Resum de Tesi Doctoral

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Títol de la tesi	Statocyst sensory epithelia ultrastructural analysis of cephalopod spp. exposed to noise
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(Mínim 1 i màxim 4, podeu veure els codis a http://doctorat.upc.edu/doc/impresos/impres_codunesco2.pdf)

Resum de la tesi de 4000 caràcters màxim (si supera els 4000 es tallarà automàticament)

Controlled Exposure Experiments revealed lesions in the statocysts of four cephalopod species of the Mediterranean Sea (Sepia officinalis, Octopus vulgaris, Loligo vulgaris and Illex coindetii), when exposed to relatively low intensity low frequency sounds. The analysis was performed through: scanning (SEM) and transmission (TEM) electron microscopy techniques of the whole inner structure of the cephalopod statocysts, especially on macula and crista; SEM of the epidermal lines of cephalopods larvae; and proteoic studies (2E/MALDI-MS) of the statocyst's endolymph. All exposed adult individuals presented the same lesions and the same incremental effects over time, consistent with a massive acoustic trauma observed in land species that were exposed to much higher intensities of sound. Immediately after exposure, the damage was observed in the macula statica princeps (msp) and in the crista sensory epithelium. Kinocilia on hair cells were either missing or were bent or flaccid. A number of hair cells showed protuding apical poles and ruptured lateral plasma membranes, most probably resulting from the extrusion of cytoplasmatic material. Hair cells were also partially ejected from the sensory epithelium and spherical holes corresponding to missing hair cells were visible in the epithelium. The cytoplasmatic content of the damaged hair cells showed obvious changes, including the presence of numerous vacuoles and electron dense inclusionsnot seen in the control animals. The apparence of these lesions became gradually more pronunced in individuals after 12, 24, 48, 72 1nd 96 hours. Special attention was given to validate these findings with control animals that were caught, maintained and sequentially sacrificed following the same protocol as the exposed individuals. The statocyst ultraestructure was therefore revisited and a comparative analysis was carefully conducted to assess the lesions triggered by the exposure to noise. This study also presents preliminary results of the sound effects on epidermal lines of larvae. The lesions, consistent with an acoustic trauma, were identic in the three species that were exposed, but their evolution over time, in opposition with what was observed in the statocysts, was different, suggesting that the animal size and metabolic response might play a role in a possible recovery process.

The analysis of noise effects in the statocyst endolymph by proteomic techniques was only conduced on Sepia officinalis. The presence of differential staining of gels from control and subjected to sound exposure individuals demostrate that the injuries could be related to a possible physiological imbalance that would affect the protein levels of the endolymph.

The lesions and findingd described here are new to cephalopod pathology. Given that low-frequency noise levels in the ocean are increasing (e.g. due to shipping, offshore industry and naval maneuvers), that the role of cephalopods in marine ecosystems is only now beginning to be understood, and that reliable bioacoustic data on invertebrtes are scarce, the present study and future investigations will bring an important contribution to the sustainable use of marine environment.

Keywords: cephalopods, sensory systems, noise effects, electron microscopy, proteomic analysis.

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