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Structure and position of *nucleus motoris nervi facialis* in the pigeon (*Columba livia*)

Budowa i położenie *nucleus motorius nervi facialis* u gołębia (*Columba livia*)

SUMMARY

The study material were the medullas taken from 5 sexually mature pigeons (*Columba livia*). The material was fixed in formalin, dehydrated in alcohol and embedded in paraffin. The medullas were then cut into 12 μm scrapes. Every second scrape was taken for microscopic investigation. The preparations were stained according to the Klüver Barrera's method (10).

Nucleus motoris nervi facialis is located in the ventricular part of *medulla oblongata* at its abdomino-lateral region. The posterior end of the nucleus is situated at the 1/4th of the frontal part of the nucleus of the bottom olive and the frontal end is to be found at the 1/4th of the frontal segment of the nucleus of the upper olive.

At 1/4th of its part, the nucleus is divided into two secondary groups. The nucleus is composed of small and medium circular or fusiform cells. No bigger cells, above 45 μm, which are common for mammals were reported.

There were no substantial differences stated as far as the structure and the localization of nucleus motoris is concerned between pigeon and other birds.

STRESZCZENIE

Materiał do badań stanowiły rdzenie przedłużone pobrane od 5 dojrzałych gołębi (*Columba livia*). Materiał utrwalono w formalinie, a następnie odwodniono w alkoholu i zatopiono w parafinie. W dalszej kolejności rdzenie przedłużone krojono na skrawki o grubości 12 μm. Do badań mikroskopowych pobrano co 2 skrawek. Preparaty histologiczne barwiono fioletem krezylu wg metody Klüvera-Barrery (10).

Nucleus motorius nervi facialis znajduje się w części komorowej rdzenia przedłużonego tuż przy jego brzuszno-bocznej krawędzi. Koniec tylny tego jądra znajduje się na wysokości 1/4 przedniej długości jądra oliwy dolnej, zaś biegun przedni leży na wysokości 1/4 przedniego odcinka jądra oliwy górnej. Na wysokości 1/4 swojej długości jądro dzieli się na 2 grupy wtórne. W skład jądra wchodzą komórki małej oraz średniej wielkości okrągłe bądź wrzecionowate. Nie stwierdzono występowania, obecnych u ssaków, komórek dużych — powyżej 45 μm.

Porównując budowę i położenie jądra ruchowego nerwu twarzowego gołębia z innymi ptakami nie stwierdzono występowania istotnych różnic.

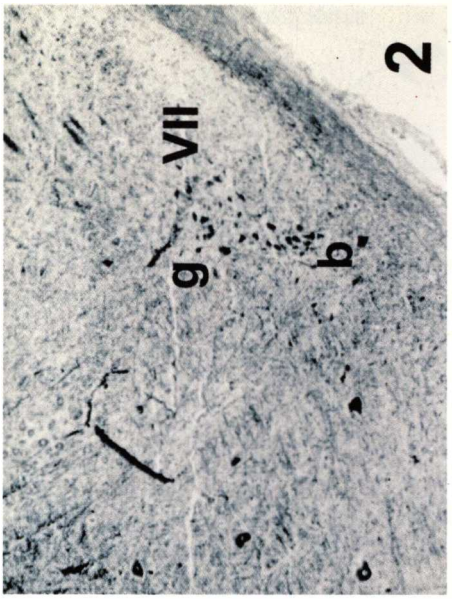
Key words: cranial nerves, facial nerve, medulla oblongata, pigeon (*Columba livia*).

INTRODUCTION

The last decade of the 20th century was named by the neuroanatomist of the world as "a decade of brain exploration". The research of mapping the human and animal brain goes on with the hope of explaining its many mysterious physiological functions. The essential part of the brain in birds and mammals is constituted by the twelve pairs of cranial nerves (Fig. 5). Out of all cranial nerves, pair VII seems to have focused special attention of the neuroanatomy research workers. This nerve has got the characteristics of the motor nerve and innervates expressory nerves of the face as well as scalp and neck muscles. A part of nerve VII (indirect nerve) is composed of parasympathetic autonomic fibres and innervates all head glands with the exception of the parotid gland. The importance of the nerve is also stressed by its somatic sensory fibres conducting the sense of smell from the 2/3rd of the tongue. Frequent occurrence of neurological illnesses in animals, the basis of which are the development disorders of the facial nerve, made research workers continue the study on the nerve structure and its localization. So far the exact topography of motor nerve VII has been described in man (11) and in some domestic animals such as: cow (4), horse (1), pig (4, 14), goat (5), sheep (2), cat (3) and other animals such as: stag (6), and camel (12) as well as in some rodents. In birds, the structure of the nerve was only performed for the domestic hen (1, 7, 8). The study done on pigeon was to allow a precise comparison of this nerve structure in mammals and birds, thus throwing some new light on the exploration of *medulla oblongata* structure in domestic animals and creating new research basis for treating many nervous diseases.

