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Structure and topography of paraventricular nucleus (*nucleus paraventricularis*) and supraoptic nucleus (*nucleus supraopticus*) in gopher (*Spermophilus suslicus* Güld.) and dormouse (*Muscardinus avellanarius* L.)

Budowa i topografia jądra przykomorowego (*nucleus paraventricularis*) i jądra nadwzrokowego (*nucleus supraopticus*) u susła perełkowanego (*Spermophilus suslicus* Güld.) i orzesznicy (*Muscardinus avellanarius* L.)

Descriptions of morphology and junctions of paraventricular nucleus (*nucleus paraventricularis*) and supraoptic nucleus (*nucleus supraopticus*) — the neurosecretory centres of hypothalamus — concern mainly the laboratory animals (1, 2, 3, 6, 13), yet domestic animals (4, 15, 16) and those living free have been also considered (5, 10, 11, 14). Special attention should be given to a work of Armstrong et al. (1) who executed a very thorough description of topography and structure of these centres in a rat Wistar.

The paraventricular and supraoptic nuclei make a "classical macrocellular neurosecretory system" (Silverman and Zimmerman 12) and are connected with the posterior lobe of the pituitary gland. Gajkowska et al. (7, 8, 9) showed the centres function in the thermoregulation and water balance in an organism using electron microscope and monitoring changes appearing in neurosecretory cells due to the thermal shock.

The results presented below concern two species of free living animals, a gopher and dormouse. Both species lie dormant in the winter from October to April. Gopher can sleep in its underground burrow for some days even at the activity period under unfavourable conditions.

The present authors hold a belief that taking up an attempt at comparison of the neurosecretory centres morphologies of the lab animals active throughout all the year and hibernating ones may provide some interesting observations. While describing paraventricular nucleus there was accepted nomenclature used by Armstrong et al. (1) investigating rats Wistar. The mentioned above authors distinguish a following division of paraventricular nucleus: 1) medial magnocellular paraventricular nucleus (PVM); 2) lateral magnocellular paraventricular nucleus (PVL); 3) dorsomedial cap of the paraventricular nucleus (PVDC) and 4) posterior group (PVPO).

In the supraoptic nucleus there are: 1) anterior portion of the supraoptic nucleus (NSOA) and 2) tuberal portion of the supraoptic nucleus (NSOT) (Silverman and Pickard, 13).

METHODS

The examinations were conducted on the brains of a gopher and dormouse (two brains of each species). The paraffin sections 15 μm thick (gopher) and 10 μm (dormouse) were stained with cresyl violet according to the Klüver and Barrera's method.

RESULTS AND DISCUSSION

Paraventricular nucleus (*nucleus paraventricularis*)

In this nucleus in a gopher there are singled out three portions: medial (PVM), lateral (PVL) and dorsomedial (PVDC). PVM is the best developed portion. It is an elongated, horizontally placed band of cells parallel to ventricle III. The posterior pole consists of a small group of loosely arranged cells. While moving forward, the transverse cross-sections of this portion of paraventicular nucleus enlarge and take shape of an elongated drop pointing its sharp end downwards (Phot. 1). The cells are arranged irregularly — in the dilated (dorsal) part they are positioned closely, whereas in the ventral portion — quite loosely. a nasal segment of PVM shows a shape of narrow, vertical bond (Phot. 3) at the transverse cross-sections.

The cells forming PVM — multipolar and fewer spindle-shaped and rounded are of 10 μm to 25 μm (Phot. 10).

The lateral portion (PVL)appears as a rounded group of multi-polar cells of 15–25 μm that lies in a small distance laterally of the posterior segment PVM

(Phot. 2,11). PVL is connected with PVM by means of a broad band of rather closely arranged spindle-shaped cells that reach 35 μm of length (Phot. 2). The long axes of cells are positioned horizontally (Phot. 12). This band is visible in a very short segment.

The transverse cross-sections PVL have a rounded shape. The anterior pole PVL reaches approximately half a PVM length. In a small distance from the anterior pole PVM towards the tail over its dorsal region there occurs a slight, at first rounded (Phot. 3) and oval towards the front, a group of loosely arranged small cells. The cells get stained poorly, usually show multipolar and spindle shape. This group may be considered as dorsal cap (PVDC) of paraventricular nucleus. The cells included there reach the length up to 10 μm.

