

The Female Urogenital System of *Antechinus* (Marsupialia).¹

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(With Two Plates)

SUMMARY

An examination of the female urogenital system of *Antechinus* confirms the view that the sub-family Phascogalinae is the most generalized group of Australian marsupials. This system in *Antechinus* is as primitive as that of the members of the American super-family Didelphoidea and has many striking features.

GENERAL ACCOUNT

The sub-family Phascogalinae which comprises the most primitive members of the super-family Dasyuroidea is composed of about half a dozen genera of which *Antechinus* may be regarded as a typical example. There are two Tasmanian species of this genus, *Antechinus swainsonii* (Waterhouse) which is also found in Victoria and New South Wales, and *Antechinus minimus* (Geoffrey) which occurs only in Tasmania and its associated islands.

Four specimens have been examined in the course of the present investigations, as follows:—

<i>Antechinus swainsonii</i>	<i>D.C.L. Head and Body.</i>
Tasmanian Museum, No. 269	135 mm.
National Museum, Melbourne, No. C886	150 mm.
National Museum, Melbourne, No. C890	135 mm.
<i>Antechinus minimus</i>	
Tasmanian Museum, No. 291	147 mm.

All the above specimens are fully grown adult females, though unfortunately it is not known which, if any, are parous.

Measurements. In these four specimens the antero-posterior length of the urogenital system, excluding the uteri, varies from 10.725 mm. to 25.25 mm. In the following table the antero-posterior lengths of the various parts are given in terms of μ as well as in percentages of the combined antero-posterior length of the vaginal complex and urogenital sinus (*af*). Reference should be made to Fig. 1 in which are shown the various levels at which the measurements given

⁽¹⁾ The investigations dealt with in this paper were carried out at the Tasmanian Museum and were assisted by a grant provided equally by the Trustees of the Commonwealth Science and Industry Endowment Fund and by the Tasmanian State Government.

in the table are taken. These are:—*a*, anterior extremity of the vaginal system; *b*, anterior extremity of the culs-de-sac; *c*, posterior extremity of the culs-de-sac; *d*, anterior extremity of urethra (level at which the ureters, indicated in Fig. 1 by two crosses, enter the neck of the bladder); *e*, junction of the lateral vaginae (In *Antechinus* and most marsupials this also corresponds approximately to the opening of the urethra into the urogenital sinus. In the Potoroidae, however, in which the posterior sections of the lateral vaginae fuse to form the posterior vaginal sinus, the opening of the urethra is some distance caudal to the point of fusion of the lateral vaginae); *f*, level of clitoris (posterior extremity of urogenital sinus).

TABLE

Measurements of the Urogenital System of Antechinus
(in terms of μ and in percentages of the length *af*)

	af <i>Combined antero- posterior length of vagina and urogenital sinus</i>	ae <i>Antero- posterior length of vagina</i>	ef <i>Length of urogenital sinus</i>	bc <i>Length of cul-de-sac</i>	ce <i>Pseudo- vaginal gap</i>	de <i>Length of urethra</i>
No. 269	10,725 μ	3,270 μ 30%	7,455 μ 70%	0,960 μ 9%	1,800 μ 17%	1,530 μ 14%
No. C886 ⁽¹⁾	14,270 μ	4,440 μ 31%	9,830 μ 69%	0,930 μ 6.5%	2,670 μ 18%	1,830 μ 13%
No. C890	25,250 μ	6,515 μ 26%	18,735 μ 74%	1,572 μ 6.2%	2,440 μ 10%	1,660 μ 7%
No. 291	11,425 μ	2,870 μ 25%	8,555 μ 75%	0,720 μ 6.3%	1,500 μ 13%	1,310 μ 11%
Average	28%	72%	7%	14.5%	11%

⁽¹⁾ *af* and *ef* in C886 are only approximate as the posterior part of the urogenital sinus was not sectioned. This part, however, was measured as carefully as circumstances would permit.

As far as can be ascertained no adequate description of the female urogenital system of a Phascogale has been published hitherto, though Wood Jones (1949) recently discussed the general anatomy of a related form, *Dasyercus cristicauda* (Krefft), and gave a brief description of the female urogenital system of that species. The present account is given in some detail and forms part of a comprehensive study of the marsupial urogenital system which has been in progress for some years. Ultimately it is hoped to bring together in a single paper the salient features of the female urogenital system of the Marsupialia and to discuss from this angle the relationship of the five super-families of that Order.

