

Histo-Architectural Study of Beak of Pigeon (*Columba Liviadomestica*) With Reference to Geomagnetic Field Perception

P.M. Gedam¹, N.C. Nandeshwar², A.M. Salankar³, P.M. Shirsikar⁴ and J.A. Kesharkar⁵

Department of Anatomy and Histology, Nagpur Veterinary College, Nagpur (M.S.)- 440006

Corresponding author e-mail: pm.gedam06@gmail.com

ABSTRACT

The anatomy of birds play an important role in migration and navigation, as they have super efficient haemoglobin, four chamber heart, lung and air sac system and hollow bones for flying. Histological study support that the delicate iron containing structures in the skin of upper beak of pigeons serve as biological magnetometer. The present study was carried out on beaks of six different pigeons of either sex. Histo-architectural studies indicated the presence of iron deposits in the sections of beak. These iron deposits in the most rostral part of birds streamline the body and might be helping the migratory birds for the navigation in line with the earth's magnetism.

Key words: Pigeon, Migration, Navigation, Beak, Iron, Biological magnetometer

Migration of Birds is the curious thing in the nature. Migratory birds serve an important role for researchers to study the nature and changes occurring in the nature. The migratory Birds also help to study about certain zoonotic diseases like Bird-flue and its prevention. Navigation is the technique used by the birds during flying to find out the way of their final destination, in which their beak play important role (*Anonymous, 2009a*). Homing pigeons are capable of travelling very long distance. Record is 2719 km and return back to home. Pigeons can fly very fast up to 50 miles per hour. Pigeons have very strong homing instincts that help them to find their way back to home from far away. Some pigeons have travelled 600 miles in a day. Pigeons have been on this earth at least 20 million year that is longer than humans. About 5000 to 10000 years ago human began to capture and raise pigeons. In 776 BC the first Olympic Games were held in Greece, the pigeons carried the news of winners to people. Julius Caesar, the emperor of Rome more than 2000 years ago used pigeons to send messages back home from battle. The pigeons were used for the purpose of transmitting messages in Baghdad in 1150. In 1850, Poul Reuter, the founder of world famous news agency Reuters-distributed news and stock exchange bond prices between the Belgian capital and German city and Brussels by 45 pigeons. Pigeons are still sometimes used as

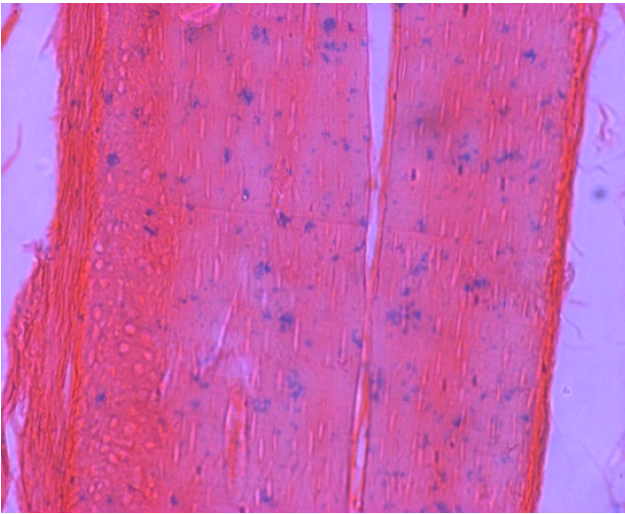
messenger's for example medical worker on an island in France put blood samples in to the tiny pocket of a vest worn by pigeon The pigeon then flies and carry the blood samples to the mainland. As the iron deposit in the beak of birds helps to navigate, here an attempt is made to study the iron deposit in beak of pigeons (*Anonyms, 2009b*).

