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## SPATIAL MEMORY OF AGGRESSIVE AND NON-AGGRESSIVE ANIMALS

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აგრესიული და არა აგრესიული ცხოველების სივრცითი მეხსიერება

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### რეზიუმე

აგრესიული ცხოველები დამახსოვრების მაღალი რეპროდუქციული უნარით გამოირჩევიან ღია სივრცეში, რაშიც მათ აგრესიულობის მაღალი ხარისხი ეხმარებათ. მოცემულ სიტუაციაში მორისის წყლის ლაბირინთში აგრესიულ ცხოველებს არააგრესიულებთან შედარებით უკეთესად უვითარდებათ ნავიგაციური დასწავლა, მათში ხდება სხვადასხვა ორიენტირის საშუალებით, პლატფორმის ადგილმდებარეობის სივრცითი წარმოდგენის ფორმირება. ასეთი გონებრივი რუქა შესაძლებელია იყოს ზუსტად აღქმული ვირთავვის მიერ. ჩვენს შემთხვევაში ასეთი რუქა კარგად აქვს აღქმული ორივე აგრესიულ ცხოველს.

Establishment of social hierarchy is characterized for all those species that have social hierarchy and social behavior. Thus, social behavior and formation of social hierarchy are under a great deal of attention. Bio- and neurochemical features of dominant as well as subdominant animals' behavior in literature are studied in details. Although these studies do not give us evidence how the organisms differ from each other before gaining the status [5,6,7]. It is known that dominants differ from organisms by various behavioral, physiological, biochemical, physical parameters, as well as by health condition, and the amount of generation [7,8]. While investigating the answers to these questions, we have found that the quantity of articles where there are these kinds of questions is really small. So, the particular goal of the study was to determine the features in rats that define the occupation of the position in social hierarchy by an animal and to realize their importance of learning and memory in the formation of hierarchy.

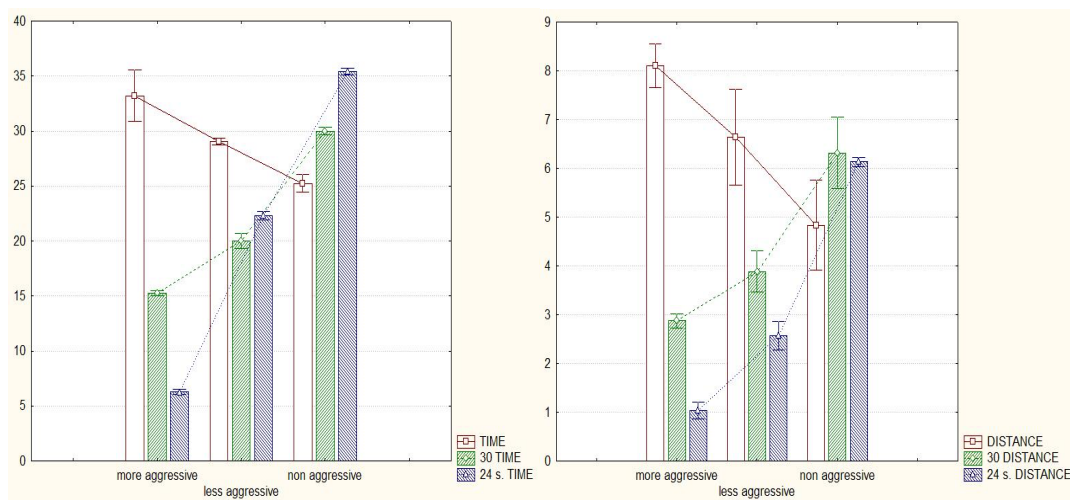
Aggressive behavior takes part in the development of dominant hierarchy. Clash activities are maintained by intensified aerobic and anaerobic metabolic activity, suggesting that body stability correlates with the clash ability of the animal [3,4,7]. As we concentrated on animals' personal abilities, we were interested in studying the features, that have often been the subject of the study in dominant and subdominant animals after the development of hierarchy. Although our main goal is to use in our experiment those rats that did not have the experience of social relationships, and the younger rats.