Serial sections have been cut of all four specimens and the following description may be regarded to some extent as a composite one based upon an examination of the sections in the four specimens.

At a cursory glance the most noticeable features of the female urogenital system in the Phascogalinae are the relative insignificance of the vaginal region and the predominance of the uterine region and the urogenital sinus (see Fig. 1). These characters may be said to be common to all members of the Dasyuroidea.

UTERUS (fig 1, *ut* and *ut.n.*). The uterine region has an antero-posterior length equal to about three-sevenths of the entire length of the urogenital system and is about equal to the length of the urogenital sinus. Each uterus is clearly divided into a fusiform uterine body (*ut.*) and a well-defined uterine neck (*ut.n.*). The Fallopian tubes lie in the normal position on the outer side of the anterior extremities of the uterine bodies. The right and left uterine bodies are slightly splayed and lie some distance apart but the two uterine necks after leaving the uterine bodies rapidly converge and for the more caudal part of their course run parallel to each other and in close contact, embedded in a common sheath of connective tissue. Thus the uterine necks present a characteristic Y-shaped appearance which, however, is not so marked as in the Dasyurinae. In three of the specimens examined the character is not so obvious since the two anterior converging arms of the Y are splayed and distorted so as to lie transversely or even to be reflected posteriorly, a condition probably caused by post-mortem pressure of the neighbouring abdominal organs. This distorted condition is somewhat similar to that shown by Wood Jones (1949) in his drawing of the right uterus of *Dasyercus cristicauda*.

In the case, however, of the Melbourne specimen No. C890, the Y-shaped appearance of the uterine necks is clearly shown (see Fig. 1), a condition which probably represents the normal disposition of the organs in the living animal and which is reminiscent of the Dasyurine arrangement. Each uterine neck opens into the proximal region of the vagina (cul-de-sac) near the free tip of a well-defined uterine papilla (*ut.p.*) which almost completely fills the cul-de-sac. This is shown in Fig. 2 except that the os uteri is made to open on the tip of the papilla, as it proved difficult to show the actual position of the opening and at the same time to preserve the essential features as clearly as was desired.

VAGINAL COMPLEX. The vaginal region comprises all that part of the genital system which lies distal to the uteri and which extends caudally as far as the anterior limit of the urogenital sinus. The vaginal system of each side may conveniently be divided into (a) a proximal region, the vaginal cul-de-sac (*m.v.c.*); (b) an intermediate region, the anterior vaginal canal (*a.v.c.*); and (c) a distal region, the lateral vagina (*l.v.*).

VAGINAL CULS-DE-SAC (*m.v.c.*). These lie side by side immediately posterior to the two uterine necks with which they are connected, as indicated above. In all four specimens the right and left culs-de-sac are completely separate, but a good deal more material would need to be examined before it could be said with justification that this separation holds good throughout life. Unfortunately, it is not known whether any of the four specimens are parous, though some are fully grown and mature.

It is known from observations on other primitive forms, the members of the American super-family Didelphoidea for example, that the septum which separates the two culs-de-sac probably breaks down in some species at the first parturition and certainly does break down, whatever the cause may be, in mature specimens.

In the case under examination, however, the tissues separating the right and left culs-de-sac are so thick that it is not unlikely that the separation of the right and left culs-de-sac remains inviolate throughout life in the Phascogalinae.

It is interesting to record that each cul-de-sac is remarkably small and undeveloped, and varies in antero-posterior length from 720 μ to 1572 μ in the four specimens (see Table). Even this minute chamber is still further reduced as its cavity is almost entirely occupied by the uterine papilla (*ut.p.*), and the condition of the culs-de-sac in the Phascogalinae is certainly as primitive as in any known marsupial.

ANTERIOR VAGINAL CANAL (*a.v.c.*). Each canal arises ventro-laterally from its cul-de-sac and sweeps forward and outward to the anterior limit of the vaginal bend where it passes imperceptibly into the lateral vagina. Actually there is no true morphological distinction between these two elements of the vaginal loop, and it might be claimed with justification that both elements are merely components of the lateral vagina. However, in *Perameles* Hill (1899) coined the term 'anterior vaginal canal' for a duct at each side which is probably homologous with the one now under discussion, and it is considered convenient to adopt Hill's designation for the proximal portion of the loop throughout the Marsupialia (see Pearson, 1950, p. 216). It is interesting to note, too, that the perameloid condition is also found in a somewhat modified form in the specialized Potoroidae, particularly in *Bettongia* (Pearson, 1950). In *Antechinus*, as might be expected in such a generalized form the vaginal complex follows the basic plan which is common to the less specialized marsupials.

