

XXVI. *On the Ova of the Ornithorhynchus paradoxus.* By RICHARD OWEN, Esq.,
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Communicated by Sir ANTHONY CARLISLE, F.R.S.

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THE modes of generation of which the ultimate result is the birth of young endowed with powers of action and liberated from the foetal coverings, are usually comprehended under the terms viviparous and ovoviviparous. But the processes by which the requisite development of the foetus is effected in the first of these modes, vary remarkably; and so far as they have been investigated in the different orders of *Mammalia*, to which true viviparous or placental generation is peculiar, a very regular gradation has been traced towards the oviparous or ovoviviparous modes, in which the exterior covering of the ovum never becomes vascular.

As lactation has been generally regarded as exclusively associated with a true viviparous generation, the arguments adduced in favour of the mammary nature of the abdominal glands of the *Ornithorhynchus* have been supposed to imply a necessary belief in the accordance of its mode of generation with that of the higher orders of *Mammalia*. They have consequently been objected to most strenuously by those physiologists who maintain the oviparous nature of this animal*: and various explanations have been offered, with a view to reconcile the lately ascertained facts respecting the mammary glands with the oviparous theory of the *Monotremata*, and their supposed position in the natural system as a distinct class of *Vertebrata*. The reasonableness or necessity of these objections would have been more apparent if the essential dependence of lactation on placental development had first been demonstrated: for with respect to the observations† against which they were directed, these were confined to the elucidation of a single disputed and doubtful point in the economy of the *Monotremata*; the uterine apparatus being considered so far only as was necessary to determine the correspondence of its periodical changes with those of the mammary glands; while the objections to the oviparity of the *Ornithorhynchus* extended only to the theory which maintained that the ovum was expelled with a calcareous covering, and that embryonic development took place after exclusion by a process of incubation.

In proceeding now to the more immediate consideration of the structure of the

* GEOFFROY ST. HILAIRE, in the *Gazette Médicale de Paris* for January and February, 1833; *Revue Encyclopédique* for July and August, 1833.

† *Philosophical Transactions*, 1832, p. 517.

ovary of the Ornithorhynchus, with a view to determine its exact relations with that of the normal *Mammalia*, I believe myself in no way biassed by the proof of the mammiferous nature of the Ornithorhynchus, which has been afforded by the concurrent testimonies of several scientific observers who have themselves witnessed the lacteal secretion; since it is obvious that in order for the milk, the elaboration of which is determined by the derivation of blood from the generative system, to meet with a due recipient after the cessation of the uterine functions, it is only necessary that the offspring should possess the capability of receiving the maternal secretion, and not that it should have gained that power by any particular mode of development, or through the agency of any given system of vessels.

From an examination of the internal structure of the mammary foetus of the marsupial animals, there appeared, indeed, previously to the present inquiry, to be grounds for entertaining a belief that lactation might coexist with a mode of generation essentially similar to that of the Viper and Salamander; and a subsequent examination of the uterine foetus in the Kangaroo has gone far to establish the truth of this supposition*.

In the specimen of the female organs of the Ornithorhynchus figured in Plates XVI. and XVII. of the Philosophical Transactions for 1832, two ovisacs, or Graafian follicles, had taken on the action of preparation for the male influence; and, it is probable, from a comparison of these ovisacs with the corpora lutea of specimens hereafter to be described, in which the ova had recently passed into the uterus, that they had nearly if not quite attained their full development. This opinion is further corroborated by the circumstance of the uterus to which the ovisacs in question belonged having increased almost to the size of that of the impregnated female figured at Plate XXV. fig. 2. in illustration of the present communication. In a female

