

Some examples of zoological contribution of Ġāhiz

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Introduction

More than a century ago and precisely in 1883, the famous orientalist Ernest Renan asserted in a lecture given in the Sorbonne:

“Such is this great philosophical body that we are used to calling Arab, because it’s written in Arabic, but which is actually Greek-Sassanide. It would be more accurate to say Greek; for the really creative element in all this came from Greece. [...] Greece was the unique source of knowledge and the right thought ...”¹

This verdict pronounced by Renan, can be perceived even today, as the idea of the non-existence of an Arab-Moslem science still persists. In spite of this, it was possible to notice the emergence, all along the twentieth century, of some authors whose judgement was more objective and impartial. This led to

¹ Ernest Renan, *L'Islamisme et la Science*, Calman Lévi Editeur, Deuxième édition, Paris, p. 11.

a relative recognition of the contribution of the Arab-Moslem civilisation to the development of the Western science². However, the biological and especially zoological sciences are not as yet taken into consideration.

Indeed, the medieval Arab zoology is practically overlooked in the books of biology history³ as well as in the introductions to the textbooks devoted to this discipline⁴. In the rare cases when Arab zoology is mentioned, these authors assert that it did not exist. The way they deal with the

² See especially:

Benoit, P. & Micheau, F. (1989): L'intermédiaire arabe ?, dans *Eléments d'Histoire des sciences*, sous la direction de Michel Serres, Ed. *Bordas Cultures*, Paris, pp. 151-175

Hunke, S. (1969): Le soleil d'Allah brille sur l'Occident, *Albin Michel*, Paris, p. 10

Mieli, A. (1966): La science Arabe et son rôle dans l'évolution scientifique mondiale, 2^{ème} éd., Leyde ;

Nasr, S. H. (1976) : Sciences et savoir en Islam, *Sindbad*, Paris

Rashed, R. (1997) : Histoire des sciences arabes, sous la direction de Roshdi Rashed, avec la collaboration de Régis Morelon, Ed. *Seuil*, Paris, 3 vol.

Rashed, R. & Annawati, G. (1997) : L'Islam, Les mathématiques et les autres sciences, *Encyclopaedia universalis*, Paris

Sarton, G. (1927-1948) : Introduction to the History of Science, vol. 1 From Homer to Omar Khayyam, Ed. *Williams and Wilkins Co.*, Baltimore,

Schacht, J. & Bosworth, C.E. (Editors) (1974) : The legacy of Islam, Ed. *Clarendon Press*, Oxford.

Taton, R. (Editeur) (1957-1964) : Histoire générale des sciences, Ed. *Presses universitaires de France*, Paris

³ See especially :

Hendrik De Wit, C.D. (1992): Histoire du développement de la biologie, *Presses polytechniques et universitaires romandes*, Lausanne, 3 vol.

Mayr, E. (1989): Histoire de la biologie : Diversité, évolution et hérédité, Ed. *Librairie Arthème Fayard*, Paris, 2 vol

Petit G. & Theodorides J. (1962) : Histoire de la zoologie des origines à Linné. Ed. *Hermann*, Paris, 360 pp.

⁴ See especially :

Beaumont, A. & Cassier, P. (1981): Biologie animale, des Protozoaires aux Métazoaires épithélioneuriens, Ed. *Bordas*, Paris, 2 vol.

Campan, R. (1980): L'Animal et son univers, Ed. *Privat*, Toulouse.

zoological texts dating back to this period is limited to a description of the history of zoology literature. They always end up with the same verdict affirming that the classical Arab civilisation has not brought anything to zoology and botany, except for a few anecdotes or some geographical accounts or when it has dealt with hunting practices or finally in matters concerning the licity, according to the *fiqh*⁵, of the use of animals for whatever purposes. According to them, the only merit of the Arabs is to have preserved the Greek scientific heritage before passing it on to Europe.

From these assertions, some questions can be raised:

- Does the thesis about the eventual non-existence of a medieval Arab zoology hold one's own?
- Was the Arab zoologist authors' role limited to serving as compilers and intermediaries?
- Or did they, on the contrary, modify, ameliorate, transform or even create, new branches from the existing knowledge and from resources of their own civilisation, therefore giving a new identity to their own zoology?