LATERAL VAGINAE (*l.v.*). This region of the vaginal system runs caudally and the right and left portions converge and fuse near their point of entry into the urogenital sinus. In nearly all members of the Dasyuridae examined in the course of these investigations there is a short caecal outgrowth arising from each lateral vagina. This has been found without exception in all specimens of the genera *Dasyurus*, *Sarcophilus* and *Thylacinus* which have been examined, but in the case of *Antechinus* only one of the four specimens so far examined, viz., C890, shows this condition.⁽¹⁾ It is not unlikely that this short caecum represents the last vestige of the Wolffian duct. The fate of this duct in female marsupials and the composition of the marsupial lateral vagina are matters of considerable interest which will be discussed in a subsequent paper.

UROGENITAL SINUS (*u.g.s.*). As in the case of all members of the Dasyuroidea the length of the urogenital sinus is considerably greater than the antero-posterior length of the vaginal complex. It will be seen from the figures given in the table that in *Antechinus* the sinus is about two and a half times the antero-posterior length of the vagina. The relatively great length of the sinus in the two most primitive of the five marsupial super-families, viz., the Didelphoidea and the Dasyuroidea, indicates that this character may be regarded as a primitive feature.

DISCUSSION

In the genus *Antechinus*, which is a typical member of the Phascogalinae, the female urogenital system has the following notable features:—

- (1) The uteri have an antero-posterior length equal to that of the urogenital sinus. The right and left uterine necks form a Y which is, however, relatively much shorter than in the Dasyurinae.

⁽¹⁾ After this paper had gone to the press a fifth specimen of *Antechinus* was examined and showed no sign of the vestigial Wolffian duct. As in the other specimens the two culs-de-sac were completely separated.

- (2) The vaginal complex is relatively small and its antero-posterior length is less than one-half that of the urogenital sinus.
- (3) The vaginal culs-de-sac are extremely small and probably remain separate throughout life. The cavity of each cul-de-sac is almost entirely obliterated by the swollen uterine papilla.
- (4) The pseudovaginal gap is equal to about one-half of the vaginal length.

The condition of the female urogenital system of the Dasyuroidea as a whole will be discussed in a paper which is now in course of preparation, but it may be said that the female urogenital system of the Phascogalinae is more primitive than that of the Dasyurinae. Nothing is known of the condition in mature members of the Thylacininae but an examination of young female specimens of *Thylacinus* indicates the probability that the female urogenital system of that genus is less primitive than that of *Antechinus*.

It is not proposed to discuss here the various interesting problems which are suggested by a morphological study of the primitive marsupials which are placed in the sub-family Phascogalinae. Such a study would naturally evoke speculations on the nature and character of the earliest marsupials which found their way into the Australian area. There is, too, the question whether this entry was made from the north or through a former land connexion with the Antarctic continent. Much emphasis has been placed upon the evolutionary specializations which have resulted from the isolation of a marsupial fauna within the Australian continent. But it is as well to be reminded that in the midst of this evolutionary activity certain groups have persisted more or less unaltered both in structure and habit and probably differ in no important respect from the first marsupial immigrants into the Australia area. The phascogales are a case in point and the evidence provided in the present paper shows that the female urogenital system of the Phascogalinae is as primitive as that found in any recent marsupials including even the American Didelphoidea.

