

Stefan MĘCZYŃSKI

Morphohistological Structure of Female Genital Organs in Souseliks

[With 4 Figs. & Plates I—II]

A description is given of the structure of the female genital organs in *Citellus suslicus* and *Citellus citellus* in adult individuals in process of oestrus. Examination was made of the structure of the ovaries and it was found that the ovary is surrounded by *bursa ovarica*. Three parts were distinguished in *tuba uterina*: *infundibulum tubae*, *ampulla tubae* and *isthmus tubae*. A description is given of the passage of *tuba uterina* into *cornus uteri*. The uterus in both species is of the *uterus duplex* type. The copulating organ consists of two parts: vagina and a fairly long *vestibulum vaginae*, together forming the copulating canal. *Ostium urethrae externum* opens 2/3 along the length of this canal. *Glandulae vestibulares maiores* were found to be present. Differences were shown in the structure of *os clitoridis* in both species of souseliks. A discussion is given of similarities and differences in the structure of the genital organs in souseliks and other representatives of *Rodentia*.

I. INTRODUCTION

This study is concerned with questions relating to the structure of the female genital organs in two Polish species of souseliks. The structure of the male genital organs has been described in a separate publication (Męczyński, 1971).

In view of the considerable similarity in the anatomical structure of the genital organs in the two species examined the description has been based on the genital system in *Citellus suslicus*. A detailed description is given for certain of its elements in *Citellus citellus* only in cases where there are significant differences between the species.

No information on the female genital organs of these species of souseliks has been found in the relevant literature available, but there are numerous publications on genital organs in other representatives of the *Sciuridae* family (Asdell, 1964).

II. MATERIAL AND METHODS

A morphological and histological analysis was made of the genital organs of 12 sousliks belonging to the two species occurring in Poland: *Citellus suslicus* (Güldenstaedt, 1770) (N=8) and *Citellus citellus* (Linnaeus, 1766) (N=4). The material was collected during the period from 1968—1972 at Gliniska, in the Lublin voivodship (*C. suslicus*) and at Kamień Śląski, in the Opole voivodship (*C. citellus*). Only sexually mature females in oestrus were examined.

The genital system excised for histological examination (*C. suslicus* — 4 individuals and *C. citellus* — 2 individuals) was fixed whole in Bouin's fluid, and the various parts of it steeped in paraffin, sectioned to 5—10 μ and stained with Mayer's haematoxylin and eosine water solution.

The genital organs were fixed for anatomical examination by excising the whole pelvis of the souslik together with the organs and immersing them in 10% formalin. After fixing, the organs were removed and measurements made with a slide-rule with accuracy to 0.5 mm. This method can be recommended, as organs fixed in this way retain their shape and position. If fixed after excision they become deformed to a greater or lesser extent, which renders anatomical examination and measurements difficult. Preparations from *os clitoridis* were made by the method given by Layne (1954).

The anatomical nomenclature used was based on *Nomina Anatomica Veterinaria* (Paris, 1967) and other sources given in the list of references.

III. RESULTS

Ovarium and bursa ovarica

The position of the ovary in the abdominal cavity is determined by the mesovarium, *ligamentum ovarii proprium* and *ligamentum suspensorium ovarii* (Fig. 1), which are attached to the *hilus ovarii*. The mesovarium passes without any distinct line of demarcation into the mesometrium. Both ligaments are embedded in a thick layer of fat. *Ligamentum ovarii proprium* runs to the apex of the uterine horn and also passes into the mesometrium, and determines the location of the ovary in relation to the uterus. Characteristic sulci in the form of notches run from the *hilus ovarii*, into which blood vessels enter and ligaments are attached (Fig. 2).

The ovary, which is triangular in outline (Fig. 2, ov), has the following dimensions: length — 3 mm, breadth — 2 mm, thickness — 2 mm (average data from macroscopic measurements). It proved impossible to establish differences in the size of ovaries in the species examined, because the small amount of material available.

The histological picture of the ovaries of females caught on April 2nd and 25th (*C. suslicus*) and April 26th (*C. citellus*), that is, midway and at the end of the oestrus, when pregnant females were already encount-

ered, reveals numerous well-formed Graafian follicles, and it is also possible to observe a few atresic follicles, but no split Graafian follicles or *corpora lutea* were found. This suggests that provoked ovulation may take place in these sousliks.

The ovary is formed of two layers (*zona parenchymatosa*) with follicles in different stages of development and atresia, and *zona vasculosa*, which is abundantly vascularized. There is, however, no distinct boundary between these layers.

The diameter of mature Graafian follicles is approx. 0.68 mm. Each follicle has a distinct *theca folliculi*. It is also easy to distinguish *corona*

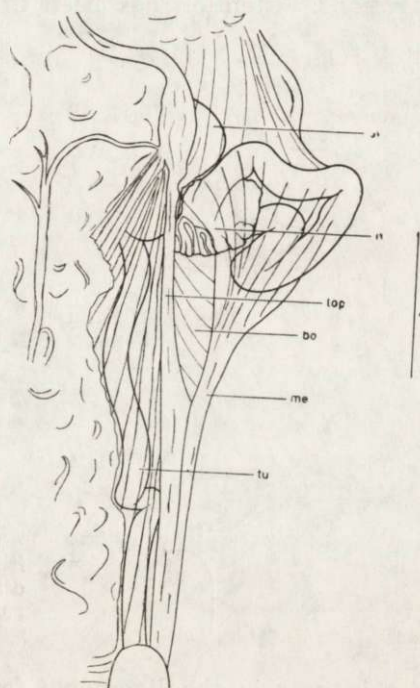


Fig. 1. Ovarium, system of *ligamenta ovarii* and *tuba uterina*.

