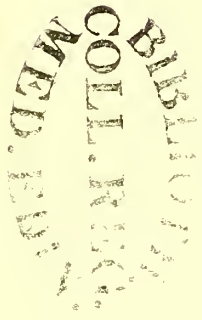
The Royal College of Physicians
in Edinburgh
with the Author's Respects

RESEARCHES

IN

EMBRYOLOGY.

(First Series.)



BY

MARTIN BARRY, M.D. F.R.S.E.,

Fellow of the Royal College of Physicians in Edinburgh.

From the PHILOSOPHICAL TRANSACTIONS.—PART II. FOR 1838.

LONDON:

PRINTED BY R. AND J. E. TAYLOR, RED LION COURT, FLEET STREET.

1839.

XV. *Researches in Embryology. First Series.* *By* Martin Barry, *M.D. F.R.S.E., Fellow of the Royal College of Physicians in Edinburgh. Communicated by* P. M. Roget, *M.D. Sec. R.S.*

Received June 20,—Read June 21, 1838.

It has been truly said, that "in all the sciences of observation, the great difficulty generally consists in taking the first steps." A hundred and fifty years have now elapsed since the celebrated Regner de Graaf, after a series of well-conducted observations, maintained that the ovum of the Mammalia must exist already formed in the ovary; an opinion which, after meeting with violent opposition, appears to have been nearly abandoned, and superseded by the notion countenanced by Haller, that the ovum was formed in the Fallopian tube out of a substance discharged from the ovary. A century after De Graaf had promulgated his opinions, Cruikshank arrived at the same conclusion, that the ovum was really formed in the ovary; but he sought it there in vain. Prevost and Dumas in 1824 obtained a glimpse of something that must have been the ovum in that organ; Von Baer in 1827 found and recognised it there.

This important discovery of Baer formed an epoch in the history of development; but it was a "first step," and the object one of extreme minuteness. It was therefore not surprising if the excellent discoverer did not see or justly estimate all that appertained thereto; and he said himself "there remains yet many a thing that will become a prize" for others.

Von Baer for instance did not see the germinal vesicle contained within the mammiferous ovum; he saw no more than a transparent space. This, however, was an oversight of the first importance, because that which gives peculiar interest to the germinal vesicle is the fact, now generally acknowledged, that it is the most essential portion of the ovum; and besides, as in the following pages I shall have to show, this structure and its contents are the earliest that appear in the order of formation. Overlooking the germinal vesicle in the Mammalia, Von Baer supposed the ovum itself to represent, in that class of animals, the germinal vesicle of Birds†. Other analogies, and they are not few, which he based on this were consequently erroneous.

I have thought it proper to make these introductory remarks, because of the neces-

† Professor Baer called the vesicle he discovered in the ovary, not the *ovum* but the "*ovulum*." If, however, it can be made to appear extremely probable that the chorion or external membrane of the ovum of the uterus is a primitive part of the ovarian vesicle of Baer, it is perhaps better to call the latter an *ovum*, as will be done in this memoir.

sity that lies before me, in offering the present contribution in embryology, for pointing out several other structures connected with the discovery of Baer, the nature of which I believe this author to have mistaken, and some that appear to have escaped his notice. This I shall do with great deference, asking his re-inspection of the parts, and respectfully soliciting an examination of them by other physiologists who have been engaged in researches on the early stages of the ovum of the Mammalia, especially Professors Purkinje, Krause and Coste; but more particularly Professor Valentin and my valued friend Professor Rudolph Wagner.

In the course of this investigation, which occupied many months, the number of individual animals examined was very large, furnishing me an opportunity for verifying most of the facts by repeated observation. The examinations were generally made very soon after death; and the drawings having been all taken by myself, I have it in my power to say that their fidelity may be relied upon†.

In the year 1837, preparatory to the commencement of my own researches, I spent some time in Germany for the purpose of becoming acquainted with the known facts on animal development and other objects of microscopic research; and cannot omit this opportunity of gratefully acknowledging the facilities afforded me on that occasion by my honoured friends Professors Johann Müller, Ehrenberg, Rudolph Wagner, and Dr. Th. Schwann. The microscope I use is an achromatic, since made for me by Schiek of Berlin, and similar in all respects to the instrument employed by Professor Ehrenberg.

It may not be improper in the first place to furnish an idea of what has been already published on some branches of the subject; for it is one to which the attention of physiologists in this country has scarcely begun to be directed.

Valentin gives the following comprehensive description of the vesicles of Graaf:—

"In the ovary of each of the Mammalia, there is found a greater or less number of spherical pellucid vesicles, the so-called *folliculi Graafiani*, (Graafian vesicles,) the greater part of which are situated near the surface of the organ. Their size is very different, as well in different animals as in the same ovary of the same animal, since the older ones are sometimes four to five times, as in Rabbits, Dogs, Cats; sometimes eight to ten times, as in Man; sometimes ten to twenty times, as in ruminating animals; sometimes thirty to fifty times, and still more, as in the Swine; larger than those recently formed, and this, too, independently of their increase in volume after impregnation. When situated close to the surface, they are covered by the peritoneum alone; when deeper, by the latter, and by the fibrous tissue of the ovary, and closely invested by a net-work of vessels, between which there is a granular membrane. They are everywhere closed, without a trace of processes, but in-

† Some of the figures to be seen to advantage should be viewed with a large lens.

timately united with the substance of the ovary, so that in general it is not so very easy to dissect the vesicle freely out on all sides without laceration†."

Plate VII. fig. 62‡ presents the parts which Baer considers to enter into the formation of a Graafian vesicle. For an explanation of this figure I refer to the description of the plate. It appears to me however, as I shall endeavour presently to show, that a "Graafian vesicle" is *an ovisac that has acquired a covering proper to itself*, and as such the term will be used in the present paper.

The figure just referred to, exhibits the situation of the "ovulum" (ovum) of Mammalia, *according to* Baer, surrounded by its so-called "disc" within the Graafian vesicle. It will be shown in this memoir that there is no structure in the Graafian vesicle of a *discoid* form; and the error of Baer in mistaking the "ovulum" (ovum) of Mammalia for a part corresponding to the germinal vesicle of other animals, appears to be attributable in part to his misconception of the situation of the "ovulum" (ovum) in reference to its surrounding granules.

Purkinje§ questioned the analogy which Baer had imagined between his "ovulum" (ovum) of the Mammalia and the germinal vesicle of other animals; and the discovery at length by Coste in France, and by Valentin and Bernhardt in Germany, of a germinal vesicle in Mammals, showed the justness of Purkinje's reasoning, increasing the analogy between the bodies expelled respectively from the ovaries of Mammalia and those of other vertebrated animals. It will presently be shown that a perfect analogy does not exist between these bodies.

One of the last additions made to our knowledge in embryology, exceeding in minuteness all the rest, is the discovery by Professor Rudolph Wagner‖, on the internal surface of the germinal vesicle, of the *macula germinativa*, or germinal (germinative) spot.

The object of this memoir is to add some discoveries of my own on the early stages of the ovum, not only of the Mammalia, but of the other Vertebrata. This cannot be done except by means of details both minute and, I fear, fatiguing; but perhaps I may venture to hope for the reader's indulgence when he recollects the precision requisite in treating a question comparatively new in the history of physiology. The perusal would, however, be much facilitated by occasional reference to the following tabular Synopsis of the parts to be described. It might also be advantageous to examine the plates (V. to VIII.) in connexion with this table; for as the same letters denote the same objects in all the figures, and as these letters have been introduced

† Translation from the German, in the Edinburgh Medical and Surgical Journal, No. 127; which contains the early part of Professor Valentin's elaborate work "Handbuch der Entwickelungsgeschichte des Menschen mit vergleichender Rücksicht der Entwickelung der Säugethiere und Vögel," Berlin, 1835.

‡ Taken from Baer, Lettre sur la Formation de l'Œuf, translated by Breschet, Paris, 1829. fig. ix. (I have not the original at hand.)

§ Encyclopädisches Wörterbuch, Band x. Artikel "Ei," pp. 124—128, Berlin, 1834.

‖ Lehrbuch der Vergleichenden Anatomie, S. 351, Leipzig, 1834–5. Edinburgh Medical and Surgical Journal, No. 127. Prodromus Historiæ Generationis Hominis atque Animalium, Lipsiæ, 1836.

into the table, a reference to the more particular explanation of the plates might thus in a great measure be spared.

Synopsis showing the Order of Formation and the relative Position of the several Parts of the unimpregnated Ovum and the Graafian Vesicle of Mammalia, according to the author's observations.

First.	Second.	Third.	Fourth.	Fifth.	Sixth.		Seventh.
Fluid, *a*.	Fluid.	Fluid, *a*.	Fluid, *a*.	Fluid, *a*.	Fluid, *a*.		Fluid, *a*.
	Germ. spot.	Germ. spot, *b*.	Germ. spot, *b*.	Germ. spot, *b*.	Germ. spot, *b*.		Germ. spot, *b*.
Germ. vesicle, *c*.	Germ. ves.	Germ. ves. *c*.	Germ. ves. *c*. Oil-like globules (*).	Germ. ves. *c*.	Germ. ves. *c*.		Germ. ves. *c*.
Granules (*g*) and oil-like globules (*) †.	Granules (*g*) and oil-like globules(*).	Granules (*g*) and Fluid.	Granules (*g*) and Fluid.	Oil-like globules (*), Minute gran., and Fluid.	Yelk, *d*.	At this period the ovum is conveyed from the centre of the Graafian vesicle to its periphery.	Yelk, *d*.
				Memb. vit. *e*.	Memb. vitelli.		Memb. vitelli.
	Ovisac, h.	*Ovisac, h*.	*Ovisac, h*.	Chorion, *f*.	Chorion, *f*.		Chorion, *f*.
				Granules (*g*) and Fluid.	*Tun. gran.* g^1.		*Tun. gran.* (g^1) *and appendages.*
				Ovisac, h.	*Retinac.* g^2.		*Retinac.* (g^2) *and Memb.*
					Fluid.		Fluid.
					Memb. gran. g^3.		Memb. gran. g^3.
					Ovisac, h. *Tunic, i*. } = Graaf. ves. *h i*.		Graaf. ves. *h i*.
Plate V. figs. 1, 2, 3.	Plate V. fig. 9. &c.	Plate V. fig. 10. &c.	Plate V. fig. 14. &c.	Plate V. fig. 17.	Plate VII. fig. 50. &c.		Plate VII. fig. 55. &c.

The Table viewed *from left to right*, presents successive stages of Formation. The parts inserted in the same Column exist at the same time. Small print denotes such parts as, though existing, are obscured.

Viewed *from above downwards*, the Table shows the order of Position of the parts, proceeding outwards from the centre of the ovum; the innermost being marked *a*, the next *b*, the third *c*, and so on.

Italics are used in cases where the part has not been hitherto described, or where the name employed is new.

† The term "oil-like," occurs frequently in this memoir. It is not intended to describe the nature of the globules to which it is applied, but simply their appearance.

PART I.

On the origin and structure of the true Ovisac, a vesicle common to all vertebrated animals, but hitherto described as the inner membrane of the "Folliculus Graafianus" in Mammalia, and by some authors denominated the "chorion" in other Vertebrata; on the real nature of the "Folliculus Graafianus," and its relation to the calyx of the Bird; on the Germinal Vesicle and its contents, as the most primitive portion of the ovum; on the order of formation of the several other parts of the Ovarian Ovum; and on the true Chorion of Mammalia as a structure superadded within the ovary.

1. The early structure of the ovisac in the Mammalia may be seen in either quite young animals, or in those that have lately reached the state of puberty, when this vesicle and its contents are in the full vigour of formation. To find it in a young animal, I am in the practice of placing under the microscope thin slices cut from the surface of the ovary; or in animals after puberty, the outer portion of a large Graafian vesicle. Compression is of course required, but it should be very gradually applied. Great pressure is rarely wanted, and for the most part very undesirable.

The Ovisac of the Mammalia.

2. This vesicle originates in the proper substance (*stroma*) of the ovary†. Its general appearance when first formed is as a minute, pellucid, often yellowish sac, having an elliptic form, and plaits or folds in its contour (Plate V. figs. 4. to 12. *h*.). The ovisacs are found in groups, and those belonging to the same group are often of nearly the same size (figs. 4. 10. *h*.), though this is by no means constantly the case. Sometimes a group occupies more than the whole field of view; some of the ovisacs, more deeply imbedded than the rest, having the appearance of obscure pellucid spaces, others being superficial and distinct (fig. 4. *h*.). Could a fragment of amygdaloidal rock be made translucent and its amygdaloidal portions luminous, it would present an appearance not unlike that of a collection of minute ovisacs in the parietes of a Graafian vesicle from one of the Ruminantia. In Carnivora, such as the Dog and Cat, I have met with them having less of interstitial substance, innumerably heaped together (Plate V. figs. 6. 10., Plate VIII. fig. 68. *h*.). The surface of an ovary presents to the naked eye perhaps ten, twenty, or fifty Graafian vesicles, while the microscope discloses myriads; so that some parts bear no mean resemblance to the roe of fishes.