REFERENCES TO LITERATURE

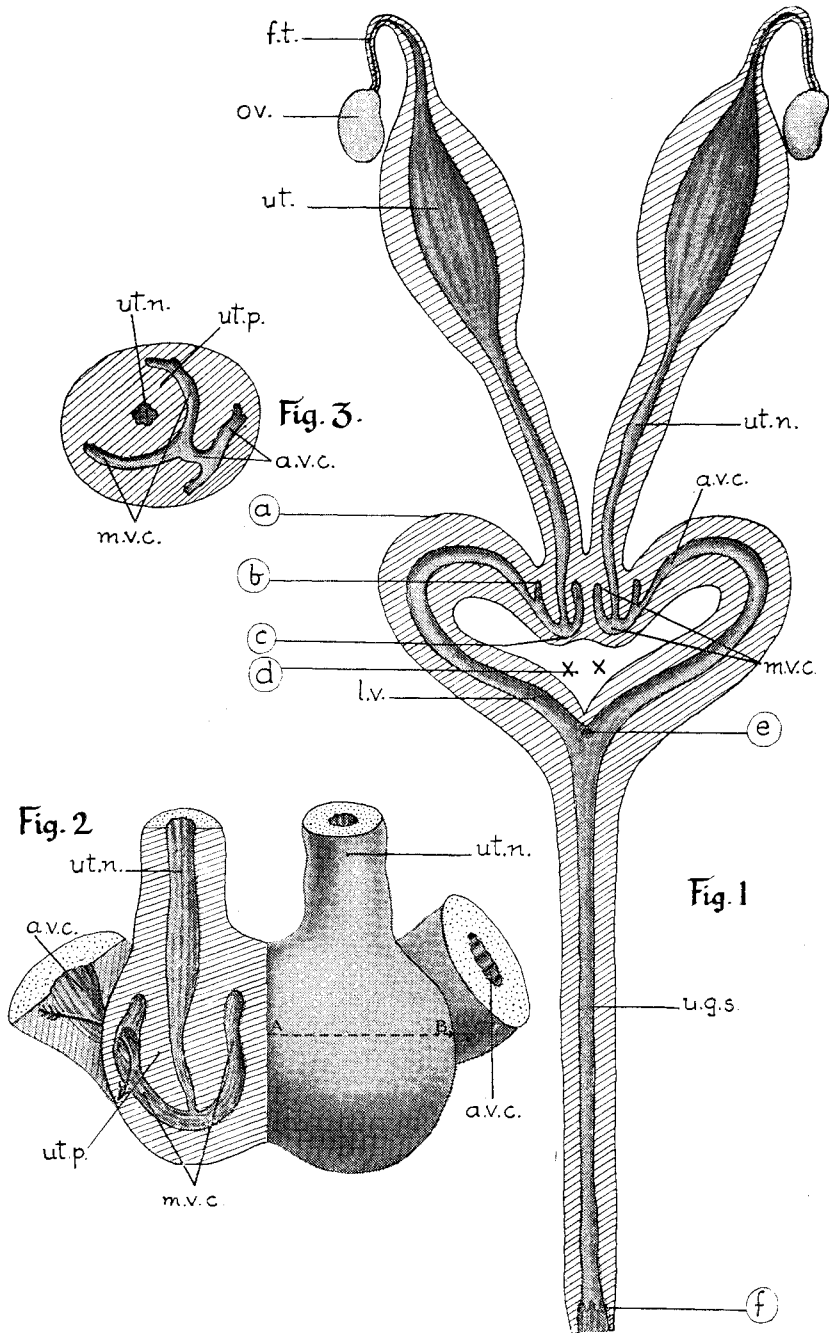
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REFERENCES TO FIGURES

