

## COGNITIVE ABILITIES IN DOLPHINS BRED UNDER HUMAN CONTROL (*TURSIOPS TRUNCATUS*)

### ABILITĂȚI COGNITIVE LA DELFINII CRESCUȚI SUB CONTROL UMAN (*TURSIOPS TRUNCATUS*)

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#### ABSTRACT | REZUMAT

The modern concept of demonstrating the cognitive skills in dolphins through a broader evolutionary approach involves understanding the concept of cognitive convergence. In this context, convergence involves the existence/appearance of some structural or functional similarities in phylogenetic distant organisms, as a result of the adaptation to relatively identical environmental conditions. Ethological studies have shown that the higher the phylogenetic separation of two species is, the stronger the convergence case. Demonstrating the cognitive abilities in dolphins bred under human control and monitoring certain types of behavior, can represent the premise of adapting these marine mammals, as quickly and as well as possible to their new life conditions, which is a priority objective of the specific national and international research programs. In the case of dolphins bred under human control, an important role is attributed to the biological balancing and to verifying the adaptability of these marine mammals to new living conditions, but also to investigating various behavioral factors, necessary in order to develop an appropriate methodology for their training. Considering that a healthy environment is essential in order to ensure the wellbeing and performance of dolphins, at the same time focusing on the quality of life of these marine mammals bred under human control, it is very important to assess extremely carefully their complex cognitive skills, but also the set of sophisticated behaviors that this species possesses.

**Key words:** dolphins, cognitive abilities, behavioral manifestations

Conceptul modern de demonstrare a abilităților cognitive la delfini printr-o abordare evoluționistă cât mai largă, implică înțelegerea conceptului de convergență cognitivă. În acest context, convergența implică existența/apariția unor asemănări structurale sau funcționale la organisme îndepărtate filogenetic, ca rezultat al adaptării la condiții de mediu relativ identice. Studiile etologice au arătat faptul că, cu cât este mai mare separarea filogenetică a două specii, cu atât mai puternic este cazul convergenței. Demonstrarea abilităților cognitive la delfinii crescuți sub control uman, și monitorizarea anumitor tipuri de comportament, poate reprezenta premiza adaptării acestor mamifere marine, cât mai repede și cât mai bine la noile condiții de viață, acesta fiind un obiectiv prioritar al programelor specifice de cercetarea națională și internațională. În cazul delfinilor crescuți sub control uman, un rol important îl are echilibrarea biologiei și verificarea capacității de adaptare a acestor mamifere marine la noile condiții de viață, dar și investigarea diversilor factori de ordin comportamental, necesari pentru elaborarea unei metodologii corespunzătoare instruirii lor. Ținând seama că un mediu sănătos este esențial pentru asigurarea bunăstării și performanței delfinilor, punându-se, în același timp și un mare accent pe calitatea vieții acestor mamifere marine crescute sub control uman, este foarte importantă evaluarea cu mare atenție a abilităților cognitive complexe ale acestora dar și a setului de comportamente sofisticate pe care această specie le posedă.

**Cuvinte cheie:** delfini, abilități cognitive, manifestări comportamentale

Dolphins are some of the smartest and most amazing mammals on Earth. Following a particular arrangement of the dolphin's cortex (visual and auditory processing areas are much closer, even extremely integrated compared to all other mammals), cognitive convergence specifically represents the convergence of those processes that include the way that the body

processes information coming from the external and internal environment. It is worth mentioning that these processes include memory, learning some mechanisms, sensory and perceptual processing and levels of awareness. In general, cognitive convergence refers to convergence in intelligence. Dolphins are endowed with many of those capacities that make them special beings and worthy of protection (3).

Their evolution precedes ours with about ten million years, and during this long evolutionary path they have developed a brain that rivals ours in terms of size

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and complexity and geneticists have recently discovered the fact that the human genome and the dolphin genome are "mostly identical", more precisely, they have a similar chromosome structure, each human chromosome has a correspondent in the dolphin genome.

The neocortex of the dolphins (the part of the brain responsible for thinking, emotions processing and social behavior) is very developed. Also, a large part of the brain hemispheres is intended for echolocation and auditory communication.