METHODOLOGY

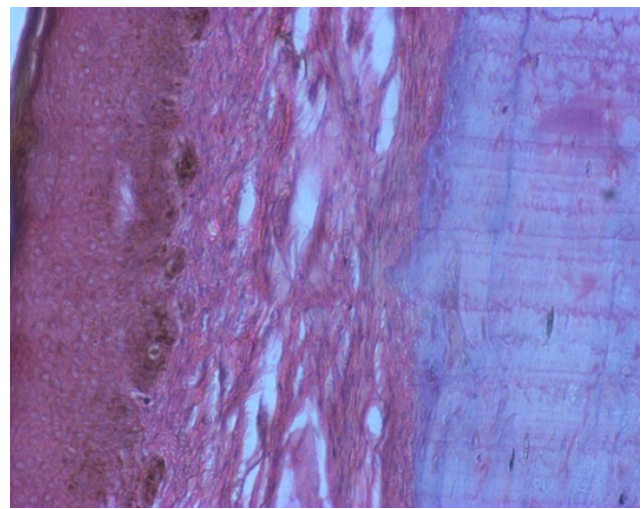
The present study was conducted on the beaks of six adult pigeons of either sex. The samples of beaks were collected from freshly died birds and washed thoroughly with saline water. The samples were fixed in 10% neutral buffer formalin solution and subjected for routine paraffin technique as per Drury and Wallington (1980). The sections were stained with H&E stain for general histomorphology and Prussian blue stain for Iron as per Singh & Sulochana, (1996).

RESULTS AND DISCUSSION

Histomorphological and physiochemical examination showed iron containing subcellular particles in sensory dendrites of the skin lining of upper beak. Powerful source of x-ray found iron containing particles in nerve branches within the skin lining of the upper beak of pigeons. According to the Fleissner *G, et.al* (2007) dendrites are arranged in a complex three di-



PRUSSIAN BLUE STAIN 20X
(Inner dermal lining of upper beak)



H&E STAIN 20X
(Inner dermal lining of upper beak)

mensional pattern and react to the Earth's external magnetic field in a very sensitive and specific manner. Histological study supported that delicate iron-containing structures in the skin of the upper beak of pigeons serve as biological magnetometers. Histology has revealed various iron sites within dendrites of the Trigeminal nerve, their arrangement along strands of axon, the existence of three dendritic fields in each side of the beak with specific 3D orientations and the bilateral symmetry of the whole system should be able to separately sense the three vector components of the earth magnetic field and simultaneously allowing birds to detect their geographic position by magnetic vector i.e. amplitude and direction of the local magnetic field.

In the study present, the histomorphology of the beak revealed that it had an outer layer of dense keratin. The stratified epithelium was 4-5 cell layers thick. The

stratum germinatum was the distinct inner-most layer. The central dermal core was prominent besides scaffolding of osseous tissue of jaw bones towards the caudal aspect of the beak and deposits were noticed. The presence of iron deposits might serve as a magnetic entity, responsible for imparting a sense of navigation to the pigeons as a geo-magnetic mechanism.

CONCLUSION

Histomorphological study supports that the delicate iron-containing structures in the skin of the upper beak of pigeons serve as biological magnetometers. The presence of iron deposits might serve as a magnetic entity, responsible for imparting a sense of navigation to the pigeons as a geo-magnetic mechanism.

Paper received on : October 05, 2014

Accepted on : October 15, 2014

REFERENCES

- Anonymous (2009a). Available at <http://www.wavecrestdiscoveries.com/articles/migration-navigation.htm>
- Anonymous (2009b). Available at <http://ehrweb.aaas.org/ehr/parents/pigeons!html>
- Fleisner, G, Stahl B, Thalau P, Falkenberg G – Novel concept of Fe-mineral based magnetoreception : histological and physiochemical data from the upper beak of homing pigeons. www.pubmed.com
- Drury, R.A.B. and E.A. Wallington (1980). In "Carleton's Histological Technique" 5th Ed; Oxford University Press, New York / Toronto.
- Sing, U. B. and S. Sulochana (1996). In "Handbook of Histological and Histochemical Technique, 1st edition, premier publishing House, Hyderabad.