3. The ovisac at its origin, as just said, has an elliptic form. As its size advances it becomes more spherical, and is often met with somewhat tapered at one end (Plate VIII. fig. 74. *h*.). When it appears round in an early stage, this is perhaps owing to its being transversely situated under the compressor.

† It appears sometimes to originate in the parietes of a Graafian vesicle. Ovisacs met with in this situation will be more particularly referred to hereafter as *parasitic* ovisacs.

4. Its size when first formed is exceedingly minute. I have found it in several orders of Mammalia measuring not more than the 50th of a Paris line† in length. Such is the case, for instance, in the Ox (Plate V. fig. 4. *h*.); so that a cubic inch would contain upwards of two hundred millions, not merely of the elements of the ovum, but of the *ovisacs* of this animal. The minuteness of these vesicles indeed is almost incredible. In the Dog I have seen them measuring only the 100th of a Paris line‡ (Plate V. fig. 9. *h*.), thus little more than one third the long diameter of a blood-granule (red particle) of the *Proteus anguinus*§.

5. The ovisac is more or less pellucid according to its size; being most so in the early stages of formation, and becoming merely translucent as development advances. This is partly owing to the gradual addition of an external covering or tunic, to be hereafter more particularly mentioned (24. 25.). It continues however in all its stages more translucent than the substance in which it lies.

Cavity in which the Ovisac is often found.

6. More particularly considered, the situation of the ovisac in its early state is often found to be a cavity (Plate VIII. fig. 69.), sometimes, as already said, in the proper substance (*stroma*) of the ovary, and sometimes in the parietes of a Graafian vesicle. It lies loose in, and unconnected with the walls of, its containing cavity. That it does so is shown in the figure just referred to (fig. 69.), which presents an ovum, *f*, escaped from the ovisac, *h*, and lying external to the latter in the cavity. (This change in the situation of the ovum was seen to take place on the ovisac being burst under the microscope by means of the compressor; when the ovum became squeezed into an elliptic form. This has repeatedly occurred‖.) The cavity in which the ovisac lies, may sometimes be found after the latter has been pressed out of it.

The proper membrane of the Ovisac in Mammalia.

7. In ovisacs of the minutest size this membrane is perfectly transparent; yet in and near to its contour it looks as though it were "concentrically lamellar"¶ (Plate V. figs. 9. 11. 12. *h*.). I apprehend this appearance to arise from plaits or folds occurring in the membrane under pressure even at that early period, and indicating great susceptibility of distention. Its thickness is relatively very considerable in the smaller

† That is, about the 562nd of an English inch. See the table of measurements (118.), for a simple mode of reducing the fraction of a French line (‴) into the fraction of an English inch.

‡ = $\frac{1}{1125}$ of an English inch.

§ Through the kindness of Professor R. Wagner I possess a living specimen of this animal, and have repeatedly confirmed the observation first made by him, that the red particles of its blood measure in some instances $\frac{1}{30}$ of a Paris line in length, and that they are visible with the naked eye, being larger than those of any other animal the blood of which has been examined.

‖ The ovum in this instance was ruptured before escaping, and left its germinal vesicle, *c*, behind.

¶ The appearance here referred to has been observed by R. Wagner, who uses the above expression in describing what he considers minute *Graafian vesicles* (Beiträge, &c., S. 28.).

ovisacs. The membrane of one of these, measuring in its long diameter $\frac{1}{50}$th of a Paris line†, had a thickness of $\frac{1}{600}$th of a line‡. When somewhat advanced in size, however, the thickness is sometimes relatively as well as absolutely greater. Yet so transparent is this membrane, that even the form of granules contained in its cavity may be tolerably well observed from the exterior (Plate V. figs. 9. 10. 11. 12. 17. *g*.); the degree of transparency varying with the pressure applied: and when great pressure has been removed, the previous state in this respect returns, and the vesicle resumes more or less completely its natural size, which indicates elasticity as well as susceptibility of distention. This membrane has a kind of undulating surface, presenting myriads of depressions or cells, to which is referrible the plaited or folded appearance of the contour, produced by pressure. Neither fibres nor granules being found in the texture of this membrane, it is probably without organization.

The peculiar Granules of the Ovisac.

8. The only objects which in general are *visible* (12.) in the ovisac when the latter is first formed, are a few granules (Plate V. figs. 8. 9. 11. 12. *g*.). These granules deserve a particular description, from their peculiar appearance, from their entering into the formation of several important structures to be described in Part II. of this memoir, and from their being very intimately connected with the evolution of the ovum from its early appearance as the germinal vesicle (14—22.), until as a mature ovum it has passed into the Fallopian tube.

9. These granules are elliptical or ellipsoidal, sometimes nearly round, and generally flattened (Plate VIII. fig. 73. *g*.). When lying closely together, their form becomes by pressure polyhedrous (Plate VI. fig. 44. g^1.). They are exceedingly transparent, yet often punctate, which latter appearance seems sometimes to arise from the presence of very minute oil-like globules. They present, with more or less distinctness, a nucleus; and I have met with two nuclei in a single granule. In the substance of the nucleus, when highly magnified, there is observable a point still darker (Plate VIII. fig. 73.). These peculiar granules sometimes disappear, apparently by liquefaction; preparatory to which change I have observed them to become more spherical and brightly pellucid, seeming to contain a fluid in their interior (Plate VI. fig. 44. g^1.). In size I have found them to vary from about the 400th to the 100th of a Paris line§, but they are often about the 200th of a Paris line‖ in length. As viewed with reflected light, they appear greyish white in colour. Water dissolves them.

10. This is a general description of these very peculiar granules. In some orders of the Mammalia I have found them more regularly elliptic or more round than in others; in birds I have thought them less regular in form; in certain animals they have a decided tinge of yellow: but in these respects, as well as in their punctate or subgranulous appearance, and in their stages of liquefaction, their condition

† = $\frac{1}{50}$ of an English inch.

‡ = $\frac{1}{600}$ of an English inch.

§ = $\frac{1}{400}$ to the $\frac{1}{100}$ of an English inch.

‖ = $\frac{1}{200}$ of an English inch.

differs at different periods in the same animal. Yet notwithstanding these varieties there is always found a general resemblance, so that when once examined these granules cannot fail to be recognised†.

The Fluid contained in the Ovisac.

11. This fluid is pellucid, often yellowish, partially coagulable, and is generally considered to be albuminous. It contains a large quantity of the peculiar granules just described, and a varying quantity of oil-like globules. This fluid having been already described by others‡ I need not add more respecting it.

On the Germinal Vesicle and its contents as the most primitive portion of the Ovum.

12. It has appeared desirable to give a description of the ovisac the first place in this memoir, but there is a portion of the ovum which exists before it. Each of the many ovisacs already referred to, such as those in Plate V. fig. 4. *h.*, and even the minutest of those in fig. 9. *h.*, probably contained, besides the peculiar granules visible (8.) in their interior, a concealed part, which, supposed to be the most important, also appears to be the most primitive element of the ovum.

13. Purkinje, the first discoverer of the germinal vesicle in any animal (the Bird), having observed that its relative size was greater, the more minute its containing ovum, has expressed the opinion that it is the first part of the ovum formed§. Baer, the discoverer of this vesicle in other oviparous Vertebrata, as well as in Mollusca, Annelida, Crustacea, and Insects‖, believes that he observed its formation in animals belonging to the two first-mentioned classes to precede the evolution of the ovum¶. R. Wagner has described and figured the posterior extremity of the oviduct in insects (*Achèta campestris*)†† as filled with little besides germinal vesicles, each of which contains a spot; and in a later publication‡‡ he has shown similar objects in one of the Libellulæ (*Agrion*), and also in the freshwater Beetle (*Dyticus marginalis*). These observations of Baer and Wagner I have been enabled to extend certainly to two, and I think to three classes of the Vertebrata.

14. Plate V. fig. 1., taken from the Rabbit, presents vesicles, *c*, containing fluid, each of which has its own envelope, consisting of the peculiar granules, *g*, just described (8.). These vesicles, of which a considerable number was seen in the same field of view, were for the most part elliptical, some of them nearly globular, their long diameter varying from the 150th to the 50th of a Paris line§§. The contained

† Several writers have made mention of these granules, but an adequate description of them I do not find to have been given.

‡ Baer, Lettre, &c., pp. 18, 19. Valentin, Handbuch der Entwickelungsgeschichte, &c., S. 15, 16. Bernhardt, Symbolæ ad Ovi Mammalium Historiam ante Prægnationem, pp. 10, 11; Vratislaviæ, 1834.

§ Encyclopädisches Wörterbuch, Band x. S. cxi.

‖ Burdach, Die Physiologie als Erfahrungswissenschaft, Band i. § 63. 1835.

¶ Lettre, &c., p. 21. †† Prodromus, &c., fig. xviii. *a*. ‡‡ Beiträge, &c., Tab. ii. figs. 1 to 6.

§§ = $\frac{1}{150}$ to $\frac{1}{350}$ of an English inch.

fluid did not appear perfectly pellucid, but presented an indistinct cloudiness. In one of the larger vesicles there was observed a well-marked spot (fig. 1. *b*.). The envelope of granules, *g*, was in all instances elliptical, its long diameter being about three times that of the vesicle it surrounded.

15. In the same Plate, figs. 18 and 19, from the Pigeon, are seen vesicles of the same kind containing fluid, some of them surrounded by oil-like globules, and others by granules of the same appearance as those in fig. 1, having mixed with them a few oil-like globules; the chief difference being that here the form of the whole object is not quite so regular as that of those in fig. 1. It will be observed that in fig. 18. the vesicles are surrounded by oil-like globules only (*); the envelope of peculiar granules seems to be subsequently added (fig. 19. *g*.).

16. In figs. 2. and 3, *g*, are presented elliptic masses of the same kind of peculiar granules. One of these masses (fig. 2. *g*.) measured $\frac{1}{75}$th, and the other (fig. 3. *g*.) $\frac{1}{50}$th of a line in length. These objects, met with in the Cat, appear to have been of the same nature as those just described from the Rabbit and the Pigeon, with this difference, that here the contained vesicle was not seen; the cause of which is perhaps referrible to oil-like globules having been mixed in large quantity with the peculiar granules. See figs. 2. and 3 (*). That these elliptic masses from the Cat (figs. 2. and 3.) corresponded to those from the Rabbit and the Pigeon, and that each of them contained a vesicle, is not indeed demonstrable; but their form, their size, and the nature of the granules render this extremely probable. I should add, as another reason for this opinion, that *patches* of these elliptic masses (figs. 2. and 3.) have been met with, sometimes in the state *g*, and sometimes in that marked (*). Similar objects have been seen in the Hog†.

17. I have found distinct vesicles in the Salmon, measuring in diameter the 50th of a Paris line‡, and less (Plate VI. fig. 30. *c*.), apparently corresponding to those from the Rabbit (Plate V. fig. 1. *c*.) and Pigeon (figs. 18. and 19. *c*.), but having more obscure contents§, and being destitute of a regularly formed envelope of granules.

18. I return to figs. 1, 18, and 19, Plate V., from the Rabbit and the Pigeon, and shall not refer to any besides these in drawing my conclusions. After an attentive examination of these objects, I do not think it hazardous to express my belief that they present one of the earliest stages in the formation of the ovum, the enveloped sac (*c*) being, as I suppose, the *germinal vesicle* itself.

19. The long diameter of this vesicle (*c*) in fig. 1, the stage now under consideration, varies, as already said, from the 150th to the 50th of a Paris line. It is not likely

† In one of the Mammalia I have seen vesicles filled with fluid, and apparently of the same kind as those in fig. 1, but without any peripheral accumulation either of granules or oil-like globules. These vesicles, however, were immediately lost from the field of view, and I have not since observed any in the same state.

‡ = $\frac{1}{56\cdot7}$ of an English inch.

§ Which consisted of a fluid and minute oil-like globules, having a yellowish colour. Compare the vesicles in this figure with the vesicles (*c*) in fig. 35. from the same animal.

One of the vesicles (*c*) in fig. 30. has another vesicle external to it. (See Explanation of the Plates.)

that so great a difference in magnitude as this in the same animal should be permanent; and if this be admitted, it follows that after formation the germinal vesicle increases in its size. It may therefore when first formed be much minuter than the smallest of those which I have figured.

20. I find that the germinal vesicle of a mature ovum of the Rabbit does not generally exceed the 50th of a Paris line† in diameter; and this being just the size of the largest of those from the same animal in fig. 1, it seems probable that in the Rabbit‡ the vesicle does not increase much in magnitude after this early period.

21. It is proper to state, that in certain animals I have met with *ovisacs* much minuter than some of the objects (still uncovered by an ovisac) in fig. 1. This admits of explanation by supposing either that the germinal vesicle is much *smaller*, that its granulous envelope is much *thinner*, or that the period of formation of the ovisac, in reference to the size of the germinal vesicle, is much *earlier* in some animals than in others. There may also be a difference in different animals in each of these respects.

22. From the observations of Professors Baer and R. Wagner in invertebrated animals, and those now recorded from researches in two classes of the Vertebrata, I think I am warranted in concluding that the germinal vesicle and its contents constitute throughout the animal kingdom the most primitive portion of the ovum. In Birds and Mammalia the succeeding process appears to consist in the accumulation around the germinal vesicle of oil-like globules and peculiar granules. See the first column in the Table, page 304.