* LATREILLE, in his *Familles Naturelles du Règne Animal*, 8vo, 1825, excludes the *Monotremata* from the Mammiferous series, at the conclusion of which he observes, "tous ceux dont nous traiterons désormais sont ovipares ou ovovipares, et par conséquent dépourvus de mamelles." (p. 66.) ARISTOTLE says, "No oviparous animal has an epiglottis:" and there are perhaps few generalizations in the *Historia Animalium* that testify more strongly to the extent of his anatomical researches. This remarkable proposition has stood the test of ages of subsequent research, and is adopted by CUVIER without any modification in the *Règne Animal* (Nouv. Ed. tom. i. p. 300.); yet it must always have been difficult to suppose that the relation which subsisted between a small part of the larynx and any given mode of generation could be other than that of simple coincidence; and it now appears that, in the sense in which CUVIER defines oviparous generation (Ibid. p. 300.), the *Marsupiatæ* do form an exception to the Aristotelian rule. The Ornithorhynchus also possesses a large and well-formed epiglottis, and it certainly has mammary glands. From this we may be led to conclude that an epiglottis is formed not because the foetus is developed by a placenta, but because it is to be nourished after birth by a lacteal secretion. The larynx requires, at that feeble period, an extraordinary protection, for which the young bird or reptile has no need: and it is worthy of remark, that the epiglottis is proportionately developed as the young mammal is prematurely born. Having therefore, as its peculiar coexistence with lactation would show, an especial reference to the earlier periods of life, we can better understand why the epiglottis should be of secondary importance to the adult, in which both accident and experiment have shown that it is not essential to safe deglutition.

Ornithorhynchus preserved in the Military Museum at Chatham*, I subsequently found three ovisacs developed in the ovary to a similar but not greater extent. Mr. HILL†, who first detected the ovarian ova in the recent animal, also states that they were not larger than a small pea; and they have never exceeded that size in any of the specimens examined by Sir EVERARD HOME.

A knowledge of the size which the ovarian ovum of the Ornithorhynchus acquires before it finally escapes, is of great consequence in forming a judgement as to the ultimate mode of development of the embryo, as a direct deviation from the generation of the ordinary Mammal, and a proportional approximation to that of the Bird, would be manifested in the ratio of the accumulation of the vitelline matter in the ovisac. Now it has very recently been supposed that the ovulum of the Ornithorhynchus attains a greater diameter than in other *Mammalia* before passing from the ovary; and Professor DE BLAINVILLE‡ adduces in favour of this opinion the size of the ova discovered by Lieutenant MAULE, and the corresponding capacity of the orifice of the Fallopian tube. But the expression of the zealous officer just alluded to, leads to the belief that the eggs of the size of a large musket-ball which he saw, were in the uterus rather than in the ovary; and the size of the orifice of the Fallopian tube in *Mammalia* is in relation with that of the entire ovary which it embraces, and not with that of the ovum which it is destined to transmit to the uterus.

The two ovarian ova or ovisacs§ were two lines and a half in diameter, and adhered to the ovary by about one third part of their whole circumference.

In the specimen in the Chatham Museum the three ovisacs which had attained nearly the same size, were attached to the ovary by a smaller portion of their circumference, but were still sessile, and not appended, as in the Bird, by a distinct pedicle. In both specimens smaller ovisacs of different sizes projected to a greater or less extent from the surface of the ovary.

The clustered form of the ovary, which results from this position of the ovisacs, is not, however, peculiar to the Ornithorhynchus among *Mammalia*, but obtains in a greater or less degree throughout the Marsupial and Rodent orders. DE GRAAF long ago figured the ovary of the Rabbit as composed, when prepared for impregnation, like that of the Ornithorhynchus, of a cluster of spherical ovisacs or folliculi||; and DAUBENTON, in describing the ovaria of the Black Rat¶ and of the Water Rat**, particularly notices their tubercular or racemose figure, and the yellow colour of the

* My thanks are especially due to G. J. GUTHRIE, Esq. F.R.S., and to the officers in charge of the Museum at Fort Pitt, for the facilities there afforded me in the examination of this specimen.

† Transactions of the Linnean Society, vol. xiii. p. 623.

‡ Nouvelles Annales du Muséum, tom. ii. p. 405.

§ Philosophical Transactions, 1832. Plate XVI.

|| De Mulierum Organis, Tab. xxv. p. 412. Opera Omnia, Lugd. Batav. 1677.

¶ Buffon, Hist. Nat., tom. vii. Plate xxxviii. p. 293.

** Ibid., Plate xlvi. p. 357.

larger ova; the affinity, therefore, which the Ornithorhynchus and some other Marsupial animals manifest in this particular to the class of Birds, obtains also in those orders of the more normal *Mammalia*, of which the foetus is characterized by the magnitude and persistence of the vitelline or umbilical vesicle.