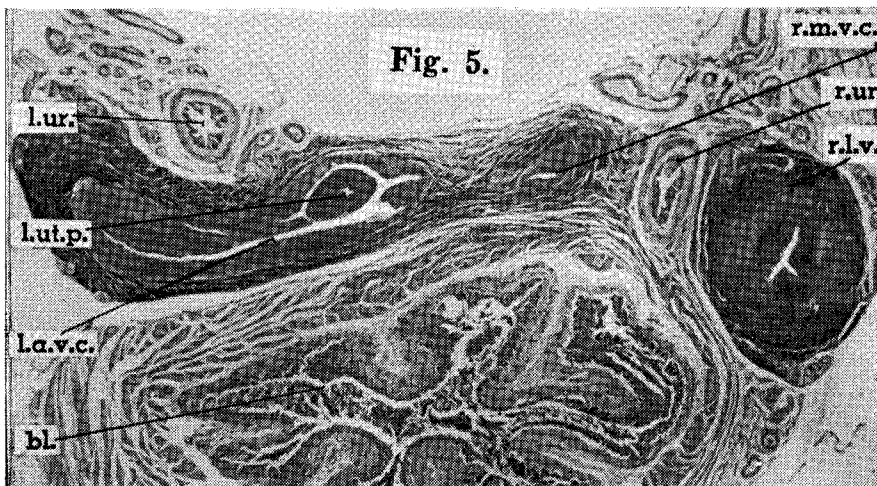
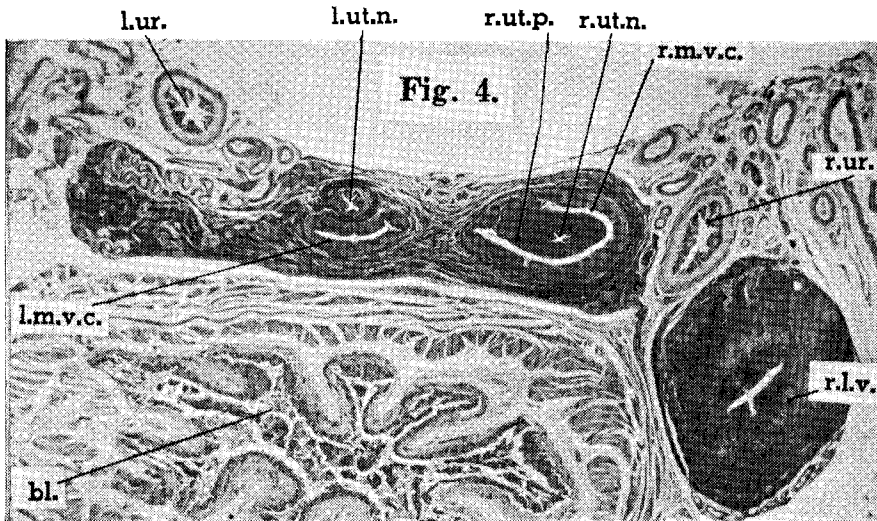
<i>a.v.c.</i> —Anterior vaginal canal.	<i>ov.</i> —Ovary.
<i>bl.</i> —Bladder.	<i>r.l.v.</i> —Right lateral vagina.
<i>f.t.</i> —Fallopian tube.	<i>r.m.v.c.</i> —Right vaginal cul-de-sac.
<i>l.a.v.c.</i> —Left anterior vaginal canal.	<i>r.ur.</i> —Right ureter.
<i>l.m.v.c.</i> —Left vaginal cul-de-sac.	<i>r.ut.n.</i> —Right uterine neck.
<i>l.ur.</i> —Left ureter.	<i>r.ut.p.</i> —Right uterine papilla.
<i>l.ut.n.</i> —Left uterine neck.	<i>u.g.s.</i> —Urogenital sinus.
<i>l.ut.p.</i> —Left uterine papilla.	<i>ut.</i> —Uterus.
<i>l.v.</i> —Lateral vagina.	<i>ut.n.</i> —Uterine neck.
<i>m.v.c.</i> —Median vaginal cul-de-sac.	<i>ut.p.</i> —Uterine papilla.

DESCRIPTION OF PLATE I

- FIG. 1.—Diagram of the female urogenital system of *Antechinus*. $\times 10$. (The letters (a)—(f) indicate the various levels at which the measurements given in Table I. were made).
- FIG. 2.—Diagrammatic representation of right and left culs-de-sac. $\times 25$. The left cul-de-sac is shown in horizontal section so as to expose the cavities of the uterine neck, cul-de-sac and anterior vaginal canal of the left side. (Note.—In Figs. 1 and 2, for the sake of simplicity, each os uteri is shown as though opening on the tip of the ureteric papilla. Actually it opens on the ventral side of the papilla slightly anterior to the tip).
- FIG. 3.—Diagrammatic transverse section of the right cul-de-sac through AB (see Fig. 2). $\times 25$.



For references to figures see opposite page



Photomicrographs of transverse sections through region of vaginal cul-de-sac in *Antechinus minimus* (no.291) x 20. (The sections are cut slightly obliquely and are asymmetrical in consequence. Therefore the left lateral vagina is not shown).

FIG. 4.—Slide 27, section 16. The right uterine papilla almost completely fills the right cul-de-sac. Only the anterior portion of the left cul-de-sac is shown.

FIG. 5.—Slide 28, section 11. The posterior extremity of the right cul-de-sac is shown. The connexion of the left anterior vaginal canal with the left cul-de-sac is seen.