The manner of Origin of the Ovisac.

23. Around the elliptic envelope of granules and oil-like globules just described as proper to the germinal vesicle of Mammalia and Birds in an early stage, I find that there is formed a membrane, seen in Plate V. fig. 20. *h*. If the contents of this membrane, which is still incomplete, be compared with the granules (*g*) in fig. 19, these objects will be found to be the same; in farther proof of which it may be added that they were met with, as well as those in fig. 18, all lying together§. The membrane, *h*, is shown completely formed in nearly all the other figures of the same Plate. This is the membrane which I have already described in Mammalia, and intend describing in other Vertebrata, as the *ovisac*. See the second column in the Table, page 304.

The order of Formation of the several parts of the Ovarian Ovum.

24. After the formation of the ovisac, the germinal vesicle, as already said (12.), is generally for a short time concealed. This is perhaps partly referrible to minute oil-like globules being mixed with the peculiar granules of the ovisac, and causing great refraction. Liquefaction, however, of some of the granules appears to take place, or a fluid from some other source is added, and then the germinal vesicle is seen in or

† = $\frac{1}{50}$ of an English inch.

‡ And probably in Mammalia generally.

§ All of these objects, moreover, were lying among newly-formed ovisacs.

near the centre of the ovisac. The germinal vesicle is here surrounded by the peculiar granules of the ovisac, either immediately† (Plate V. fig. 10. *c.*), or having minute oil-like globules interposed‡ (fig. 14. and 15. (*)). The latter, with a pellucid fluid, indicate the incipient formation of the yelk around the germinal vesicle§. The oil-like globules accumulate (fig. 15. (*)), and minute opake granules gradually present themselves among them. When the formation of the yelk has thus proceeded to a certain stage, two membranes are seen surrounding it; one of which is the proper membrane of the yelk, *membrana vitelli* (49.), and the other, more external, is the true *chorion*‖ (52.) (fig. 17. *e.* and *f.*). The ovum is seen with great distinctness through the transparent membrane of the ovisac, and it is thus possible to follow its several stages of formation. Subsequently, a covering or tunic, consisting of a kind of dense cellular tissue susceptible of becoming highly vascular, and closely connected with the surrounding stroma, is gradually formed upon the outer surface of the ovisac, which previously in a high degree transparent, now becomes translucent only.

The Folliculus Graafianus, or Graafian Vesicle.

25. From the union of the ovisac with the covering or tunic now mentioned, I apprehend it is that there results what has been called a *Graafian vesicle*; and it appears to me that the "Couche *interne* de la capsule de la vésicule de De Graaf" of Baer (Plate VII. fig. 62. *h.*) is in reality the previously independent *ovisac*, while the "couche *externe*"¶ of this author (Plate VII. fig. 62. *i.*) is the *covering* or *tunic* of the ovisac above mentioned.

26. Professor Baer has expressed his belief that the formation of the "ovulum" (ovum) precedes that of the Graafian vesicle; but he adds, "Je doute qu'il soit jamais possible à l'homme de s'en convaincre par l'observation††." I trust that the facts mentioned in the preceding pages, and illustrated in Plate V., will suffice to show how far this eminent naturalist was right in his conjecture as to the priority in formation of the ovum; and that they will also serve to demonstrate the possibility (questioned by Baer) of determining this point *by observation*.

† See the third column in the Table, page 304. ‡ See the fourth column in the Table, page 304.

§ The germinal vesicle is thus in or near the centre of the yelk when the latter is first formed. This vesicle subsequently passes to the surface of the yelk.

T. W. Jones (London and Edinburgh Philosophical Magazine, No. 39, Sept. 1835, p. 209.) mentions the germinal vesicle as "having on one side a small elevation, which, projecting among the grains composing the granular sac, fixes the vesicle in its place." I have never observed this "small elevation," nor do I find any mention to have been made of it by either Coste or Valentin, who had previously described the germinal vesicle in Mammalia, or by those who have since written on it.

‖ See the fifth column in the Table, page 304.

¶ Von Baer says of this "couche externe," "Elle reçoit des vaisseaux, les contient dans son intérieur, et leurs extrémités vont dans la couche suivante" ("couche interne"). Lettre, &c., p. 17.

†† Lettre, &c., pp. 20, 21.

The Ovisac of Birds ("Chorion" of Authors) compared with the Ovisac of Mammals.

27. The ovarian calyx of the Bird, if deprived of its peritoneal investment, and what there is of the parenchyma† of the ovary, would, I apprehend, present *a structure analogous to the Graafian vesicle of Mammals*, that is, *a structure consisting of an ovisac that has acquired a proper (and in the later stages a highly vascular) covering.* Yet the ovisac of Birds has been mistaken for a vesicle corresponding to the *chorion* of Mammals, and accordingly it has been called the "chorion." The impropriety of this designation will appear evident if the vesicle in question be followed through its several stages of formation, which I do not find to have been hitherto attempted. For this purpose I need not do more than refer to the several figures.

28. Plate V. fig. 22. Ovisacs of the Pigeon, $\frac{1}{33}'''$ to $\frac{1}{25}'''$. Germinal vesicle (*c*) in the centre, surrounded by oil-like globules (*), the incipient yelk. Compare with fig. 15. from the Hog.

29. Plate V. fig. 23. Ovisac of the Common Fowl, $\frac{1}{20}'''$, with similar contents. Compare with fig. 15. from the Hog.

30. Plate V. fig. 24. Ovisac of the common Fowl, $\frac{1}{17}'''$. Yelk (*d*) just formed, but the membrana vitelli not yet visible.

31. Plate V. fig. 25. Ovisac of the common Fowl, $\frac{1}{14}'''$. Membrana vitelli (*e*) now seen. Compare with fig. 16. from the Hog.

32. Plate V. fig. 26. Ovisac of the common Fowl in a stage much more advanced; *g*, peculiar granules (8.). The yelk (*d*) has become in some degree opake. The ovisac has now a proper covering or tunic, and presents by this addition a structure (capsule) (*h i*) analogous to the Graafian vesicle of Mammals. The quantity of yelk in Birds is very large; hence that portion of the ovary which contains the structure now described (as analogous to the Graafian vesicle of Mammals) becomes pendent, and now the united coverings of the yelk-ball, viz. the ovisac, its proper tunic, the parenchyma of the ovary, and the peritoneal investment, are together called the *calyx*, which is connected with the ovary by a pedicle‡.

33. Plate VIII. fig. 76. Ovisac of the Pigeon, with its vascular covering or tunic. The yelk has escaped, and large granules, essentially the same as those in the ovisac of Mammalia (8.), are seen slowly passing out.

† This term is here intended to include the "*capsula propria*" of authors, for the same reason as that which influenced Baer in declining to admit any distinction, except a difference in density, between his *stroma* and the so-called "*tunica albuginea*" in the ovary of Mammals.

‡ When a minute incipient capsule is crushed under the microscope, the yelk is observed to escape into the pedicle. If the ideal section (Plate VI. fig. 38½.) be referred to, it will be seen that the yelk, in taking this direction, ruptures the parietes of its containing cavity at a point where it meets with the least resistance. It ruptures, not the whole thickness of the capsule, but its internal membrane only, formerly the ovisac. (In this instance (Plate V. fig. 26.) the yelk is seen to have subsequently ruptured also the pedicle itself, and appears escaping through the opening.)

The Ovisac of Amphibia and Fishes ("Chorion" of Authors) compared with the Ovisac of Mammalia.

34. The ovisac of Amphibia, and that of Fishes, improperly called the "chorion," first presents itself in a very similar condition to the ovisacs of Mammalia and Birds, viz. *size*, the 50th of a Paris line† and less; *form*, generally elliptical or ellipsoidal; *contour*, in plaits or folds. The chief difference consists in the fluid of the ovisac not generally (though in some instances) presenting the peculiar granules (8.) described as occurring in Mammalia and Birds.

35. Plate VI. fig. 31. Ovisacs of the Cod, $\frac{1}{40}'''$ to $\frac{1}{10}'''$. Contour in folds. Germinal vesicle (*c*) in the centre, with its numerous germinal spots (*b*)‡.

36. Plate VI. fig. 27. Ovisac of the common Frog, ("chorion" of R. Wagner§, from whom I take this figure,) $\frac{1}{50}'''$: *c*. germinal vesicle; *b*. germinal spots (many‡); *e*. membrana vitelli, yelk pellucid.

37. Plate VI. fig. 32. Ovisacs of the Whiting, $\frac{1}{7}'''$ to $\frac{1}{5}'''$. There is a trace of yelk (*d*), with something like the peculiar granules (*g*) of the ovisac in Mammalia and Birds in the fluid of the ovisac. Compare with fig. 10. Plate V. from the Cat, and fig. 21. Plate V. from the Pigeon.

38. Plate VI. fig. 33. Ovisacs of the Haddock. Yelk (*d*) circumscribed by its proper, and here very delicate membrane.

39. Plate VI. fig. 27½. Ovisac‖ of the *Coluber natrix*: *b*. germinal spot (single‡); *c*. germinal vesicle; *d*. yelk; *e*. membrana vitelli.

40. Plate VI. fig. 28. Ovisacs of the common Frog, $\frac{1}{5}'''$: *b*. germinal spot; *c*. germinal vesicle; *e*. membrana vitelli; *h*. proper membrane of the ovisac; *d'*. a spot which I always find on the internal surface of the membrana vitelli of the Frog in ovisacs of about this size. This spot does not appear to have been hitherto described. It is generally elliptic, rarely round, has a well-defined contour, and is perhaps slightly lenticular in form. In this instance it measured $\frac{1}{25}'''$ in length, and is often of about the same size. It appears to be composed of granules.

41. Plate VI. fig. 34. Ovisac of the Turbot, $\frac{1}{10}'''$: *e*, membrana vitelli now visible; *d*. yelk, with oil-like globules (*) around the germinal vesicle. Compare with fig. 25. Plate V. from the common Fowl, and fig. 16. Plate V. from the Hog.

42. Plate VI. fig. 35. Ovisacs of the Salmon, $\frac{1}{10}'''$ to $\frac{1}{8}'''$, in nearly the same stage of formation as the ovisac of the Turbot, fig. 34. At *g* are seen some of the peculiar

† = $\frac{1}{56\frac{1}{2}}$ of an English inch.

‡ Professor R. Wagner finds a *single* spot in cartilaginous, and *many* spots in osseous Fishes. He finds also a *single* spot in the scaled, and *many* spots in the naked Amphibia.

§ Beiträge zur Geschichte der Zeugung und Entwickelung, tab. ii. fig. 6. *a*. (aus den Abhandlungen der Mathematisch-physikalischen Klasse der Königl. Bayer. Akad. der Wissenschaften in München besonders abgedruckt).

‖ "Chorion" of R. Wagner, from whom I borrow this figure. (Beiträge, &c., tab. ii. fig. 7 *c*.)

granules (8.) in the fluid of the ovisac. Compare with fig. 16. Plate V. from the Hog, and fig. 25. Plate V. from the common Fowl.

43. Plate VI. fig. 29. Ovisac of the common Frog; the yelk (*d*) becoming opake, and the germinal vesicle (*c*) in its centre.

44. Plate VI. fig. 36. Ovisac of the Salmon, acquiring a proper covering or tunic. In this instance two minute ovisacs are *included* (57.) by that portion of the covering which enters into the formation of the pedicle.

45. Plate VI. fig. 37. Ovisacs of the Salmon, no longer to be distinguished from their proper coverings or tunics, with which they have coalesced to form vesicles (capsules) analogous to the Graafian vesicle of Mammals. The vesicles have been crushed, and the yelk is seen escaping by the pedicles, taking with it its proper membrane (*e*). See the ideal section, Plate VI. fig. 38½; which shows why the yelk escapes by this passage.

46. Plate VI. fig. 38. Perfect calyx of the Salmon, with its pedicle.

The Graafian Vesicle of Mammals, how related to the Calyx of Birds, Amphibia, and Fishes.

47. Should the accuracy of the figures now compared be confirmed by future observation, it may perhaps be considered as established, in the first place, that the primitive elements of the ovum of Birds, Amphibia, and Fishes, are contained in a vesicle (the "chorion" of authors) essentially the same as that which I have called the *ovisac* of the Mammalia; secondly, that if it be, as I suppose, by acquiring a proper covering or tunic† that the ovisac of the Mammalia becomes what has been by others called a *Graafian vesicle*, the ovisac of Birds, &c. by acquiring a proper covering or tunic† presents a structure (capsule) analogous thereto; and thirdly, that it is the structure so constituted in the Bird, &c., which on becoming pendent from the ovary, and invested by what there is of the substance of the ovary, as well as in some instances by the peritoneum‡, has been called a calyx§.

48. From the foregoing it appears that the Graafian vesicle is not, as it has been supposed to be, a structure peculiar to Mammalia. Nor is it correct to consider the Graafian vesicle of Mammalia as analogous to the whole calyx of other animals. It corresponds to no more than the two internal membranes, viz. the ovisac and its proper vascular covering, the remainder of the calyx being derived from the ovary, with, in Birds, some Amphibia and some Fishes, a peritoneal covering; and however incon-

† Susceptible, as already said, of becoming highly vascular.

