Effect of UV on the Structure of the Retina in the Teleost Tilapia zillii

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ABSTRACT

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*Tilapia zillii*

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The retina of *Tilapia zillii* (*Cichlidae, Teleostei*) before and after exposure to short wave UV irradiation was examined by using light microscope (LM) and transmission electron microscope (TEM).

Two groups of fish were exposed to UV lamps with an intensity 250 μW/cm². One was exposed to one dose (15 minutes), while the other was exposed to three doses (15 minutes each) of UV irradiation. The third group was the control. All the groups were under dark-adapted condition.

The study showed that the retina of the species under study is of the duplex type and is typical teleostean in structure. However, some distinctive characteristics were observed in the retina of *T. zillii*. These
distinctive characteristics were observed in the retina of *T. zillii*. These include: 1. two types of mitochondria (oval and elongated) were recorded in the retinal pigment epithelium; 2. two types of rods depending on the shape and density of the ellipsoid’s mitochondria and the electron-density of the spherules; 3. a single mitochondrion was reported in each spherule and pedicle. This observation may be the first among teleosts.

The changes in the retina after being exposed to UV irradiation was followed by light and electron microscopy. The retinal pigment epithelium showed radial cracks in animals exposed to three doses of UV irradiation. Detachment between the retinal pigment epithelium and the photoreceptor layer was also observed after three doses of UV irradiation.

Photoreceptor outer segments of the experimental groups ranged between normal features and severely damage. Outer segments of short single cones were not affected. Outer segments of long single cones were slightly damaged at the side lacking a membranous sheath. Considerable damage of the outer segment discs of most double cones was observed. Rods were the most affected photoreceptors, because they were exposed directly to UV irradiation because of the dark adaptation state. Most of them were deformed and disconnected from their ellipsoids. In general, the damage of the outer segments caused by UV irradiation involved deformation, condensation and vacuolation of the membranous discs.
The mitochondria of the ellipsoids were not affected in all types of photoreceptors except in double cones. Some mitochondria in the double cones showed different signs of damage. This may be due to the presence of subsurface cisternae which act as conducting channels. The damage of both mitochondria and subsurface cisternae in the ventral fundic retina was more severe than in the dorsal retina. No presence of dwarf cones (UV-sensitive cones) in the retina of *T. zillii* was detected. This may be correlated to the age of fish.

The presence of the photoreceptor outer segments in retinas of fish exposed to the third dose, is an indication of the repair and regeneration of these structures after being damaged by the first and second doses of UV irradiation.

Mitochondria of the outer plexiform layer showed severe damage manifested by swelling, vacuolation and deformed crista.

The inner retinal layers in irradiated fish were not affected and showed normal histological and ultrastructural pictures.