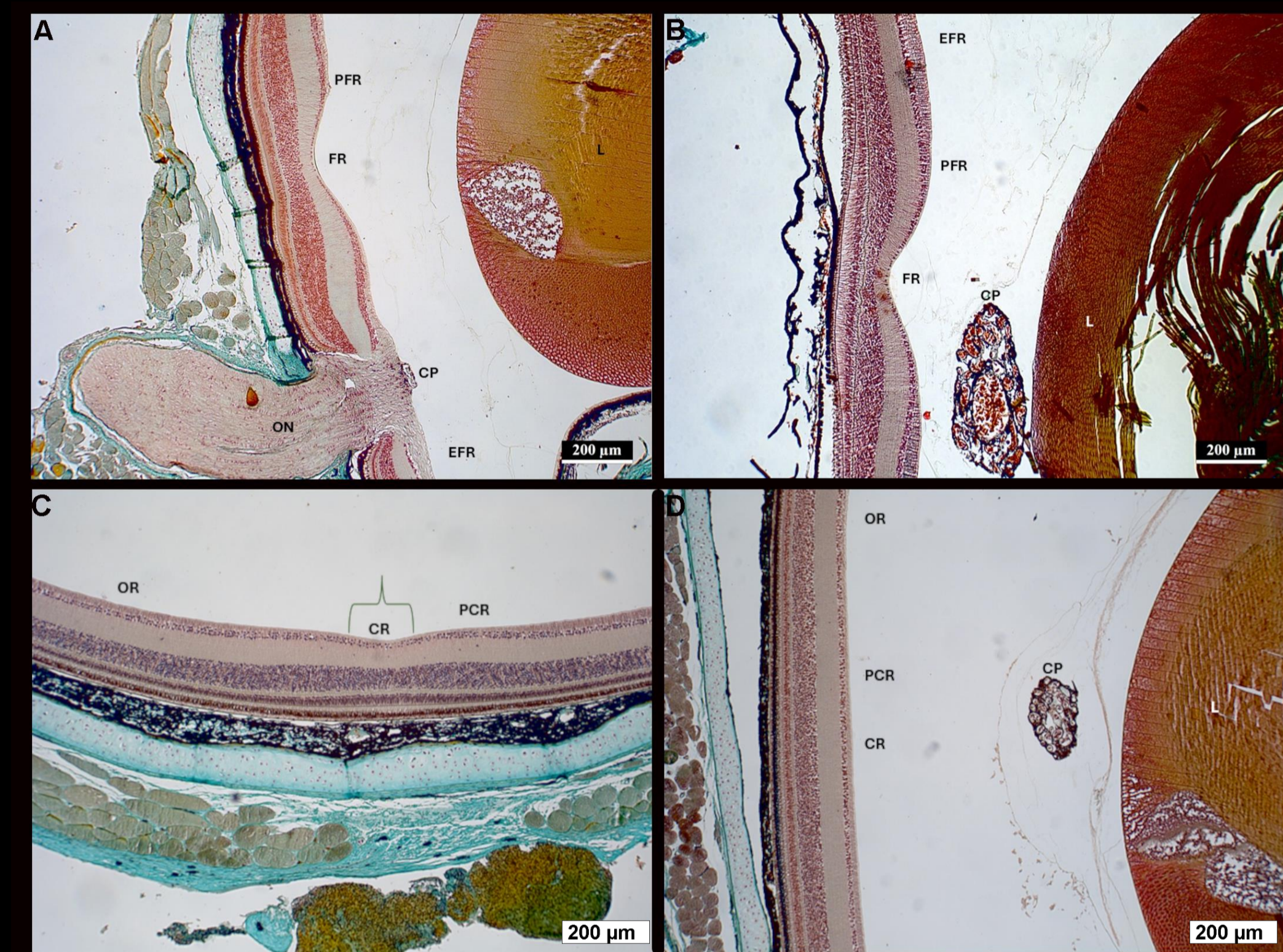