‡ In other instances the peritoneal investment does not enter into the formation of the calyx. We find examples in the naked Amphibia, in Ophidian and Saurian Reptiles, and in most osseous Fishes, where the ovaries are sacs, having the calyces pendent in their interior.

§ My researches have not yet been extended to the Invertebrata; but I am by no means disposed to consider the existence of the vesicle, which I have called the ovisac, as limited to vertebrated animals.

siderable this portion of the calyx may appear, yet for the sake of analogy the distinction is not unworthy of being made†.

The proper Membrane of the Yelk in Mammals.

49. Several distinguished authors have not described this membrane‡. And in fact it is not easy to demonstrate the separate existence of such a membrane in the class Mammalia generally, at those periods in the formation of the ovum when the latter is usually examined. On the other hand, a very accurate observer, Krause, has figured it in the Goat§, and appears to have often seen it in other Mammals. My friend Professor Rudolph Wagner pointed it out to me in the Cat; and he seems convinced from analogy that its existence must be general in the class Mammalia, but does not appear to have discerned it in any other instance‖. I have since met with and figured it in early stages of the ovum of the same animal (the Cat), and I believe also in the Hog (Plate V. figs. 17. and 16. *e.*; Plate VIII. fig. 70. *e.*). In later stages, *ante coitum*, I have sought this membrane in vain as a distinct structure¶; but I think it not improbable that the well-marked line generally regarded as representing the internal surface of the thick chorion, may be partly due to the proper membrane of the yelk, as is obviously the case in Plate V. fig. 17. *e.* and *f.*

50. It appears to me that the existence of a proper membrane of the yelk in the ovary throughout the class Mammalia, may be inferred from what we know of the effect observed to be produced on ova by maceration; when the thick chorion, imbibing fluid into its interior, becomes distended beyond the size of the yelk-ball, but the latter *retains its form*, which certainly would not be the case were not the yelk circumscribed by a proper membrane (Plate VIII. fig. 72. *f.* and *d.*††).

51. I have observed a very interesting fact connected with the proper membrane of the yelk *post coitum* not hitherto made known, which not only adds probability to the supposition that this membrane has a previous existence, but also accords in some degree with a change known to take place in Birds. I find that in the Rabbit,

† Professor R. Wagner in his examination of ova of the Frog, finding his "chorion" (ovisac) to disappear, makes the following inquiry: "Ist sie nun mit der Dotterhaut verschmolzen oder hat sie, was wahrscheinlicher ist, sich an die gefässreiche Kelch-membran angelegt und bildet sie nur die innere Lamelle derselben?" (Beiträge, &c., S. 76.) This inquiry, made by one of the most accurate of observers, bespeaks, I think, the perception, in a single instance, of something that was very near the truth.

‡ Among these are Coste (Embryogénie Comparée, p. 80.) and T. W. Jones (London and Edinburgh Phil. Mag., No. 39, Sept. 1835, p. 210.).

§ Müller's Archiv, 1837, Heft I. Taf. I. figs. 4, 5, 6.

‖ Beiträge, &c., S. 20.

¶ Since the above was written, an examination of the ovum of the Goat enables me to attest the accuracy of Professor Krause in his representation of the membrana vitelli in this animal, in which it is exceedingly distinct. I did not however, in any instance find the membrana vitelli surrounded by a fluid as described by Krause (53. Note), but by the perfectly formed and consistent chorion.

†† I borrow this figure from the excellent Thesis of Bernhardt (Symbolæ, &c., fig. xxiii. p. 45.), but am compelled to offer an explanation of several of its parts different from that given by the author. This is deferred, however, until after the description of the chorion (56. Note). See also the Description of the Plates.

just before the ovum leaves the ovary, this membrane, previously so delicately thin, becomes perfectly distinct and very thick; and that the chorion, imbibing fluid into its interior, becomes somewhat distended, so that a minute space is visible between the membrana vitelli and the chorion. This thickening of the proper membrane of the yelk, and the distention of the chorion, subsequently proceed much farther, as is proved by the state of ova found in the Fallopian tube. I find also, that the membrana vitelli is still visible, and has considerable thickness in minute ova met with in the uterus. This subject will be entered into more fully in a future paper.

The true Chorion, a Structure superadded within the Ovary in the Class Mammalia.

52. The figures above referred to, in comparing the *ovisac* of Mammalia with that of Birds, Amphibia, and Fishes, present also up to a certain period a perfect analogy between the rudiments of the *ovum* itself in these four classes. We have seen in all, the germinal vesicle and its contents, as well as the yelk, and proper membrane of the yelk. Here, however, the analogy is terminated by the formation, within the ovary, in Mammalia, of a membrane to which there is no corresponding structure *within the ovary* in other Vertebrata. This membrane appears to be the true *chorion*. In the ovary of Birds, Amphibia, and Fishes, it is, I believe, allowed that there is no membrane formed external to the membrana vitelli†. The body therefore expelled from the ovary in these animals is not an ovum, but a *yelk-ball*. The subject will be illustrated by the following Table, showing the parts present (in a mature state) in the ovary of Mammalia on the one hand, and of Birds, &c. on the other:—

Mammalia.	Birds, some Amphibia‡, and some Fishes‡.
Germinal vesicle (*c*) and its contents.	Germinal vesicle (*c*) and its contents.
Yelk, *d*.	Yelk, *d*.
Membrana vitelli, *e*.	Membrana vitelli, *e*.
Chorion, *f*.	
§*Tunica granulosa*, g^1.	
§*Retinacula*, g^2.	
Fluid, granules (*g*), and oil-like globules (*).	
§Membrana granulosa, g^3.	
Ovisac, *h*. / *Vascular tunic*, *i*. } = Graafian vesicle, *h i*.	*Ovisac*, *h*, / *Vascular tunic*, *i*. } = Capsule, *h i*
Stroma, *k*.	Stroma, *k*.
Peritoneal covering, *l*.	Peritoneal covering, *l*. } = Calyx, *h i k l*.

† Professor Rathke, however, finds that in certain Fishes, not provided with an oviduct, the "schaalenhaut" is a production of the ovary. (Burdach's Physiologie, 1837, Band II. § 339.)

‡ In other Amphibia and most of the osseous Fishes, the peritoneum does not enter into the formation of the calyx (47. Note).

§ To be described in Part II. of this Memoir (64. 80. 72.).

The foregoing Table shows that in the ovary of Mammalia, the chorion is superadded; and as I shall demonstrate in a future communication (what others, and particularly Coste and R. Wagner, have conjectured) that this membrane is really the chorion of ova met with in the uterus†, it may be said that not merely a yelk-ball, but an *ovum* is expelled from the ovary of Mammals‡.

53. The chorion, as it exists in the ovary, is soft, very thick, and remarkably transparent. It closely invests the membrana vitelli, so as in nearly all instances to conceal the separate existence of this very delicate membrane (49.). When first formed, the inner portion of the substance of the chorion is probably in a fluid state, as is evident from Plate VIII. fig. 70.*f*., in which instance slight pressure at one side forced a part of the substance of this membrane to the side opposite§. (In this figure the inner circle (*e*) is probably the proper membrane of the yelk (49.).) Subsequently the chorion acquires more consistence; for if it be ruptured no collapse takes place even after the escape of its contents, and the membrane continues throughout of equal and undiminished thickness‖. I find, as already said (51.), that just before the ovum leaves the ovary this membrane begins to be attenuated by imbibition of fluid into its interior, and consequent distention. This imbibition of fluid and distention may be produced by maceration (Plate VIII. fig. 72.).

54. The great thickness and transparency of the chorion, as it exists in the ovary, long prevented its real nature from being ascertained, and appear to have been the means of misleading several excellent observers.

55. Von Baer, for instance, after describing the yelk as "une sphère creuse à paroi épaisse," says it is separated "par un *intervalle transparent* d'une autre sphère creuse à paroi mince¶." The "intervalle transparent" of Professor Baer is obviously the transparent substance of the chorion, and his "paroi mince" the external surface of this thick membrane. It appears to have been this supposed "paroi mince" that Baer considered as subsequently forming the "membrane cortical" of ova in the uterus.

† The membrane here denominated the true chorion is considered by Coste as the "membrane vitelline" (Embryogénie Comparée, p. 80.). This author, however, as above said, is correct in supposing this membrane to become the chorion in the uterus.

‡ On the other hand, there is a structure formed in the ovary of Birds, and some other Vertebrata, which (though it has been described) I do not find existing *ante coitum, in the ovary* of Mammals. This is the incipient "germinal membrane" ("blastoderma"), to be considered in a future paper.

§ Professor Krause supposes the membrana vitelli to be surrounded by a pellucid fluid, which is circumscribed by an extremely delicate membrane (Muller's Archiv, 1837, Heft I. S. 27, 28; see also the description of these parts in Krause's admirable work, "Handbuch der menschlichen Anatomie, Band i. S. 557, 558."). The Professor's description I find very accurate, as applied to the chorion in an early state; such, for instance, as that which I have figured in Plate VIII. fig. 70, above referred to; or possibly it may be applicable to the permanent condition of this membrane in certain animals. I have never met with this state, however, except in ova newly formed.

‖ Bernhardt has thus demonstrated the nature of this membrane (Symbolæ, &c. fig. xx.); and a figure by R. Wagner (Beiträge, &c., Tab. i. fig. 2.) shows it in a manner still more satisfactory.

¶ Commentaire, pp. 39, 40.

56. Bernhardt, as already said, by rupturing this membrane demonstrated its real nature. In cases, too, where he viewed the "ovulum" (ovum) freed from its surrounding granules, he appears to have regarded it, in its whole thickness, as the "membrana externa ovuli†;" but in those instances in which granules were adherent to the ovum, concealing the outer surface of this thick membrane, the substance of the latter was mistaken by Bernhardt for a "zona pellucida," or "spatium pellucidum;" and the part which this author indicates as the "membrana ovuli externa," is obviously the internal surface of the chorion. See Plate VIII. fig. 72.‡, and the description of the Plates.

Parasitic Ovisacs.

57. Minute ovisacs (*h*) are seen in Plate VIII. fig. 75, in the parietes of a Graafian vesicle (*h i*) of one of the Mammalia, the Dog. The same Plate, fig. 76, presents a number of ovisacs similarly situated in the corresponding structure of a bird, the Pigeon §. If such a Graafian vesicle or corresponding structure be crushed, the ovum contained in its cavity escapes, but the minute ovisacs in its parietes remain unmoved. I have counted more than fifty of the latter, scarcely exceeding their primitive size, in the parietes of one of these structures from the Bird, none of which probably would have been matured. Sometimes these minute ovisacs appear to have *originated* in the substance of the covering acquired by a larger ovisac; and sometimes they seem to be *included* by the covering which the larger ovisac acquires. An instance of the latter is seen in Plate VI. fig. 36, where two small ovisacs are so included ‖. The minute ovisacs in such a situation, whether originating there or contained in it by inclusion, I propose to call *parasitic ovisacs*.

58. Plate VIII. fig. 77. presents one of these parasitic ovisacs ¶ (*h*) contained in the parietes of a Graafian vesicle of the Ox. Both have been divided, one half of each remaining in the ovary, the other being reflected. At fig. 78. is an enlarged view of the two halves of the divided parasitic ovisac ¶ seen in fig. 77. The proper membrane (*h*) is seen lined by the membrana granulosa (g^3); and within the latter is a dark space, the cavity of the parasitic ovisac which contains the ovum (*f*). Fig. 79. presents a transverse section of this parasitic ovisac; *h* being its proper membrane, and *g* granules of the membrana granulosa. The proper membrane (*h*) of the parasitic ovisac in this instance measured $\frac{1}{5}'''$ in thickness, and its cavity distended under the compressor $1\frac{1}{2}'''$ in length.

† Symbolæ, &c., figs. ii. iii. iv. x. &c.

‡ Fig. xxiii. of Bernhardt. This is the figure before referred to in the description of the proper membrane of the yelk (50. Note).

§ I have seen minute ovisacs similarly situated in a Chelonian reptile.

‖ In this instance the included ovisacs are contained in the incipient *pedicle* already mentioned (44).

¶ Incipient Graafian vesicle?

Isolated Spots in the Graafian Vesicle.

59. These *appear* to be of two kinds, but are really the same,—in the one case seen single, in the other grouped. Plate VIII. fig. 66. g^*. presents the appearance of these objects in the one state, and Plate V. fig. $26\frac{1}{2}$. their appearance in the other. Each of these spots I find to consist of one of the peculiar granules of the Graafian vesicle, having a peripheral accumulation consisting of oil-like globules†. The peculiar granules are transparent and comparatively large; the oil-like globules appear dark in their circumference by reason of a very different refracting power from that of the suspending fluid; they are also of a minuteness quite immeasurable. When these objects are in small number, they present the appearance shown in Plate VIII. fig. 66. g^*.; and when in very large number, that presented in Plate V. fig. $26\frac{1}{2}$.‡.

Disappearance of Ova, and Formation of others.