The structure of the ovary of the Ornithorhynchus exhibits all the essential characters of the mammiferous type of this organ; its fibrous coat is strong and inelastic, and the cellular substance in which the ovisacs are imbedded is dense, and cannot be stretched without much force. On making a section through an ovisac or Graafian follicle, it is found to be implanted more or less deeply in condensed layers of this cellular substance, to which its theca closely adheres. The innermost layer of the theca is less vascular, thinner, and smoother on the inner surface than in the corresponding coat in the human ovisac.

In the Ornithorhynchus the theca of the expanded ovisac at the most prominent part is very thin and transparent; and the capsule of the ovary is either wanting, or blended with its peritoneal covering, which is slightly protruded, as though the pressure of the contained follicles had stimulated the absorbents to remove the resisting laminæ, as in the progress of an abscess to the surface of the skin. In the true *Ovipara*, as in the Fowl and Tortoise, &c., this partial thinning of the capsula ovarii surrounding the mature ovarian ovum, is less perceptible on account of its general tenuity; and the part where the ovum is about to escape is indicated chiefly by the extremities of the vessels, which converge to it from all parts of the capsule; it is also of a linear form; while in the Ornithorhynchus and other *Mammalia* it is a circular protuberance.

The contents of the ovisacs of the Ornithorhynchus consist of minute granules, which in the larger ovisacs are applied in a condensed state to the inner surface of the containing membrane, and there form a granular stratum. I have opened with great care many ovisacs of the Ornithorhynchus, of different sizes, under the microscope, separating with the point of a needle the clusters of granules as they escaped, and have examined the inner surface of the capsule, especially opposite the mammillary projection, but never succeeded in detecting the vesicle described by PURKINJE and VON BAER as existing in the ovarian ova of other animals: the long maceration of the parts in spirit may, however, have destroyed this delicate but essential part of the ovum; and the coagulation of the albumen, which is mixed with the granules, adds greatly to the difficulty of this delicate investigation.

The contents of the larger ovisacs above described varied both in colour and consistency: in the smaller of the two taken from the first specimen, the fluid in which the granules were immersed was more abundant, and bore a slight straw-coloured tinge; in the other ovisac from the same animal, and in those of the Chatham specimen, the granules were more numerous, the contents having a caseous consistency, and being of a deep yellow hue.

DE GRAAF describes a similar variety in the consistence and colour of the contents

of the ovarian follicles or ovisacs in the Rabbit,—a difference which he considers to be dependent on impregnation; the ovisacs then becoming denser and of a redder tinge until the ova escape, which takes place the third day after the coitus.

From a comparison of the ovarian ovum of the Ornithorhynchus with the mature ovarian ova of the Rabbit, the Sow, and the Ewe, the principal difference consists in the greater proportion of granules in the contained fluid, and in the more coherent nature of the external granular stratum, which however appears not to possess the necessary consistence to be, with its contents, expelled entire from the ovisac. In the Fowl, on the contrary, where there is no adhesion between the ovarian ovum and the calyx, the former passes unbroken into the oviduct. Thus in every essential particular the monotrematous ovum up to this period of development is the same as that of the ordinary *Mammalia*; and its structure is in exact physiological correspondence with the mode of nourishment of the young animal.

Soon after the preceding observations had been made, three uteri of the Ornithorhynchus, containing ova of different sizes, were transmitted from New South Wales to the Museum of the Royal College of Surgeons, by my friend GEORGE BENNETT, Esq. F.L.S.*

The Board of Curators having liberally granted me permission to describe and figure these interesting preparations, I am enabled to resume the subject of the previous observations, and proceed with the description of the ovaries as they appear after the impregnation and the escape of the ova into the uterus.

In each of these specimens, the left ovary only had taken on the sexual actions, but did not exceed in size the same parts in the unimpregnated specimens above described. The right ovary had, however, become enlarged; it measured half an inch in length, a third of an inch in breadth, and was about half a line in thickness: a few ovisacs, about the size of a small pin's head, projected from the surface.

The left ovary in each of the specimens was concealed by the thin membrane, forming the expanded orifice of the oviduct. In one of these it was with some difficulty it could be withdrawn from the Fallopian aperture, owing to the adhesion which was produced by what appeared to be a coagulated secretion; a circumstance which must have effectually ensured the passage of the ovum into the oviduct.