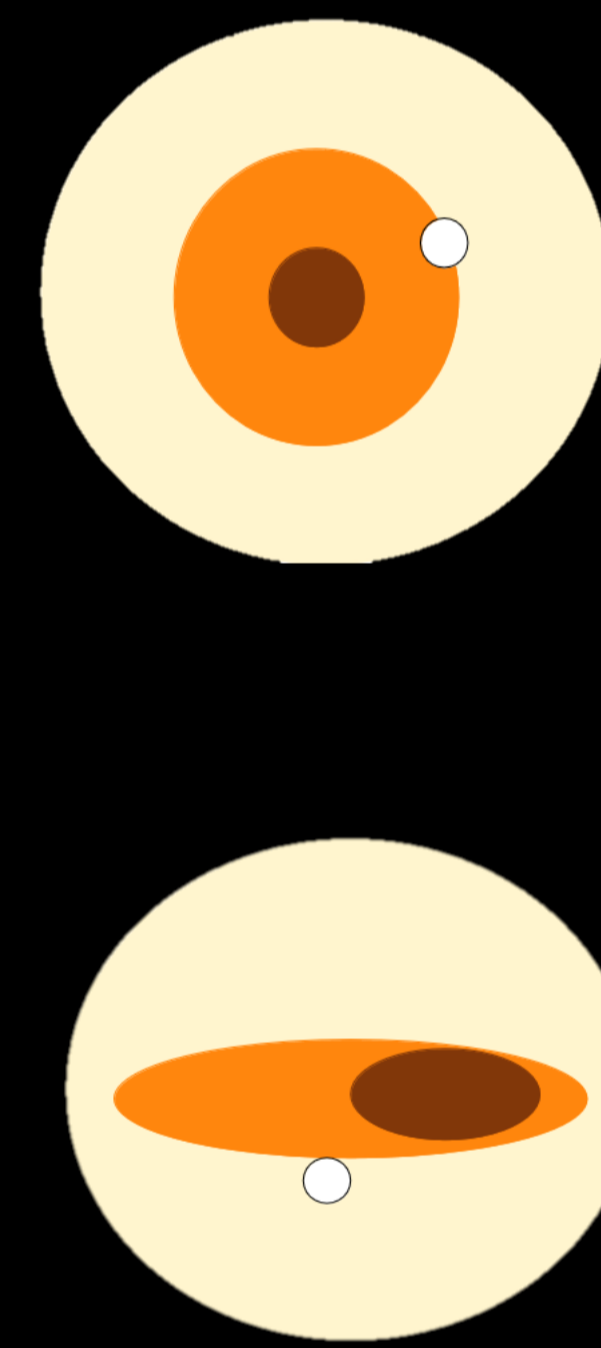


