THE HISTORY AND DEVELOPMENT OF ETHOLOGY

Mihaela Liana FERICEAN, Olga RADA, Mihaela BADILITA
Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania", Faculty of Agricultural Sciences, Aradului St. 119, Timisoara-300645, Romania,

Abstract: *This paper presents a synthesis by relating the history of the occurrence, development and consecration of Ethology, as independent branch of biological sciences. Throughout history aspects of animal behaviour were studied by many naturalists and zoologist. Many thinkers of antiquity, have studied animal behaviour long before the word 'ethology' was introduced. For instance Aristotle, Plato, Chrysippos, Plutarch, have left written evidence about their concerns and their contemporaries attempts theorizing concerning animal behavioural motivation. Ethology has its scientific roots in the work of Charles Darwin and of American, German and French naturalist, including Charles O. Whitman, Oskar Heinroth, Wallace Craig, H.S. Jennings, Georges-Louis Leclerc, Comte de Buffon, Jean-Baptiste Lamarck, Georges Cuvier, René Antoine, Ferchault de Réaumur, Piere Gassendi, René Descartes, Charles-Georges Le Roy, Georges-Frédéric Cuvier, Pierre Flourens. Although many naturalists have studied aspects of animal behaviour through the centuries, the modern discipline of ethology is usually considered to have begun as a discrete discipline with the work of Dutch biologist Nikolaas Tinbergen and by Austrian biologists Konrad Lorenz and Karl von Frisch, joint awardees of the 1973 Nobel Prize in Physiology or Medicine. In Romania, research regarding animal behaviour have started in the second half of the twentieth century. The works published by M. Beniuc (1970; 1971), Elena Chenzbraun (1973; 1978), and M. Cociu (1980; 1982) and, mainly, works: Salantiu et al, 1998, Palica, Coman (1998), Mihai Cociu (1999), Acatincai (2009) contributed to development and popularization of ethology in our country. Ethology is a combination of laboratory and field science, Ethologists are typically interested in a behavioural process rather than in a particular animal group, and often study one type of behaviour, such as aggression, in a number of unrelated animals. Understanding ethology or animal behaviour can be important in animal training. Considering the natural behaviours of different species or breeds enables the trainer to select the individuals best suited to perform the required task. It also enables the trainer to encourage the performance of naturally occurring behaviours and also the discontinuance of undesirable behaviours.*

Keywords*: history, development, Ethology*

INTRODUCTION

Over the last few years the desire to understand the animal world has increased dramatically. Animal behaviour is now a rapidly growing field and many prior understandings of the behaviour, characteristics and communication of animals are being rewritten. The big question, how and why do animals behave the way they do, is far from being comprehensively answered, but the emergence of a new generation of animal behaviourists is helping to begin the answering of this and other questions.

The study and interpretation of the natural behaviour of animals is a fascinating subject and those who choose to study animal behaviour are concerned with understanding the causes, functions and evolution of behaviour. There is an increasing need for humans to take an element of responsibility towards animals and their welfare. Not just for domestic pets but for wild animals, who are having to adapt to new environments as a result of climate change and the effects that this is having on the natural habitats of some wild animals.

On a more domestic level, there is a greater awareness among the general public of issues involved with the welfare of companion, performance and farm animals. Animals that are bred for food, animals that we keep as pets and those that are kept in zoos and aquariums, horses that are used in horseracing and animals that are used in films are all looked after by people with a good scientific knowledge of animal behaviour.

(http://www.thecompleteuniversityguide.co.uk/courses/options/animal-behaviour/)

MATERIAL AND METHOD.

I made a short references incursion on the history, occurrence, development and consecration of Ethology, using existing materials from foreign and our country literatures.

RESULTS AND DISCUSSION

Ethology is the science that study animal behaviour, usually with a focus on behaviour under natural conditions. The term *ethology* derives from the Greek language *ethos* meaning "character" and *logia* meaning "the study of".

