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The structure and topography of the parasympathetic nucleus
of the glossopharyngeal and vagus nerves
and of the ambiguous nucleus in medulla oblongata
in the reindeer (*Rengifer tarandus* L.)

Budowa i topografia przywspółczulnego oraz dwuznacznego jądra
nerwu językowo-gardłowego i błędnego u renifera (*Rengifer tarandus* L.)

The studies of autonomic nervous system in man and domestic animals present a particular cognitive value for the science of anatomy and physiology. Due to the fact that the parasympathetic nervous system takes part in the regulatory processes of the majority of internal organs (heart, lungs, stomach, etc) the results of such studies are willingly taken advantage of by the clinical researchers in their practical work. The description of the ambiguous nucleus and parasympathetic nucleus of nerves IX and X in reindeer (ruminants do not inhabit our climate) constitutes another important element of research on learning about the structure and topography of the autonomic nerve centres of wild animals. So far the structure and the localisation of the ambiguous nucleus of glossopharyngeal (IX) and vagus (X) nerves have been described in most domestic animals (1, 2, 3, 5, 9, 10, 11, 12) and in some species of wild animals (4, 6, 7, 8). The present study should also allow the comparison of the autonomic nervous system structures of reindeer described here with analogical structures of other animals living in our geographical region.

MATERIAL AND METHODS

Material for study was *medulla oblongata* of a sexually mature reindeer (*Rangifer tarandus* L.) which was fixed in 10% formalin and dehydrated in alcohol and mounted in paraffin. Medulla prepared in this way was cut into 15 μm pieces. Every fifth piece was taken for examination. The pieces were stained with cresyl-violet according to Klüver-Barrera's method.

RESULTS

Parasympathetic nucleus of the glossopharyngeal and vagus nerves
(*nucleus parasympaticus nervi glossopharyngei et vagi*)

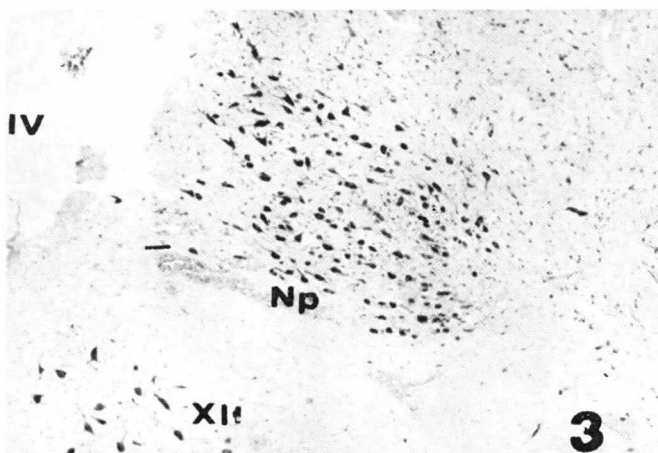
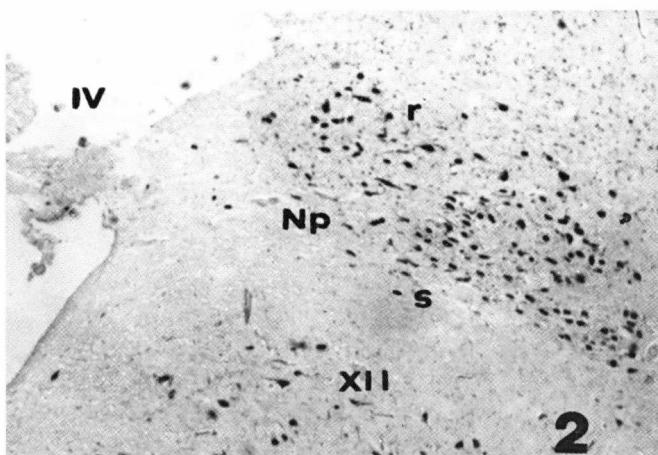
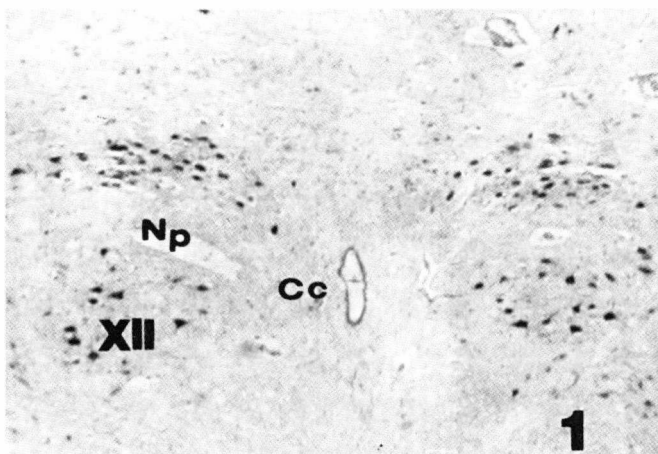
Nucleus parasympaticus of nerves IX and X is composed of a range of nerve cells situated in the posterior and middle segment of *medulla oblongata*. The posterior end of the nucleus is situated in the extraventricular part of *medulla* and forms the "prolongation" of the medial group of intradorsal nucleus range of accessory nerve (XI) in frontal direction. The anterior end of the nucleus of nerves IX and X is situated in the bottom of the fourth ventricle in the transverse section of the facial nerve nucleus (VII). The length of the parasympathetic nucleus of nerves IX and X in reindeer is approximately 14.1 mm.