Figure based on preparations made from organs of *C. suslicus* and *C. citellus*.

bo — *bursa ovarica*, it — *infundibulum tubae uterinae*, lop — *ligamentum ovarii proprium*, me — *mesosalpinx*, ov — *ovarium*, tu — *tuba uterina*.

radiata surrounding the egg cell (Photo 1). The diameter of the egg cell is 75—82 μ . No basic differences were found in the structure of the ovary in the species examined.

The ovary is surrounded by *bursa ovarica* (Photo 1, Fig. 1), which is formed on one side by *mesosalpinx*, and on the other by *mesovarium* and *lig. ovarii proprium*. There is an opening in *bursa ovarica*, through which there is connection with the peritoneal cavity of the abdomen. This opening can be seen in the form of a longitudinal gap (about 1 mm in

length) from the dorsal side (Fig. 1, bo). Some of the *fimbriae tubae* protrude through it.

In order to reveal the opening in *bursa ovarica* the ovaries were removed from the anterior ends of the uterine horns before fixing the preparations, on the basis of which the drawing was made (Fig. 1), and as the result of this operation this opening is far longer in the figure than in reality.

The thickness of the walls of *bursa ovarica* is not uniform: it is greater in the places in which the ligaments are attached to the ovary, and varies from 10 to 30 μ . Numerous fibres, probably smooth muscle fibres, can be seen running along the walls of *bursa ovarica* in histological preparations. Attention has been drawn to the existence of muscle fibres

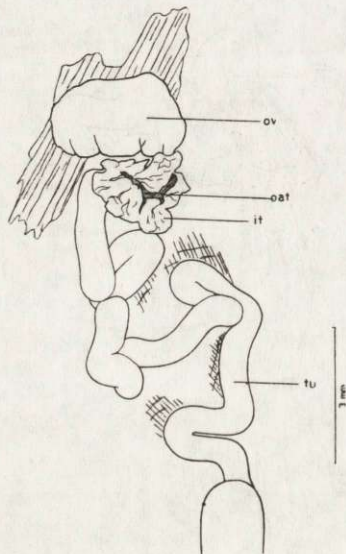


Fig. 2. Ovarium and *tuba uterina* isolated from ligaments and fat.

it — *infundibulum tubae uterinae*, oat — *ostium abdominale tubae uterinae* ov — *ovarium*, tu — *tuba uterina*.

of this type in the ligaments forming *bursa ovarica* by Seiferle (cited after Finger, 1957) and Watzka (1957).

There is an extensive space filled with fluid between the walls of *bursa ovarica* and the ovary (Photo 1).

Tuba uterina

Tuba uterina (Fig. 1, 2) is about 30 mm long (average data), and forms from 11 to 14 loops. The first part of it surrounds the ovary from the ventral side. In Fig. 1, 2 it is shown in partly straightened form. It lies in the mesosalpinx, which forms the wall of *bursa ovarica*.

Three parts can be distinguished in *tuba uterina*: a) *infundibulum tubae uterinae*, b) *ampulla tubae uterinae*, c) *isthmus tubae uterinae*.

a) *infundibulum tubae uterinae* (Fig. 1, 2. it) takes the form of a saucer-shaped broadening with irregular margins, with numerous folds and fimbriated lamina possessing sinuses of blood vessels. *Ostium abdominale tubae uterinae* (Fig. 2, oat) occurs in the form of an irregular cleft in the hollow of the broadening. *Infundibulum tubae uterinae* is partly attached to the ovary.

b) *Ampulla tubae uterinae* surrounds the ovary with its coils. The diameter of this part of *tuba uterina* is 0.7 mm (average value of macroscopic measurements).

The wall of *ampulla tubae uterinae* exhibits a three-layer structure, and consists of *tunica mucosa*, *tunica muscularis* and *tunica serosa* with blood vessels.

Tunica mucosa forms numerous *plicae tubariae* of the first and second order (Photo 2), 250 μ high, and is covered with single-layer columnar epithelium with well-formed cilia. Cells with oval nuclei, cells with round nuclei (there are probably secretory cells without cilia) and elongate narrow cells with dark cytoplasm can be distinguished in this epithelium. The height of the epithelium varies from 20 to 25 μ , as is the case with the epithelium covering the fimbria of *infundibulum tubae uterinae*.

Tunica muscularis, consisting of smooth muscle fibres, is about 50 μ thick. The diameter of *ampulla tubae uterinae* is 0.62 mm (average value from microscopic measurements).

c) *Isthmus tubae uterinae* — the diameter of this part of *tuba uterina* is smaller, being 0.5 mm (average value from macroscopic measurements).

Tunica mucosa forms about 11 single-order longitudinal folds here, with average height of 87 μ . The epithelium is lower than in the previous part, and its average height is 12.5 μ . The cilia are less well-formed and are present only in the initial section of this part of the *tuba uterina*, whereas they are not observed in the terminal part.

