The relation between the migration function of birds and fishes and their lagenal function

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Abstract: Conclusion. The lagena of pigeons is a unique organ and it is concluded that it is a key element in the magnetic sensor system of pigeons and migrating birds. The lagenal otolith in pigeons contains more iron than saccular and utricular otoliths. The function of the lagena of pigeons was clarified because the homing ability of pigeons was largely disrupted after unilateral lagenal nerve section and attachment of magnetic balls with a magnetic field strength under 5 Gauss. The lagena of pigeons may have a navigational function as a geomagnetic sensor. Objective. Otoliths of many kinds of fishes and birds were analyzed. Materials and methods. The otoliths of fish and birds were analyzed using synchrotron X-ray fluorescence analysis. Behavioral experiments concerning homing ability of pigeons were done by sectioning their lagenal nerves or interfering with the function of the lagena using a magnet. Twenty-one birds were treated in this way and 30 birds from the same loft of racing pigeons were used as controls. Results. By comparing the compositions of the three different kinds of otoliths among several species of sea fish and birds, it was found that the saccular and utricular otoliths contain scarcely detectable levels of iron but that iron is present in significant quantities in the lagenal otoliths of the birds and sea fish. The results of homing tests clearly revealed a magnetic influence on the function of the lagena in terms of navigation ability of pigeons. The treated pigeons were either lost or significantly delayed while the controls returned within 30 min of release.

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