doi:10.1017/S1431927620022758
Microsc. Microanal. 26 (Suppl 2), 2020

Mitochondria Can Trigger the Axodendritic Polarization of OSRN in Fish?

Subrata De[1] and Madhabi Aich[2]

[1]Vidyasagar University, Midnapore, West Bengal, India, [2]Khalisani Mahavidyalaya, Midnapore, West Bengal, India

Olfaction is a chemosensory modality of vertebrates mediated by olfactory sensory receptor neurons (OSRNs). The OSRNs are associated with odorant receptors and they are responsible for olfactory signal transduction [1]. The present research pertinently raises the question that "is axodendritic polarization of OSRN is influenced by mitochondria in fish?"

Anabas testudineus (Bloch, 1792) is a climbing perch (IUCN-'Least Concern' ver. 3.1). The olfactory lamellae of sex independent *A. testudineus* were fixed in 2.5% glutaraldehyde in phosphate buffer [0.1 (M), pH- 7.4] for 2 hours at 4°C. Dehydration of sample using graded chilled acetone followed by CPD and coated with platinum, viewed under a scanning electron microscope (Zeiss EVO18) operated at 20 kV. For transmission electron microscopy (TEM), specimens were primarily fixed in Karnovsky's fixative for 6-12 hours at 4°C and secondary fixation using 1% osmium tetraoxide. The ultrathin sections (70- 90) nm were stained by 1% uranyl acetate (UA) and lead citrate respectively, viewed under TEM [Tecnai, G 20 (FEI)] operated at 200 Kv.

The OSRNs are bipolar and marked with dendron, perikaryon, and axon (Fig. 1b). The dendron at apex shows an olfactory knob with radiating cilia (diameter: 0.2µm) at the surface (Fig. 1a). The early differentiating OSRN within the olfactory epithelium is apolar in nature and possesses ribosomes, rough endoplasmic reticulums, mitochondria and vesicles at supra nuclear cytosol (Fig. 2). The intermediate phase of OSRN appeared as an elongated structure and bipolar like shape (Fig. 3,4). The cytosol of the growing dendron exhibits mitochondria with dense cristae and microtubules at the peripheral part of nucleus (Fig. 3). The axoplasm exhibits an abundance of free ribosomes and vesicles (Fig. 4). The mature OSRN is equipped with terminal olfactory knob and cilia with distinct basal body (Fig. 5). The dendritic cytoplasm is characterized by crowding of several long tubular mitochondria (average length: 0.79 to 2 µm and diameter: 0.15 to 0.19 µm) with thick cristae and microtubules (Fig. 5, 8). Occasionally, these mitochondria show in a state of functional fusion (Fig. 8, 9). The axon has a vesicular cytoplasmic matrix with ribosomes and less number of subcellular organelles (Fig. 6, 7) compared to dendron.

Mitochondria are a dynamic cellular organelle. Probably, due to metabolic reprogramming the mitochondrial biogenesis increases at the time of neural differentiation [2]. The mitochondrial accumulation are noted in the apical neuroplasm may trigger the polarity of dendritic growth (?) during earlier differentiation of OSRN.

Authors are thankful to Prof. T. C. Nag, Department of Anatomy, AIIMS, New Delhi, India for his guidance and Dr. S. K. Sarkar, Vidyasagar University for his motivation.