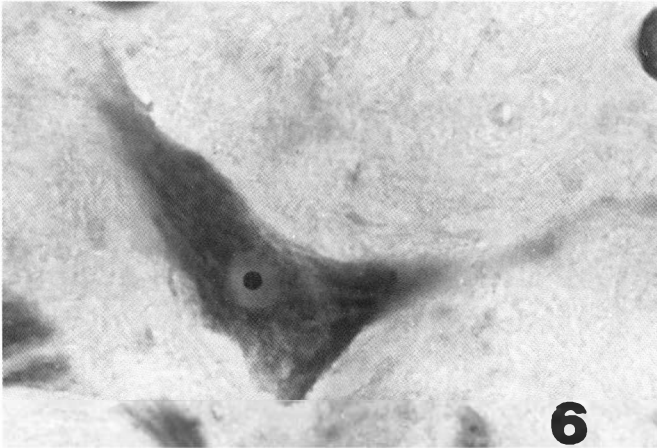
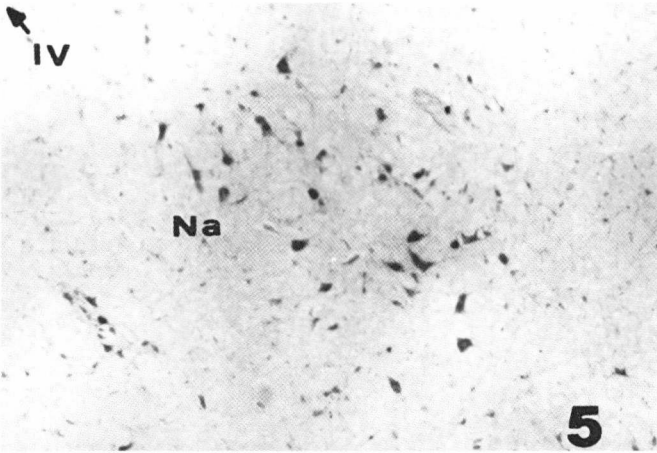
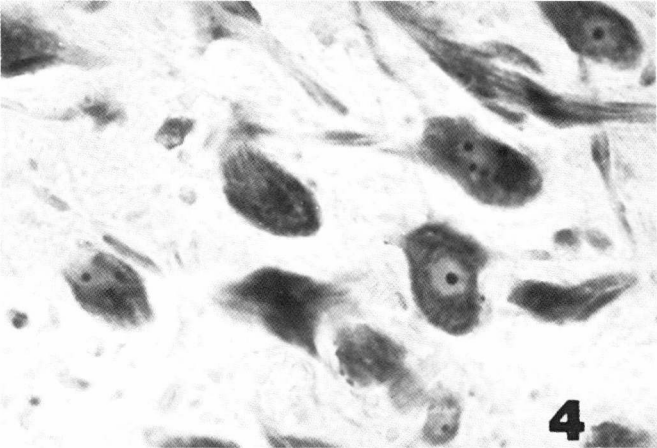
Posterior 2/3rd of nerves IX and X is situated intracaudally from obex and the remaining 1/3rd is situated intracranially. In the transverse sections, cell agglomerations of the nucleus examined, situated on the both sides of medulla at the central canal are placed very close to each other and with the transforming of the central canal into ventricle IV they scatter in the lateral direction, and cell agglomerations in the bottom of ventricle IV are quite dispersed (Fig. 1).