In two of the specimens, the left ovary presented two empty ovisacs, or corpora lutea (Plate XXV. fig. 2. *b.*), corresponding with the number of ova found in the uterus. In the third specimen, the left ovary presented two ovisacs still uncitrized, but only one ovum was contained in the uterus. In a fourth specimen, three similar ovisacs were present, but the ova had been removed from the uterine cavity.

The discharged ovisacs were of an elongated flask-shaped form, about three lines

* Natural history owes much to this gentleman; he discovered what had so long been a desideratum in science, the animal of the Pearly Nautilus, and first transmitted to this country the impregnated uterus of the Kangaroo; and now his indefatigable exertions have materially contributed to elucidate the still more obscure subject of the generation of the Edentate *Marsupialia*.

in length, and two in diameter, with the margins of the orifice, through which the ovum and granular substance had passed, everted, with a slight contraction, resembling the neck of a flask, below the aperture. On compressing these ovisacs, small portions of coagulated substance escaped. When longitudinally divided, they were found to consist of the same parts as the ovisac before impregnation, with the exception of the granular contents and granular stratum; but the theca, or innermost parietes of the sac, was much thickened, and encroached irregularly upon the empty space, so as to leave only a cylindrical passage to the external opening.

DE GRAAF'S accurate figure of the corpora lutea in the Rabbit is given at Plate XXV. fig. 11, to show the close correspondence between the two animals in the appearance of these parts; and their structure is essentially the same.

The undischarged ovisacs of the left ovary, in the impregnated Ornithorhynchi, were numerous and of a globular form, but did not exceed a line and a half in diameter; a circumstance which corroborates the opinion before expressed relative to the size of the mature ovisacs. For if these parts really attained, prior to the escape of the ovum, much greater dimensions than those in Plate XXV. fig. 1., it might be expected that the other ovisacs would at least have exhibited some proportional degree of increase.

The impregnated Ornithorhynchus, in the uterus of which the two smallest-sized ova (Plate XXV. fig. 3.) were found, was shot on the evening of the 6th of October 1832, in the Yas River, Murray County, New South Wales. These ova were of a semitransparent white colour when recent, but had lost that appearance when examined at the Museum, to which they had been transmitted, *in situ*, with the uterus and surrounding parts well preserved in spirits. The ova were situated at the upper part of the left uterus, and at the distance of about a line from each other. Each ovum was spherical in form, and measured two lines and a half in diameter: they were of a deep yellow colour, with a smooth and polished surface, and had not the slightest adherence to the uterine parietes.

The specimen containing the two ova next in size (Plate XXV. figg. 2 and 4.) was shot in the same locality on the 7th of October. These ova measured each three lines in diameter, and were situated a little below the middle of the left uterus: they were of a spherical form, but had evidently been slightly compressed in the uterine cavity. They were of a lighter colour than the preceding; a circumstance which was specially evident at the upper part, from the subsidence of the contained vitelline mass. Externally they were smooth, and rolled freely out of the position where they were lodged, like those of the preceding specimen.

The third specimen, in the uterus of which the largest ovum was contained, was shot on the evening on which the first specimen was obtained. This ovum had the same spherical form, smooth exterior surface, and freedom from connexion with the uterus, as the preceding, but was of a much lighter colour, owing to the increased quantity of its fluid contents, to which its greater size was chiefly attributable. It

measured three lines and a half in diameter, and had been situated in a depression or cell a little below the middle of the left uterus. The lining membrane of the uterus was highly vascular in the recent state in each of the above specimens.

In all these ova the contents could be seen, through the cortical or outer membrane, to be of two kinds, viz. a greyish subtransparent fluid, and a yellowish denser mass, which varied in their relative proportions as above mentioned, the denser substance always subsiding to the lowest part of the ovum, whichever way it was turned.

In the largest ovum, the yellow mass or yolk occupied about one third of its cavity, while in the smallest it constituted four fifths of the whole mass.

The chorion or cortical membrane of these ova (Plate XXV. fig. 6. *a.*) offered a moderate degree of resistance when torn open with the forceps, and yielded equally in every direction when separated from the yolk, the rent margins curling inwards like the coat of an hydatid. This membrane was of a dull greyish colour, inclining to brown, slightly transparent, and more polished upon its inner than upon its outer surface: it resembles the cortical membrane of the ovum of the Salamander, but is of a more delicate texture. The fluid contents occupied the space between the cortical and vitelline membranes, a situation analogous to that of the albumen in the egg of the Fowl, but had not become coagulated by the action of the spirit in which it had been so long immersed.