In addition to these characteristics, dolphins have a common ability with ours, that of feeling pain and pleasure and developing complex and lasting emotional connections, that can even cross the boundaries between species.

Since dolphins have all of these capabilities, like us humans, we must recognize the fact that these marine mammals deserve the same moral and legal protection that we grant to human beings.

Because of this, dolphin species individuals are considered non-human beings endowed with sensitivity and with a developed level of intelligence.

Specialists have come to the conclusion that, dolphins are similar to humans in terms of the level of understanding the surrounding world, acting and communicating, consciously adopting and expressing social behaviors. Dolphins know who they are, both individually and as a member of a group or family. They interact and understand the idea of health and illness, have feelings about other dolphins and communicate very quickly with each other as if they were "interconnected".

In this context, a large dimension of the brain is evidence of a more developed intelligence and research has concluded that dolphins express a series of abilities (14) comparable to those of human individuals (e.g., they have the notion of themselves, can recognize their own image, are able to anticipate, plan and understand abstract symbols and notions, use proto tools in order to develop new behaviors, fact that proves they have innate intelligent capabilities).

Dolphins demonstrate the ability to learn a variety of rules to solve some abstract problems (6). For example, they can reliably categorize / systematize pairs of objects of the same type or of different types (11). Also noteworthy is the fact that emotional empathy is specific to dolphins, having the desire to help newborns and sick individuals, helping them reach the surface in order to breathe.

Dolphins have demonstrated the ability to mimic

(7) and are one of the few species that can imitate arbitrary sounds or arbitrary behaviors. Dolphins can innovate even spontaneously, and create new behaviors on demand (6), hence the ease of their training.

In addition, dolphins are among the few species that have demonstrated convincing evidence of self-awareness during the experiments. Self-consciousness is seen by some scientists as a sign of highly developed abstract thinking, believing that cetaceans have a level of consciousness similar to human individuals. Self-consciousness, though not well scientifically defined, is considered to be the precursor of more advanced processes, such as meta-cognitive reasoning (thinking about thinking) that is typical of man (10).

Worth mentioning is the fact that the most widespread test for demonstrating self-knowledge in dolphins is the mirror test, which consists in applying a temporary dye on a particular area of the dolphin's body, and after the dolphin is seated in front of a mirror, it looks and even turns to observe the marked area (10). Since dolphins can investigate their own bodies, they show that they have a deep self-esteem, representing solid evidences of self-awareness and self-monitoring, cognitive abilities that probably support complex social models.

Thus, the body's awareness of dolphins could be demonstrated by their ability to use those parts of the body in ways, often new, specified by the trainer / instructor (6). Some researchers have provided evidence that dolphins anticipate, monitor, organize, and even alter the oriented behavior towards certain purposes, particularly in the event of some unforeseen circumstances.

The acquired behavior expresses the dolphin's life experience, which provides it with an adequate response to environmental changes (their growth under human control). The acquired programs have a predominantly individual character and serve especially the momentarily satisfaction of the body needs. In fact, the very notion of an archetype created by the Swiss psychologist, Carl Gustav Jung (1961), represents the syntax of the informational model of the individual, with the gain he acquires in his own life through his own experience. Acquisition of ontogenetic information is achieved through exogenous stimulation of the body. The behavioral ontogenetic development is a complex process being the result of the experience gained (accumulated) by the individual in his lifetime through learning.

To a certain extent, what an individual needs to

learn, as well as the moment when the learning process is supposed to happen, is predetermined and fixed in the genetic endowment of the individual (4).

