

u zolotistih homjačkov v ontogeneze. Tr. In-ta Fizjol. im. Pavlova, 12: 277—282. Taylor P. M., 1960: Oxygen consumption in the new-born rats. J. Physiol., Lond., 154: 153—168. Trojan P. & Wojciechowska B., 1967: Resting metabolism rate during pregnancy and lactation in the European common vole — *Microtus arvalis* (Pall.). Ekol. pol. A, 15, 44: 811—817. Vişinescu N., Nersesian-Vasiliu C. & Radu D., 1965: Observații asupra termoreglării în ontogeneză la *Mesocricetus auratus* W. Studii și Cerc. de Biol., Seria Zool., 17, 4: 347—354.

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### Circumanal Glands in the European Beaver

Gruczoły przyodbytowe bobra europejskiego

Teresa DOBOSZYŃSKA

Doboszyńska T., 1978: Circumanal glands in the European beaver. Acta theriol., 23, 18: 301—305 [With 1 Table & Plates XXIII—XXIV].

Observations were made of the glands of 19 females and 8 males of the European beaver (*Castor fiber* Linnaeus, 1758) describing their topography and macro- and microscopic structure. It was found that they belong to typical dermal glands of the complex — vesicular-tubular type. Their secretion is formed in vesicles and then passes through the system of efferent ducts and collects in the capacious cavity of the gland. These glands, on account of the way in which the secretion forms, are holocrine glands and produce a greasy, fatty secretion.

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The paired *diverticula laterales fossae preputialis* and pair of fat glands are included in the organs of the beaver situated caudad to the rear of the pelvis. A considerable amount of attention has been given to the first pair up to the present on account of the secretion produced, which is termed musk or castoreum (Hinze, 1950; Kacnielson & Orlova, 1954, 1956; Doboszyńska, 1976).

As stated by Nikulin (1954) and Gienc & Doboszyńska (1972), both pairs of sacs, characteristic of the beaver, lying caudad to the rear of the pelvis under the caudal vertebra, open into the dermal diverticulum together with the anus and vagina, termed by Nikulin (1954) the cloaca, but by Gienc & Doboszyńska (1972) the pseudo-cloaca.

No exact macro- and micromorphological description of the circumanal glands of the beaver has been encountered in the literature available and consequently the purpose of the present study is to determine the structure of these organs in both females and males of different age.

The author made her own studies on the glands of 19 females and 8 males in the following age groups: (1) newborn animals, (2) animals

aged 4—6 months, (3) 1—4 years old and (4) over 3 years old. The animals were obtained from the farm of the Experimental Centre of the Polish Academy of Sciences at Popielno and the Fur Farm of the State farm at Wiartel. Healthy animals, which had died accidentally as the result of mechanical injuries, bites, smothering etc., were chosen for the studies.

Before fixing and selecting material for microscopic examination, macroscopic observations and measurements were made, that is, measurements of the length and breadth of circumanal glands, also weighing the excised organs together with their contents.

Sections from the bottom, lateral wall and ostial region of the gland were taken for histological examination. Bouin's fluid, AFA (alcohol 70%, 10% neutralized formal, glacial acetate acid; 90:5:5), neutralized formol and Carnoy's fluid were used for fixing. Some of the preparations were embedded in paraffin, and some directly after fixing were sectioned with a freezing microtome. Hematoxylin-eosine was used for staining, using Mallory's method for connective tissue, Gomori's method for staining argentophilous fibres, orceine for elastic fibres and sudan III

Table 1

Macroscopic measurements of circumanal glands in the beaver (average length and breadth given in mm, weight in g; observed ranges are in parentheses). F—female, M—male

Group	Left circumanal gland			Right circumanal gland		
	Length	Breadth	Weight	Length	Breadth	Weight
Newborn beavers (4 F, 2 M)	14 (10—17)	12 (10—14)	— —	13 (10—16)	12 (8—14)	— —
Aged 4—6 mts (5 F, 2 M)	48 (35—65)	21 (15—25)	6.8 (3.4—16.0)	47 (35—60)	21 (15—25)	7.1 (3.7—16.2)
Aged 1—3 years (5 F, 1 M)	75 (60—95)	37 (31—45)	10.2 (4.9—15.0)	73 (64—94)	39 (29—45)	10.8 (5.8—17.0)
Over 3 years old (5 F, 3 M)	99 (79—112)	45 (39—55)	23.7 (12.0—28.1)	98 (87—110)	48 (40—64)	24.5 (11.5—34.5)

and R scarlet for revealing fats (B a g i ń s k i, 1969; Z a w i s t o w s k i, 1970).

In the case of newborn animals serial sections were made in the frontal or sagittal part of the whole postpelvic region, including the circumanal glands.