Paraventricular nucleus of dormouse has a simpler structure as compared to that of gopher's; it is made of only two portions — PVM and PVL.

Dormouse's PVM does not differ significantly from that portion of gopher's paraventricular nucleus (Phot. 4). The cells demonstrate predominantly a multipolar shape; rounded cells are less numerous. The cells size ranges from 10 to 20 μm (Phot. 13). Dormouse's PVL is considerably smaller as against gopher's. The PVL contours are not clear (Phot. 5) and that is why it is not possible to determine accurately the extent of the anterior pole. The PVL is made of multipolar and rounded cells whose size reaches 15 μm. Alike a gopher, PVL is connected with PVM by means of spindle-shaped cell band, yet they are arranged more loosely (Phot. 5) and they are from 10 to 12 μm.

Supraoptic nucleus (*nucleus supraopticus*)

There are two portions distinguished in gopher's supraoptic nucleus — *nucleus supraopticus pars tuberalis* (NSOT) and *nucleus supraopticus pars anterior* (NSOA).

Greater part of NSOT (about 2/3 of length) is positioned caudally from the optic nerves chiasm (Phot. 6). Anterior segment — 1/3 — lies over the medial region of the chiasm. The caudal segment is a narrow band of cells; at the transverse cross-sections it shows a rounded or oval contour. a part of NSOT placed over the optic nerves chiasm has a shape of a narrow band positioned along its dorsal surface.

The transverse cross-sections of NSOT got smaller in a slight distance rostrally from the posterior chiasm edge and take a rounded or oval shape.

NSOA arranges over lateral part of the optic nerves chiasm (Phot. 7). The posterior pole of NSOA is positioned a little caudally of the chiasm and the anterior one reaches about half of its width. The posterior segment — about 1/3 of length — in transverse cross-sections shows a shape of a very narrow vertical band of cells grouped quite loosely (in some places it is a row of single cells).

The anterior portion — 2/3 of length — is better developed and substantially wider than posterior one.

The cells making supraoptic nucleus arrange very closely. They are multipolar and spindle-shaped of 15–30 μm (Phot. 14). The multipolar cells reach 35 μm. Some spindle-shaped cells are very elongated — their length exceeds the width several times. Cells that compose NSOA stain very intensively.

Alike gopher, in dormouse's supraoptic nucleus there are distinguished two portions: NSOT and NSOA. Their posterior poles lie roughly in the transverse plane assigned through nasal edge of the optic nerves chiasm.

NSOT proves to be a quite short, homogeneous band of nervous cells grouped closely (Phot. 8). The transverse cross-sections have a rounded or irregular shape. The cells making NSOT are mostly multipolar and spindle-shaped, with a relatively small nucleus well visible because of an intensive colour of nuclear membrane. Tigrid is microgranular, not abundant. Cell size is 10–20 μm.

NSOA is elongated, on the transverse cross-sections have a shape of a narrow band. Posterior portion is positioned laterally to the optic nerves chiasm. Moving forward, NSOA shows toward dorsal displacement and pulls over the lateral region of chiasm, taking an arched shape (Phot. 9). Near the anterior pole the transverse cross-sections of NSOA considerably diminish and have an outline of a thin and oblique band.

The cells making up NSOA are similar to those of NSOT but in NSOA cells, tigroid proves to appear in greater amount thereby they stain more intensively (Phot. 15).

Comparing the morphology of neurosecretory centres in a rat Wistar with those in a gopher and dormouse, that is a lab animal and free living ones, there were stated very significant differences to occur. Armstrong et al. (1) single out four portions in paraventricular nucleus of a rat Wistar: medial portion, mainly microcellular; lateral; dorsal cap and posterior portion. The medial portion is developed best.

In a gopher and dormouse, paraventricular nucleus does not display such a clear division. There is no posterior portion in gopher. Alike a rat, medial portion is developed best. In dormouse there are two portions — a very long medial portion and a very short lateral one that are connected (alike at a gopher) by means of a broad but very short cell bridge consisting of spindle-shaped cells.

Supraoptic nucleus of both species under investigation has a very similar structure, however differences refer mainly to the topography of both portions of nucleus. Gopher's NSOT begin in a substantial distance back of the optic nerves chiasm (2/3 of length of NSOT lie toward tail chiasm), NSOA also start caudally to the chiasm, whereas in dormouse caudal poles of both portions of supraoptic nucleus (NSOA and NSOT) are placed in the same plane, about the height of the posterior edge chiasm. The cell structure of both portions of supraoptic nucleus is similar.