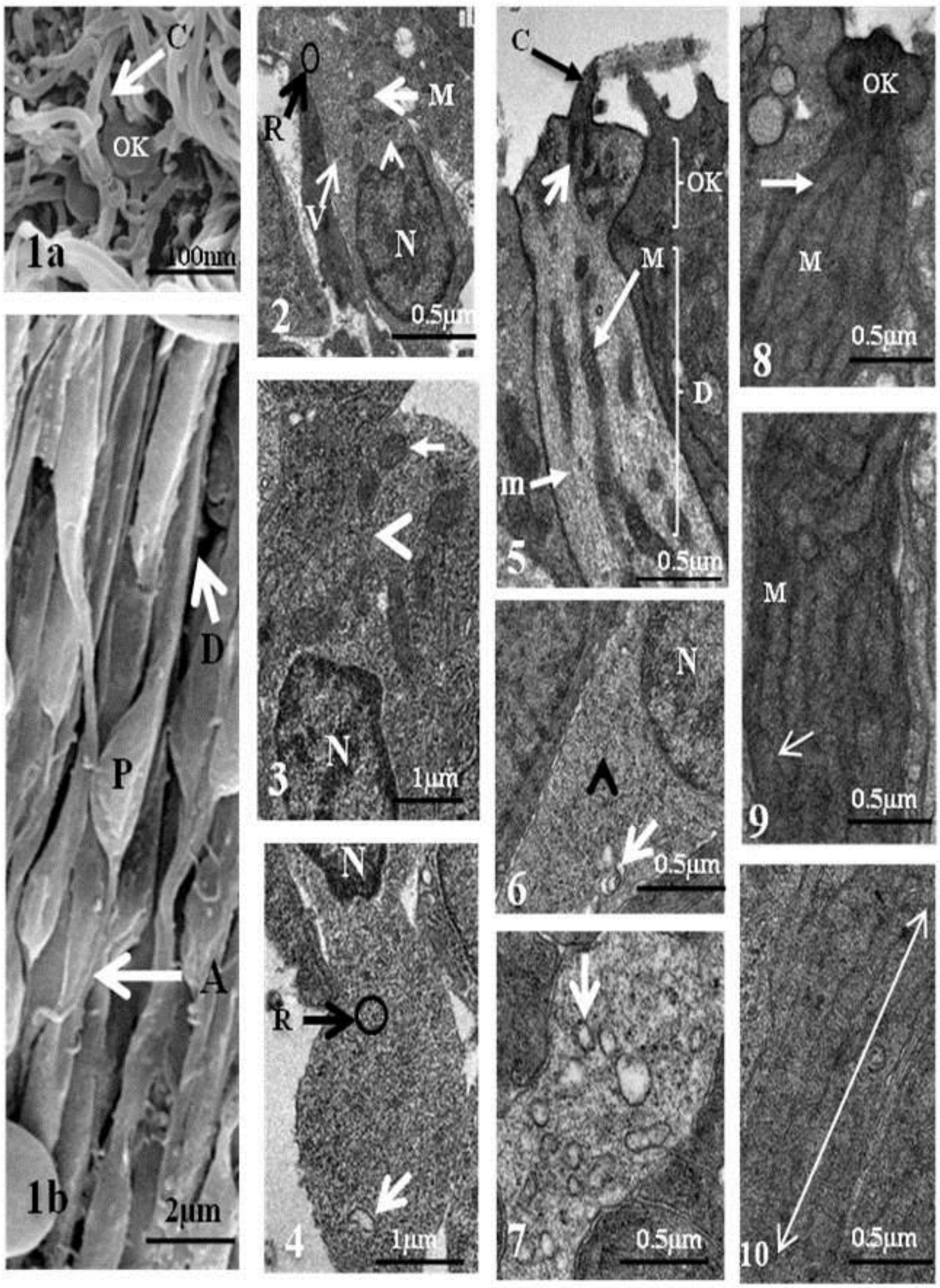

Figure 1. Fig. 1a: Photomicrograph shows the olfactory sensory receptor neuron (OSRN) under SEM. Olfactory knob (OK) and Cilia (C). Fig. 1b: 3D view of OSRN. Dendron (D), Perikaryon (P) and axon (A). Fig. 2: TEM micrograph shows earlier stage of OSRN. Nucleus (N), rER (arrow head), mitochondria (M), ribosome (R), and vesicle (V). Figs. 3 & 4: Polarized OSRN (dendritic region) with distinct mitochondria (arrow) and microtubules (arrow head). Axoplasm with ribosome (R) and vesicle (arrow)

https://doi.org/10.1017/S1431927620022758 Published online by Cambridge University Press

are noted. Fig. 5: Photomicrograph of mature OSRN (dendron) associated with distinct olfactory knob (OK), cilia (C), basal body (arrow), tubular mitochondria (M), microtubules (m), etc. Fig. 6: Axon hillock of mature OSRN. Ribosome (arrow head). Vesicle (arrow). Fig. 7: Morphs of vesicles within axon (arrow). Figs. 8 & 9: Dense tubular mitochondria (arrow) in dendron with probable mitochondrial fusion (?). Fig. 10: Single tubular dendritic mitochondria (arrow).

References

[1] Buck, L. and Axel, R. *Cell* **65** (1991), p. 175- 187.
[2] Agostini, M., Romeo, F., Inoue, S., *et al.*, *Cell Death Differ*. **23** (2016), p. 1502- 1514.