The muscular layer of this part is 75 μ thick (average data) and is thus thicker than in *ampulla tubae uterinae*.

The passage of *tuba uterina* into *cornus uteri* does not take place gradually, as is the case in, e.g., *Cavia*, but similarly to the relations found in the rat and laboratory mouse, or in *Mesocricetus auratus* (Finger, 1957). *Tuba uterina* runs for a certain part with its own muscular layer within the uterine wall, then opens into the lumen of the uterus in the narrow *ostium uterinum tubae*. It is therefore possible to see two separate lumina in the histological sections made from the proximal part.

of *cornus uteri*. In this part of *tuba uterina* there are low longitudinal folds covered with low epithelium (Photo 3).

Uterus

In both the species examined the uterus is of the duplex type. The average length of *cornua uteri* is 40 mm (minimum 27 mm, maximum 47 mm). Differences of up to 8 mm can be found in the length of the right and left uterine horns. The diameter of the uterus measured in the middle part of the horn is 1.8—2 mm (average values from macroscopic measurements).

The paired *cornua uteri* connect for a distance of about 5 mm in the externally unpaired part, the breadth of which is about 3.5 mm. This unpaired part enters into the lumen of the vagina as *portio vaginalis cervicis* (about 4.5 mm long). The uterus is suspended on mesometrium, which is embedded in a large amount of fatty tissue.

The walls of the uterus consist of three layers of follows: *tunica mucosa* (endometrium), *tunica muscularis* (myometrium) and *tunica serosa* (perimetrium).

Cavum uteri in its proximal part takes the form of an L or T-shaped cleft widening in a distal direction (Photo 4). The mucous membrane here forms low and scanty longitudinal folds. Mucus and numerous nucleated cells from 12 to 25 μ in diameter can be seen in the lumen.

The epithelium covering the mucosa of the uterus in single-layer columnar epithelium with oval nuclei, varying in height from approx. 12.5 to 17.5 μ on the medial side to distinctly lower on the external side. The thickness of the uterine mucous membrane is about 416 μ .

Tunica muscularis is composed of two layers: the external thicker layer of orbicular fibres (approx. 208 μ) and an internal thinner layer of longitudinal fibres (about 166 μ). There are blood vessels between these layers.

At the place of attachment of the mesometrium both the mucous membrane and *tunica muscularis* are distinctly thinner, as the *stratum vasculare* is particularly thick here.

There are numerous duct-like *glandulae uterinae* in the mucous membrane (Photo 4) distributed on the opposite side from the insertion of mesometrium. They are lined with single-layer columnar epithelium and filled with secretion. The diameter of the ducts of the glands varies from 25—50 μ . The number of glands decreases in the direction of *cervix uteri*, and consequently no such glands were found in the mucous membrane of the ducts of *cervix uteri*. The total diameter of the uterus

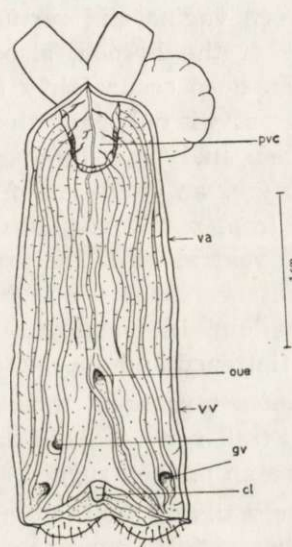
measured in the middle is 1.5—1.6 mm (average values from microscopic measurements).

The two *canales cervicis uteri* (Photo 5) open into the vagina in two separate slit-like *ostia uteri externa*, situated on the lateral surfaces of *partio vaginalis cervicis* (Photo 6).

The mucous membrane of *canales cervicis uteri* forms high longitudinal folds and is covered with flat stratified epithelium similar to that of the vagina, which is not keratotic here (Photo 5). Its height is 37—50 μ . Layers of desquamated epithelium can also be seen (particularly near the ostia of *canales cervicis uteri*). The diameter of the lumen of each

Fig. 3. Vagina and *vestibulum vaginae* with dorsal wall cut longitudinally and opened outwards (seen from dorsal side).

Figure based on preparations made from organs of *C. suslicus* and *C. citellus*. cl — clitoris, gv — openings of efferent canals of *gll. vestibulares maiores*, oue — *ostium urethrae externum*, pvc — *partio vaginalis cervicis*, vv — *vestibulum vaginae*, va — vagina.



canalis cervicis uteri is about, 1 mm, and mucus and numerous cells are present in it.

Tunica muscularis of the *cervix uteri* encircles each canal. Those two canals, together with the layers of muscle fibres surrounding them, are next surrounded by a muscle layer which also runs in an orbicular direction.

Partio vaginalis cervicis fuses with the dorsal and ventral wall of the vagina along its median line in a narrow band of connective tissue. Only the terminal part is free and unattached for about 0.5 mm. The place in which it is attached can be seen in Fig. 3.

Partio vaginalis cervicis is covered by desquamating keratotic stratified flat epithelium, similar to that lining the mucous membrane of the vagina.

Vagina and *vestibulum vaginae*

In both the species of sousliks examined the copulating organ consists of two parts: vagina and a fairly long *vestibulum vaginae*.