The description of gopher's supraoptic nucleus was executed by Kołaczkowski and Wender (10). The findings of these authors, not quite detailed, correspond to the description presented above.

In both, gopher and dormouse case the supraoptic nucleus shows considerable similarity to that in rat.

Galert (5) disitinguishes two portions in paraventricular nucleus in the following insectivorous animals studied: *Sorex araneus, Sorex minutus, Talpa europaea, Erinaceus europaeus*. This author mentions horizontal and vertical portions, drawing attention to a fact that horizontal one (corresponding, acc. to Armstrong et al., to a lateral portion and probably a band connecting PVM and PVL) is several times (5 times in *Sorex araneus*) shorter than a vertical portion.

In supraoptic nucleus Galert (5) singles out two portions — anterior and posterior. These portions correlate to *pars anterior* and *pars tuberalis* of supraoptic nucleus in rat (acc. to Armstrong).

What is worth considering, is a fact of a considerably better development of paraventricular nucleus in rat as against gopher or dormouse. May that be connected with a mode of living and environment of both species? It is difficult to state basing only on the morphological examinations. However it should be stressed that rats are the animals active all the year living in various environments thus, they may be exposed to great fluctuations of temperature and moisture, not only season-conditioned. Furthermore, both a gopher and dormouse sleep for about 6 months in the autumn-winter period and even (in gopher case) sink into a short sleep at the activity time when the weather conditions are unfavourable.

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PHOTOGRAMS

Phot. 1 Transverse cross-section of gopher's interbrain at 1/3 of height of caudal portion of paraventricular nucleus. Mag. 32×.

Phot. 2 Transverse cross-section of gopher's interbrain at the height of lateral portion of paraventricular nucleus. Mag. 32×.

Phot. 3 Transverse cross-section of gopher's interbrain at the height of dorsal cap of paraventricular nucleus. Mag. 32×.

Phot. 4 Transverse cross-section of dormouse's interbrain in half length of medial portion of paraventricular nucleus Mag. 60×.

Phot. 5 Transverse cross-sections of dormouse's interbrain at the height of the band connecting PVM and PVL. Mag. 60×.

Phot. 6 Transverse cross-section of gopher's interbrain in half length of *nucleus supraopticus pars tuberalis*. Mag. 32×.

Phot. 7 Transverse cross-section of gopher's interbrain in half length of *nucleus supraopticus pars anterior*. Mag. 32×.

Phot. 8 Transverse cross-section of dormouse's interbrain in half length of *nucleus supraopticus pars tuberalis*. Mag. 60×.

Phot. 9 Transverse cross-section of dormouse's interbrain near nasal pole of *nucleus supraopticus pars anterior*. Mag. 60×.

Phot. 10 Cells of medial portion of paraventricular nucleus in gopher. Mag. 500×.

Phot. 11 Cells of lateral portion of paraventricular nucleus in gopher. Mag. 500×.

Phot. 12 Cells of the band connecting the medial portion of paraventricular nucleus with the lateral one of this nucleus in gopher. Mag. 500×.

Phot. 13 Cells of the medial portion of paraventricular nucleus in dormouse. Mag. 400×.

Phot. 14 Cells of *nucleus supraopticus pars anterior* in gopher. Mag. 500×.