Although there is an innate predisposition to learning in animals, their possibilities to acquire new knowledge through learning are limited, animals not being able to learn anything, anyway and anytime, for the simple reason that the respectively behavioral pattern is not sketched in the genetic background of the individual/species. A stimulus received by an organism is, therefore, information about the environment in which the dolphin is located at a given moment. External stimuli can instantly provide information about where and when certain behavioral activities will be triggered and targeted. In this context, information is a *sine qua non* condition for the survival of any biological system that has organs and tissues specialized in receiving, transmitting and processing it, which can be materialized or completed by a proper behavior. Dolphins have an innate ability of learning, and the basis of this predisposition is the playful behavior, that is highly developed and expressed in this species. Dolphins are generally playful animals, spending most of their time playing, and that is the reason why dolphins can easily be trained. The dolphin training process is based on developing some conditioned reflexes (receiving a reward, favorite food). Worth mentioning is the fact that dolphins are easily suitable to group training (due to imitative behavior) and harder to train individually. Some aspects regarding behavioral manifestations of dolphins raised under human control are limited to their adaptation to play, to the ability to understand, to foresee a connection between two or more elements of the environment. Dolphins naturally display a wide variety of behaviors, out of which many can be observed in correlation with a specific hand gesture performed by a coach during the show/ training. It has been demonstrated that dolphins raised under human control enjoy the multitude of objects that they get in order to play, but to them, however, the most interesting toy is the man. Dolphins can spontaneously indicate to the trainer/instructor (using the snout and body alignment), the desired objects (14) and they seem to understand that the man has to be present and participate in these actions in order to make this communication effective (15). The combination of novelty during training and the formation and the consolidation of positive relationships with the trainers help achieving the desired results (1, 8).

Dolphin training can begin early (sometimes even one month after birth), the use of several tools being

needed. An instrument is, in fact, a target on which dolphins need to focus during training. Thus, the target can be the palm/ hand of the trainer, a ball, a circle, which can be placed on the water surface near the dolphin. Worth mentioning is the fact that strengthening a specific behavior is done by giving a reward (favorite food) after the dolphin touches the target with the snout. Once the dolphin has made the association between reaching the target and rewarding (the result being strengthening of that behavior), the target can be moved to various other places (9, 15).

Another important tool used during training in order to attract the attention of dolphins is recalling using a sound (whistling) or vibrations sent through water. When the dolphin hears the recall, it must approach the source of the sound or the water vibration in order to receive the reward. Through this training tool, dolphins can be redirected to another part of the pool (even in case of emergency). Worth mentioning is the fact that dolphins that show a certain custom-made behavior represents an assurance that they are healthy and feel comfortable in the pool. It has also been shown that training is a physical and mental stimulator for dolphins. In this context, demonstrating cognitive skills in dolphins bred under human control and monitoring certain types of behavior, may represent the premise of adapting these marine mammals as quickly and well as possible to new living conditions (2). Noteworthy is the fact that these processes include memory, learning some mechanisms, sensory and perceptual processing and levels of awareness. But, in general, cognitive convergence refers to convergence in intelligence. Highly important mentioning is the fact that, in dolphins raised under human control, the study of the different types of behavior must be consistent with some cognitive functions such as attention, judgment and social awareness in accordance with new environmental conditions (size of the pools, water quality, human contact), health status (by periodic medical checkouts) and, last but not least, with ensuring their well-being. In this context, integrating living organisms into the natural or artificial environment in which they live represents a particular way for them to receive and decode information.

From this point of view, the conditioned reflex is the temporary nervous connection of an external stimulus with the body's response activity, acquired in the course of life and formed under certain conditions of individual experience. These acquired reflexes are strictly individual, variable, they appear, fix and fade disappearing in the course of the individual's life, and

the premises of the conditioned reflex acts is the cerebral cortex (12).

In conclusion, in dolphins, acquiring as many and varied as possible conditioned reflexes is an objective biological necessity that helps them to maintain complex social relationships, knowing and staying in touch with the environment and, in the end, developing a proper behavior according to the living conditions, counteracting the harmful action of various environmental factors. In this context, they understand the surrounding world, communicate consciously and adopt complex social behaviors, learn and acquire the semantic characteristics of gestural and acoustic languages (5), and last but not least, present self-consciousness, a sense of personal identity, consequently being considered non-human beings. Thus, in dolphins raised under human control, it is very important that the study of the different types of behavior is made in accordance with some cognitive functions that they possess (attention, judgment and social awareness), according to the new environmental conditions (pools size, water quality, contact with the man), but also in accordance with the state of health (by periodical medical check-ups) and last but not least, with ensuring their wellbeing.

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