MATERIAL AND METHODS

The study material were the medullas taken from 5 sexually mature pigeons (*Columbia livia*). The material was fixed in formalin, dehydrated in alcohol and embedded in paraffin. The medullas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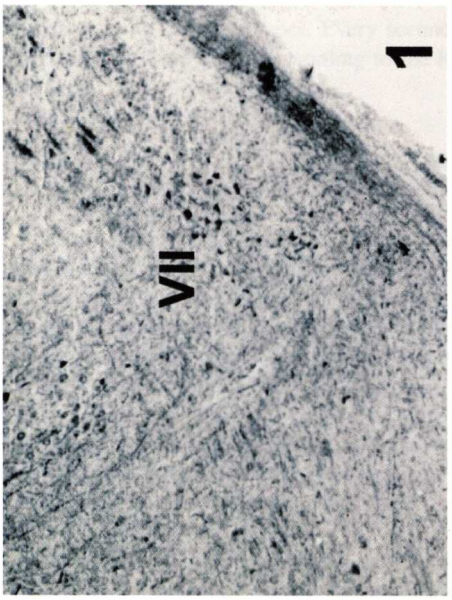
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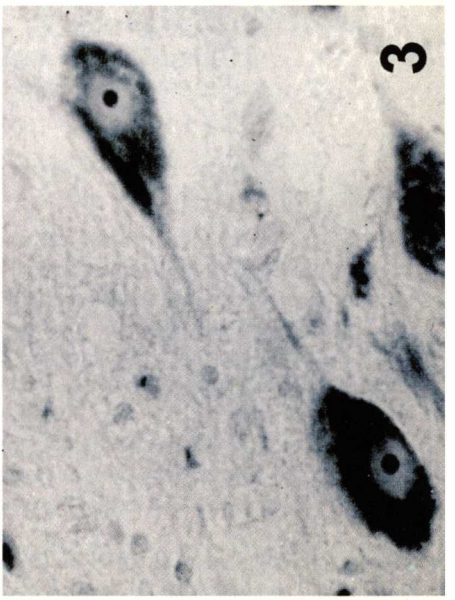
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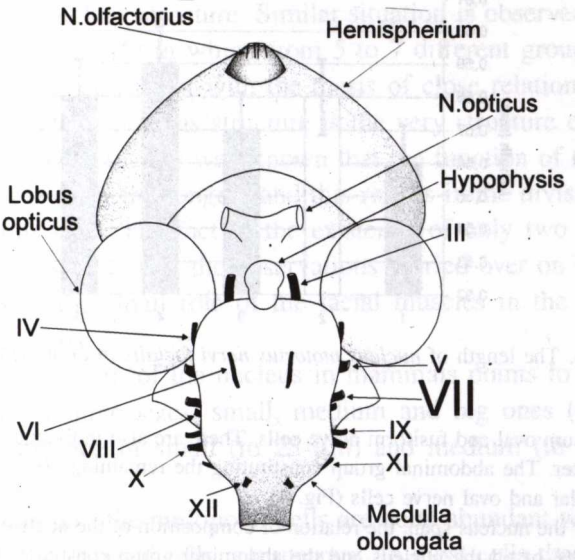

Fig. 5. Brain of the pigeon

were then cut into 12 μm scrapes. Every second scrape was taken for microscopic investigation. The preparations were stained according to the Klüver Barrera's method (10).

OBSERVATIONS

Nucleus motoris nervi facialis is situated in the ventricular part of the medulla oblongata at its abdomino-lateral part. The posterior end of the nucleus is localised at 1/4th of the frontal part of the bottom olive and the frontal end is situated at the 1/4th of the frontal part of the upper olive of the nucleus. In the preparations of the ventricular part of *medulla oblongata,* the discussed structure borders dorsomedially with *nucleus tractus spinalis nervi trigemini.* In 5 pigeons examined in the study, the medium length of *nucleus motorius nervi facialis* is 0.576 ± 0.011 mm (average ± SD), (Fig. 6).

In the transverse sections of the medulla, the frontal part of the nucleus described is visible as the homogenous structure of a small amount of nerve cells. Next, the nucleus is divided into two secondary groups. At the very end, at the posterior part the nucleus is visible as the group of tightly placed nerve cells.

The frontal part of *nucleus motoris nervi facialis* has got the shape of a circular group of nerve cells placed at 3/4th of the segment extending abdomino-laterally from the bottom of chamber IV to the external edge of the medulla (Fig. 1). The cells creating the nucleus are mostly oval and in small percentage (about 10%) — circular (Fig. 3). A well formed, centrally situated nucleus with its nucleolus and evenly placed in the neoroplasm fleck-like tigroid was observed in the nerve cells described.