The circumanal glands examined were paired formations situated in the postpelvic region (Fig. 1) at the level of the 8—12 caudal vertebra. On the exterior the whole postpelvic region was covered by hairy, very elastic skin, under which both the circumanal glands and *diverticula laterales fossae preputialis* producing castoreum, were concealed.

Unlike the hard thick *diverticula laterales fossae preputialis*, the circumanal glands were soft to the touch, filled with a greasy substance of a whitish-grey colour and consistency of fat, congealing in the air, and with a specific smell similar to phenol.

The glands are situated laterally to *diverticula laterales fossae preputialis*. *Ostia gl. circumanal*, in the form of small highly constricted

openings, were situated on convex hairy papillae of the margin of the pseudo-cloaca, being visible near the anus at the level of the 9th or 10th caudal vertebra. These ostia were situated at a distance of 1—2 cm from the widely extended ostia of *diverticula laterales fossae preputialis*.

The circumanal glands were far narrower and often shorter than *diverticula laterales fossae preputialis*. It is only in newborn beavers, during development of these two pairs of organs, that the circumanal glands are distinguished by greater dimensions, in particular breadth. In the majority of the individuals examined there were only slight differences between the size of the right and left gland (Table 1), the right gland usually being slightly smaller than the left. In adult animals they reached a length of 10 cm and breadth of 4.5—5.0 cm, weighing from 11.5 to 34.0 g together with their contents (after removing the skin).

In newborn beavers the circumanal glands were far better developed than *diverticula fossae preputialis*, were oval in shape and had the structure of typical fat glands (Fig. 3). There was a fairly thick muscular layer beneath the dermis, this layer consisting of bundles of transversely striated muscle fibres descending to the gland from the walls of the »muscular cap« surrounding the terminal region of the rectum and anus. The muscle fibres ran parallel to the long axis of the gland. Numerous elastic fibres were found in the connective tissue of this layer. Under the muscle layer there is a thick layer of glandular tissue which contained numerous vesicles embedded in flaccid connective tissue. In the longitudinal sections a group of vesicles was observed which were set on short tubular ductuli (Fig. 2) which, joining the gland.

The walls of the different vesicles, collecting tubules, and efferent ducts and the cavity of the gland are formed of squamous epithelium. The reproductive layer of epithelium formed one or two rows of cylindrical cells with large oval nuclei. The median layers consisted of large oval vesicular cells in which the nuclei were small, often pycnotic, while drops of fat appeared in the cytoplasm. The closer to the lumen of the vesicle, the more the cells were subject to greater holocrine secretion, until total decomposition of the internal layers of epithelial cells took place. A greasy, fatty secretion (Fig. 2) staining deeply with sudan III or R scarlet, was observed in the lumen of vesicles.

There are only desquamated cells of the superficial layers of the epithelium in the cavity of these glands in newborn beavers, as was the case in the pseudo-cloaca. Secretion did not occur there, as in the case in older animals.

The circumanal glands were of uniform structure in males and females. As from the 4th month of life the cavity of the gland become oval in shape and narrowed funnel-wise in the direction of the ostium. The macroscopic view, after cutting open the gland, revealed ostia of the efferent ducts, protruding in the form of plugs, from which they fatty secretion was discharged. Examination of microscopic sections showed that the walls of the duct were lined with a relatively thin stratified epithelium, and that inside the duct there was secretion, often containing remains of incompletely desquamated cells (Fig. 5). The glandular vesicles

were then large and secretion in different phases of its formation could be observed in the lumen (Fig. 4), and this in preparations stained by Mallory's method gave an iridescent appearance from greenish-blue to orange-red.

The observations show that the circumanal glands of both females and males of the European beaver belong to typical fat glands, similar in their structure to the sebaceous glands of the skin. On account of the fact that the cells of the glandular epithelium lining the vesicles, their efferent ducts and the cavity of the gland, as a result of the single drops of fat initially appearing in them and in turn their complete fatty degeneration and decomposition, are included in the composition of the secretion, the circumanal glands of the beaver are gland with a holocrine way of secretion.

As stated by Hinze (1950) the secretion of the circumanal glands is used by beavers to spread fat over their fur, which then becomes suitable to their aquatic-terrestrial way of life. These animals are often observed at their toilet, consisting in rubbing the anal region with their fore limbs, thus expressing the contents of the circumanal glands, and distributing them over their fur.

#### REFERENCES

- Bagiński S., 1969: Technika mikroskopowa. Państw. Wyd. Nauk.: 1—729. Warszawa. Doboszyńska T., 1976: Strój bobrowy (Castoreum). *Wszechświat*, 1: 8—10. Gienc J. & Doboszyńska T., 1972: Macromorphological description of the genital organs of the female beaver. *Acta theriol.*, 17: 399—406. Hinze H., 1950: Der Biber. Akademische Verlag.: 1—214. Berlin. Kacnielson Z. S. & Orlova I. I., 1954: Gistologičeskoe stroenie tak nazyvajemyh prepucjalnyh (muskusnyh) żelez wzroslogo bobra. *Tr. Voronež. Gos. Zap.* 5: 58—63. Kacnielson Z. S., Orlova I. I., 1956: Ravvitie prepucjalnyh żelez bobra. *Ib.*, 6: 67—72. Nikulin V N., 1954: Pozaditazovaja oblast' rečnogo bobra. *Ib.*, 5: 56—58.