In the extraventricular part of *medulla oblongata*, the nucleus has a shape of a flat, horizontally oval, group of nerve cells situated dorsolaterally from the central canal. In the abdomen it borders with the nucleus of the sublingual nerve (XII). With the transforming of the central canal into brain ventricle IV (*obex*) the nucleus alters its position from the dorsolateral one into lateral one in relation to ventricle IV (Fig. 2). The shape of the nucleus changes as well. It becomes oval and the number of the cells creating it is on the increase.

Parasympathetic nucleus of nerves IX and X is most finely formed in the section on the bottom of ventricle IV and is characterised by the greater number of cells in relation to other structures described above. In the transverse sections, the nucleus takes circular shape and lies laterally to its bottom (Fig. 3).

The posterior end of the nucleus is composed of the spindle and oval cells creating homogenous agglomeration. In the middle part, (situated near obex) of the parasympathetic nucleus of nerves IX and X, one can observe a clear division into two parts: agglomerated part (composed of cells lying next to each other) and the scattered part (with the cells being dispersed) (Fig. 2). The anterior end of





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the nucleus described is characterised by the presence of a large quantity of scattered spindle and oval cells. In the cells, one can spot a well visible nucleus, nucleolus and tigroid – evenly placed in the neuroplasm. The cells creating the parasympathetic nucleus of nerves IX and X are the cells of spindle oval and multipolar shape of average size of 35-45 μm or above 50 μm (Fig. 4).

The ambiguous nucleus of motor nucleus of the vagus and glossopharyngeal nerves (*nucleus ambiguus s. nucleus motorius nervi vagi et glossopharyngei*)

The posterior part of the ambiguous nucleus is situated in the extraventricular part of *medulla oblongata* and the anterior part is situated in the bottom of brain ventricle IV. The posterior end is situated at the level of the posterior pole of the olive nucleus. The anterior end reaches the transverse plain crossing the frontal pole of nerve nucleus XII. The nucleus described lies in half of the section situated abdominolaterally from the parasympathetic nucleus of nerves IX and X to the lateral margin of the medulla. The length of *nucleus ambiguus* is about 8.6 mm. In the nucleus, one can observe clear narrowings in its structure which result from the differentiated number of the cells creating it (from a few to several cells). In the transverse sections, the ambiguous nucleus takes the shape of the oval fascicle of the nerve cells, the long axis of which is directed from the dorsomedial to abdominolateral side. *Nucleus ambiguus* in its anterior part is created by a smaller, than in its posterior part, number of cells situated freely which gives the nucleus an irregular shape (Fig. 5). Nerve cells creating the ambiguous nucleus are mainly multipolar cells of 50 μm size (Fig. 6). Beside the multipolar cells one can spot individual triangular cells of medium size.

DISCUSSION

The topography of the parasympathetic nucleus of nerves IX and X in reindeer is similar to the topography of the nucleus in other animals. As in other ruminants as: sheep, cow, goat (1, 2, 3, 10, 11) and pig (2, 12), its anterior 1/3rd is situated in the bottom of brain ventricle IV and the remaining 2/3rd in the extraventricular part of *medulla oblongata*. In other animals described previously: horse (2), elk (8), camel (6), bison (7) analogical nucleus is found in its half in the bottom of brain ventricle IV, the other half being situated in the extraventricular part of the medulla.

The size of the nucleus studied in this work is smaller in relation to the nucleus of elk and comparable with the nucleus in other ruminants (cow, bison, camel).

