

Citation:

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But besides the function, discovered by BONNIER and the significance of the secreted nectar for the fertilisation, it has become clear to me that as well the glucose, formed from saccharose, as the outwardly secreted nectar, are also in other respects of great importance to the plant. The observations, here communicated, point already to one very important function, i. e. *to enable the stamens to bring their pollen to the surface at the right time, independent of the hygroscopic condition of the air.*

I hope before long to be able to point out still another function.

The secretion of nectar now appears in another light. The view that it must be considered as an excretion of "a waste product of chemical changes in the sap"¹⁾, which in the course of time has become more marked through natural selection, as a useful adaptation for promoting cross-fertilisation, since this liquid was eagerly taken away by insects, has to give way to the conception that, preceding any adaptation, it has in its further development kept pace with the sexual organs.

Anatomy. — "*On the relation of the genital ducts to the genital gland in marsupials.*" By A. J. P. v. D. BROEK. (Communicated by Prof. L. BOLK).

(Communicated in the meeting of October 27, 1906).

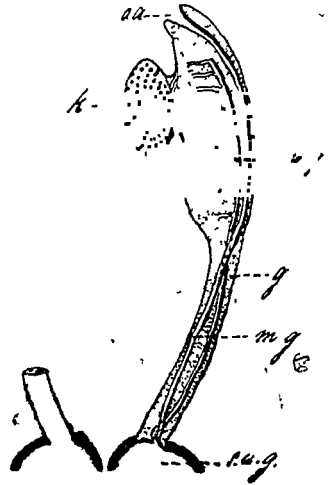
In the following communication the changes will be shortly described which the cranial extremities of the genital ducts in marsupials undergo during the development and their relations in regard to the genital gland. In more than one respect the ontogenetic development differs in these animals from what can be observed in other mammals.

It is especially a series of young marsupials of *Dasyurus viverrinus* in successive stadia of development from which the observations are derived. The preparations of other investigated forms (*Didelphys*, *Sminthopsis crassicaudata*, *Phascologale pincillata*, *Trichosurus vulpecula*, *Macropus ruficollis*) correspond however completely with the conditions we meet in *Dasyurus*.

In our description we start from a stadium schematically represented in figure 1 that still prevails for both sexes, (*Dasyurus*, *Didelphys*, *Macropus*). The genital gland (Figure 1 *k*) is situated at the medial

¹⁾ CH. DARWIN. Origin of species. Sixth Edition. 1872. Chap. IV, p. 73 and The effects of Cross and Self-fertilisation. Edition 1876. Chap. X, p. 402.

side of the mesonephros and is attached to it by a narrow band (afterwards the mesorchium or mesovarium) (Fig. 1 *m*). The genital ducts are developed on their whole length. The Wolffian duct (*w.g.*) joins transversal mesonephridial tubules in the mesonephros but has no connection whatever as yet with the genital gland. The Müllerian duct (Figure 1 *m.g.*) commences with an ostium abdominale (*o.a.*) and runs as far as the region of the mesonephros is concerned at the lateral side of the Wolffian duct.



relation of the genital gland and genital ducts
in an indifferent stadium.

- k.* genital gland.
- o.a.* Ostium abdominale tubae.
- g.s.* genital cord.
- w.g.* Wolffian duct.
- m.g.* Müllerian duct.
- s.u.g.* Sinus uro-genitalis.

Fig. 1.

We firstly will follow the transformations, which appear in the female sex. The first change is a reduction in the cranial part of the mesonephros. Here nothing is to be observed that points to a transformation of the mesonephridial tubules by renovation of the epithelium. The Wolffian duct meanwhile grows cranially, remains situated near the Müllerian duct, and moves then, passing archwise through the mesovarium, to the ovarium, penetrates in it and there ends blind (Figure 2 *w.g.*). The condition which issues from this I have demonstrated in Figure 2 (*Dasyurus* 40 m.m.).

Only now the reduction of the Wolffian duct begins. This occurs in such a way, that the medial part disappears; both at the cranial and at the caudal extremity, a remnant of the duct remains.