⁵ Islamic jurisprudence

To answer these questions, we are going to deal in this study with a work entitled *Kitāb al-ḥayawān*⁶ (The Book of Animals) by Ḡāḥiẓ, an Arab scientist who lived in the 8th/9th century (775-867). It's a book composed of seven volumes of approximately 400 pages each.

Ḡāḥiẓ was a contemporary of the most important Abbassid califs such as Ar-Rashid, al-Ma'mūn and al-Mu'tassim, whose reign witnessed the golden era of the Arab-Moslem civilisation⁷. It was an epoch where the intellectual climate was propitious to the development of sciences.

This famous humanistic Arab is more known for his philosophical and literary works than for his scientific achievement. His documents in zoology have been studied only by some orientalist⁸ that, unfortunately, had no training in

⁶ Ḡāḥiẓ, *Kitāb al-ḥayawān*, established and annotated by Abdessalām Mohammed Hāroun; ed. Dār-el-Gil and Dār-el Fikr, 7 vols, (Beyrouth, 1988).

⁷ See especially :

Endress, G., (1997): « The Circle of al-Kindi. Early Arabic Translations from the Greek and the Rise of Islamic Philosophy », *Studies on the Transmission of Greek Philosophy and Sciences* dedicated to H.J. Drossaart Lulofs, ed. par G. Endress et R. Kruk, Leiden, pp. 43-76.

Gutas, D., (1998): *Greek Thought, Arabic Culture. The Graeco-Arabic Translation Movement in Baghdad and Early 'Abbasid Society (2nd-4th/ 8th-10th centuries)*, Routledge, London

⁸ See especially :

Kopf, L. (1953): The « Book of animals » (*Kitāb al-ḥayawān*) (ca. 767-868). *Actes 7e Congr. Int. Hist. Sci.*, Jérusalem, pp. 395-401.

Lewin, B. (1952): The book of animals of the Arab writer Jahiz, *Lychnos*, p. 210-246.

Nefti, B. M. (1977): *La psychologie des animaux chez les Arabes*, Klincksieck, Paris

Palacio, M.A. (1930) : El « libro de los animales » de Jāḥiẓ. *Isis*, 14, pp. 20-54.

biological sciences. In scientific circles however, his works have never been studied and are quite unknown. A specialization in zoological sciences and knowledge of the Arabic language are therefore two necessary conditions to study medieval Arab zoology.

In the present work, we will focus on various aspects of Ġāhiz's zoology and specially those related to ecology and ethology. We will particularly focus on the main contributions of this author in this field, namely animal communication, bird orientation, influence of the environment upon animal reproduction, parental investment and, learning and conditioning.

First example: Animal communication

Skimming through *Kitab al-haywān* , we can appreciate Ġāhiz's contribution to the field of animal communication. Several animal species have been mentioned as examples illustrating the existence of language between individuals belonging to the same species.

Pellat, C. (1953) : Le milieu basrien et la formation d'al-Gahiz, Ed. *Adrien-Maisonneuve*, Paris

Wilson, W. J. (1965) : Al-Jahiz and Arabic zoology, *UMI Dissertation Services*, Michigan, pp. 285

In each of these examples, we can draw some information such as the following⁹:

- * Each animal species has its own language;
- * Language in a given animal species is limited to its living needs;
- * The acoustic message organization in animals can be analyzed and classified;
- * The acoustic message in a few species is spaced out, shaped, composed and organized;
- * In addition to the audible acoustic message, there are other message types which could be inaudible acoustic, visual or with unknown characteristics;
- * It is possible to understand the animal message;
- * Understanding animal language is the object of a science of great value.

The subtlety and pertinence of Jahiz's arguments and assertions in favor of the existence of a language specific to each species as described in *Kitāb al-haywān* reveal a remarkable depth of analysis and observation spirit. Moreover,

⁹ *Kitāb al-haywān*, I, 31-33; II, 76, 251-252; IV, 6-8, 22; V, 288-289; VI, 25, 408; VII, 56-58

the passages and assertions about animal communication can be considered the first ones of their kind.

Which leads us to affirm that Ğāhiz laid down the first foundations of a science unknown up till then and that he himself qualified as being "a science of great value". As every one knows, animal communication was not really studied and developed until the twentieth century.

