ORIENTATION MECHANISMS IN PIGEONS (*Columba livia*)

Beatriz Carayol Lorenzo. Degree in Veterinary Medicine (June 2017)

FACULTAT DE VETERINÀRIA

OBJECTIVE

The objective of the project is to make a brief compilation of the orientation mechanisms in messenger pigeons. Each of them is important, but it supports the theory that they function as a multifactorial factor and that each one helps in one way or another in the navigation of these animals.

MAGNETIC FIELDS

Magnetic fields and their interpretation:

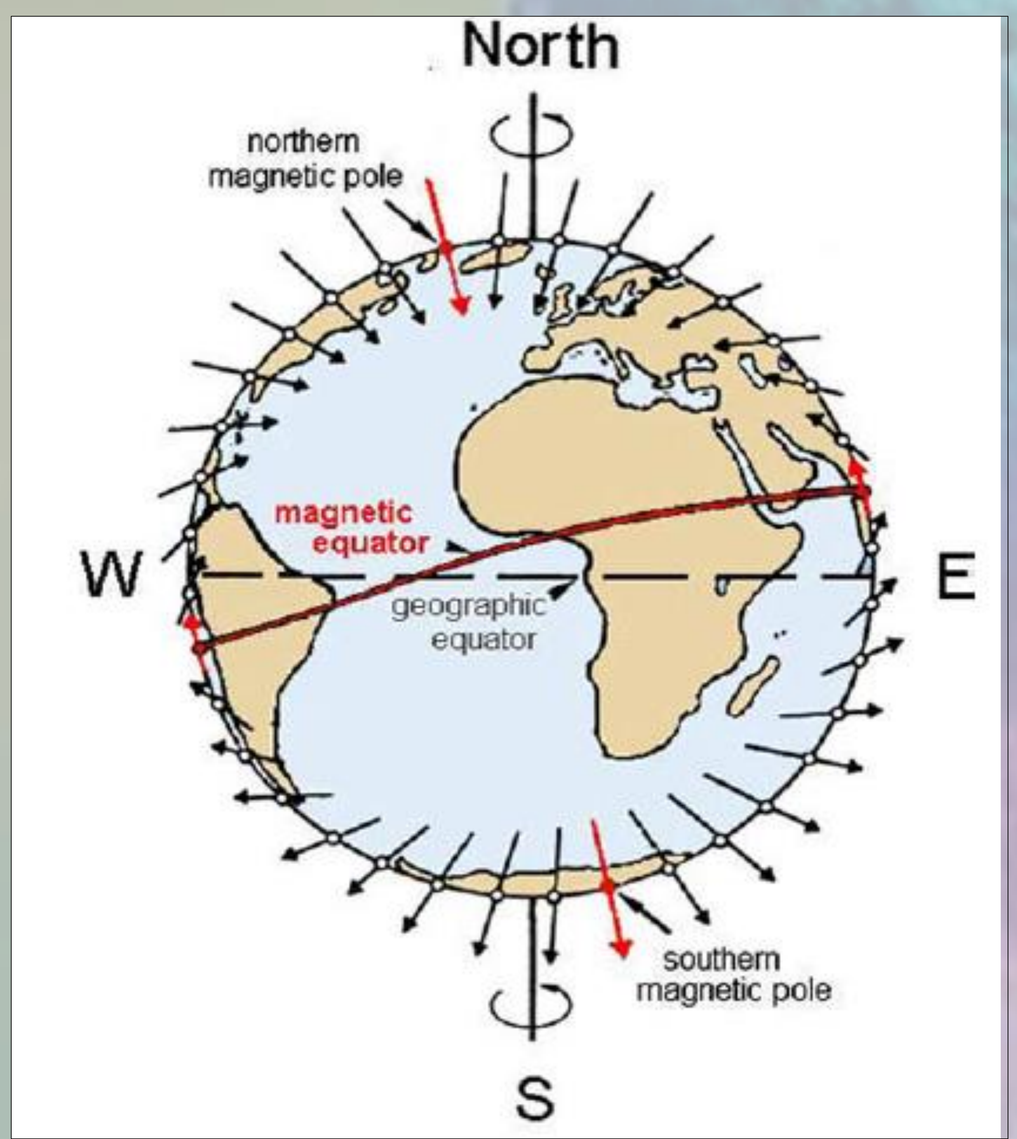

Figure 1. Representation of the earth magnetic fields (Wiltschko & Wiltschko, Journal of Comparative Physiology A: Neuroethology, Sensory, Neural, and Behavioral Physiology ,2005).

Theories to explain this mechanism

- **Radical pair model or compass**
- **Magnetite (Fe_3O_4)**

Is necessary to emphasize the importance of the memorization and the learning of these birds to arrive their lofts (Biro et al. J. Navig. 59, 43-53. 2006).

Some of these landmarks are discontinuities of landscapes such as forests and rural areas, or linear and long structures (Mann et al. Journal of the Royal Society, Interface/the Royal Society, 8 (July 2010), 210-219, 2011).

VISUAL

The hypothesis of the "mosaic map" made with landmarks of the environment is one of the most studied ideas in this field.

However, according to Holland (The Journal of Experimental Biology, 206(Pt 11), 1773–1778, 2003) the knowledge acquired so far of these landmarks does not go beyond that the pigeons use them in their navigation.

INTRODUCTION

The pigeon is a truly resilient animal with extraordinary abilities to return home from unfamiliar places that are kilometers away. For this reason it's the animal for excellence to carry out studies on the orientation and navigation of the animals on their return home.

The mechanisms we can observe in the following work are: magnetic fields, olfactory and visual.

Each of them plays a role in the navigation of these birds and it's important to be understood that each has a function and information to give to pigeons.

About 40 years ago Papi et al (Monit. Zool. Ital. 5, 265-267, 1971), performed a study with two groups of birds, the first was cut off the olfactory nerve and the second nothing → the group without nerve did not return to their homes.

Papi et al (Monit. Zool. Ital. 6, 85-95, 1972), and more recently Gagliardo (The Journal of Experimental Biology, 216, 2165–2171, 2013), support the hypothesis of "olfactory navigation", in which birds and other animals are able to remember odors.

OLFACTORY

In the Gagliardo (The Journal of Experimental Biology, 6, 2016), one group of birds was treated with zinc sulfate at the upper tip and in another group no type of treatment; as a result, the first group did not know how to orient themselves correctly.

But in a study by Benvenuti et al (Comp. Biochem. Physiol. A Physiol. 103, 519-526. 1992), with the same treatment and released in familiar places they returned to their homes → other possible factors may intervene in the orientation.

CONCLUSIONS

- **Although much work remains to date, much progress has been made on pigeon navigation.**
- **Because of their easy domestication and high motivation to return home, pigeons are one of the best models for this kind of studies.**
- **The study field is very extensive, to determine more accurately some of these mechanisms should be performed independently.**
- **Thanks to the new technologies, GPS, has been able to deepen more in these studies, today it's easy to follow the exact route that these animals do.**
- **With regard to the magnetic field theories, the most stand out are magnetite and position compass hypothesis.**
- **The olfactory orientation mechanism is based on the determination of different odors and know where they come from.**
- **Finally, and not least, the visual orientation mechanism is based on the theory of "mosaic map" that form with the landmarks of the familiar environment to reach their homes.**
- **It's believed that these three mechanisms don't function independently in the orientation of the messenger pigeons, they are a combination of the three (multifactorial mechanism).**

Background picture: https://quecome.org/palomas/