The cranial rudiment of the Wolffian duct is then found as a little tubule blind at both ends, which commences in the ovarium and can be traced till in the mesovarium. Figure 3 points out this little tubule as I have found it in several animals (*Dasyurus*, *Sminthopsis*) (Fig. 3 *w.g.*).

In how far the remnant of the Wolffian duct has relation to the

little tubules which I described and represented in the mesovarium of a fullgrown *Petrogale penicillata*, remains out of discussion here¹⁾).

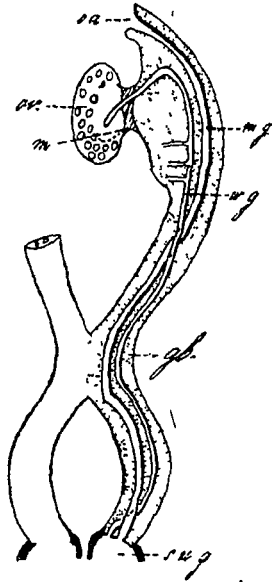


Fig. 2.

Relation of the genital ducts to the ovarium.

- ov. Ovarium.
- m. Mesovarium.
- o. a. Ostium abdominale tubae.
- m. g. Müllerian duct.
- w. g. Wolffian duct.
- tr. c. Transversal combination of both the genital cords.
- s. u. g. Sinus uro-genitalis.

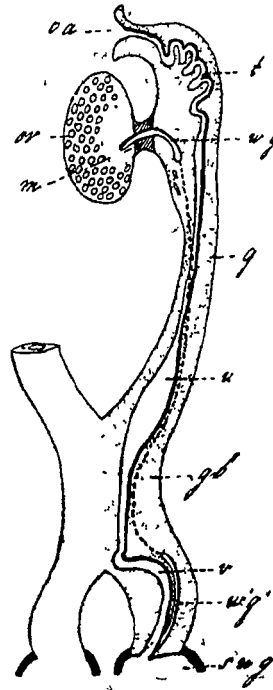


Fig. 3.

Relation of the genital ducts to the ovarium.

- ov. Ovarium.
- m. Mesovarium.
- o. a. Ostium abdominale tubae.
- t. Tuba Falloppie.
- u. Uterus.
- v. Vagina.
- w. g. Remnant of the Wolffian ducts.
- w'. g'. " " " " " "
- g. s. genital cord.
- tr. c. Transversal combination of both the genital cords.
- s. u. g. Sinus uro-genitalis.

In the male sex the Wolffian duct shows in the development of its cranial extremity, very much resemblance to that of the female sex. (Fig. 4 and 5).

During the reduction of the mesonephros the cranial extremity of

¹⁾ v. D. BROEK, Untersuchungen über die weiblichen Geschlechtsorgane der Beuteltiere. Petrus Camper III.

the Wolffian duct grows forth and takes its course archwise through the mesorchium in the testicle. (Fig. 4 *w.g.*). Here is brought about in one place (*Dasyurus*) a connection with the future spermatic tubes, which are still present in the stadium of solid cords of cells.

The mesonephridial tubules disappear almost quite, so that at a certain stadium (*Dasyurus viverrinus* 53. m.m.) the Wolffian duct, strongly grown forth in length, runs twisting through the mass of tissue, which must be considered as the epididymis, without any appearance of tubules in the form of the *coni vasculosi*.

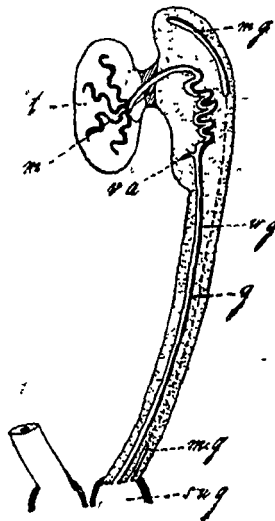


Fig. 4.

Relation of the genital ducts to the testicle.

- t.* Testicle.
- m.* Mesorchium.
- m.g.* Remnants of the Müllerian duct.
- w.g.* Wolffian duct (*vas deferens*).
- g.s.* Genital cord.
- s.u.g.* Sinus uro-genitalis.
- v.a.* Vas aberrans.