Second example: Bird orientation

When one goes through Ğāhiz's texts, one notes that during his epoch, people in general, were not convinced that migratory birds are guided by marks. The idea that prevailed then, was that these birds fled their cold and snowy region to continue their voyage until they find a hotter and more nourishing land in order to establish themselves.

Being aware of all these trophic and climatic causes of birds migration, Ğāhiz refused the random character attributed to their journey. He was certain that these birds after their migration return with a very precise manner to their place of origin. For him, to be able to accomplish this, they are guided by the azimuth or use other marks. He also specified that the use of marks is a common characteristic of all migratory birds

without any exception¹⁰. generalizing this phenomenon among all birds in the final analysis.

In the case of birds that migrate by night, Ğāḥiẓ affirms that they rely on the stars for their orientation.¹¹

Talking about the homing pigeon, Ğāḥiẓ points out that rivers, routes, the wind and the sun are the main marks used by this bird in its orientation.¹² However, Ğāḥiẓ does not exclude the idea of a mental map among homing pigeons. According to him, the pigeons only resort to the previously described marks when they no longer dispose of a map of the region that they travel through¹³.

Finally, a survey of the content of *Kitāb al-ḥayawān* shows us that Ğāḥiẓ was also aware of the existence of orientation among some species belonging to other zoological groups such as Fish and Reptiles.

It is important to mention that this author studied and developed such a topic during an epoch when nobody believed that birds use marks for their orientation. It is also interesting to note that his ideas about bird navigation are similar to those expressed presently by modern scientists. Ğāḥiẓ is actually the first naturalist to embark upon this study of animal orientation.

¹⁰ *Ibid*, III, 258-259

¹¹ *Ibid*, III, 216

¹² *Ibid*, III, 274-275.

¹³ *Ibid*, III, 216

Third example: Parental investment

Ğāhiz asserts that eggs laid by very prolific species are autonomous. This led him to undertake an interesting reflexion aiming at finding out an etho-ecological explanation to variability according to species of the size of the litter or that of the brood. Thus, for Ğāhiz, fish are more prolific because they do not have to nurture their progeny (here, no regurgitation, or feeding through the bill, or incubation or breast-feeding takes place). Contrarily to fish, pigeons, regurgitate and incubate and need to look for food so as to feed their chicks. Consequently and because of the effort they have invested, pigeons cannot have more than two chicks in their nest. On the other hand, for our author, since hens incubate and do not ensure regurgitation, or feed their chicks, God has endowed them with a higher number of eggs and chicks. However, this number is far from equaling that of fish, scorpions or even *uromastix*, which do not take care of their eggs or young. The same applies to the ostrich, which does not regurgitate and incubates its eggs only partially. This animal lays at least thirty eggs in each clutch. The same can be said of the snake which does not breastfeed its progeny and which lays about thirty eggs that it incubates for a short time only.¹⁴

From this reflexion undertaken by Ğāhiz we can draw a law that puts an emphasis on the close relationship between the

¹⁴ *Ibid*, VII, 53, 66-70.

importance of parental investment in the care given to eggs and progeny and the size of the brood and the litter. This means that the more investment in parental care giving there is, the less high the size of progeny is and *vice-versa*. It is therefore obvious that Ğāḥiẓ had already laid down the first steps in Fisher's theory¹⁵ on parental investment.

Fourth example: Influence of the environment change upon animal reproduction

Concerning animal reproduction and development, Ğāḥiẓ points out to the difficulty of the rearing of elephants in Iraq as well as the impossibility of their reproduction in this land¹⁶. This is due, according to our author, to the incompatibility of this region with the elephants' nature causing these animals to fall easily ill and be vulnerable to death. He brings to our attention another factor that makes elephants unable to adapt in Iraq: it consists in the passage from the wild life to the domestic life. Being wild, these animals instinctively feed according to their usual diet. However, once they are captured and domesticated, these elephants undergo a major change in their feeding behavior. Servants are in charge of

¹⁵ Fischer, R. A. (1930): The genetical theory of natural selection, Ed. Clarendon Press, oxford.

¹⁶ *Kitāb al-hayawān*, VII, 134-135.

taking care of all the elephants' needs and impose upon them another food diet, which creates many problems.

Ğāhiz observes that this elephants' unadaptability in Iraq is a phenomenon that is not merely limited to elephants, but that it also exists among other animals.