Fig.3: Micrographs of the retinas of A) *Tribolonotus gracilis* B) *Mochlus fernandi* C) *Tiliqua scincoides* and D) *Tiliqua gigas* . A and B both possess a fovea (in the optical axis while C shows a sketched fovea (CR). By contrast (D) is totally devoid of fovea. FR : Fovea, PFR : Parafoveal retina, EFR : Extrafoveal retina, PCR : Pericentral retina, OR : Outer retina, CP : Conus papillaris, ON : Optic nerve.

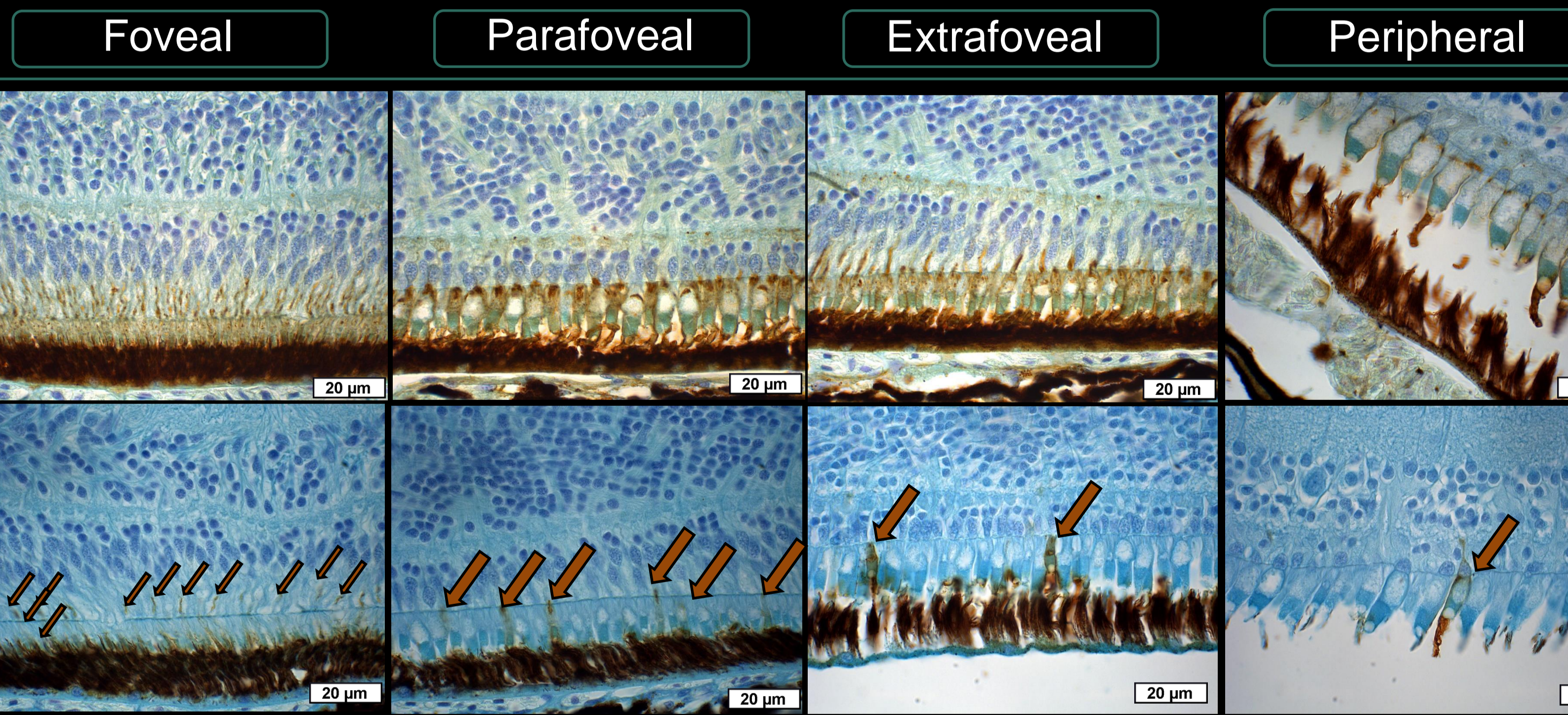


Fig.4: Immunohistochemical labelling of the anti-LWS and the anti-rhodopsin photoreceptors in the retina of *Mochlus fernandi*. In this species, "rod-like" cells (arrowed) represent 15.79% of all photoreceptors in the fovea, 6.25% in the parafoveal region, 3.51% in the extrafoveal region and less than 1% in the peripheral region.