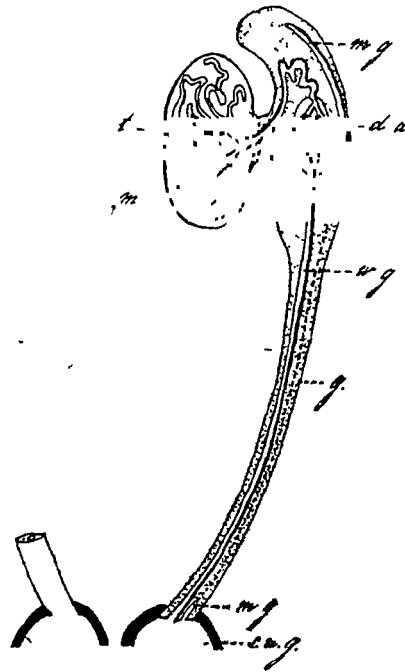


Fig. 5.

Relation of the genital duct to the testicle.

- t.* Testicle.
- m.* Mesorchium.
- m.g.* Remnants of the Mullerian duct.
- d.a.* Glandule part in the epididymis.
- w.g.* Wolffian duct (*vas deferens*).
- g.s.* Genital cord.
- s u.g.* Sinus uro-genitalis.

Meanwhile the Müllerian duct is for the greater part reduced. The cranial extremity remains as a remnant of the duct either beginning with an *ostium abdominale* or not, and ending caudally blind in the epididymis tissue.

The change following on this consists therein that the spermatic tubes obtain a lumen and combine in one or two places (Didelphys) with the Wolffian duct grown into the testicle. In the epididymis a great many cell cords have meanwhile appeared in the course of the Wolffian duct (Vas epididymidis), out of which cell cords the little tubules of the epididymis will develop.

Of the Mullerian duct a rest has remained in the tissue of the epididymis, I have not observed rests of this duct in the form of hydatis. Neither did I find them mentioned in literature.

In the genital gland of the full grown animal I found that the connection of the testicle and epididymis is formed by a mesorchium, in which evidently a single tube forms the communication between the two parts (Didelphys, Halmaturus). Probably the same holds true for *Hypsiprymnus*, where, according to DISSELHORST¹⁾, the epididymis is a spindle shaped swelling in the course of the vas deferens.

About the microscopic structure of the testicle and epididymis I found in DISSELHORST the communication that it agrees with that of other animals. As on this immediately follows: "die Spermatogenese war in vollem Gange", it seems to me that this communication relates more to the structure of epithels of the tubules than to the nature of the connection of testicle and epididymis.

A comparison with what we find in other mammals shows us the following.

There now and then is to be observed in the female sex (at least in man) an excrescence of the cranial extremity of the Wolffian duct, which then becomes the tubo-parovarian tube, which was first described by ROTH²⁾ and recognised by MIHALKOVICS³⁾ as a part of the Wolffian duct. Where however in Marsupials the Wolffian duct penetrates into the genital gland, the tubo-parovarian tube of man remains in the Ligamentum latum.

For the male sex the following holds true.

A rete testis, whether it has to be considered as tubules, which have appeared afterwards, and must be considered as a second generation of tubuli seminiferi (COERT)⁴⁾ or as homologa of the

¹⁾ R. DISSELHORST. Die männlichen Geschlechtsorgane der Monotremen und einiger Marsupialen.

SEMON's Zoologische Forschungsreisen in Australien und den Malayischen Archipel. 1904. p. 121.

²⁾ Quoted by MIHALKOVICS.

³⁾ MIHALKOVICS, Untersuchungen über die Entwicklungsgeschichte der Uro-genitalorgane der Cranioten.

Internat. Zeitschrift für Anatomie und Histologie. Bd. 2.

⁴⁾ COERT, Over de ontwikkeling der geslachtsklier bij de zoogdieren. Diss. Leiden 1898.