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EXPLANATION OF PLATES

Plate XXIII

Fig. 1. Postpelvic region of a newborn beaver, natural size.

1 — *regio postpelvicalis*, 2 — *arcus ischiadicus*, 3 — *ostium pseudocloacae*, 4 — *glandula circumanalis*, 5 — *diverticulum laterale fossae preputialis*.

Fig. 2. Vesicles of circumanal gland in a newborn beaver. Magn. 250X.

1 — vesicles of gland, 2 — short tubules of gland, 3 — squamous stratified epithelium, 4 — secretion in vesicles, 5 — connective tissue. Staining: hematoxylin-eosine.

Plate XXIV

Fig. 3. Postpelvic region of newborn female in horizontal section. Magn. 8X.

1 — dorsal wall of urogenital antrium, 2 — nucleus of *diverticulum laterale fossae preputialis*, 3 — *glandula circumanalis*, 4 — wall of pseudocloaca, 5 — anus. Staining: hematoxylin-eosine.

Fig. 4. Vesicles of circumanal gland of adult female in different phases of secretion. Magn. 80X. Staining: Mallory's method.

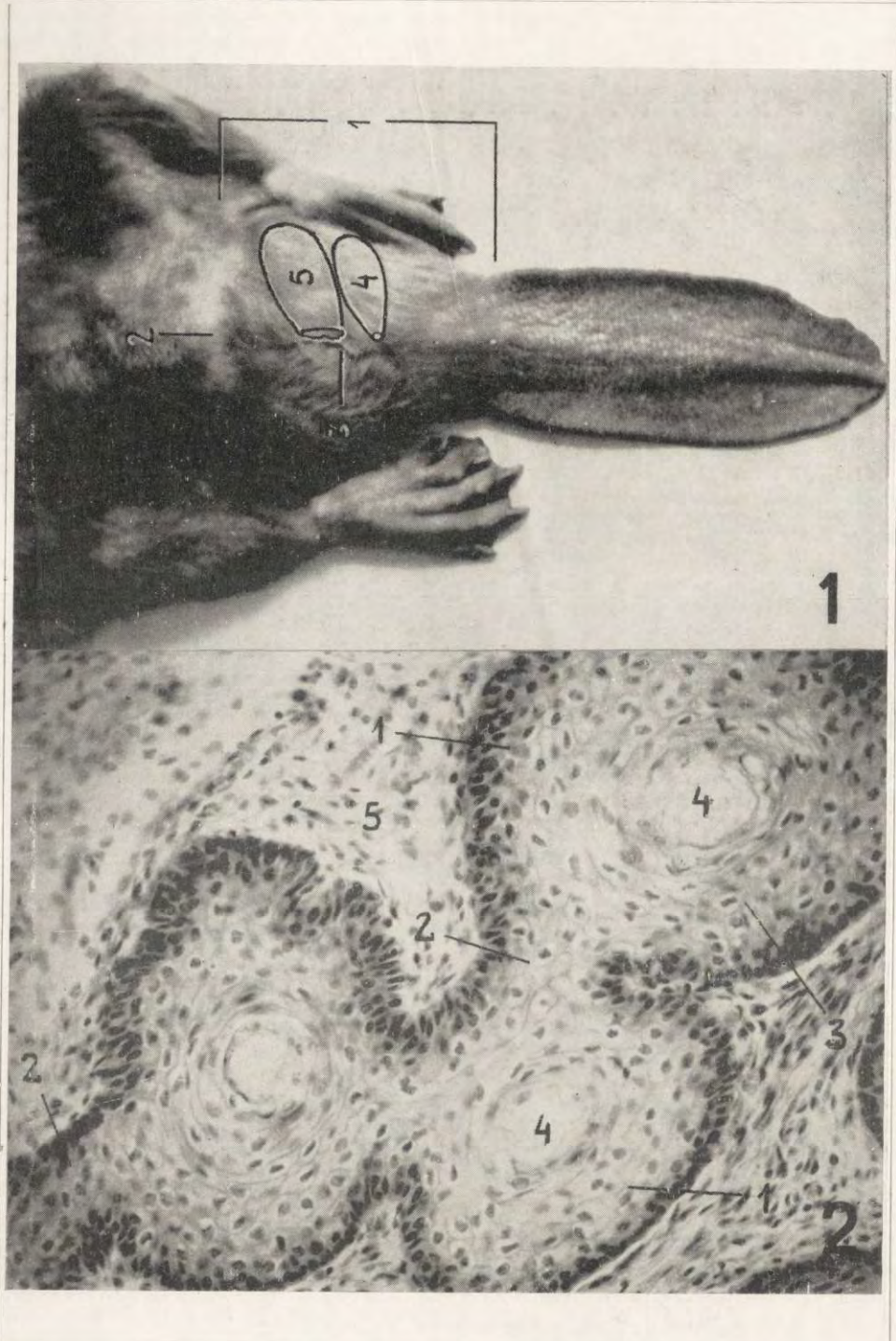
Fig. 5. Longitudinal section through efferent duct of circumanal gland in an adult animal. Magn. 125X.