60. I have very often met with ova in the state represented in Plate VIII. fig. 67, which was observed in a Rabbit of about ten weeks old. The chorion (*f*) has become thin, distended, and of an elliptic form. It measured in this instance one-fifth of a Paris line in length§. The yelk (*d*) is nearly black, consisting chiefly of granules of extreme minuteness, with some oil-like globules and a fluid. Its membrane, if still existing, is not distinguishable from the chorion; and indeed the chorion itself is scarcely to be distinguished from the yelk. The germinal vesicle (*c*) is generally situated at one end of the ovum, as in this instance,—appears more or less flattened or collapsed,—and is much enlarged. It measured in this case $\frac{1}{75}$th of a line in length. The germinal spot (*b*) also was enlarged, having measured in this instance $\frac{1}{45}$th of a line in length, for it was somewhat elliptical. Its contour is not well marked. The colour of the Graafian vesicle, with such a condition of its ovum, is often tinged with yellow. In young Rabbits this state of the ovum has presented itself so frequently, that I have observed several in the same field of view. I apprehend it to denote a stage in the absorption of ova; which on the other hand appear to be continually replaced by new formations||.

† Among the oil-like globules there are sometimes visible a few minute opake granules.

‡ Spots which I suppose to represent the first of the two states now described, have been figured in Bernhardt's Dissertation, Symbolæ, &c., fig. xvii.; but the author's description of them does not quite accord with that which I have given.

§ = $\frac{1}{50}$ of an English inch.

|| In a future paper it will be shown that, *post coitum*, many ova are absorbed. In Plate VI. figs. 44. and 46. are seen two ova in which absorption is incipient, as indicated by a loosening of the granules, and consequent enlargement of the tunica granulosa (g^1),—by the more globular form of some of these granules (9.),—and by liquefaction of the yelk around the germinal vesicle.

PART II.

On a granulous Tunic of the Ovum of Mammalia not hitherto described; on the manner of origin of the "Membrana Granulosa" of Authors; on the different situations of the Ovum in the Graafian Vesicle at certain periods ante coitum, not hitherto observed; and on certain structures by means of which the Ovum is made to occupy those several situations.

61. Professor Baer has described and figured the "ovulum" (ovum) of Mammalia as situated in a mass of granules at or near to the periphery of the vesicle of Graaf (Plate VII. fig. 62.), and the following is the substance of the description he has given.

The "Disc" of Professor Baer.

62. This accumulation of granules, according to Baer, is not globular but discoid†, thicker at the central part‡, and surrounding the "ovulum" like the frame of a lens its glass, but probably extended so as completely to inclose the under surface of the "ovulum"§ in addition to its sides. The lateral portion of this mass of granules Von Baer calls the disc ("*discus proligerus*")‖, and the central thickened part he calls the "*cumulus strati proligeri*‖." This description is intended to apply to this part in the Mammalia generally; but Von Baer describes the form of the "cumulus" as varying in different animals, and in the same animal at different periods, perhaps according to its degree of maturity. Thus it is very inconsiderable in the Dog, requiring the greatest attention to discern that the disc is thickened at its middle: and here Von Baer compares the granulous accumulation to a plate used at table, as seen on its lower surface. In the Cow he has seen the "cumulus" cylindrical or globular. This convex middle part is also very considerable in other animals; in the human female it has the appearance of a depressed hemisphere; and in the Hog it presented very varied forms¶, the cause of which differences Baer was not able to explain††. In the Cow he saw a plane granulous substance, very distinct from the eminence ("cumulus"), extending itself at the surface of the fluid of the Graafian vesicle; but whether this was situated internal to the cumulus, or formed a part of it destined to be detached, he considered extremely difficult to decide‡‡. He adds, "when we examine an ovulum of the Sow or Cow under the microscope, we there see commonly adherent a portion more or less considerable of a flat disc. In the Sow I have seen this little membrane bounded by a circular border; I believe that I have sometimes obtained it entire. In the Dog the disc is always limited by a circular border, but in this animal the membrana granulosa is too small to admit of being well examined. In the ovary of the human female I think I have distinctly

† Lettre, &c., p. 15. ‡ *L. c.*, p. 16. § *L. c.*, p. 16.

‖ He gives it this name from the supposition of its analogy with the granules surrounding the germinal vesicle of Birds.

¶ *L. c.*, p. 16. †† Commentaire, &c., p. 40. ‡‡ Commentaire, &c., p. 40.

seen the membrana granulosa to pass above the discus proligerus. On the immature ovulum [ovum] of the Cow, on the contrary, I have recognised no more than a continuous lamina, which I consider as the membrana granulosa. From all that has been said, I think I may conclude that the ovula [ova] of the Mammalia, those at least which are approaching maturity, are plunged into a couch, formed of a thick eminence, the cumulus, and of a flat disc, and that the latter may or may not be primitively isolated from the membrana granulosa; development predominating sometimes on the part of the disc, sometimes on the part of the cumulus, examples of which are offered (respectively) by the Bitch and Cow†." See Plate VII. fig. 62. and Plate VIII. fig. 80.‡.

63. This description appears to be accurate in a few particulars, but for the most part it does not accord with my observations. I have naturally felt some hesitation in stating this, not only from its being opposed to the opinion of so experienced and, generally speaking, so accurate an observer, but because those who have succeeded Baer in these researches appear to have adopted entirely his description of this structure. In now offering a different account of it, I would express my belief that should this prove more accurate, it will have been rather due to my examination of the ovum when situated in the *centre* (as well as near the surface) of the Graafian vesicle, than to imperfect observation on the part of those eminent observers. But I must first describe a structure which, to my surprise, has not been hitherto observed, though visible in those situations in which the ovum has been usually examined.

The Tunica granulosa.

64. On the rupture of a Graafian vesicle under the compressor, the ovum escapes, and with it a mass of the peculiar granules I have at some length described (8.). This mass of granules, as hitherto obtained, has presented the appearance of a lacerated structure, and been regarded simply as a portion of the "disc" of Baer§. I find, however, that if the mass thus escaping be attentively examined, those granules that immediately surround the ovum appear to be in a state of denser aggregation than the rest, from which they are to be distinguished therefore by a circumscribing line. If the granules thus circumscribed be viewed at different distances, they are seen to invest the whole surface of the ovum, forming a tunic, which is perfectly spherical in form (Plate VI. figs. 42. to 47.g^1.). I have frequently obtained the ovum invested by no other granules than those of this tunic; that is, this tunic has been freed from the other granules, which on the bursting of a Graafian vesicle generally escape adherent to it; the fact being, that all that properly belongs to the ovum of the mass of granules in which it is found imbedded in the Graafian vesicle is this

† Commentaire, &c., p. 40.

‡ Lettre, &c., figs. ix. and xii. of Baer. These figures I have introduced for the purpose of contrasting them with my own drawings.

§ This lacerated structure is the "zona granulosa" of Bernhardt, Symbolæ, &c., figs. i. vii. xviii. xxi. xxiii. See also (in the present memoir) Plate VIII. fig. 72. g^1., which is taken from that author.

tunic, between which and the surrounding mass there is much less adhesion than there is between the granules of either among themselves. Having never failed to find this tunic enveloping mature ova in the Mammalia, I believe its presence to be constant and essential; and I am also of opinion that in form, substance, and situation it is essentially the same throughout this class of animals. I propose to call it the granulous tunic of the ovum, *tunica granulosa*.

65. At a certain period this tunic, in some animals at least, is seen to have tail-like appendages consisting of granules precisely similar to its own (Plate VII. fig. 63. g^1.). These appendages appear to be frequently four in number, and their direction corresponds to that of other granulous cords or bands to be presently described (86.). They are not very distinctly seen while within the Graafian vesicle, and in this situation I have not figured them.

66. Should the existence of this structure as a *tunic* be confirmed by the observations of others, it will no longer be surprising that the outer line in the double contour of the thick chorion remained so long unseen, and that this thick membrane was regarded as a "zone," "halo," or "pellucid space." For the same reason it will be obvious why it has been found so difficult to free the ovum from the surrounding mass of granules; though I find that these granules do not adhere to the chorion they invest, so closely as to each other.

67. The tunica granulosa may be obtained in an uninjured state, either by carefully opening a Graafian vesicle of considerable size, and receiving its fluid and granulous contents into a watch-glass (Plate VII. fig. 61. g^1.), or by bursting one of middling size under the microscope with the compressor, when the escape of the ovum in its tunica granulosa may be observed. In both cases, however, portions of another granulous structure (the retinaeula, to be presently described (80.),) generally escape adherent to it. This tunic is also very distinctly visible *in situ*, as in Plate VI. figs. 39, 40. and Plate VII. figs. 55. to 59. g^1.

68. I have met with the ovum when immature, and apparently just after the formation of the chorion (Plate V. fig. 17. *f*.), at which period the tunica granulosa does not exist; and in subsequent stages its gradual formation may be observed, as in Plate VI. fig. 41. g^1., where its thickness is inconsiderable and its contour irregular.

69. The tunica granulosa, as already said, is spherical. In whatever direction it is viewed, whether as in Plate VII. fig. 61. g^1., or in any other of the figures of this Plate, there is perceptible no difference in its form; the distinctness with which the contained ovum is seen, depending, not on the absence of the investing granules at any part of its periphery, but on the extreme transparence of these granules. The flattening at one side which this tunic may undergo, and the entire deprivation of granules, perhaps, at one point of the surface of the chorion, by pressure against the membrane of the ovisac, I shall have to notice (88.)†.

† I shall presently describe a structure supposed, as already said (56.), by Professor Baer to be "discoid" in its form. In the *Dog*, however, this author has obviously figured as the "*discus proligerus*" the structure

70. The granules forming this tunic being soluble in water (9.), the fluid of a large Graafian vesicle, or some thin albumen, is a preferable medium in which to view this structure, as well as all the other parts connected with the ovum.

71. In a future paper I shall show that the tunica granulosa accompanies the ovum into the Fallopian tube.

The Membrana granulosa.

72. Von Baer† gave this name to a stratum of granules lining the internal surface of the Graafian vesicle. That author's description of the membrana granulosa appears to be very accurate so far as it goes; but there remains something to be said respecting it, for to this day doubts are entertained whether this stratum of granules really constitutes a membrane, though Dr. Pockels recently demonstrated it to be such in a mature Graafian vesicle of the Deer‡. Von Baer has also figured it§, but so little magnified that no adequate idea is thus given of this membrane.

73. It is composed of the peculiar granules of the ovisac (Plate VIII. fig. 71.). With the proper membrane of the ovisac, now the lining membrane of the Graafian vesicle, the membrana granulosa is in contact only‖, appearing very easily to break down and separate from it. The membrana granulosa may be made to escape by rupturing a Graafian vesicle under the compressor; when, after the escape of the other contents, it slowly passes out in a membranous form¶. It is then possible to roll portions of this membrane on themselves, and even to obtain folds, as seen in Plate VIII. fig. 71.

74. The granules forming the internal surface of this membrane are sometimes found less densely aggregated together than those in other parts; portions of the membrane projecting like villi into the fluid of the Graafian vesicle. This membrane is also frequently found to be of very unequal thickness, projecting at some parts much farther into the cavity of the Graafian vesicle than at others. The cause of these apparent villosities and projections will be presently explained, when the manner of origin also of this membrane will be shown (79.).

---

which I am now describing as the *spherical* tunica granulosa. He probably saw it in no other state than that to which I have just referred, viz. flattened or removed by pressure against the membrane of the ovisac.

† Lettre, &c., p. 18, and Commentaire, p. 47.

‡ Müller's Archiv, 1836, Heft ii. S. 193—204. Tab. vi.

§ Lettre, &c., fig. xi.

‖ It was observed by Baer, that between the membrana granulosa and the internal surface of the Graafian vesicle there was no "liaison organique." Commentaire, p. 41.

By maceration, as observed by Baer also, the membranous structure of this granulous lining may be well seen *in situ* from the exterior of a Graafian vesicle; the membrana granulosa separating as a distinct vesicle, and a space intervening between it and the walls of the cavity it lines.

¶ It is often more yellow in its colour than the other granulous contents of the Graafian vesicle.

The Ovum in the centre of the Ovisac. Manner of origin of the Membrana granulosa.

75. The formation of the ovum, shown in Part I. of this memoir (12—22.) to commence before the existence of the ovisac, is completed in the number of its parts, (though probably not matured) in or near the *centre* of this vesicle (Plate V. fig. 17.).

76. But if the ovum at this period is situated in the centre of the ovisac, by what means is it supported there? At first this appears to be effected by an equable diffusion of the peculiar granules of the ovisac throughout the fluid of this vesicle (Plate V. fig. 17.). Subsequently a peculiar structure arises partly for this purpose.

77. The ovisac, as already said (24. 25.), acquires a proper covering or tunic susceptible of becoming highly vascular, and thus passes into the condition of what has been denominated a Graafian vesicle. As this covering or tunic begins to form at the period just referred to, viz. while the ovum is still in the *centre* of its containing cavity, it will be proper in future to lay aside the term *ovisac* and to substitute that of *Graafian vesicle*, the former being now no more than the lining membrane of the latter.