The vagina, together with *vestibulum vaginae*, form the female copulating organ, about 27 mm in length. *Ostium urethrae externum*, about 1 mm in diameter (Fig. 3, oue), is situated about 2/3 along the length of this canal on the ventral side. Urine flows along a groove formed by two longitudinal folds running diagonally on the right side of the canal (Fig. 3). This was found in all the animals examined.

The mucous membrane does not exhibit any folds on the boundary between vagina and *vestibulum vaginae* which would point to the presence of the hymen, although according to Poplewski (1948), this hymen does occur fairly frequently in rodents. The boundary between these parts is only indicated by the position of *ostium urethrae externum*.

When analysing the macroscopic structure of the vagina it is possible to observe an eminence of mucous membrane with a folded surface, running from *portio vaginalis cervicis* as far as *ostium urethrae externum* on its ventral wall. The urethra runs beneath this eminence. The mucous membrane of the urethra has no glands and is covered with stratified epithelium. In histological preparations of crosssections of the urethra it is flattened and approx. 1.4 mm wide (Photo 7).

Tunica mucosa of the vagina forms numerous *rugae vaginales* and small transverse folds in the form of cracks, which gives the walls of the vagina an uneven rugged appearance (Fig. 3, va).

The walls of *vestibulum vaginae*, on the other hand, form a smaller number of folds and are smoother in appearance. In addition *ostia glandulae vestibulares maiores* are located in them (Fig. 3, gv).

In histological preparations the vagina exhibits dorso-ventral flattening (its breadth is 2.4 mm, height 0.5 mm). The folds of the mucous membrane of the vagina are covered with stratified flat epithelium (Photo 7), which is 100—120 μ high near *portio vaginalis cervicis*. There are thick layers of flaking keratotic epithelium there. In the posterior of the vagina, in the direction of its opening into *vestibulum vaginae*, the epithelium is lower, from 62—75 μ . There is also a small number of desquamating cells there.

A layer of orbicular muscle, and also a far thinner layer of longitudinal muscles, run on the exterior of the mucous membrane. Fatty tissue is distributed between the mucous membrane and the muscle layer. A large amount of such tissue is present in the lateral position where the urethra opens into *vestibulum vaginae*.

The mucous membrane of *vestibulum vaginae* is covered with epithelium similar to that present in the vagina and approximately similar in height — 60—70 μ (Photo 8), but there is a far smaller amount of desquamated epithelium here.

Concentrations of *glandulae vestibulares maiores* occur in the mucous membrane of the lateral walls of *vestibulum vaginae* (Photo 9). They are 0.62 mm in height. The glands are lined with single-layer columnar epithelium filled with a secretion staining a faint pink with eosine. The efferent canals into which *gll. vestibulares maiores* open are probably *recessi vestibulum vaginae*, as indicated by the stratified epithelium lining them (Photo 10).

Clitoris

The structure and location of the clitoris can be best traced in the picture obtained from a series of sections made from the distal part of *vestibulum vaginae*.

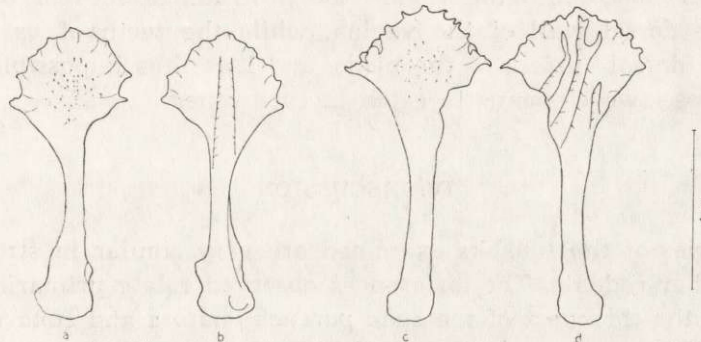


Fig. 4. *Os clitoridis*.

a, b — *C. suslicus*, a — seen from dorsal side, b — seen from ventral side.
c, d — *C. citellus*, c — seen from dorsal side, d — seen from ventral side.

This organ is located on the ventral wall of *vestibulum vaginae*, near the edge of *rima vulvae* (Fig. 3, cl). It consists of two *corpora cavernosa* which pass into a single flattened *corpus clitoridis*. *Os clitoridis*, formed of cartilage and sometimes partly ossified, is situated in *corpus clitoridis* (Photo 11, 12).

The extruding part of clitoris — *glans clitoridis* — has a folded mucous membrane covered with stratified epithelium and contains numerous sinuses of blood vessels. When at rest *glans clitoridis* is hidden in the depression formed by the transverse ventral fold of the wall of *vestibulum vaginae*.

In shape *os clitoridis* (Fig. 4) is similar to *os glandis* in males (Męczyński, 1971), and three parts can be distinguished in it: the basal, middle and terminal parts, the latter widening in the shape of a spade, with a toothed margin. These teeth are, however, relatively more weakly formed than the corresponding teeth in males. They protrude from *glans clitoridis* and can be felt by touch.

Differences in the size and shape of *os clitoridis* occur between *C. suslicus* and *C. citellus* and are in principle the same as the differences in the shape of *ossa glandis* in males of the species examined.

In *C. citellus* *os clitoridis* is larger (2 mm long, 1 mm broad — average values) has longer teeth and a convex ridge on the ventral side (Fig. 4, c, d).