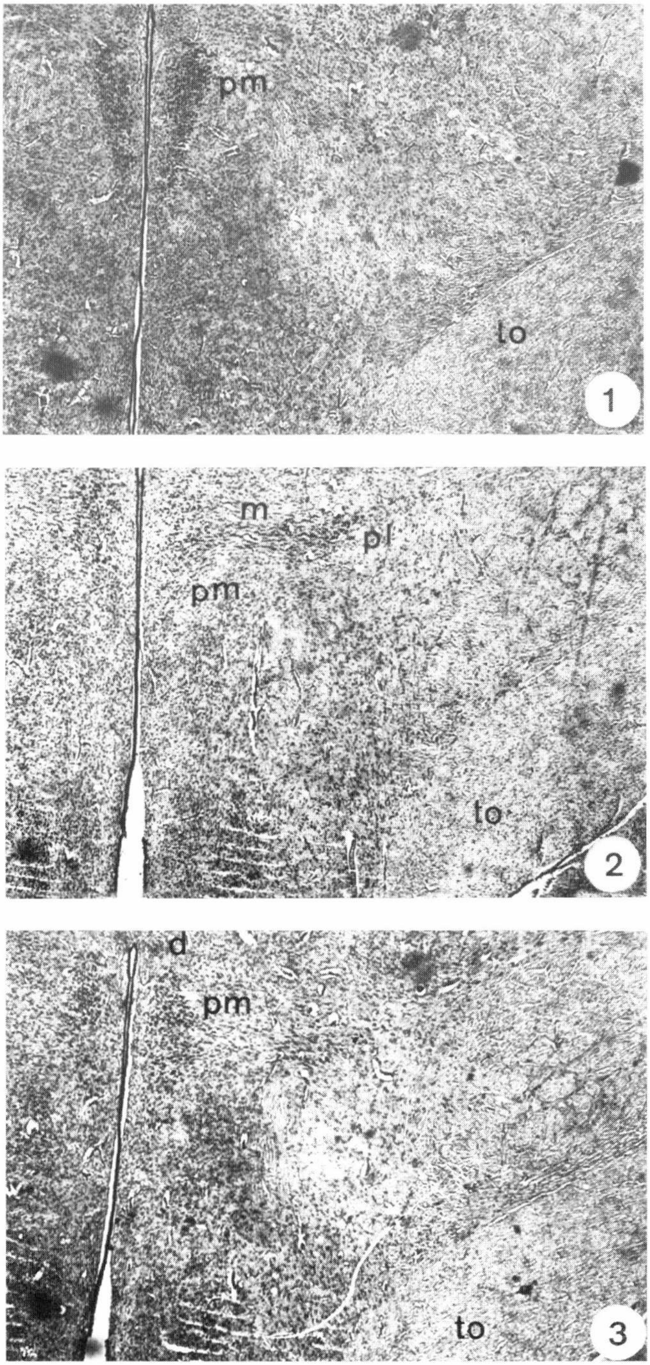
Phot. 15 Cells *nucleus supraopticus pars anterior* in dormouse. Mag. 500×.

ABBREVIATIONS USED

ch — optic chiasm, d — dorsal cap of paraventricular nucleus, m — cell bridge connecting PVM and PVL, pl — lateral portion of paraventricular nucleus, pm — medial portion of paraventr--cular nucleus, sa — *nucleus supraopticus pars anterior*, st — *nucleus supraopticus pars tuberalis*, to — *tractus opticus*

STRESZCZENIE

W pracy opisano budowę i topografię jąder neurosekrecyjnych podwzgórza u susła perełkowanego i orzesznicy. Po dwa mózgowia (samca i samicy) każdego gatunku utrwalone w formalinie i zatopione w parafinie krajano na poprzeczne skrawki grubości 15 μm — w przypadku susła i 10 μm — w przypadku orzesznicy. Skrawki barwiono fioletem krezylowym według metody Klüvera i Barrery. Stwierdzono, że u susła jądro przykomorowe jest stosunkowo większe i wyróżnia się w nim trzy części: część przyśrodkową (największą), część boczną i pokrywę grzbietową. U orzesznicy brak pokrywy grzbietowej. Jądro nadwzrokowe u obu badanych gatunków zbudowane jest podobnie. Składa się z dwu części — *pars tuberalis* i *par anterior*. U orzesznicy *pars tuberalis* jest bardzo krótka.



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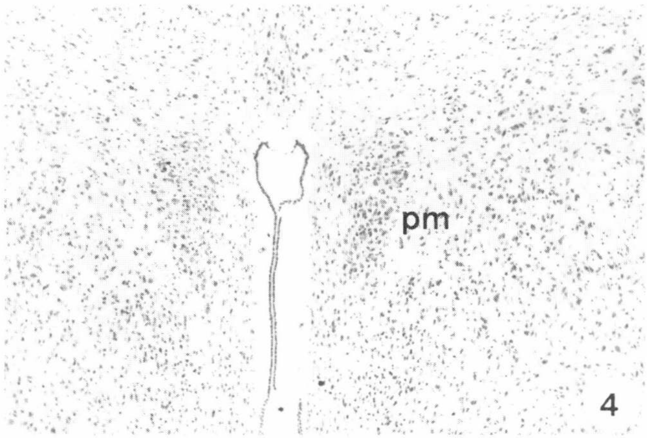