78. The granulous contents of the *Graafian vesicle* now assume an amygdaloidal appearance (Plate VII. fig. 48.), which seems to arise from a denser aggregation of the granules in certain parts, and the occupation, by the fluid, of the spaces thus occasioned; in other words from a *histological* separation. If examined more closely, however, the condition of the interior of the ovisac is not found to be really amygdaloidal, as the cavities communicate with one another (Plate VII. fig. 49.).

79. In a stage somewhat more advanced this separation is found to have proceeded farther, the peculiar granules of the Graafian vesicle having arranged themselves so as to constitute three distinct structures (Plate VII. fig. 50. g^1, g^2, g^3.). Some of them are collected on the surface of the chorion, forming the *tunica granulosa* (g^1), which I have already described (64.); others constitute a structure, or rather an assemblage of structures, consisting of a central mass, in which the ovum (in its granulous tunic) is contained, and of cords extending from the membrana granulosa to this central mass (g^2), which will be now described; and the third portion of these granules is collected on the inner surface of the Graafian vesicle, where they constitute the membrana granulosa (g^3), *this being, I apprehend, the manner of origin of this membrane.* See the sixth column in the table, page 304.

The Retinacula.

80. The central mass and cords of granules just mentioned (Plate VII. fig. 50. g^2.) do not appear to have been hitherto observed. One of their uses will perhaps be apparent from the figure now referred to. They obviously suspend the ovum, and retain it in its situation in the fluid of the Graafian vesicle; from which office, with others to be hereafter mentioned, I propose to name these structures the *Retinacula*†.

† The granulous cords extending from the membrana granulosa to the central mass are probably much more numerous at this period than represented in the figure; but the minuter ones could not in this instance be seen, nor are the minutest ever visible, from the exterior of the Graafian vesicle.

81. Every observer who has burst a Graafian vesicle under the microscope must have noticed the mass of granules that always escapes with the ovum. Von Baer, indeed, mentions "shreds" formed of granules as being visible in the mass thus escaping. The structures I have just mentioned (*retinacula*) (Plate VII. fig. 50. g^2.) explain the nature of the escaping mass of granules, and the "shreds" observed by Baer, which latter appear to have been the ruptured retinacula.

82. When describing the membrana granulosa (74.), I stated it to be sometimes of very unequal thickness, and to present villi projecting from its inner surface into the fluid of the Graafian vesicle. If Plate VII. fig. 50. g^2 and g^3 be again referred to, and the manner of origin, as I suppose, of the membrana granulosa borne in mind, the cause of those inequalities in the thickness of the latter will be evident. The villi on the internal surface of this membrane are nothing more than the remains of the retinacula, broken off as these are when the contents of a Graafian vesicle escape†.

83. The retinacula as now described, extending from the membrana granulosa to the centre of the Graafian vesicle, are in most animals very indistinctly seen, and hence it is that they have been hitherto overlooked. I first saw them in the Rabbit, and to those who may wish to convince themselves of their existence I recommend this animal, from the comparative distinctness with which they are here seen (Plate VII. fig. 50. g^2.). They are very distinct also in the Ferret (*Mustela Furo*); less so, yet visible, from the exterior of the ovisac in the Ruminantia (figs. 51 and 52. g^2.): and having never failed to find some trace of them, it is my opinion that these structures are general in the class Mammalia‡.

84. Very often when the central mass is visible, and the ovum distinct within it, nothing is seen of the cord-like portions of the retinacula. This is sometimes owing to the size of the Graafian vesicle rendering the object too remote, or to the imperfect transparency of its membranes, and sometimes to undue pressure having been applied, which breaks the cord-like portions down. Care must be taken, when they are sought for, to apply no more pressure than is absolutely needful; and perhaps the general remark may not here be out of place, that even with the most careful manipulation these parts may sometimes become displaced. Dissecting out a Graafian vesicle, stripping off the peritoneal covering of the ovary, or slicing and even handling the latter, tend to disturb the exquisitely suspended ovum.

The Ovum conveyed to the periphery of the Graafian Vesicle.

85. From the centre of the Graafian vesicle the ovum passes to its periphery. This change of place is gradual, and the same structures which we have seen to suspend the ovum in the former situation convey it to the latter. In Plate VII. fig. 55. this

† Although for the sake of perspicuity I have thought it best to distinguish the membrana granulosa and retinacula by two appellations, I think they are but parts of the same structure.

‡ I have seen these structures (as well as the tunica granulosa) in the Goat, the Hedgehog, and the Human subject.

change is seen in profile taking place. The granulous cords that are situated on one side of the central mass have in this instance disappeared, while those on the other side have become shortened, until the ovum has nearly reached the periphery of its Graafian vesicle. And what is very remarkable, and an interesting instance of *design*, the particular part of the periphery of the Graafian vesicle to which the ovum is thus conveyed, is always that directed towards the surface of the ovary.

The Ovum at the periphery of the Graafian Vesicle†.

86. Nor does the office of the retinacula end here. Having suspended the ovum in the centre, and conveyed it to the periphery of the Graafian vesicle, they now retain it in the latter situation (Plate VII. figs. 55 to 59. g^2.‡). The central mass in which the ovum is contained has become smaller, in many instances nearly of the size and form of the tunica granulosa (g^1), and in some animals appears more or less distinctly circumscribed by a membrane§, a continuation of which invests the cord-like, or at this period the band-like portions of the retinacula‖. The band-like portions of the retinacula have become reduced frequently to four in number, which are at right angles to each other (figs. 58 and 59. g^2.). Sometimes only two remain, and I have met with more than four (figs. 56 and 57. g^2.). The retinacula often seem closely pressed against the inner membrane of the Graafian vesicle, for which purpose, apparently, a portion of the membrana granulosa is in some instances previously removed (figs. 57 and 59. g^3.). In others the membrana granulosa is quite entire.

87. In Plate VII. fig. 61. is seen a fragment (g^2) of the central portion of the retinacula, from which the granulous bands have been broken off¶; and fig. 60. presents the same part *in situ*, and of the real size, as viewed in a large Graafian vesicle (*h i*) removed from the ovary, laid open, and its outer third reflected.

88. In the determinate pressure of the ovum towards the periphery of its Graafian vesicle, the retinaeula obviously perform an important part††. One effect of this de-

† See the seventh column in the Table, page 304.

‡ One of the figures now referred to (fig. 58. from the Ferret,) presents a curious resemblance to the eye-ball with nearly all its parts, including the four *recti* muscles.

§ It is generally supposed that the surface of the "ovulum" (ovum) is in contact with the wall of its containing cavity; which however cannot be the case if the membrane now mentioned circumscribe the central portion of the retinacula on all sides.

In some animals that portion of this membrane which invests the central part of the retinacula is exceedingly distinct, as for instance in the Cat and Dog.

This membrane sometimes presents wrinkles or folds, as if susceptible of enlargement.

‖ It is not improbable that a continuation of this membrane, reflected from the retinacula, may invest the internal surface of the membrana granulosa (82. Note).

¶ Drawn as seen lying in a watch-glass.

†† In the Dog the retinacula generally become at this period very obscure (Plate VIII. fig. 66. g^2.), often quite imperceptible; and their central portion is reduced to a distinct membrane, closely investing the tunica granulosa (fig. 66. g^1. and g^2.); this membrane being, I presume, the "circular border" mentioned by Baer as circumscribing his "disc" (tunica granulosa) in this animal. That the retinacula, however, though generally indistinct, and indeed invisible, in this animal, continue to exercise an influence on the situation of the ovum,

terminate pressure appears to be penetration through the membrana granulosa, when the latter has not been previously removed. Another effect, probably in all instances, is the attenuation or removal, at one point, of the proper granulous tunic of the ovum (69.). By continued pressure, also, the retinaeula may contribute to attenuate that part of the inner membrane (formerly the ovisac) of the Graafian vesicle in contact with which they lie†, and thus promote the expulsion of the ovum from the ovary.

89. All those who have been engaged in researches of this kind, must have noticed that on the bursting of an ovisae under the compressor, the ovum and a mass of granules are among the parts escaping first. This has been mentioned as remarkable. I think it will appear less so if the situation of the ovum as seen in most of the figures in Plate VII. be considered.

90. The whitish or yellowish white speck visible with the naked eye from the exterior of the ovary in the Dog, which led to Baer's discovery of his "ovulum" (ovum) of Mammalia, appears to be in this animal the tunica granulosa rather than the ovum. In some others in which such specks are visible from the exterior of the ovary, the central portion of the retinacula is also seen. This I find to be the case in the Rabbit and the Ferret, and in minute Graafian vesicles of the Ox. In the Rabbit I have with a good pocket lens discerned, from the exterior of the ovary, several of the *band-like portions* of the retinaeula; and this I find possible in minute Graafian vesicles even of the Ox.

91. I have now gone through a minute description of the parts concerned in producing those appearances denominated by Von Baer the "cumulus" and "disc," as figured in Plate VII. fig. 62., and Plate VIII. fig. 80. If these figures, taken from that author‡, be contrasted with g^2 of my own figures in Plate VII., and particularly of fig. 55., it will be obvious that the "cumulus" of Baer is made up of what I have called the tunica granulosa, and the central portion of the retinacula; and that the band-like portions collectively of what I have called the retinaeula, mainly contribute to present the appearance denominated the "flat disc" by Baer.

---

is rendered probable by the fact, that when gentle compression has in some degree displaced this vesicle, it resumes its previous situation as soon as the pressure has been removed. This fact was observed by Professor Baer, but from not having seen the true form of the structures here called the retinacula, he was not in a condition to explain it.

One of the figures now referred to, from the Dog (Plate VIII. fig. 66.), presents four ova in one Graafian vesicle, which number, as well as three, I have repeatedly met with in this animal. Professor Valentin has also figured three in one Graafian vesicle of the Dog (Dissertation by Bernhardt, "Symbolæ," &c., fig. viii.). Two ova are very frequently present in the same Graafian vesicle in this animal; but in the Ferret (*Mustela Furo*) this is still more frequently the case. In the last-mentioned animal indeed I saw in many instances three, and not rarely four, ova in one Graafian vesicle. When this is the case, it is not unusual to find one or two ova apparently defective. To explain the existence of a plurality of ova in one Graafian vesicle, we must suppose that in such instances the membrane of the ovisac forms around, and thus includes in one cavity, the granulous envelopes of a corresponding number of germinal vesicles (23.).

† Von Baer, without having seen the peculiar structure of the retinacula, conjectured that this effect might be produced by the "ovulum" (ovum) on the parietes of its Graafian vesicle.

‡ Figs. ix. and xii. of Baer, Lettre, &c.

The Tunica granulosa and Retinacula of Mammals compared with the Membrana chalazifera and Chalazæ of Birds.

92. After what has been stated on the subject of the tunica granulosa and retinacula, it may by some be supposed that these structures are analogous to the membrana chalazifera and chalazæ of the Bird. They differ however in several respects. Thus the tunica granulosa and retinacula invest the *chorion*, while the membrana chalazifera invests the *proper membrane of the yelk*. The former exist *ante* coitum, the latter are formed *post* coitum. The retinacula and chalazæ may agree in the function of both having reference to the *position* of the ovum, but the *object* of the positions they respectively influence is essentially different, the one determining the situations of the ovum in the ovary, and assisting in its expulsion from that organ; the other (as it is supposed) performing a function which has reference to the parent heat in incubation.

Recapitulation.

93. In Mammalia and in Birds the germinal vesicle and its contents are those parts of the ovum which are first formed. This is probably the case in ova throughout the animal kingdom (12—22.).

94. The germinal vesicle at an early period is surrounded, in Mammalia and in Birds, by oil-like globules and peculiar granules, forming an envelope not hitherto described (14.).

95. The ovum of all vertebrated animals is contained in a vesicle, (the "chorion" of some authors, as found in Birds, Amphibia, and Fishes,) which is essentially the same in structure wherever found, and which it is desirable universally to denominate an *ovisac* (2. 47.). This vesicle is the "couche *interne*" of the Graafian vesicle of Mammalia as described by Baer (24. 25.).

96. The Graafian vesicle of the Mammalia is an ovisac that has acquired a proper covering or tunic, susceptible of becoming highly vascular, which covering is the "couche *externe*" of the Graafian vesicle as described by Baer (25.).

97. The ovisac of Birds, Amphibia, and Fishes ("chorion" of some authors) acquires in like manner a proper covering or tunic, susceptible of becoming highly vascular; and by the union of the ovisac with this covering, there is constituted a structure analogous to the Graafian vesicle of Mammalia (47.). The quantity of yelk in the former being large, that portion of the ovary which contains the structure here referred to (as analogous to the Graafian vesicle of Mammals) becomes pendent; and now the united coverings of the yelk-ball, viz. the ovisac, its proper tunic, the ovarian substance, and in some instances the peritoneal investment, are together called the *calyx* (32. 45. 47.). From this it will be obvious that the Graafian vesicle is not, as it has been supposed to be, a structure peculiar to Mammalia; nor is it correct to consider the Graafian vesicle of Mammalia analogous to the whole calyx of other animals (48.).

98. The ovisae has at first an elliptieal or ellipsoidal form, beeomes more spherical, and in certain Mammals somewhat tapered at one end (2. 34. 3.).