**Materials and methods.** We conducted spatial memory reception and remembering in Morris maze. We used Morris maze to study spatial learning and memory in rats, the best test for spatial movement, learning and reproduction. The maze is a white round shapes basin 2 m in diameter and 55 cm in height. 25 cm is filled with water. The water is heated to 25 degrees Celsius, there is a large platform inside 0.5 cm in height. The animal swims through the maze. Time and distance are registered until it finds the platform. Over time the rat finds the platform faster and faster. This improvement depends on the fact that the rat memorizes the place of covered platform [3]. In the experiment we used immature rats at the age of 2 months that were included

in the experiment directly from the bulk. The rats were selected by Yumatov method [2] as more aggressive and less aggressive rats.

The basin had 4 fixed start points. We registered time and distance the rat needed to find the covered platform. At the first day we let the animals go from each start point. If the animal could not find the platform we were placing them on the platform for 15 seconds and let them have a rest. After the 4 trials we let them have a rest for 30 minutes. After 30 minutes and 24 hours we assessed the hidden platform memorization rate

**Results and discussion.** According to the chart less aggressive rats need less time to find the platform than more aggressive ones. But in 30 minutes after learning they find the platform later than more aggressive ones and in 24 hours after learning they find the platform even later than in case of a 30-minute learning. This could be explained by the fact that the fast navigation of learning in less aggressive rats in case of constant position of the platform causes less consolidation in conditions of long-term spatial memory. Learning rate is less in less aggressive animals than in more aggressive ones in time as well as in distance, that is clear from the **figure 1**.



**Figure 1. less and more aggressive animals' speed and time in Morris maze.**

More aggressive animals find the hidden platform relatively late, want to come out of water, trying to find way out of the situation, thus move chaotically and faster, but after the further 3<sup>rd</sup> and 4<sup>th</sup> tests they find the platform quickly and get rid of water. But after 30 and 24 hours they are the fastest not only by the distance they covered, but by the fact how fast they find the platform. This once more proves their individuality and dominant features. If we look closely we will see that both aggressive animals look for the safe place in almost equal speed than non-aggressive animal, that is, we can say that aggressive animals are distinctive by higher reproductive ability of remembering in open space where the high rate of memorization plays the great role [1,2]. In this particular case in Morris water maze aggressive animals develop better navigation learning than non-aggressive ones. This kind of mental map could be perceived by the rat or not. In this case, this chart is well perceived by both aggressive animals. The main mechanism of remembering this kind of invisible platform could be relate to the development of proprio-vestibular apparatus. It seems that aggressive animals remember the motion sequence that enables them to find a target (praxis or idiopathic strategy). This increases consolidation with spatial memory. As it is known from the literature, administration of cycloheximide which is blocker of protein synthesis destroyed spatial memory consolidation, even fullerene small amount 1.7 mcg intrahippocampal microinjection had a warning effect [1,4,9]. As it is known fullerene injection removes anaphylactic shock without side effects. Also, cell immunohistochemical contrasting showed that cell cytoplasm contains a lot of fullerene that suggests about inhibiting processes inside the cell. Hence, we can consider that in aggressive

animals there is more active protein synthesis than in non-aggressive. This probably contributes to faster spatial reception, memorization and prolonged consolidation.

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**ПРОСТРАНСТВЕННАЯ ПАМЯТЬ АГРЕССИВНЫХ И НЕАГРЕССИВНЫХ ЖИВОТНЫХ**  
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### РЕЗЮМЕ

Агрессивные животные обладают высокой репродуктивной способностью запоминать в открытом космосе, чему способствует их высокая степень агрессии. В данной ситуации агрессивные животные в водном лабиринте Морриса развивают навигационную подготовку лучше, чем неагрессивные, формируя пространственное представление о местоположении платформы через разные ориентации. Такая мысленная карта может быть точно воспринята крысой. В нашем случае такая карта хорошо воспринимается обоими агрессивными животными.

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### SUMMARY

Aggressive animals have a high reproductive ability to memorize in open space, which is facilitated by their high degree of aggression. In this situation, aggressive animals in the Morris water maze develop navigational training better than non-aggressive ones, forming a spatial representation of the platform's location through different orientations. Such a mental map can be accurately perceived by a rat. In our case, such a card is well accepted by both aggressive animals.

**Key Words:** Aggressive, Non-aggressive, Animals, Spatial memory.