The yellow matter, or yolk, was seen to be invested by its proper capsule (Plate XXV. fig. 6. *b.*), which, when reflected under the microscope, was found to consist of an extremely thin, smooth, and transparent outer layer, which I regard as the *membrana vitelli* (Plate XXV. fig. 7. *a.*), with a thicker granular membrane immediately lining it, analogous to the *blastoderma* or germinative membrane (Plate XXV. fig. 7. *b.*)

The contents of the above investments, or substance of the yolk, consisted of innumerable minute opaque granules, similar in size and regularity of form to those contained in the ovarian follicles; and with these granules were mingled larger transparent globules of yellow-coloured oil. There was not the slightest trace of chalazæ attached to the vitelline membrane, as, from analogy, we should expect to be the case had the ovum been destined to have been perfected by incubation. I was unable to detect any rudiments of the embryo: an opaque streak was discernible on one part of the yolk, but not sufficiently definite to be satisfactorily recognised as a cicatrix; it is indeed, probable, from the observation of Lieutenant MAULE, that the ova attain a greater size by the imbibition of nutrient material before the lineaments of the foetus become visible.

The ova of the Rabbit figured by DE GRAAF the seventh day after the coitus, agree in size with the largest of the ova of the Ornithorhynchus: in Mr. CRUIKSHANK'S plate* they are represented somewhat smaller. According to both authors no trace of foetal development is visible at this period; but it is probable that the formative actions have commenced, as the ova of the Rabbit have now contracted

* Philosophical Transactions, 1797, Plate IV. p. 204.

an adherence to the parietes of the uterus. On the sixth day, when the ova of the Rabbit nearly correspond in size to the smallest ova of the Ornithorhynchus above described, they are equally devoid of any adherence to the uterine walls. As, however, the differences between the ova of these animals are so obviously manifested in the greater strength of the outer, or cortical membrane, of the ova of the Ornithorhynchus, and in the magnitude which they are already known to attain before any distinct development of the foetus can be perceived, there can be little doubt that the generation of this species proportionately approximates towards the oviparous mode.

On comparing the ovum of the Rabbit with that of the Bitch, it is seen to attain in the former to a considerably larger size before it contracts an adhesion to the uterus, which appears to have relation to the greater share which the umbilical vesicle has in the development of the embryo; since in the Kangaroo, in which the umbilical vesicle fulfills the functions of the placenta, the chorion remains unattached to the uterus, and unvascular when the foetus is almost fully formed. And as the quantity of vitelline granules accumulated in an ovum is indicative of the size and persistence of the umbilical or vitelline vesicle, we may infer that, in the Ornithorhynchus, the latter will play an important part in the development of the embryo.

The changes which the impregnated uteri of the Ornithorhynchus had undergone, as compared with the same part in the quiescent state, were greater than those which have been observed to take place in the Kangaroo. The uterus containing the two smallest-sized ova measured seven lines in diameter, but was much firmer and denser than in the unimpregnated specimens; and having also increased in length, was thrown into more abrupt curves on either side of the ovarian ligament. The uterus which had contained the largest ovum measured an inch in diameter; and that containing those of the second size was of nearly the same size (Plate XXV. fig. 2.). The right uterus in all the specimens had become sympathetically affected, being firmer in texture and thicker in its coats.

The parietes of the impregnated uteri were from three to four lines in thickness; an increase which was principally occasioned by the extension of small vascular folds between the fibrous and internal coats, which were so placed at right angles to these tunics as to present an appearance very similar to that of the second cavity of the stomach of the Porpessa. The fibrous coat was slightly thickened near the cervix, and the serous covering was separated from it by the ramifications of numerous large and tortuous uterine vessels.

There was not the slightest trace of a decidual or adventitious membrane in the cavity of the womb; and especial attention was directed to this circumstance in consequence of the office assigned to it in a recent work*, as ministering support to the ova in the higher *Mammalia*, at a period when, like those of the Ornithorhynchus, they have no attachment to the uterine parietes†.

* BRESCHET, Etudes de l'Œuf Humain.

† In the recent specimens Mr. BENNETT noticed besides the ova only a "moisture" in the uterus.