The parasympathetic nucleus of nerves IX and X in various transverse sections of medulla oblongata is close in its shape to the nucleus in other animal

species: cow (1), goat (3), horse (2) or a pig (2). The posterior end situated in the extraventricular part of the medulla presents itself as the horizontally arranged agglomeration of nerve cells. In the obex region the nucleus is divided into agglomerated and scattered parts as it is in elk, camel and bison while in deer (4), roe-deer (4), cow (2, 10), horse (2), pig (12) and goat (3) the nucleus is divided into dorsomedial and abdominolateral groups.

The cells creating the parasympathetic nucleus of nerves IX and X are spindle and oval shape and medium (35-50 μm) or big (above 50 μm) size. Similar cells were found in other animals, with the exception of reindeer where there are no traces of such multipolar cells.

The localisation of the ambiguous nucleus in reindeer is not substantially different from the localisation of the nucleus in other animals. It is situated in its half in the bottom of ventricle IV and in other half in the extraventricular part of medulla oblongata.

The shape of the ambiguous nucleus in reindeer resembles the shape of the nucleus in bison (7) and elk (8). The cells constituting *nucleus ambiguus* are freely situated, similarly to the cells in bison and elk. What seems to be different, in comparison with other animals, is the fact that the nucleus part situated intracranially from *obex* is definitely weakly developed than the part in the caudal region. There was no division into groups, as well, which was the case in pig (2, 12), horse (2) and goat (3).

Similarly to other animals, the ambiguous nucleus in reindeer is mainly composed of the medium multipolar cells (to 50 μm) and large ones (above 50 μm) localised on the full length of the nucleus. In nucleus ambiguus of reindeer triangular cells were localised as well, which also was the case in bison (7). No traces of oval or spindle cells were found in reindeer (similarly to cow (2,10), pig (12), horse (2) and goat (3)) such cells are, however characteristic feature of sheep (1), camel (6) and bison (7).

Taking into account the results of this study, one has to conclude that both parasympathetic nucleus of nerves IX and X and the ambiguous nucleus of reindeer do not substantially differ from analogical structures in other animals described before.

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PHOTOGRAMS

- Phot. 1. Transverse section of the pars posterior of *nucleus parasymphaticus* n. IX and X. Mag. 30 × .
- Phot. 2. Transverse section of the middle part of *nucleus parasymphaticus* n. IX and X. Mag. 30 × .
- Phot. 3. Transverse section of the pars anterior of *nucleus parasymphaticus* n. IX and X. Mag. 30 × .
- Phot. 4. Nervous cells of *nucleus parasymphaticus* n. IX and X. Mag. 400 × .
- Phot. 5. Transverse section of *nucleus ambiguus* on the level of its 1/3 posterior length. Mag. 30 × .
- Phot. 6. Nervous cell of *nucleus ambiguus*. Mag. 400 × .

ABBREVIATIONS USED

Cc – *canalis centralis*, Na – *nucleus ambiguus*, IV – *ventriculus* IV, XII – *nucleus nervi hypoglossi*, r – dispersed part, s – concentrated part, Np – *nucleus parasymphaticus* n. IX and X.

STRESZCZENIE

Zbadano rdzeń przedłużony renifera. Materiał badawczy odwodniono w alkoholu, zatopiono w parafinie i pocięto na odcinki o grubości 15 μm . Odcinki zabarwiono zmodyfikowaną metodą Klüver-Barrera. Zbadano co piąty odcinek.

Jądro przywspółczulne nerwów językowo-gardłowego i błędnego u renifera jest wydłużonym pasmem komórek osiagających długość ok. 14 mm. Przednia część jądra przywspółczulnego nerwu IX i X leży na dnie komory IV, zaś tylna – w pozakomorowej części rdzenia przedłużonego, 1/3 jego części tylnej i przedniej występują jako jednolite skupisko, zaś 1/3 część środkowa jądra dzieli się na część rozproszoną i skupioną. Jądro zbudowane jest z małych i średnich owalnych wrzecionowatych i wielobiegunowych komórek. Jądro leży w połowie długości na dnie komory IV oraz pośrodku pozakomorowej części rdzenia przedłużonego. Jądro dwuznaczne zbudowane jest z dużych komórek wielobiegunowych oraz rzadko występujących komórek trójkątnych.