In *C. suslicus* the length of *os clitoridis* is 1.8 mm, while the spade-like part is 0.8 mm wide (average data). Usually only one eminence runs through the middle of the spade-like part (Fig. 4, a, b).

The position of *os clitoridis* in relation to *os glandis* in males during copulation is interesting. The examination made shows that after the penis is introduced into the vagina the protruding teeth of *os glandis* contact the dorsal wall of the vagina, while the teeth of *os clitoridis* contact the dorsal surface of the penis, and it is thus impossible for the teeth of these two elements to catch in each other.

IV. DISCUSSION

The ovaries of the sousliks examined are very similar in structure to those of other rodents. The differences observed relate primarily to size and shape, the thickness of the *zona parenchymatosa* and *zona vasculosa* and sometimes also in the structure of the ovarian follicles. For instance multi-egg follicles occur in *Myocastor coypus* Mol. (Ślebodziński & Ptak, 1959), whereas this was not found in sousliks.

The dimensions of the ovaries in sousliks are similar to those of the ovaries of *Citellus tridecemlineatus*, in which species, after Johnson *et al.* (1933), during the oestrus when the vagina is open, the dimensions of ovaries are as follows: length — 3.1 mm, breadth 2.5 mm. Graafian follicles also are similar in size, with a diameter of 0.70 mm, as compared with ovaries 5 mm long and 3 mm wide in a laboratory rat (Drahn, cited after Finger, 1957).

In ovaries in sousliks *zona parenchymatosa* is thicker than *zona vasculosa*, as it is in laboratory mice, whereas the opposite situation is found in a laboratory rat, guinea pig, *zona vasculosa* being thickest (Drahn, cited after Finger, 1957).

Bursa ovarica in sousliks exhibits structural characters characteristic of the *Sciuridae* family. Strauss (1964) distinguished five types of *bursa ovarica*, emphasising its specific characters, which can at most only define certain families.

He allocated the *Sciuridae* family to type II, i.e. *bursa ovarica* is not complete, *infundibulum tubae uterinae* enters into its structure and it has a wide opening into the abdominal cavity. Among *Rodentia* he allocated families such as *Castoridae* and *Histricidae* to this type.

Bursa ovarica in *Sciuridae* to some extent forms a type intermediate between the *Cricetidae* and *Muridae* families, in which e.g. in the rat or laboratory mice *bursa ovarica* is complete, with the participation of *infundibulum tubae uterinae*, and representatives of the *Gliridae* family, in which *bursa ovarica* does not occur. Strauss (1964) emphasises that this heterogeneity is due to functional conditions and no values forming evidence of developmental tendencies can be attributed to these different forms. On the basis of more up-to-date data he emphasises that the significance of *bursa ovarica* does not consist only in transferring the egg cells to *tuba uterina*, but primarily on creating hydrostatic pressure of the fluid contained between the walls of *bursa ovarica* and the ovary, essential to the development of follicles and the action of *corpora lutea*.

It is usually possible to distinguish there main and clearly distinct parts in *tubae uterinae* of rodents, but in some species, e.g. *M. auratus* (Oeri, 1960) a fourth part — *praeisthmus tubae* — was found between *ampulla tubae uterinae* and *isthmus tubae uterinae*, which differs from the neighbouring parts in respect of histological structure.

The fact that three parts can be distinguished in *tubae uterinae* of sousliks, i.e. *infundibulum*, *ampulla* and *isthmus tubae uterinae*, does not mean that there is no intermediate part — *praeisthmus tubae*. It will be possible to solve this problem by examining a larger number of *tubae uterinae*.

An interesting point in the morphology of the uterus is the question of the type of uterus. Attention has been drawn to the inadequate elaboration of this problem in rodents, despite the large number of publications on the subject, by Bashenina (1967), who states that newly-discovered facts do not agree with data commonly to be found in literature (Weber, 1928; Ottow, 1955; Jung, 1955 and many others) since there is a general conviction that the uterus duplex type predominates in rodents.

When considering the structure of the uterus in sousliks, in particular the shape of the *cervix uteri*, in comparison with its shape in certain other rodents, the following very characteristic feature can be observed:

the cervix protrudes into the vagina in the form of a well-formed *portio vaginalis cervicis* and does not hang freely in the vaginal cavity, but is attached to the dorsal and ventral wall of the vagina. As a result *fornix vaginae* is divided into two chambers not in contact with each other. *Ostia uteri externa* open into these recesses. Similar relations occur, as stated by Lutnicki (1958), in *Myocastor coypus*, except that *portio vaginalis cervicis* is there attached only to the ventral wall of the vagina, and *ostia uteri externa* are located more medially. In other species e.g. laboratory rat, in which the uterus is also the uterus duplex type, *portio vaginalis cervicis* does not occur (Preissecker, cited after Finger, 1957).

In the guinea pig in which *uterus bipartitus* occurs, the two *canales cervicis uteri* occur in the medial part of the *cervix uterinae*. *Portio vaginalis cervicis* is relatively small and there is a single *ostium uteri externum* at its terminal end.