The term was first popularized by William Morton Wheeler an American myrmecologist (the study of ants) who in 1902 became the leading authority on the behaviour of social insects, achieving particular renowned for his studies of social behaviour of ants. He was instrumental in the development of ethology and first popularized the term in a 1902 paper in *Science*. (SLEIGH, CHARLOTTE, 2007)

An earlier, slightly different sense of the term was proposed by John Stuart Mill in his 1843 *System of Logic*. (BOURG, JULIAN, 2007)

He recommended the development of a new science, "ethology," the purpose of which would be explanation of individual and national differences in character, on the basis of associanistic psychology. This use of the word was never adopted.

The overall study of the behaviour of animals in their natural environment has a long history. An enormous amount of descriptive material, as well as some experimental material, was collected in the works of 18th- and 19th-century natural scientists—for example, in the descriptions of the German scholar H. Reimarus and the French scientists G.-L. de Buffon and J. H. Fabre and in the experimental work of the French zoologist G. Cuvier. It was on the basis of such material that the category of instinctive behaviour was singled out and clearly defined.

Ethology was directly influenced by the works of Charles Darwin. The great number of facts he collected about the behaviour of animals in their natural environment made it possible to distinguish the basic categories of behaviour—namely, instinct, learning ability, and the elementary ability to reason. Darwin also showed that animals' behavioural traits, like physical traits, are inherited and subject to change. Using instincts as an example, Darwin indicated the ways in which behavioural traits can evolve in the process of natural selection. The development of ethological notions was directly influenced by the research studies of various scientists (the Englishman D. Spaulding, the American C. O. Whitman, and the German O. Heinroth) who demonstrated experimentally that certain forms of behaviour are of innate origin, are uniformly manifested, and are peculiar to certain species.
(http://encyclopedia2.thefreedictionary.com/Ethology)

The modern discipline of ethology is generally considered to have begun during the 1930s with the work of Dutch biologist Nikolaas Tinbergen and by Austrian biologists Konrad Lorenz and Karl von Frisch, joint winners of the 197. The Nobel Prize in Physiology or Medicine 1973 "*for their discoveries concerning organization and elicitation of individual and social behaviour patterns"*
*(*http://www.nobelprize.org/nobel_prizes/medicine/laureates/1973/index.html)

The desire to understand animals has made ethology a rapidly growing field. Since the turn of the 21st century, many aspects of animal communication, animal emotions, animal culture, learning, and even sexual conduct that experts long thought they understood, have been re-examined, and new conclusions reached. New fields have developed, such as neuroethology. (http://en.wikipedia.org/wiki/Ethology)

Scientists and amateurs have studied animal behaviour long before the word

'ethology' was introduced. For instance, Aristotle had many interesting observations concerning animal behaviour. The study of animal behaviour was taken up more systematically mainly by German and British zoologists around the turn of the 19th century. The great British naturalist Charles Darwin (1809-1882), in his classic book on the theory of evolution by natural selection (Darwin, 1859), devoted a whole chapter to what he called 'instinct'. As early as 1873, the British amateur investigator Douglas Spalding recorded some very interesting observations on the attachment behaviour of young domestic chicks to abnormal objects, a phenomenon that was later called 'imprinting', after the German 'Prägung'

Karl Ritter von Frisch, (20 November 1886 – 12 June 1982) was an Austrian ethologist

His work centred on investigations of the sensory perceptions of the honey bee and he was one of the first to translate the meaning of the waggle dance. His theory, described in his 1927 book *Aus dem Leben der Bienen* (translated into English as *The Dancing Bees*), was disputed by other scientists and greeted with scepticism at the time. Only much later was it definitively proved to be an accurate theoretical analysis. (Riley, J. et al, 2005).

Nikolaas "Niko" Tinbergen (15 April 1907 – 21 December 1988) was a Dutch biologist and ornithologist. In 1951, he published *The Study of Instinct*, an influential book on animal behaviour.

In the 1960s, he collaborated with filmmaker Hugh Falkus on a series of wildlife films, including *The Riddle of the Rook* (1972) and *Signals for Survival* (1969), which won the Italia prize in that year and the American blue ribbon in 1971 (http://en.wikipedia.org/wiki/Nikolaas_Tinbergen)

Konrad Zacharias Lorenz (7 November 1903 – 27 February 1989) was an Austrian zoologist, ethologist, and ornithologist.