It may, however, be said that the deciduous membrane is here represented by the cortical or outer covering of the ovum: but this membrane, though of a denser structure and without villi, is certainly analogous to the outer tunic of the uterine ovum of the Rabbit and Bitch, which in them is gradually separated from the vitelline membrane by the imbibition of albuminous fluid. Now the relative proportion of the fluid interposed between the cortical and vitelline membranes in the small and large ova of the Ornithorhynchus, shows that the mutual recedence of the two membranes is effected in the same way.

The form, the structure, and the detached condition of the ova of the Ornithorhynchus, may still be regarded as compatible with, and perhaps favourable to, the opinion that they are excluded as such, and that the embryo is developed out of the parent's body. But the following objections present themselves to this conclusion;—the only part of the efferent tube of the generative apparatus which can be compared in structure or relative position to the shell-secreting uterus of the Fowl, is the dilated terminal cavity in which, in all the specimens above described, the ova were situated; and upon the oviparous theory it must be supposed either that the parietes of this cavity, after having secreted the requisite quantity of soft material, suddenly assume a new function, and complete the ovum by providing it with the calcareous covering necessary to enable it to sustain the superincumbent weight of the mother during incubation; or that this is effected by a rapid deposition from the cuticular surface of the external passages; or lastly, according to a more recent, but still more improbable supposition, by a calcareous secretion of the abdominal glands poured out upon the ovum after its exclusion.

But granting that the egg is provided in any of these ways with the necessary external covering, yet from the evidence afforded by the specimens under consideration, the ovum is still deficient in those parts of its organization which appear to be essential to successful incubation, viz. a voluminous yolk to support the germinal membrane, and the mechanism for bringing the cicatricula into contiguity with the body of the parent. Add to this, that such a mode of development of the foetus requires that all the necessary nutritive material be accumulated in the ovum prior to its exclusion. Now the bony pelvis of the bird is expressly modified to allow of the escape of an egg, both large from the quantity of its contents, and unyielding from its necessary defensive covering; but whatever affinities of structure may exist in other parts of the Ornithorhynchus, it is most important to the question of its generation to bear in mind that it manifests no resemblance to the bird in the disposition of the pubic bones.

Again, as we have seen that the ova of the Ornithorhynchus have attained a diameter of little more than two lines after having traversed the whole of the Fallopian tube, the length of which is six inches, and the internal secreting surface increased by numerous folds, it may be reasonably inferred from the analogy of the Rabbit and other *Mammalia*, that the ovum was of much smaller dimensions when first received into

the oviduct. But the yolk in Birds and oviparous Reptiles is invariably the product of the ovary, and derives no appreciable increase from the secretions of the efferent tube, which supply only the albuminous part of the egg, or the material for the first formation of the chick. If, therefore, the gestation of the Ornithorhynchus terminates by the exclusion of an egg, as in the Bird or Tortoise, the preparatory steps in the formation of the ovum are widely different, for the parts concerned manifest the essential characters of the mammiferous type, and the germ itself has a corresponding structure.

These facts, it is agreeable to find, are in exact accordance with the now ascertained functions of the abdominal glands; for since the yolk in the Bird, besides its uses in the course of the foetal development, is intended as an after-substitute for a mammary secretion, remaining, as it does, but little diminished at the close of incubation, it might have been concluded, from *à priori* physiological deduction, that the Ornithorhynchus, in which no such substitute is required, would approximate the other *Mammalia* in the small size of the ovarian ovum.

The nature or amount of subsequent deviations from a true viviparous generation, can be determined only by future examinations of more advanced ova. From the structure of the cortical membrane it is probable that they do not become organized, and that the *Monotremata*, like the *Marsupiatæ*, are essentially ovoviviparous. Since, however, the female Ornithorhynchus has no tegumentary pouch to protect a prematurely born offspring, it must be presumed that the foetus acquires greater proportional bulk* and more mature strength by a longer continuance within the uterus. In this case it may be doubted whether the vitelline vesicle will suffice for nourishment and respiration through the whole period of development, and the allantois and umbilical vessels will probably be more or less developed for that purpose.

The means of prosecuting this inquiry are the more likely to be afforded, since, through the exertions of Mr. BENNETT, the period when the pregnant female may be procured is now ascertained. Had not a specimen supposed to be in this condition, which my friend had preserved alive, unfortunately escaped from its confinement, he would, there is little doubt, have ascertained the true nature of the generative product, and the probable duration of gestation.