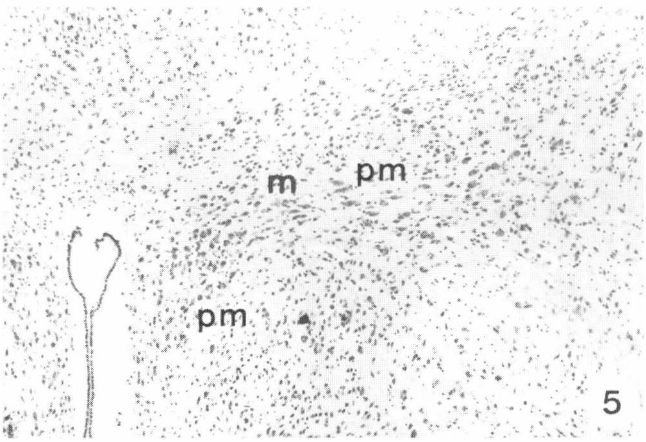

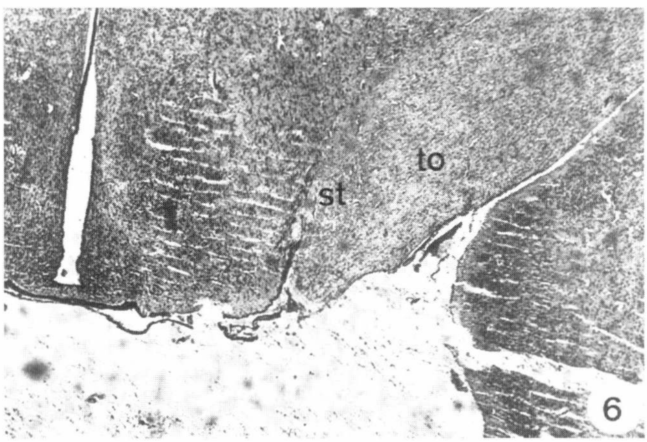

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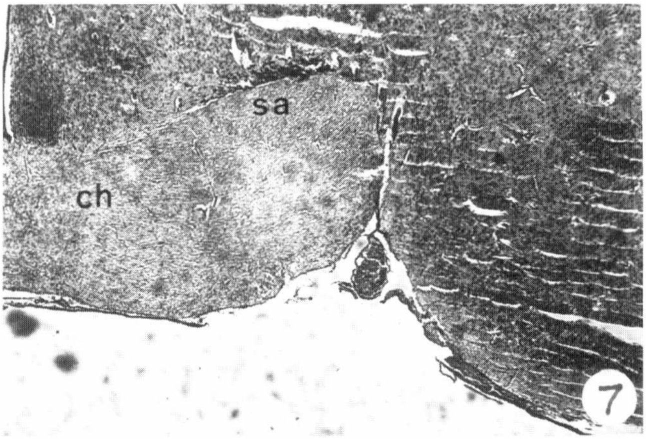