“Markstränge” of the ovarium (MIHALKOVICS), or as tubules of the mesonephros grown into the tissue of the testicle (KOLLMANN)¹⁾ is not found in marsupials. If, during further development a network resembling the rete testis, arises in the marsupial testicle, it must be considered as a part which appears quite secondary.

The connection of the testicle and epididymis is not caused by a number of tubules of the mesonephros, transformed to vasa efferentia, but by a single tube which must be considered as a part of the Wolffian duct. For the conception that the connecting tube really is the Wolffian duct, the phenomena of development in the female sex can be cited together with those in the male animals. In the marsupials all the tubules of the mesonephros are reduced to minimal rests (vasa aberrantia). In the mass of tissue, which represents the so-called epididymis of these animals, a great number of tubes arise secondary, which afterwards probably possess as epididymis tubules the same function as the coni vasculosi in the epididymis of other mammals.

To explain the differences in the connection of the testicle and epididymis in marsupials and in other mammals, the following considerations seem to me to be of importance.

About the changes, which the mesonephros undergoes, by its connection with the testis, which connection furnishes the later vasa efferentia testis, we read the following in the extensive investigations of COERT²⁾: In the proximal part of the Wolffian body where the Malpighian bodies are connected with the blastem of the rete testis, we see the glomeruli and the inner epithelium of the capsules disappearing gradually; after which the outer walls of these capsules form the blind extremities the mesonephridial tubules. The epithelium of the mesonephridial tubules also begins to have another aspect. Two kinds of processes occur here together: a number of epithelium cells are pushed out into the lumen and are destroyed, while on the other hand many new cells are formed (mitosis). With this the cells get another appearance both as concerns the nucleus and the protoplasm. The result is that at last the tubules of the mesonephros are surrounded all over their extent, which formerly was not the case, by an uniform epithelium, formed by cylindrical cells, the nuclei ranged regularly at the basis of the cells. Whether the connection of these tubes with the Wolffian duct always remains unchanged during those transformations or is perhaps broken off and afterwards re-established in another place I have not been able to investigate.

¹⁾ KOLLMANN, Lehrbuch der Entwicklungsgeschichte des Menschen.

²⁾ l.c. p. 96.

My opinion is that these investigations show that the vasa efferentia testis must not be considered as simple tubules of the mesonephros, but newly formed tubules, which use quite or for the greater part the way given to them by the tubules of the mesonephros. And that they are able to use this way finds its cause in this, that, according to FÉLIX and BÜHLER¹⁾ there is most probably no idea of a functioning of the mesonephros in monodelphic mammals, even not in the pig, where it is so strongly developed.

Not so in the didelphic mammals. Here the mesonephros does not only function embryonally, as is known, but still during the first period of the individual life. A separation of the mesonephros in two parts as is found in reptilia does not come about here.

The connection of the genital gland, especially of the testicle and its duct, the Wolffian duct, could not, it may be supposed, in the stadium in which this connection will come about in other animals, be established in marsupials with the help of tubules of the mesonephros, because these had still to fulfill their excretory function.

Instead of this the connection could be established in such a way that the Wolffian duct grows out cranially and brings about itself the connection between the gland and its excretory duct.

At last the tubes, which occur secondary and independently of the tubules of the mesonephros in the tissue of the epididymis, might be explained in the same way, i.e. as tubules which have the same signification as the con. vasculosi, but for the same reason do not originate on the bottom of tubules of the mesonephros but are separated from them both locally and temporarily.

Another view may be, that the tube which encroached in the genital gland, might not be the Wolffian duct but the most cranial tubule of the mesonephros so that in other words the so-called sexual part of the mesonephros in marsupials should be reduced. I do not believe that this conception is true, firstly because no separation between the tubules can be observed, and secondly because at the reduction of the mesonephros, as is mentioned above, in marsupials, nothing can be observed, as far as my preparations are concerned, of differences between the tubules of the mesonephros, what must surely be the case at a transformation of a tubule of the mesonephros to a connecting duct.

¹⁾ FÉLIX und BÜHLER, Die Entwicklung der Harn und Geschlechtsorgane in HERTWIG's Handbuch der vergleichenden und experimentellen Entwicklungsgeschichte der Wirbeltiere.