Cervix uteri is also distinguished by the fact that it has a thick layer of orbicular muscle and its mucous membrane forms numerous longitudinal folds and has no glands — at least they were not found in the two species of sousliks examined. Drahn also (cited after Finger, 1957) draws attention to the absence of glands in *cervix uteri* of the guinea pig. Ślebodziński & Ptak (1959), on the other hand, found glands to be present in *cervix uteri* of *M. coypus*, where they are longer than the glands in the uterine horns and take a more twisting course. There is some degree of discrepancy between these data and those of Lutnicki (1958), who states that there are no glands in the vaginal part of the *cervix uteri* in *M. coypus*, but that they occur abundantly in the network of small blood vessels.

The reciprocal relation described in sousliks between the genital and urinal systems (where *urethra feminina* opens high up in the copulating canal) can be observed in species of the order *Lagomorpha* e.g. in *Oryctolagus cuniculus* and also in domestic mammals.

The reciprocal connection of these ducts does not, however, occur in such rodents as: *Rattus rattus*, *Mus musculus*, *Myocastor coypus* (Ślebodziński & Ptak, 1959) or *Mesocricetus auratus* (Finger, 1957), and consequently *vestibulum vaginae* is not differentiated in these animals.

There are also intermediate stages, e.g. in the genus *Castor* (Vandenbroek cited after Ślebodziński & Ptak, 1959) *vestibulum vaginae* is shallow, as in the case in the guinea pig.

Apart from the oestrus the vagina may be closed by fused bands of epithelial cells during the anoestrus. This takes place particularly in numerous representatives of the *Sciuridae* family (Asdell, 1964). The

phenomenon of closing and opening of the vagina in sousliks will be discussed in a separate publication on the reproduction cycle.

Among the additional reproductive glands which were distinguished by Drahn (cited after Finger, 1957) (*gll. Bartholini*, *gll. clitorales*, *gll. perineales* and *gll. anales*) only the presence of *gll. vestibulares maiores* and *gll. anales* have been shown in sousliks. No *gll. urethrales* were found in the wall of urethra. Such glands can be observed in, e.g., *Mesocricetus auratus* (Finger, 1957).

Glandulae anales in sousliks are very characteristic, consisting of three glands in the form of papillae. Each of them is formed of numerous glandular vesicles. When at rest these papillae cannot be seen, but extrude from the anus when the animal is alarmed. They can be made to extrude in a dead animal by pressing the anal region.

The structure of anal glands in sousliks will form the subject of a separate study. A review of literature on this subject is given by Slegg (1926).

Descriptions of *os clitoridis* in the species of sousliks examined are based on a small amount of material, and it is therefore difficult to speak of the taxonomic value of characters which have been given as differentiating these structures from each other. As stated by Layne (1954), they are built of cartilage but are very often similar to bony formations. It must be remembered during studies that decalcification may take place here due to the action of fixing substances.

The general shape of *os clitoridis* is very similar to that of corresponding structures in other representatives of the genus *Citellus*. Layne (1954) gives a set of drawings of *os clitoridis* for 10 North American species of this genus. Even a superficial comparative analysis shows that it is possible to distinguish three parts in these structures (except for the species *C. variegates*, where this is more faintly marked) similar to those described in the sousliks examined. It may be that these are features characteristic of the whole of the genus *Citellus*.

REFERENCES

1. Asdell S. A., 1964: Patterns of mammalian reproduction. Cornell University Press : 1—670. Ithaca, New York.
2. Bashenina N. V., 1967: K morfologii matki mielkih gryzunov. Materialy III zol. Konf. Pedag. Institut. RSFSR. Volgograd: 466—468.
3. Finger M., 1957: Beitrag zur Anatomie der Weiblichen Geschlechtsorgane des Syr. Goldhamsters (*Mesocricetus auratus* W.). Vet. Diss. Leipzig: 1—43.
4. Johnson G. E., Foster M. A., Coco R. M., 1933: The sexual cycle of the thirteenlined ground squirrel in the laboratory. Trans. Kans. Acad. Sci., 36: 250—269.

5. Layne J. N., 1954: The os clitoridis of some American *Sciuridae*. *J. Mammal.*, 35, 3: 357—366.
6. Lutnicki W., 1958: Anatomie und Histologie der Geschlechtsorgane des Sumpfbibers *Myocastor coypus* Molina. *Annls Univ. M. Curie-Skłodowska, sect. DD*, 13: 1—23.
7. Męczyński S., 1971: Morphohistological analysis of the male genital organs of the genus *Citellus*. *Acta theriol.*, 16: 371—386.
8. Watzka M., 1957: *Handbuch der Mikroskopischen Anatomie des Menschen. (Weibliche Genitalorgane das Ovarium)*. 7, 1. Springer: 1—178. Berlin, Göttingen, Heidelberg.
9. *Nomina Anatomica Veterinaria*. 1968. Vienna: 1—144.
10. Oeri H. U., 1960: Der Bau des Eileiters beim Goldhamster (*Mesocricetus auratus*). *Z. Säugetierkunde*, 25, 1—2: 52—65.
11. Ottow B., 1955: *Biologische Anatomie der Genitalorgane und der Fortpflanzung der Säugetiere*. Gustav Fischer Verlag: 1—201. Jena.
12. Poplewski R., 1948: *Anatomia ssaków*. 4: 1—407. Stockholm.
13. Ślebodziński S. & Ptak W., 1959: Zarys budowy anatomicznej narządu rodnego samicy nutrii (*Myocastor coypus* Mol.). *Przegląd zool.* 3, 1: 31—44.
14. Sleggs G. F., 1926: The adult anatomy and histology of the anal glands of the Richardson ground squirrel, *Citellus richardsonii* Sabine. *Anat. Rec.*, 32, 1: 1—43.
15. Strauss F., 1964: Weibliche Geschlechtsorgane. *Hand. Zool.*, 8, 36: 1—96.