With reference to the latter point, Mr. BENNETT observes, that two months after the capture of the female specimen with the smallest ova, viz. on the 8th of December 1832, he succeeded in laying open one of the burrows of the *Ornithorhynchi*, on the banks of the Murrumbidgee River, in which three living young ones were found: they were naked, and measured only one inch and seven eighths in length, and he considers them to have been recently brought forth. Not having any means of preserving these specimens, and being at a great distance from Sidney, they were lost.

* In reference to this point it may be observed, that the kidneys are not lodged low down in the pelvis, as in the true *Ovipara*, but occupy the position characteristic of the mammiferous type of structure, which allows free space for the enlargement of the uterus during pregnancy.

The nest was most carefully scrutinized by Mr. BENNETT, but not the slightest trace of egg-shell could be perceived in it.

The principal points, therefore, in the generative economy of this paradoxical species which still remain to be determined by actual observation, are,

- 1st. The manner of copulation.
- 2nd. The season of copulation. (This is probably at the latter end of the month of September, or beginning of October.)
- 3rd. The period of gestation.
- 4th. The condition of the ovum both before and immediately after it has quitted the ovisac.
- 5th. The nature and succession of the temporary structures developed for the support of the foetus during gestation.
- 6th. The exact size, condition, and powers of the young at the time of birth.
- 7th. The act of suckling.
- 8th. The period during which the young requires the lacteal nourishment.
- 9th. The age at which the animal attains its full size.

Description of the PLATE.

Fig. 1. The ovary and expanded extremity of the Fallopian tube of an Ornithorhynchus preserved in the Military Museum at Chatham, in which three ovisacs, or Graafian follicles, had taken on the sexual actions.

Fig. 2. The pelvis and surrounding parts of a female Ornithorhynchus, with the urinary and genital organs *in situ*: the left uterus contains two ova.

- a.* The left, *a'* the right, ovary.
- b.* The two discharged ovisacs or corpora lutea, from which the ova, *c*, had escaped.
- d.* The expanded orifice of the oviduct.
- e.* The left uterus, showing its thickened parietes, and the depressions in the vascular internal membrane, in which the ova were lodged. *e'* the right uterus.
- f, f.* The convoluted oviducts, or Fallopian tubes.
- g, g.* The ovarian and uterine ligaments.
- h, h.* The kidneys.
- h', h'.* The supra-renal glands.
- i.* The urinary bladder, turned down.
- k.* The rectum.
- l.* The external oblique muscle.

- m.* The internal oblique muscle.
- n, n.* The recti abdominis.
- o, o.* The pyramidales.
- p.* The cloacal passage. (The letter is placed on the retractor muscle.)
- q.* The common outlet.

Fig. 3. The two smaller-sized ova of the *Ornithorhynchus paradoxus*. (p. 560.)

Fig. 4. The two ova next in size, seen *in situ* in fig. 2.

Fig. 5. The larger ovum taken from the third specimen.

Fig. 6. The same ovum magnified three diameters, with the cortical membrane torn open, showing the vitelline membrane and its contents.

Fig. 7. A small portion of the vitelline membrane, *a*, more highly magnified, with part of the germinal membrane, or membrana granulosa, *b*, adhering to its inner surface.

Fig. 8. A portion of the ovary of an impregnated Ornithorhynchus, magnified.

- a.* The capsule of the ovary.
- b.* The laminated cellular substance, or stroma of the ovary.
- c, c.* The theca of a discharged ovisac, thickened, and encroaching upon the cavity from which the ovum had been expelled, forming a corpus luteum.
- d.* A small ovisac filled with its coagulated granular substance.
- e.* Part of a larger ovisac, with the granular substance removed, but the external granular stratum remaining.
- f.* Ovisacs artificially emptied, showing the state of the theca before the discharge of the ovum.

Fig. 9. The ovary of a Kangaroo six months after parturition, showing the cavity of the ovisac obliterated by its thickened parietes, nat. size.

Fig. 10. The ovary of a Rabbit two days after the coitus, showing its racemose structure, and the papillæ of the Graafian follicles.