1 — abundant secretion in lumen of duct. 2 — squamous stratified epithelium. Staining. Mallory's method.

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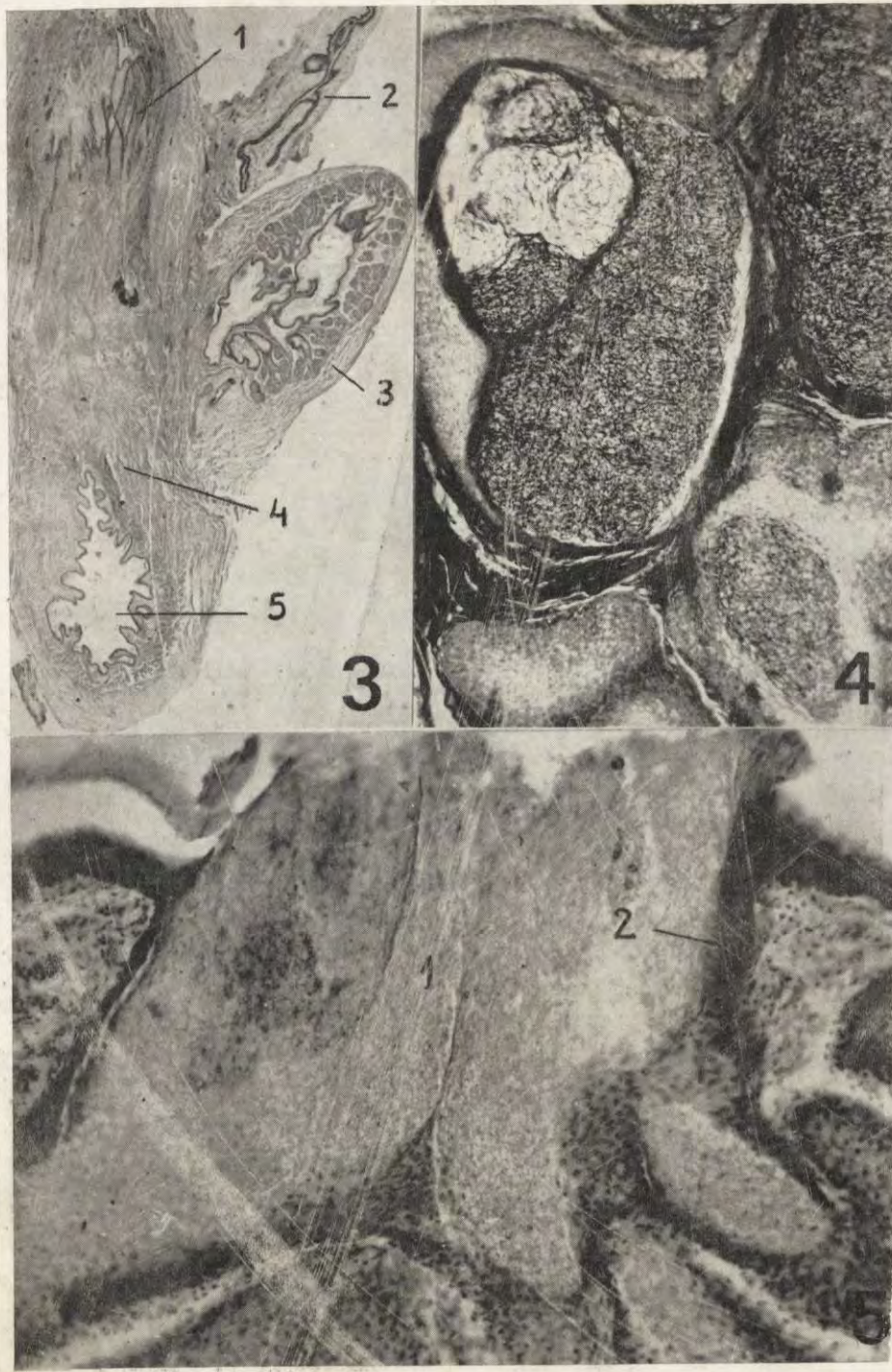
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