Accepted, October 23, 1973.

Department of Comparative Anatomy of Vertebrates,
Maria Curie-Skłodowska University,
Akademicka 19, 20-033 Lublin, Poland.

Stefan MĘCZYŃSKI

BUDOWA MORFOHISTOLOGICZNA UKŁADU ROZRODCZEGO ŻEŃSKIEGO SUSŁÓW

Streszczenie

Opisano budowę układu rozrodczego żeńskiego *Citellus suslicus* (Güldenstaedt, 1770) i *Citellus citellus* (Linnaeus, 1766) u dorosłych osobników bzdących w okresie rui. Zbadano strukturę jajników i układ więzadeł jajnikowych. Stwierdzono, że jajnik otoczony jest kieszonką jajnikową (*bursa ovarica*) (Ryc. 1, Fot. 1). Kieszonka jajnikowa posiada otwór w postaci podłużnej szpary, przez który łączy się z jamą otrzewnową brzucha. Przeanalizowano strukturę jajowodu i wyróżniono w nim trzy odcinki: *infundibulum tubae uterinae*, *ampulla tubae uterinae* i *isthmus tubae uterinae* (Ryc. 1, 2, Fot. 2). Opisano sposób przejścia jajowodu w róg macicy (Fot. 3).

U obu badanych gatunków susłów macica jest typu podwójnego (*uterus duplex*) (Fot. 5, 6). W błonie śluzowej macicy znajdują się liczne cewkowate gruczoły

(*glandulae uterinae*), natomiast w błonie śluzowej przewodów szyjki macicznej (*cervix uteri*), gruczoły takie nie występują. *Portio vaginalis cervicis* zrasta się wąskim pasmem tkanki łącznej z grzbietową i brzuszną ścianą pochwy wzdłuż jej linii pośrodkowej (Ryc. 3). U obydwu badanych gatunków narząd kopulacyjny składa się z dwóch odcinków: pochwy (*vagina*) i dość długiego przedsionka pochwy (*vestibulum vaginae*), które razem tworzą kanał kopulacyjny (Ryc. 3). *Ostium urethrae externum* otwiera się w 2/3 długości tego kanału. Stwierdzono obecność *glandulae vestibulares maiores* (Fot. 9, 10). Wykazano różnice w budowie os *clitoridis* u obu gatunków susłów (Ryc. 4). Dyskutowane są podobieństwa i różnice budowy układu rozrodczego susłów i innych przedstawicieli gryzoni.

EXPLANATION OF PLATES I-II

Plate I.

Photo 1. Cross-section through ovarium and *bursa ovarica* in *C. suslicus*. Arrow points to wall of *bursa ovarica*.

Photo 2. Cross-section through *ampulla tubae uterinae* in *C. suslicus*.

Photo 3. Cross-section through uterine tube part of *cornus uteri* in *C. suslicus*. The lumen of *tuba uterina* and of the uterus can be seen.

Photo 4. Cross-section through middle part of *cornus uteri* in *C. suslicus*.

Photo 5. Cross-section through *portio vaginalis cervicis* in *C. suslicus*. The two *canales cervicis uteri* can be seen.

Photo 6. Cross-section through *portio vaginalis cervicis* in *C. suslicus*. Opening of *canalis cervicis uteri* into vagina.

Plate II.

Photo 7. Cross-section through *urethra feminina* and vagina in *C. suslicus*.