Konrad Lorenz is considered to be one of the principal founders of ethology, a branch of science that attempts to gain a deeper insight of behavioural patterns in animals. With Oscar Heinroth (the author of "Die Vögel Mitteleuropas"), he is held to have discovered imprinting, an especially rapid and relatively irreversible learning process that occurs early in the individual's life where auditory and visual stimuli from an animal's parents are needed to induce the young to follow their parents. A central concept complementary to imprinting is the innate release mechanism, whereby organisms are genetically predisposed to be especially responsive to certain stimuli such that imprinting will become fixed on the parents. (age-of-the-sage.org/scientist/konrad_lorenz.html)

Piere Gassendi (1592 -1655) in his Syntagma philosophicum he undertook a comparative study of animal and human cognitive abilities and discover they were logically similar. Both human and animal souls operated on sensory images to yield reasoned action.

René Descartes (1596 – 1650) discussed the theory of animal behaviour in his letter (1646) to the Marques of Newcastle

French sensationalists continued to be chary of the use of instinct in the account of animal behaviour.

The attitude of Jean Antoine Guer (1713- 1764) a historian of animal phycology writing in mid-century is representative

Georges-Louis Leclerc, Comte de Buffon (1707 – 1788) was a French naturalist, mathematician, cosmologist, and encyclopedic author.

His works influenced the next two generations of naturalists, including Jean-Baptiste Lamarck and Georges Cuvier. Buffon published thirty-six quarto volumes of his *Histoire Naturelle* during his lifetime; with additional volumes based on his notes and further research being published in the two decades following his death.

René Antoine Ferchault de Réaumur (1683 – 1757) was a French scientist who contributed to many different fields, especially the study of insects

Charles-Georges Le Roy (1723 – 1789) was a French man of letters during the Age of Enlightenment and the author of one of the first books on animal behaviour.

In his Letters sur le animaux (1968), traced the development of intelligence in young wolves, foxes and deer against the background of their social and natural circumstances. In his analysis he preserved the notion of instinct to refer to basic psychologically desires- the need for certain food.

But he refused instinct any role in directing behaviour designed to satisfy those needs. He rather believed this was accomplished by sensory experience and the applications of wakening intelligence (http>Robert J. Richards Darwin and the Emergence of Evolutionary Theories of Mind and Behaviour - Robert J. Richards - Google Books.html)

Le Roy's publications began as texts on the behaviour and sensitivity of animals, published under the pseudonym of "the physician of Nuremberg." These appeared in the *Encyclopédie méthodique* in 1764.

Georges-Frédéric Cuvier (1773 – 1838) was a French zoologist. He was the younger brother of noted naturalist and zoologist Georges Cuvier. Frederic was the head keeper of the menagerie at the Muséum d'Histoire Naturelle in Paris from 1804 to 1838.

He is mentioned in Charles Darwin's *On the Origin of Species* as having worked on animal behaviour and instinct, especially the distinction between habit and instinct.

Pierre Flourens (1794 – 1867) De l'Instinct et de l'intelligence des animaux where is emphasized the idea that animal behavior is determined both by instinct and intelligence.

Charles Darwin (1809 - 1882) was an English naturalist and geologist, best known for his contributions to evolutionary theory, he published in 1859 “The Origin of Species”.

Alfred Russel Walace (1823 - 1913) considered that instinct were initially intelligent action, which, through regular and automatic fixing and become hereditary.

Charles Otis Whitman (1842 - 1910) who coined the term instinct to describe the display patterns of pigeons. The ethogram, a graph of the time course or switch points in a sequence of behaviours, became a way of categorizing species-typical behaviours. Many of these instincts are triggered by various environmental stimuli and von Uexkull termed such triggers of instinctive stereotyped behaviours sign stimuli. A classic stimulus triggers the courtship display of male three-spined sticklebacks fish. The enlarged belly of a female triggers the zig-zag dance in male stickleback fish. The males use the dance to entice the female stickleback to enter the nest that the male has built. (http://bio.research.ucsc.edu/~barrylab/classes/animal_behavior/HISTORY.HTM#_Toc400814869)

Wallace Craig (1876–1954) was an American the ethologist and animal psychologist. He provided a conceptual framework for the study of behaviour organization and is regarded as one of the founders of ethology. Craig experimentally studied the behavioural expression of emotion, the way innate and learned behavioural tendencies are integrated, and how vocal as well as social behaviours are organized. He encouraged a view of behaviour as an integrated process with evolutionary, motivational, experiential, social and ecological degrees of freedom. This integrative perspective helped shape modern behavioural science.