99. The structure of the ovisac in some of the Mammalia may be examined when it does not exeeed in length the 50th or even the 100th part of a Paris line, that is, in the latter case, the 1125th of an English inch (4.).

100. Myriads of ovisacs with their eontents are formed that never reach maturity (2.).

101. Some of the ovisaes whieh do not reaeh maturity are situated in the parietes of Graafian vesicles in Mammalia, or of the corresponding struetures in other Vertebrata; being sometimes formed in this situation, and sometimes included by the eovering which the larger ovisae acquires. The minute ovisacs so situated it is proposed to denominate *parasitic* ovisaes (57.).

102. The ovisac is often found in a cavity proper to itself, with the walls of whieh it has no organie union (6.).

103. The granules forming the envelope of the germinal vesiele above referred to, and subsequently found in the fluid of the ovisae, are very peculiar in their appearanee; they are generally of an elliptic form and flattened, highly transparent, eontain a nueleus and sometimes a pellucid fluid also, and are intimately conneeted with the evolution of the ovum (8. 10.). These granules are present in largest quantity in the ovisac of Mammalia; yet granules essentially the same exist at an early period in the ovisae of Birds (32. 33.), and are sometimes met with in that of Fishes (34. 42.).

104. A continual disappearanee of ova, and the formation of others, are observable even at a very early age (60.).

105. The ovum of Mammalia when eompletely formed is at first situated in or near the *centre* of the ovisac (75.).

106. It is at this period supported in the centre of the ovisac by an equable diffusion of granules throughout the fluid of the latter (76.).

107. The ovisac about the same time begins to aequire its proper eovering or tunic, by which addition, as already stated, there is eonstituted a Graafian vesicle, and of the latter the ovisae is now the inner membrane. After this period, therefore, it is proper to speak, not of an ovisae, but of a Graafian vesiele (77.).

108. The peeuliar granules of the Graafian vesicle arrange themselves to form three structures, viz. the *membrana granulosa* of authors, and two structures not hitherto described, one of which it is proposed to name the *tunica granulosa*, and the other, which is rather an assemblage of structures than a single structure, the *retinacula* (78. 79. 82—Note.).

109. The tuniea granulosa is a spherieal covering proper to the ovum, and explains why the outer line in the double contour of the thick chorion, that is, the external surface of this membrane, remained so long unobserved. At a certain period, this tunic, in some animals at least, is seen to have tail-like appendages consisting of granules similar to its own (64—71.).

110. The retinacula consist of a central mass containing the ovum in its tunica granulosa, and of cords or bands extending from this central mass to the membrana granulosa. These structures at a certain period become invested by a membrane (80—84.).

111. The office of the retinacula appears to be, first, to suspend the ovum in the fluid of the Graafian vesicle; next, to convey it to a certain part of the periphery of this vesicle; subsequently to retain it in the latter situation; and finally, to promote its expulsion from the ovary (80—88.).

112. The particular part of the periphery of the Graafian vesicle to which the ovum is conveyed, is uniformly that directed towards the surface of the ovary (85.).

113. The mass of granules escaping with the ovum on the bursting of a Graafian vesicle under the compressor, is composed chiefly of the tunica granulosa and the ruptured retinacula (64. 81.).

114. The "cumulus" of Professor Baer is made up of the parts here called the tunica granulosa and the central portion of the retinacula; and the band-like portions, collectively, of what are here called the retinacula, mainly contribute to produce the appearance denominated the "flat disc" by that author (91.).

115. In Mammals a thick and highly transparent membrane, the true chorion, is formed external to the proper membrane of the yelk, while the latter is in the ovary. The inner part of the substance of the chorion in its early stages is in a fluid state, but it subsequently acquires more consistence. There is not any corresponding structure *within the ovary* of other vertebrated animals; so that the body expelled from that organ in the latter, is not (as in Mammalia) a true ovum, but a yelk-ball (52—56.).

116. The following appears to be the order of formation, as to time, of the more permanent parts of the ovum and the Graafian vesicle, in Mammalia, viz.

1. The germinal vesicle, with its contents (12—22.).
2. An envelope consisting of oil-like globules and peculiar granules (14—16.).
3. The ovisac, which forms around this envelope (23.).
4. The yelk, which forms within the ovisac around the germinal vesicle (24.).
5. The proper membrane of the yelk, which makes its appearance while the yelk is still in an incipient state (24. 49.).
6. The chorion (24. 52.).
7. The proper covering or tunic of the ovisac (77.); and about the same time the peculiar granules of the ovisac arrange themselves (78. 79.) to form,
   - The tunica granulosa (64.),
   - The retinacula (80.), and
   - The membrana granulosa (72.).

117. Such of these structures as are present in other vertebrated animals originate in the same order as to time (27—47.).

118. *Table of Measurements.*

The measurements are given in fractions of a Paris line (‴), the micrometer used, one of Frauenhofer's, being divided according to French measure. The French inch (of twelve lines) is to the English inch, as 1·06575 is to 1·00000, or nearly one fifteenth more. Assuming it to be exactly one fifteenth more, the simplest mode of converting the fraction of a French *line* into the fraction of an English *inch*, will be to multiply the denominator of the former by the number 11·25 (or $11\frac{1}{4}$). Thus, the actual length of the smallest ovisac in fig. 9. from the Dog, measuring $\frac{1}{100}$th of a Paris line, is found to be $\frac{1}{112.5}$th of an English inch.

The compressor having been generally used in these researches, some allowance must be made on this account, the actual size of the objects *h* and *h i* being rather below the measurements given in the Table.

When the object is elliptical, it is the long diameter the measurement of which is given in the Table.

No. of Figure.	Animal.	Diameters magnified.	Actual Dimensions.					
			b. Germinal spot.	*c*. Germinal vesicle.	*f*. Chorion (ovum).	*g*[1]. Tunica granulosa.	*h*. Ovisac.	*h i*. Graafian vesicle, or corresponding structure.
1.	Rabbit.....	440	$\frac{1}{325}$	$\frac{1}{150}$ to $\frac{1}{225}$				
2†.	Cat	440						
3‡.	Cat	440						
4.	Ox (Heifer)....	100	.....	.....	.....	.....	$\frac{1}{60}$ to $\frac{1}{225}$, majority about $\frac{1}{150}$.	
5.	Sheep	60	.....	.....	.....	.....	$\frac{1}{300}$ to $\frac{1}{200}$, $\frac{1}{25}$	
6.	Cat	100	.....	.....	.....	.....	$\frac{1}{150}$ and upwards.	
8.	Cat	440	.....	.....	.....	.....	$\frac{1}{150}$	
9.	Dog	440	.....	.....	.....	.....	$\frac{1}{100}$ to $\frac{1}{225}$	
10.	Cat	240	.....	.....	.....	.....	$\frac{1}{150}$ to $\frac{1}{117}$	
11§.	Man.....	440	.....	.....	.....	.....	$\frac{1}{225}$	
12.	Man.....	150	.....	.....	.....	.....	$\frac{1}{225}$ and upwards.	
13.	Cat	440	$\frac{1}{900}$	$\frac{1}{150}$	.....	.....	$\frac{1}{225}$	
14.	Hog	240	.....	$\frac{1}{110}$	.....	.....	$\frac{1}{225}$	
15.	Hog	240	.....	.....	.....	.....	$\frac{1}{225}$	
16.	Hog	240	.....	.....	.....	.....	$\frac{1}{117}$	
17‖.	Cat	440	$\frac{1}{300}$	$\frac{1}{150}$	$\frac{1}{112}$	.....	$\frac{1}{117}$	
22.	Pigeon	440	.....	$\frac{1}{200}$ to $\frac{1}{175}$	.....	.....	$\frac{1}{133}$ to $\frac{1}{225}$	
23.	Common Fowl..	440?	.....	$\frac{1}{100}$	.....	.....	$\frac{1}{170}$	

† The whole object $\frac{1}{175}$‴. ‡ The whole object $\frac{1}{150}$‴. § The peculiar granules $\frac{1}{100}$‴.

‖ Oil-like globules, some of them $\frac{1}{200}$‴ and upwards. The peculiar granules, mean length $\frac{1}{150}$‴.

Table of Measurements. (Continued.)

No. of Figure.	Animal.	Diameters magnified.	Actual Dimensions.					
			b. Germinal spot.	*c*. Germinal vesicle.	*f*. Chorion (ovum).	g^1. Tunica granulosa.	*h*. Ovisac.	*h i*. Graafian vesicle, or corresponding structure.
24.	Common Fowl..	440	.....	.....	.....	.....	$\frac{1}{17}$	
25.	Common Fowl..	440	.....	.....	.....	.....	$\frac{1}{14}$	
26.	Common Fowl..	100	.....	.....	.....	.....	.....	$\frac{1}{5}$
27.	Frog.....	?	.....	.....	.....	.....	$\frac{1}{30}$	
28†.	Frog.....	100	.....	$\frac{1}{14}$ to $\frac{1}{13}$	.....	.....	$\frac{1}{8}$	
29.	Frog.....	60	.....	$\frac{1}{8}$	.....	.....	$\frac{2}{5}$	
30.	Salmon	240	.....	$\frac{1}{30}$ and less				
31.	Cod	100	.....	$\frac{1}{100}$ to $\frac{1}{25}$	.....	.....	$\frac{1}{40}$ to $\frac{1}{10}$	
32.	Whiting	100	.....	$\frac{1}{25}$ to $\frac{1}{20}$	.....	.....	$\frac{1}{8}$ to $\frac{1}{5}$	
33.	Haddock	100	.....	$\frac{1}{60}$	.....	.....	$\frac{1}{20}$	
34.	Turbot	240	.....	$\frac{1}{20}$	.....	.....	$\frac{1}{10}$	
35.	Salmon	240	.....	.....	.....	.....	$\frac{1}{10}$ to $\frac{1}{8}$	
36.	Salmon	100?	.....	.....	.....	.....	.....	$\frac{1}{3}$
37.	Salmon	25	.....	.....	.....	.....	.....	$\frac{4}{5}$
39.	Dog	60	.....	.....	$\frac{1}{17}$	$\frac{1}{14}$	.....	$\frac{1}{3}$
40.	Mole	100	.....	.....	$\frac{1}{17}$	$\frac{1}{14}$	.....	$\frac{1}{5}$
41.	Mole	440	$\frac{1}{250}$	$\frac{1}{70}$	$\frac{1}{20}$	$\frac{1}{18}$	$\frac{1}{8}$	
42.	Mole	240	.....	$\frac{1}{60}$	$\frac{1}{14}$	$\frac{1}{12}$		
43.	Sheep	240	$\frac{1}{150}$	$\frac{1}{40}$	$\frac{1}{14}$	$\frac{1}{10}$		
44.	Dog	440	.....	.....	$\frac{1}{12}$	$\frac{1}{9}$		
45.	Hog.....	150	.....	.....	$\frac{1}{10}$	$\frac{1}{13}$		
46.	Hog.....	100	.....	.....	$\frac{1}{10}$	$\frac{1}{10}$		
47.	Dog	150	.....	.....	$\frac{1}{14}$	$\frac{1}{11}$		
64.	Hog	100	.....	.....	.....	.....	.....	$\frac{1}{4}$
65.	Mouse	100	.....	.....	$\frac{1}{30}$	.....	.....	$\frac{1}{10}$
66.	Dog	100	.....	.....	$\frac{1}{32}$ to $\frac{1}{16}$	.....	.....	$\frac{1}{3}$
67‡.	Rabbit	100	$\frac{1}{45}$	$\frac{1}{15}$	$\frac{1}{5}$	.....	.....	$\frac{1}{4}$
68.	Dog	?	.....	.....	.....	.....	$\frac{1}{30}$ to $\frac{1}{5}$	$\frac{1}{4}$ to $\frac{1}{3}$
69.	Sheep	60	$\frac{1}{250}$	$\frac{1}{50}$	$\frac{1}{20}$	.....	$\frac{2}{5}$	
71§.	Hog.....	100						
74.	Hog.....	60	.....	.....	$\frac{1}{30}$ to $\frac{1}{20}$	.....	$\frac{1}{4}$ to $1\frac{1}{4}$	
75.	Dog	100	.....	.....	.....	.....	$\frac{1}{50}$ to $\frac{1}{20}$	$\frac{1}{2}$
76.	Pigeon.....	60	.....	.....	.....	.....	$\frac{1}{30}$	$\frac{1}{3}$
79‖.	Ox (Heifer)....	25						

† The spots, marked *d'*, $\frac{1}{25}'''$.

‡ The ovum in this instance was enlarged, and probably in the course of being absorbed.

§ g^3, Membrana granulosa $\frac{1}{75}'''$ in thickness.

‖ *h*, Proper membrane of the parasitic ovisac (incipient Graafian vesicle?) $\frac{1}{5}'''$ in thickness; its cavity $1\frac{1}{2}'''$ in length when crushed.