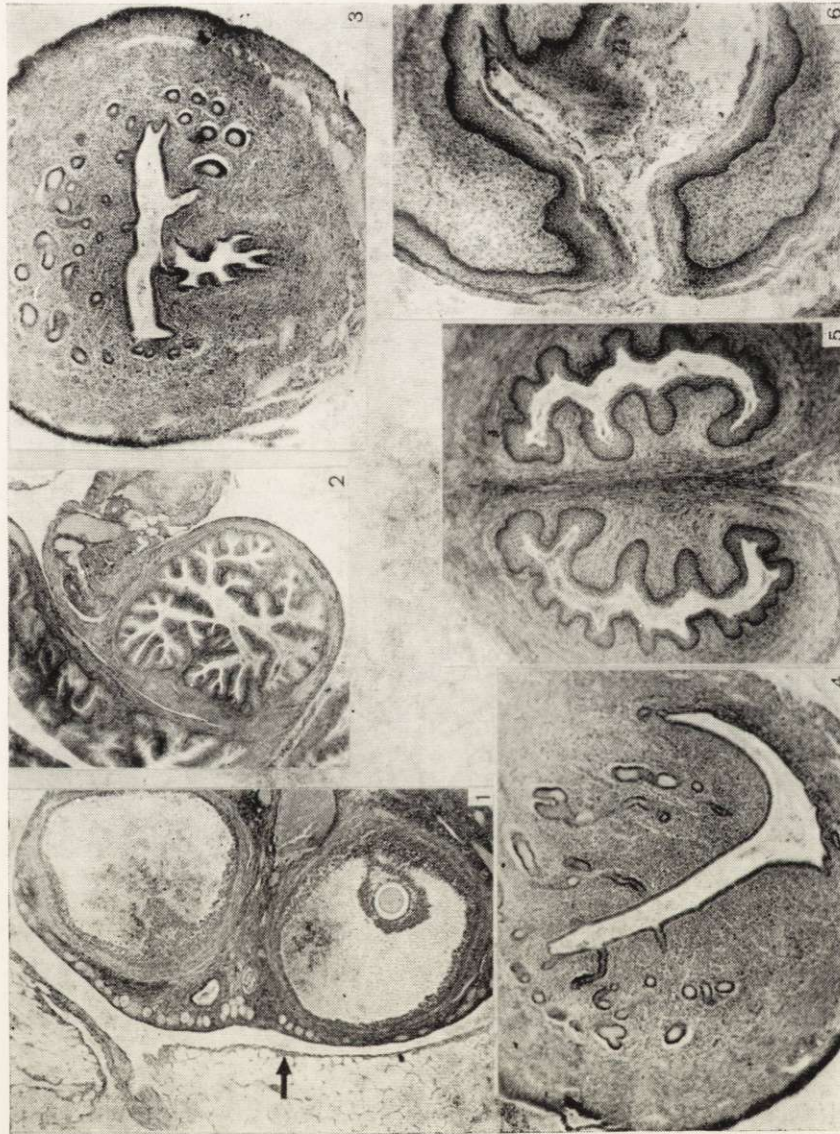
Photo 8. Cross-section in region of opening of *urethra feminina* into *vestibulum vaginae* in *C. suslicus*.

Photo 9. Cross-section through *vestibulum vaginae* in *C. suslicus*. *Gll. vestibulares maiores* can be seen.

Photo 10. Cross-section through efferent canal of *gl. vestibularis* in *C. suslicus*.

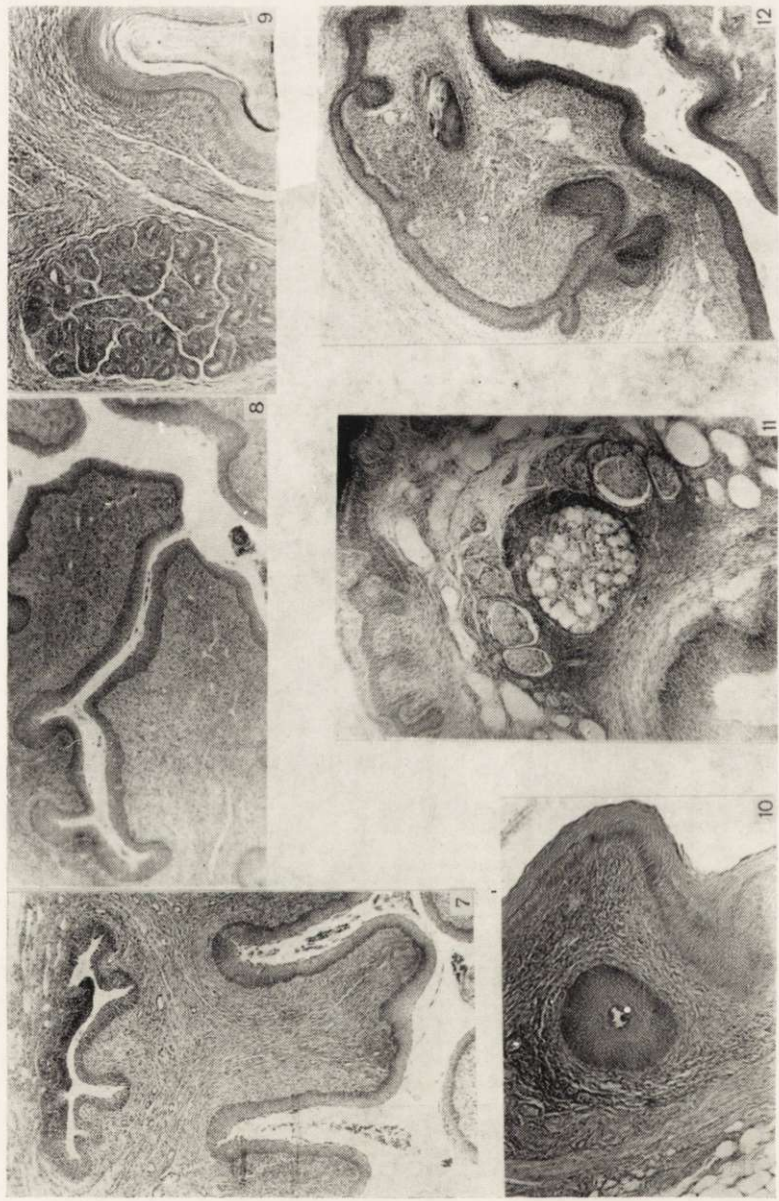
Photo 11. Cross-section through section of proximal part of *glans clitoridis* in *C. suslicus*. *Cartilago clitoridis* can be seen in the middle part.

Photo 12. Cross-section through section of distal part of *glans clitoridis* in *C. suslicus*.



S. Męczyński

auctor phot.



S. Męczyński

auctor phot.