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**Purpose:** We describe the gross and microscopic anatomy of ocular structures of the albino, blind cichlid, *Lamprologus lethops*, and its putative sister species, *Lamprologus tigrificlitilis*. (Figure 1) The two are sympatric and endemic to the Lower Congo River rapids.

**Methods:** An *L. lethops* individual was fixed and processed for paraffin sectioning. Five-micron sections, including all ocular structures, were stained with H&E. A specimen of the closely related, sighted congener, *L. tigrificlitilis*, was treated in the same manner. Immunohistochemical staining for rod and cone opsins was performed using the following primary antibodies. For rods, two antibodies were used: mouse monoclonal anti-rat rhodopsin (cat #: MAB5316, Millipore, Billerica, MA) which detects the first 10 amino acids of rhodopsin, and rabbit anti-human rhodopsin, raised against the second extracellular loop of human rhodopsin (cat #: R9153, Sigma-Aldrich, St. Louis, MO). LWS cone opsin was identified using polyclonal rabbit anti human red/green opsin (cat #: AB5405, Millipore, Billerica, MA) and SWS opsin identified using rabbit polyclonal anti human blue opsin (cat #: AB5407, Millipore, Billerica, MA). All primary antibodies were used at a concentration of 1:100 in 1X phosphate buffered saline. Antigen retrieval was performed using 10mM sodium citrate in a microwave oven and endogenous peroxidase blocked with 3% hydrogen peroxide. Sections were pre-incubated with 5% normal goat serum in PBS prior to addition of primary antibody. Negative controls were obtained through omission of the primary antibody. Mouse retina was used for positive control tissue and yielded the expected immunolabeling pattern for all antibodies (data not shown). Combined secondary antibody and HRP-or avidin-biotin labeling was achieved using a double stain (for rabbit or mouse primaries) polymer detection system (cat #: RDS513, Biocare, Concord, CA).

**Results:** Anatomical features of *L. lethops* included a diminished globe diameter. Although the scleral profile maintained a spherical shape, much of the choroid was occupied by adipose tissue containing no choroidal gland. (Figure 3). The optical globe was foreshortened in the A-P dimension and deviated dorsally towards the midline with no extraocular muscles. (Figure 2) Globes were surrounded behind the posterior pole by an open periocular space with no cell bodies. Similar to other teleosts, the sclera contains cartilage. The *L. lethops* lens appeared as fully developed as in its sighted congener. The lens size appeared appropriate to the size of the globe. The cornea has an intact scleral layer but no trace of a dermal layer. Instead, the lens appeared as fully developed as in its sighted congener. The cornea is situated beneath bone and skin. In *L. tigrificlitilis*, no adipose tissue was seen within the choroid. Extraocular muscles, a choroidal gland and cornea are present with no overlying bone. Retinal staining and comparative anatomy: The retina in *L. lethops* is markedly reduced in width. The IPL (inner plexiform layer) seems most affected. The GCL (ganglion cell layer) is retained. The ONL (outer nuclear layer) has 2 layers of nuclei in *L. lethops*, while the control (*L. tigrificlitilis*) has 2-4 layers from the peripheral to central. Inner and outer segments are visible in the *L. tigrificlitilis* retina, while inner segments are short and outer segments are barely visible in *L. lethops*. Rhodopsin staining is comparable—in cell bodies and outer segments, and weakly in inner segments. Cone opsins did not stain in either fish. It is difficult to differentiate between rods and cones on H & E in either fish. The RPE (retinal pigment epithelium) appears rounded and degenerate in *L. lethops*. RPE cells are present in the retina indicating degeneration. (see Figure 6)

**Conclusions:** Troglomorphic fishes provide excellent comparative models with which to study convergent and divergent evolution of the eye. We are in the process of phenotyping a series of blind and partially sighted fish for comparison purposes. We speculate that some of the same genetics that function in blind fish might play a role in developmental eye disease. The similarities and differences might shine light on the evolutionary mechanisms in play.

*Figure 1: Lamprologus lethops (left) and Lamprologus tigrificlitilis (right)*

*Figure 2: Sub gross images of the sighted L. tigrificlitilis (left) and its congener, the blind L. lethops. Note the distorted globes (arrow) surrounded by an expanse of open space. Extraocular muscles are not visible in this view. Identical magnification in both panels.*

*Figure 3: Histological sections through the globe of L. lethops showing a distended globe, with much of the choroid occupied by adipose tissue. The lens appears to be as fully developed as it’s sighted congener, and appropriately sized for the globe.*

*Figure 4: Higher magnification of the globe (left) and the retina in L. tigrificlitilis. Note the presence of a choroidal gland (arrow) and a cornea in contrast to L. lethops.*

*Figure 5: Higher magnification of retina in L. lethops. Note that the retina is thin as compared to L. tigrificlitilis.*

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