At its 1/4th, *nucleus motoris nervi facialis* is divided into two circular groups: dorsal and abdominal (Fig. 2). The dorsal group constitutes about 60% of the whole nucleus and is composed

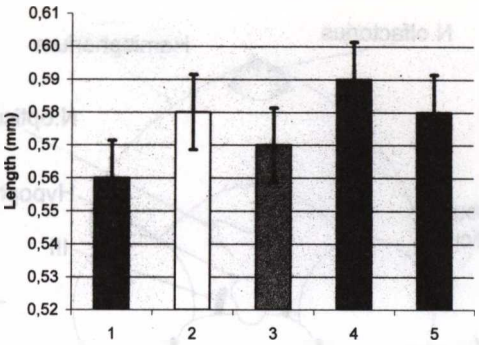

Fig. 6. The length of *nucleus motorius nervi facialis* in examined pigeons

of small and medium oval and fusiform nerve cells. There are also individual medium size cells of multipolar character. The abdominal group constituting the remaining 40% is composed of small (25–30 μm) circular and oval nerve cells (Fig. 4).

At the half of the nucleus span, the relation of composition of the nucleus changes. The dorsal group is about 60% of all the nucleus and the abdominal group constitutes the rest. There is no change in the cellular structure of the cells. The cells in both groups are characterised by the distinct nucleus with its nucleolus and evenly placed fleck-like tigroid.

At the 3/4th of the nucleus the group division is hard to notice. Up to its posterior end, motor nucleus of the facial nerve is created by the circular group of nerve cells which in their 70% are small (25–35 μm) — oval or fusiform and in the remaining part, medium size cells (45 μm). The nucleus and the nucleolus with its tigroid are visible as well.

DISCUSSION

The group of nerve cells creating *nucleus motoris nervi facialis* in pigeon is situated abdomino-laterally in the ventricular part of *medulla oblongata.* The localisation is the same in formerly studied cases of different animals (1–6, 12–14). Taking into account the average length of *nucleus motoris nervi facialis* in pigeon — 0.576 mm, it has to be said that it is comparable to the length of the nucleus in other mammals (as far as the nucleus of the olive and size of the brain is concerned). There are, however differences as far as the length of the nucleus of hen is taken into account which in this case is definitely shorter. Additionally in hen, the motor nucleus of nerve VII is characterised by the vertically oval group of cells while in pigeon it is circular (1).

The morphology of *nucleus motoris nervi facialis* is directly connected with the degree of formation of expressory mucles of the face. That is why in animals in which they are well developed (take part in consuming food — camel, horse) the nucleus is divided into many secondary groups. In camel — a mammal with a well developed facial musculature Flieger and Strzałka (12) described 6

subgroups in the nucleus structure. Similar situation is observed in other animals like: horse (4) or goat (5) in which from 5 to 7 different groups were observed. The fact that seems consistent with the thesis of close relation between the way of taking food and the nucleus structure is the very structure of *nucleus motoris nervi facialis* in cow (4). It is well known that the function of taking food in this animal is taken over by the tongue, and this results in the division of the nucleus into 4 subgroups only. The fact of the existence of only two secondary groups in pigeon confirms, in a way, the observations carried over on hen (3 subgroups) which testifies to the small role of the facial muscles in the process of taking food in both animals.

The cytoarchitecture of the nucleus in mammals points to the occurrence of the nerve cells of three sizes: small, medium and big ones (above 50 μm). In pigeon the occurrence of small (to 25 μm) and medium (to 40 μm) cells was only confirmed.

In other mammals the multipolar cells are quite abundant while in pigeon and other birds (1) this type of cells is quite rare. In most cells there is a well visible nucleus with nucleolus and evenly placed tigroid.

Summing up it has to be said that there exist substantial differences in the structure of *nucleus motoris nervi facialis* in pigeon and in other mammals. They are concerned with the division of the nucleus into secondary groups and the presence of big multipolar cells in the nucleus. Topography of the nucleus, the structure and the localisation of the nucleus is however the same for mammals and pigeon. There were no substantial differences to be noticed as far as the structure and localisation of the motor nucleus of the facial nerve in pigeon and other birds is concerned.

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EXPLANATION TO FIGURES

Fig. 1. *Nucleus motorius nervi facialis* in the level of its anterior end, magn. ca 32×.
Fig. 2. Grouping of *nucleus motorius nervi facialis*, magn. ca 32×.
Fig. 3. Nervous cells of the *nucleus motorius nervi facialis*, magn. ca 400×.
Fig. 4. Nervous cells of the *nucleus motorius nervi facialis*, magn. ca 400×.

ABBREVIATION

VII — *nucleus motorius nervi facialis*
g — dorsal group
b — ventral group