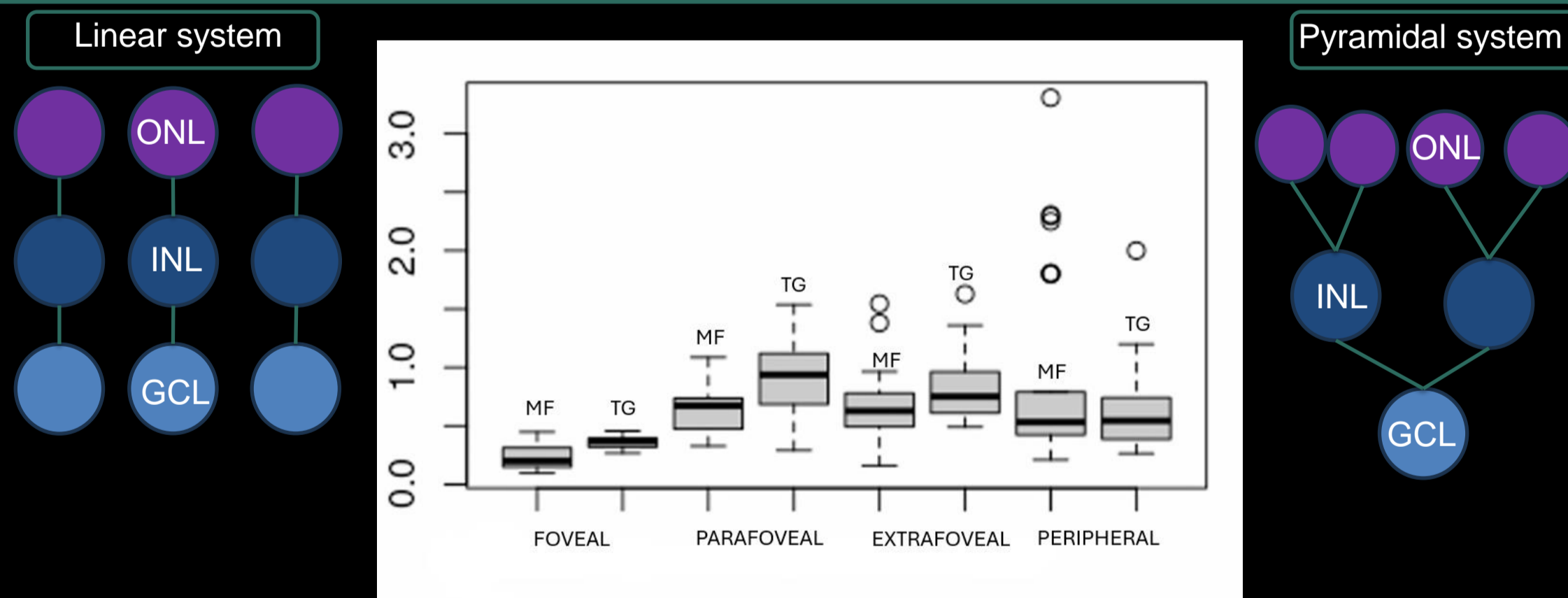


Fig.5 : Ratio « rods » / cones for *M.fernandi* (LF) and *T.gracilis* (TG). Ratio tends to be pyramidal (below 1.0) in the peripheral retina