The polemic that existed in Ğāhiz's epoch concerning the reasons that hinder the elephants' reproduction in Iraq is also reported in *Kitāb al-ḥayawān*¹⁷, Ğāhiz states, that according to certain scholars, wild birds can reproduce in captivity if they are raised from a very young age. And so, in order to succeed in rearing elephants, one must try to import them from a very young age in order to minimize their attachment to wild life.

Wild animals such as lions, wolves, cheetahs and tigers are also cited by Ğāhiz, this time in order to illustrate the phenomenon of the non-reproduction of wilds animals in captivity. But our author observes that if one can provide favorable conditions for these animals, like placing them in Iraqi prairies ensuring all their needs, these animals will surely breed. And even if one raises young elephants in these prairies they will probably succeed in reproducing.

It is important to note that in this other field of animal reproduction; Ğāhiz has the merit of having studied a few

¹⁷ *Ibid*, VII, 186-188.

factors, which could have an influence on the problem of reproduction among wild animals living in captivity.

Fifth example: Learning and conditioning

Let us now examine the studies undertaken by Ğāḥiẓ in his *Kitāb al-ḥayawān* and which deal with various aspects of animal behaviour in relation to learning and conditioning in animals.

The various learning types studied by Ğāḥiẓ are habituation, classical conditioning (or conditioning reflexes), aversive conditioning, inhibitive conditioning and finally learning through positive and negative experiences (combined learning).¹⁸

It is true that techniques to control animals or to train them to execute particular tasks or to teach them to behave according to specific orders coming from their trainer were known and well mastered. However, the originality of the *Kitāb al-ḥayawān* lies in the fact that the author did not report cases of learning in animals only, but went further than that. Indeed, Ğāḥiẓ contributed what could be considered the first systematic theoretical reflections, which seek to understand and explain learning mechanisms.

On the other hand, one cannot help being struck by the methodological concern shown in these experiments in order to

¹⁸ *Ibid*, I, 193; II, 72-75, 120-122, 129-131; V, 539-540.

control the potential factors, which could influence an animal's behaviour.

Another important observation is that the examples to illustrate various aspects of conditioning presented by this author, generally come from his observations of dogs. In this respect, one cannot help noting the striking similarity between some of these examples and the famous experiments of Pavlov carried out ten centuries later. As everyone knows, this eminent biologist, too, undertook experiments on dogs in the framework of his works on animal experimental and comparative psychology.

Conclusion

A thorough investigation of Ğāhiz's work has enabled us to appreciate the contribution of Ğāhiz to the field of zoology and in particular to that of ecology and ethology. Of particular interest is the case of animal orientation where for the first time the author affirms the existence of a faculty allowing the animals to use a given number of geographical and stellar landmarks so as to find their way back home.

It is also the case of animal communication where, through several examples taken from various animal species, Ğāhiz has been able to distinguish between different channels enabling those animals to communicate. Thus, he has been able to establish a close link between the richness of the language

and the number of needs that exist in a given species. This led him, in the case of a few species, to identify the kind of cry corresponding to their respective need.

Other original aspects stand out from his work; it is specially the case of animal reproduction. It is indeed important to note that Ğāhiz became aware of the existence of diverse reproductive strategies in animal species, which allow the latter to survive. This led him to draw a law relating the size of the progeny to the quality of the care received from the parents. Ğāhiz had therefore set the first elements of the theory of Fischer (1930) about parental investment.

In the same field of animal reproduction, Ğāhiz has the merit of having pointed to a few factors, which could have an influence on the problem of reproduction among wild animals living in captivity. These factors were equally taken into consideration to allow them to reproduce.

On the other hand, the importance of Ğāhiz's texts on animal learning and conditioning, particularly in dogs, should be stressed. These texts, remind us, in many respects, of Pavlov's experiences in the field of conditioned reflexes.

Lastly, needless to mention that even now, in the opinion of science historians, the Arabs have not contributed anything to the field of zoology. According to the same view, the Arabs have only served as intermediaries with the sole

merit of having saved the valuable Greek heritage, which later led to the development of the western science. However, through our study of Ğāhiz's *Kitāb al-ḥayawān*, we can affirm that this point of view cannot hold any more now that medieval Arab zoological texts are beginning to be studied in the light of modern zoology.

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