Fig. 11. The ovary of a Rabbit three days after the coitus, laid open. It is thus described by DE GRAAF: "Testiculus in quo tertio à coitu die folliculorum crassities et cavitates, in quibus Ova delituerunt, apparent."—*De Mulierum Organis*, p. 412. tab. xxv., from which fig. 10. and 11. are taken.

Fig. 3.



Fig. 4.



Fig. 5.



Fig. 1.



Fig. 9.



Fig. 6.

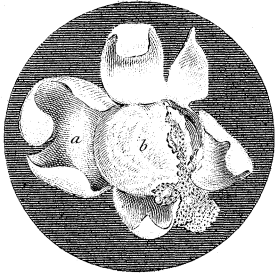


Fig. 8.

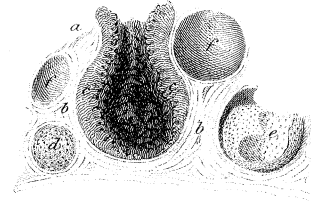


Fig. 2.

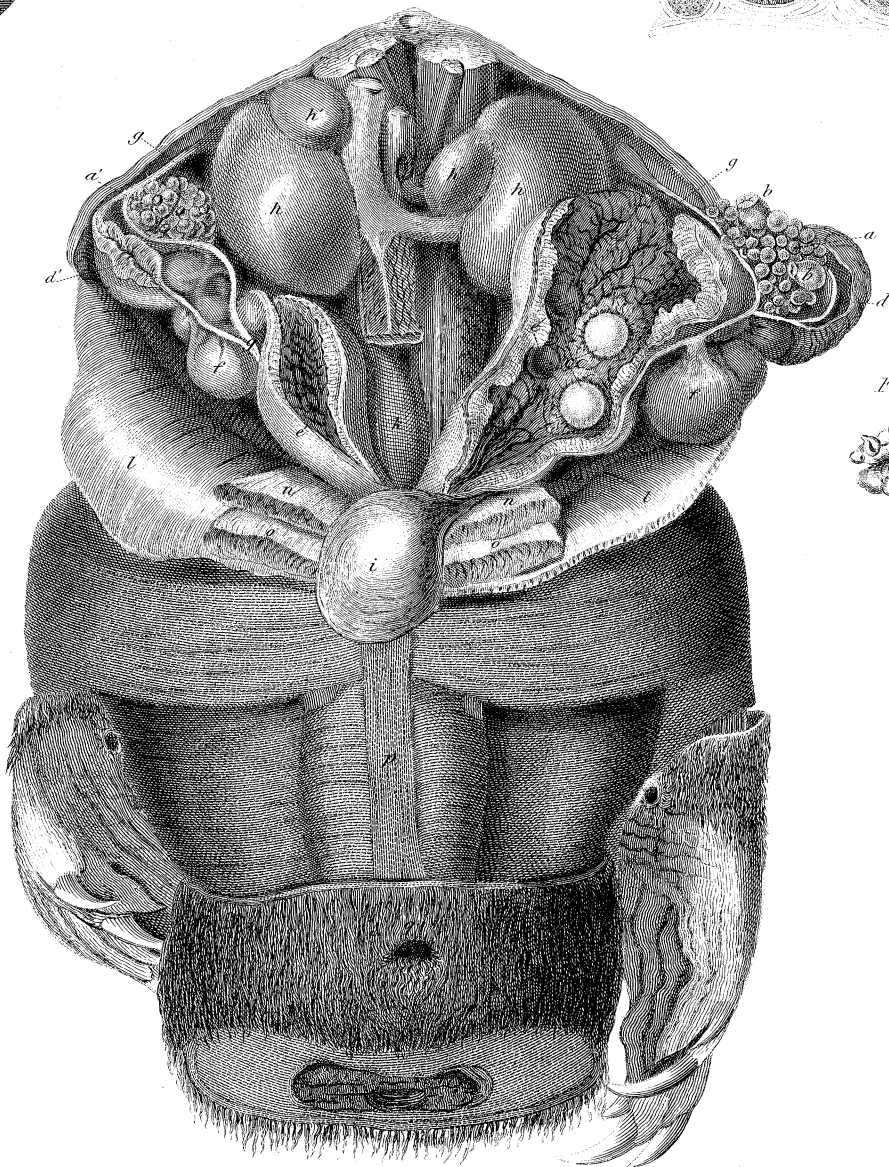


Fig. 7.



Fig. 10.



Fig. 11.