From 1908 to 1922, Craig was a professor of philosophy at the University of Maine and wrote a series of articles that gave a careful description and highly innovative conceptual analysis of pigeon behaviour. After his enforced retirement his principal contribution was his informal collaboration with Konrad Lorenz in the latter's development of much of the conceptual groundwork for ethology. ,

Jaques Loeb (1859 - 1924), was a German-born American physiologist and biologist. Loeb developed a theory of animal behaviour based on the concept of tropism, an involuntary forced movement. He found that an animal's response is a direct and autonomic function of a reaction to a stimulus. In other words, behaviour is said to be forced by a stimulus, it does not require any explanation in terms of an animal's consciousness. Loeb's theory was very influential for the time of Biological sciences, which represented a change from the work of Romanes and Morgan.

H.S. Jennings (1868 – 1947), demonstrated by his works that animals are capable of performing orientation movements learned by trial and error.

Ivan Petrovici Pavlov (1849 - 1936) elaborate the classical conditioning theory, he carried out his classical experiments on the digestive glands which is how he eventually won the Nobel Prize.

Pavlov (1897) published the results of an experiment on conditioning after originally studying digestion in dogs.

E.L. Thorndyke (1874 – 1949) was a pioneer not only in behaviourism and in studying learning, but also in using animals in psychology experiments. Thorndike was able to create a theory of learning based on his research with animals. His doctoral dissertation, "Animal Intelligence: An Experimental Study of the Associative Processes in Animals", was the first in psychology where the subjects were nonhumans. He was interested in whether animals could learn tasks through imitation or observation.

(wikipedia.org/wiki/Edward_Thorndike). From his research with puzzle boxes, Thorndike was able to create his own theory of learning. Thorndike (1905) formalized the "*Law of Effect"*.

Oskar Heinroth (1871 - 1945) was a German biologist who was one of the first to apply the methods of comparative morphology to animal behaviour, and was thus one of the founders of ethology. His extensive studies of behaviour in the Anatidae (ducks and geese) showed that instinctive behaviour patterns correlated with taxonomic relationships determined on the basis of morphological features. He also rediscovered the phenomenon of imprinting, reported in the 19th century by Douglas Spalding but not followed up at the time. His results were popularized by Konrad Lorenz, whose mentor he was. Lorenz regarded Heinroth as the true founder of the study of animal behaviour seen as a branch of zoology. He began his studies of duck and goose behaviour while working as a scientific assistant from 1898 to 1913. He subsequently became the director of the Berlin Aquarium, a post he held for more than 30 years.

After the Second World War there were two broad approaches to the study of animal behaviour in Europe and America.

The European school was founded in the 1930's by the Austrian Konrad Lorenz. He collaborated with the Dutch zoologist Niko Tinbergen to establish 'ethology' which he defined as the 'biological study of behaviour'. Tinbergen's book 'The Study of Instinct' remains the best introduction to the ethological approach to the study of animal behaviour.

The American approach to animal behaviour has its roots in the work of J.B. Watson who in 1924 laid the foundation for an experimental approach to the study of behaviour in his book 'Behaviourism'. Watson was influenced by Pavlov's work on classical conditioning, and the English philosopher John Locke who believed that we are born as a blank slate "tabula rasa" on to which we write the associations we perceive in our environment.

Behaviourism is a term that also describes the scientific and objective study of animal behaviour, but it usually refers to the study of trained behavioural responses in a laboratory context.

Watson's ideas were adopted by experimental psychologists who were particularly interested in studying learning under laboratory conditions. Perhaps the best known exponent of this approach in its purest form was Fred Skinner who believed that behaviour was shaped by reward. Essentially reward leads to the repetition of a behaviour.

CONCLUSIONS

One of the most important ideas from the works of such thinkers is that events human and animal behaviour have both common characteristics and distinctive features, such sensing the diversity of behaviour.