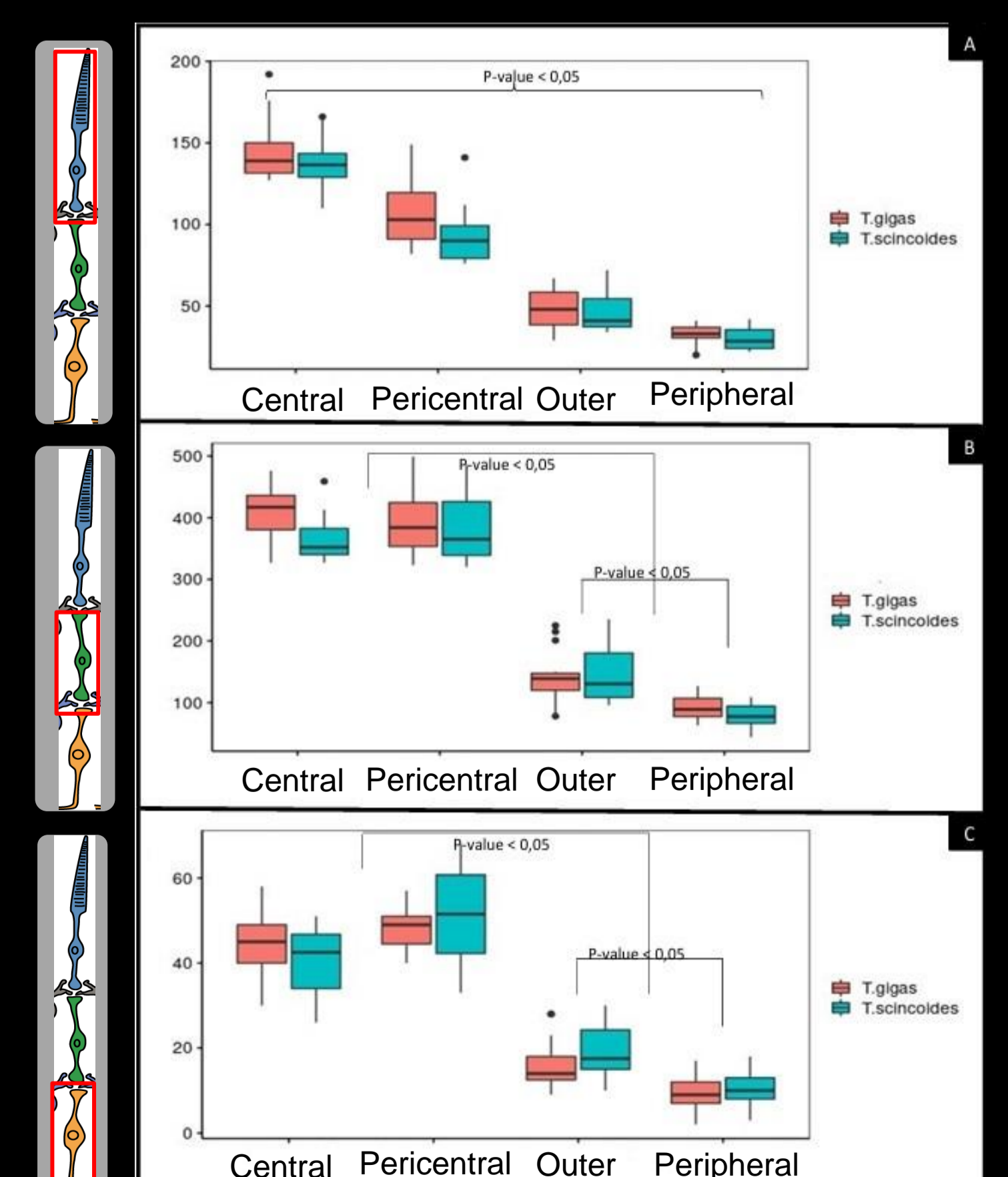


Fig.6 : Density of photoreceptors (A), bipolar cells (B) and ganglion cells (C) in the retina of *T.gigas* and *T.scincoides*. The sample size (N) is respectively 15 and 18 fields (by 146.6 μm^2). All the « * » indicate a statistically significant difference ($p < 0.05$).

DISCUSSION AND CONCLUSION

- A fovea was observed in two species: *Mochlus fernandi* and *Tribolonotus gracilis*. This is an unusual feature for skinks. The development of a fovea may be attributed to their habitat or predatory behaviour (acute vision for detecting small, fast invertebrates). In contrast, *Tiliqua sp.* are omnivorous and pursue slow-moving prey such as snails.
- The main cone populations identified in all the species were sensitive to long wavelengths (opsin LWS), but a small population of photoreceptor cells showed immunoreactivity to rhodopsin, which is highly sensitive under scotopic conditions. The rod-like cells - whose the morphology is more similar to cones - could enhance the vision near the forest floor.
- MNR analysis of the cornea and lens indicates an adaptation to photopic vision, albeit in a habitat where the light intensity is moderate. Furthermore, we observed a linear association between photoreceptors and ganglion cells, which appears to favor visual acuity.