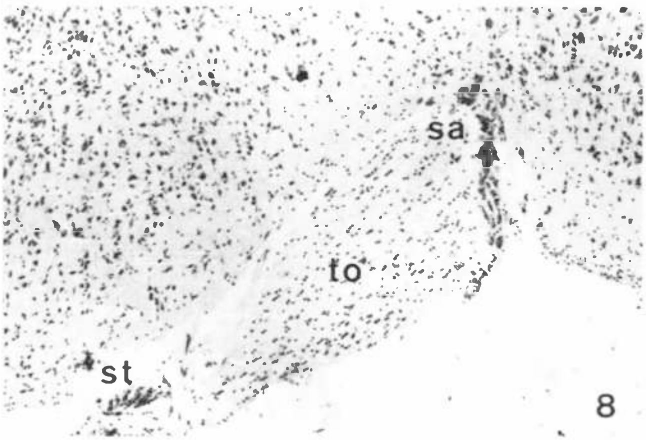

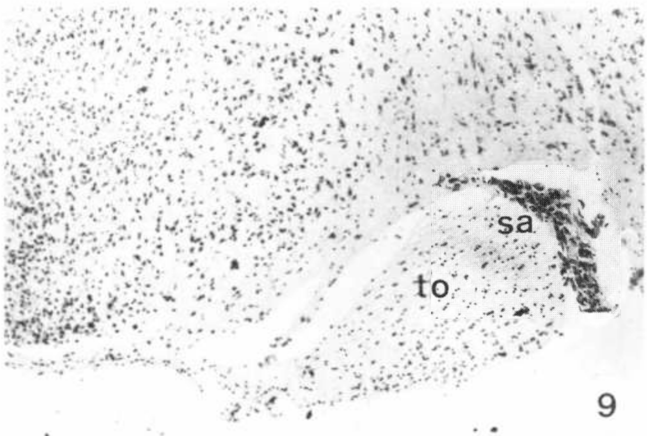

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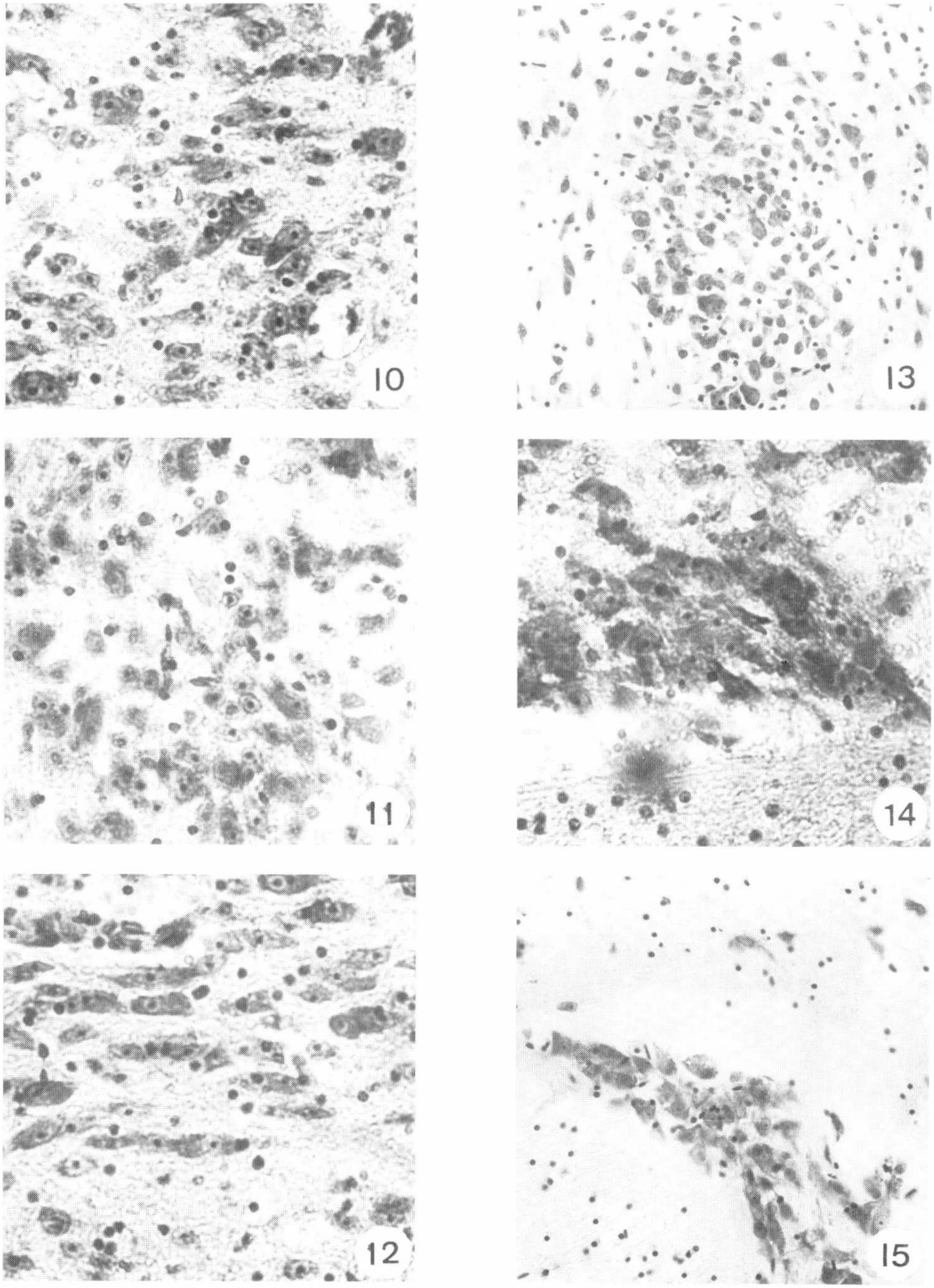

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