In Romania, research regarding animal behaviour have started in the second half of the twentieth century. The works published by M. Beniuc (1970; 1971), Elena Chenzbraun (1973; 1978), and M. Cociu (1980; 1982) and, mainly, works: Salantiu et al, 1998, Palica, Coman (1998), Mihai Cociu (1999), Acatincai (2009) contributed to development and popularization of ethology in our country.

BIBLIOGRAPHY

1. ACATINCAI S- Etologie, comportamentul animalelor domestice Ed Agroprint, Timisoara, 2009
2. BARRETT et al. -Human Evolutionary Psychology. Princeton University Press, 2002
3 BARKAN, E (1991), "Reevaluating progressive eugenics: Herbert Spencer Jennings and the 1924 immigration legislation.", *Journal of the history of biology* **24** (1): 91–112, doi:10.1007/BF00130475, PMID 11612743
4 BOURG, JULIAN (2007). *From revolution to ethics: May 1968 and contemporary French thought*. McGill-Queen's Press - MQUP.
5. BATESON, PAUL PATRICK GORDON - *The Development and integration of behaviour: essays in honour of Robert Hinde*. Cambridge University Press. 1991
6. BUCHMANN, STEPHEN - *Letters from the Hive: An Intimate History of Bees, Honey, and Humankind*. Random House of Canada. p. 105. ISBN 978-0-553-38266-2. 2006.
7. BOUTON, M.E. - *Learning and behavior: A contemporary synthesis*. MA, Sinauer: Sunderland, 2007
8. COCIU M. - Etologie comportamentul animal, Ed All, 1999
9. DAVIES, NICHOLAS B., KREBS, JOHN R., AND WEST, STUART A.- An Introduction to Behavioral Ecology, 4th ed. Oxford: Wiley-Blackwell, 2012.
10. MATTHEWS, JANICE R.; ROBERT W. MATTHEWS -*Insect Behaviour*. Springer. p. 13. ISBN 978-90-481-2388-9, 2009
11. HAGGERTY, M.E., (1909). Imitation in monkeys. Journal of Comparative Neurology and Psychology, 19: 337-455
12. PALICICA R. - Etologie –comportamentul animalelor domestice, Ed Orizonturi universitare, Timisoara, 1998.
13. PAVLOV, I. P. -. *The work of the digestive glands*. London: Griffin, 1897
14. RILEY, J.; GREGGERS, U.; SMITH, A.; REYNOLDS, D.; MENZEL, R. "The flight paths of honeybees recruited by the waggle dance". Nature, 435 (7039): 205–207. Bibcode: 2005Natur.435.205R. doi: 10.1038/nature03526 , 2005
14. RENDELL, L. AND WHITEHEAD, H. (2001). Culture in whales and dolphins. Behavioral and Brain Sciences, 2001
16. ROBERT J. RICHARDS Darwin and the Emergence of Evolutionary Theories of Mind and Behavior – Google Books.html
17. SALANTIU et al, Comportamentul animalelor domestic, Ed Oelty, 1998
18. SLEIGH, CHARLOTTE - *Six Legs Better: A Cultural History of Myrmecology*. Baltimore: Johns Hopkins University Press, 2007
19. SIBLEY, R.M. - "Optimal group size is unstable". Animal Behavior, 1983
20. TINBERGEN, NIKO - The Herring Gull's World - London, Collins, 1953
21. TINBERGEN, N. - *The Study of Instinct*. Oxford University Press, New York, 1951

22. VERBEEK, PETER - "Peace Ethology." Behaviour, 2008
23. http://bio.research.ucsc.edu/~barrylab/classes/animal_behavior/HISTORY.HTM#_Toc400814869
24. http://en.wikipedia.org/wiki/Ethology
25. http://en.wikipedia.org/wiki/Nikolaas_Tinbergen
26. http://www.nobelprize.org/nobel_prizes/medicine/laureates/1973/index.html
27. http://www.age-of-the-sage.org/scientist/konrad_lorenz.html
28. http://encyclopedia2.thefreedictionary.com/Ethology
29. http://"Definition of ETHOLOGY". Merriam-Webster. Retrieved 30 October 2012. 2 : the scientific and objective study of animal behaviour especially under natural conditions
30. http://www.flyfishingdevon.co.uk/salmon/year1/psy128animal_behaviour/animbeha.htm