119. Explanation of the Plates.

N.B. In all the figures the same letters denote the same objects, the alphabetical order of these letters corresponding with the order of position of the parts in proceeding outwards from the centre of the ovum: viz.

a. Fluid, or granulous fluid, of the germinal vesicle.
b. Germinal spot or germinal spots.
c. Germinal vesicle.
d. Yelk.
d'. Spot on the internal surface of the membrana vitelli in the Frog.
e. Membrana vitelli.
f. Chorion,—also ovum.
g. Peculiar granules, first constituting the envelope of the germinal vesicle, next contained in the fluid of the ovisac, and lastly arranging themselves to form:
g^1. Tunica granulosa.
g^2. Retinacula.
g^3. Membrana granulosa.
h. Ovisac, or proper membrane of the ovisac.
i. Proper covering or tunic of the ovisac,—also blood-vessels.
h i. Graafian vesicle, or corresponding structure (capsule) (consisting of *h* + *i*).
k. Stroma, Parenchyma, substance in which the ovisac is imbedded, or couch.
l. Peritoneum.
i k l. Pedicle (formed by the union of *i*, *k* and *l*).
xx. "Stigmate" of Baer.
* Oil-like globules.
*g**. Isolated spots (consisting chiefly of *g* + *).

PLATE V.

Fig. 1. Rabbit (*Lepus Cuniculus*, Linn.). Very early stages in the formation of the ovum (14.). *c*. The germinal vesicle containing (*a*) fluid, and in one instance (*b*) a well-marked spot. These germinal vesicles measured from $\frac{1}{150}'''$ to $\frac{1}{50}'''$ (Paris line) in their long diameter. *g*. An envelope of peculiar granules (14.). The ovisac is not yet formed. Compare with fig. 2. from the Cat, and figs. 19. and 20. from the Pigeon. 440 *diameters*.

Fig. 2. Cat (*Felis Catus*, Linn.). Stages in the formation of the ovum (16.) nearly corresponding to some of those seen in fig. 1., but the germinal vesicle in this instance is concealed (12. 24.). *g*. Envelope of peculiar granules;

*. oil-like globules added to the envelope of granules: these objects measured $\frac{1}{75}'''$ (Paris line) in length. 440 *diam.*

Fig. 3. Cat (*Felis Catus*, Linn.). Stages more advanced (16.). These objects measured $\frac{1}{50}'''$ (Paris line) in length. 440 *diam.*

Fig. 4. Ox (*Bos Taurus*, Linn.). More than a hundred parasitic ovisacs (*h*) (57.) in the field of view $\frac{1}{60}'''$ to $\frac{1}{25}'''$ (Paris line) (4.). In several of these ovisacs the germinal vesicle is visible. 100 *diam.*

Fig. 5. Sheep (*Ovis Aries*, Linn.). Ovisacs $\frac{1}{30}'''$ to $\frac{1}{20}'''$ (Paris line); one larger, $\frac{1}{5}'''$, containing an ovum. *k*. Stroma. 60 *diam.*

Fig. 6. Cat (*Felis Catus*, Linn.). Ovisacs $\frac{1}{50}'''$ (Paris line) and upwards. 100 *diam.*

Fig. 7. Ditto. Some of the ovisacs seen in the last figure more highly magnified. *g*. Peculiar granules; *b*. germinal spot; *c*. germinal vesicle.

Fig. 8. Ditto. Two of the same ovisacs still more magnified. 440 *diam.*

Fig. 9. Dog (*Canis familiaris*, Linn.). Ovisacs $\frac{1}{100}'''$ and upwards (in outline only). *g*. Peculiar granules, nearly as large as some of their containing ovisacs; *h*. proper membrane of the ovisac, very thick, and presenting folds in its contour (2. 7.). 440 *diam.*

Fig. 10. Cat (*Felis Catus*, Linn.). Parasitic ovisacs (57.) $\frac{1}{50}'''$ to $\frac{1}{17}'''$. *h*. Proper membrane of the ovisac (7.); *g*. peculiar granules; *c*. germinal vesicle. Compare with fig. 21. from the Pigeon, and fig. 32. Plate VI. from the Whiting. 240 *diam.*

Fig. 11. Man. Ovisac $\frac{1}{25}'''$. *g*. Peculiar granules; *h*. proper membrane of the ovisac. 440 *diam.*

Fig. 12. Ditto. Ovisacs $\frac{1}{25}'''$, and upwards; the minuter ones more spherical (3.) than the one in the last figure. The germinal vesicle (*c*) is visible in the largest of the ovisacs. 150 *diam.*

Fig. 13. Cat (*Felis Catus*, Linn.). Parasitic ovisacs (57.): the smallest $\frac{1}{50}'''$, the largest $\frac{1}{25}'''$. *b*. Germinal spot; *c*. germinal vesicle; *. oil-like globules; *h*. proper membrane of the ovisac. 440 *diam.*

Fig. 14. Hog (*Sus Scrofa*, Linn.). Ovisac $\frac{1}{25}'''$. *. Oil-like globules surrounding the minute germinal vesicle; *g*. peculiar granules; *h*. proper membrane of the ovisac. 240 *diam.*

Fig. 15. Ditto. Incipient yelk (oil-like globules (*) and fluid). The germinal vesicle is concealed. *g*. Peculiar granules; *h*. proper membrane of the ovisac. Compare with figs. 22. 23. and 24. from Birds. 240 *diam.*

Fig. 16. Ditto. Membrana vitelli (*e*) partly visible. *. Oil-like globules, some of which closely surround and conceal the minute germinal vesicle; *h*. ovisac. Compare with fig. 25. from the common Fowl; fig. 34. Plate VI. from the Turbot; and fig. 35. Plate VI. from the Salmon. 240 *diam.*

Fig. 17. Cat (*Felis Catus*, Linn.). Thick and transparent chorion (*f*) just formed (52—56.). *e*. Membrana vitelli almost concealed by the chorion (the

separate existence of the former is seen in two places (49.)); *b.* germinal spot; *c.* germinal vesicle; *. oil-like globules in the yelk, which consisted besides of a pellucid fluid and minute granules; *g.* peculiar granules; *h.* ovisac. No appearance yet of either the tunica granulosa (64.), the retinaeula (80.), the membrana granulosa (72.), or the proper covering of the ovisac (77.). 440 *diam.*

Fig. 18. Pigeon (*Columba livia*, Linn.). A very early stage in the formation of the ovum (15.). *c.* Germinal vesicle; *a.* its contents; *. oil-like globules†. Compare with fig. 30. Plate VI. from the Salmon. 440 *diam.*

Fig. 19. Ditto. This figure corresponds to fig. 1. from the Rabbit, and fig. 2. from the Cat (15.). *g.* Envelope of peculiar granules; *c.* germinal vesicle; *. oil-like globules†. 440 *diam.*

Fig. 20. Ditto. Proper membrane of the ovisac (*h.*) in the course of formation around (*g.*) the envelope of peculiar granules (23.). This appears to be the stage succeeding that represented by the larger objects in fig. 1. from the Rabbit, and by those in fig. 3. from the Cat†. 440 *diam.*

Fig. 21. Ditto. A multitude of ovisaes. Compare with fig. 10. from the Cat, and fig. 32. Plate VI. from the Whiting. 150 *diam.*

Fig. 22. Ditto. Incipient yelk (24.), consisting of oil-like globules (*) and a pellucid fluid. *c.* Germinal vesicle; *h.* ovisac. Compare with fig. 15. from the Hog. 440 *diam.*

Fig. 23. Common Fowl (*Phasianus Gallus*, Linn.). Incipient yelk (24.), consisting of oil-like globules (*) and a pellucid fluid. *c.* Germinal vesicle; *g.* peculiar granules; *h.* ovisae, $\frac{1}{20}'''$. Compare with fig. 15. from the Hog. 440 (?) *diam.*

Fig. 24. Ditto. The yelk (*d*) just formed (consisting of oil-like globules and a fluid), but the membrana vitelli not visible. *h.* Ovisac, $\frac{1}{17}'''$. The fluid of the ovisae is obscurely granulous. 440 *diam.*

Fig. 25. Ditto. Membrana vitelli (*e*) now visible. The yelk (*d*) consists still for the most part of oil-like globules and a pellucid fluid. *h.* Ovisac. Compare with fig. 16. from the Hog; fig. 34. Plate VI. from the Turbot; and fig. 35. Plate VI. from the Salmon. 440 *diam.*

Fig. 26. Ditto. An ovisae acquiring a proper covering or tunic, the union constituting the structure *h i* (47.), still very transparent. The yelk is seen escaping through the pedicle, which in this instance it has ruptured (32 Note). *e.* Membrana vitelli; *g.* peculiar granules. 100 *diam.* See the ideal section Plate VI. fig. $38\frac{1}{2}$.

Fig. $26\frac{1}{2}$. Cat (*Felis Catus*, Linn.). Oil-like globules (*) accumulated on the peculiar granules (*g*) of the ovisac. (Plate VIII. fig. 66. presents the same objects in less number, and therefore appearing as isolated spots, *g**).

† The objects represented in figs. 18. 19. and 20. were found lying among ovisaes apparently just formed.

PLATE VI.

Fig. 27. Frog (from R. Wagner). *h.* Ovisac, $\frac{1}{50}'''$, ("chorion" of Wagner (34.)); *b.* germinal spots, *many* in the *naked* Amphibia (R. Wagner); *c.* germinal vesicle; *e.* membrana vitelli; *d.* yelk, pellucid at this period.

Fig. $27\frac{1}{2}$. *Coluber Natrix* (from R. Wagner). *b.* Germinal spot, *single* in the *squamous* Amphibia (R. Wagner); *c.* germinal vesicle; *d.* yelk, in its membrane; *h.* ovisac ("chorion" of Wagner (34.)).

Fig. 28. Frog (*Rana temporaria*, Linn.). A spot (*d'*), generally elliptical, and in this instance $\frac{1}{25}'''$ in length, which I always find on the internal surface of the membrana vitelli of the Frog in ovisacs of about this size ($\frac{1}{5}'''$) (40.). *b.* Germinal spots; *c.* germinal vesicle; *d.* yelk; *e.* membrana vitelli; *h.* ovisac. 100 *diam.*

Fig. 29. Ditto. The membrana vitelli (*e*) rendered visible by maceration†. *c.* The germinal vesicle, indistinctly seen in the centre of (*d*) the yelk; *e.* membrana vitelli; *h.* ovisac. 60 *diam.*

Fig. 30. Salmon (*Salmo Salar*, Linn.). A very early stage in the formation of the ovum, nearly corresponding to figs. 18. and 19. Plate V. from the Bird, and to figs. 1. 2. and 3. Plate V. from Mammals (17.). *c.* Germinal vesicles, the largest $\frac{1}{50}$th of a Paris line in diameter; their contents consisting chiefly of minute oil-like globules of a yellowish colour. Compare these vesicles with the germinal vesicles in fig. 35. from the same fish. One of the germinal vesicles in fig. 30. has another vesicle external to it. Is this a minute ovisac just formed? (See the manner of origin of the ovisac (23.)). 240 *diam.*

Fig. 31. Cod (*Gadus Morrhua*, Linn.). Ovisacs, $\frac{1}{40}'''$ to $\frac{1}{10}'''$; the contour in folds (34.). The yelk is not yet visible, being pellucid at this period. *b.* Germinal spots, *many* in osseous Fishes (R. Wagner); *c.* germinal vesicle, its fluid tinged with yellow; *. oil-like globules; *h.* ovisac. 100 *diam.*

Fig. 32. Whiting (*Gadus Merlangus*, Linn.). Ovisacs $\frac{1}{7}'''$ to $\frac{1}{5}'''$; the contour in folds (34.). *c.* Germinal vesicle; *g.* peculiar granules in the fluid of the ovisac (8.); *h.* proper membrane of the ovisac; *d.* incipient yelk (24.). 100 *diam.*

Fig. 33. Haddock (*Gadus Æglefinus*). The yelk (*d*) now visible as well as its proper membrane (*e*). *b.* Germinal spots; *c.* germinal vesicle; *h.* proper membrane of the ovisac. 100 *diam.*

Fig. 34. Turbot (*Pleuronectes maximus*, Linn.). Membrana vitelli (*e*) now visible. *c.* Germinal vesicle; *h.* ovisac; *d.* the yelk, consisting of oil-like globules immediately around the germinal vesicle, and of granules on the internal

† As recommended by R. Wagner.

surface of the membrana vitelli. Compare with fig. 25. Plate V. from the common Fowl, and fig. 16. Plate V. from the Hog. 240 *diam.*

Fig. 35. Salmon (*Salmo Salar*, Linn.). Ovisacs and their contents in nearly the same state as those in the last figure. *g.* Some of the peculiar granules (8.) are seen in the fluid of the ovisac (34.). Compare with fig. 25. Plate V. from the common Fowl, and fig. 16. Plate V. from the Hog.

Fig. 36. Ditto. The ovisac (*h*) acquiring a proper covering or tunic (*i*) (47.). In this instance two minute ovisacs are included by the covering (57.), their situation here being within the incipient pedicle. 100 (?) *diam.*

Fig. 37. Ditto. The same objects (*h i*) in a more advanced stage, but the covering still very transparent. The vesicles have been crushed, and the yelk is seen escaping through the pedicles, taking with it its proper membrane (*e*). 25 *diam.* See the ideal section, Plate VI. fig. 38½.

Fig. 38. Ditto. The perfect calyx with its pedicle. 25 *diam.*

Fig. 38½. Bird, &c. Ideal perpendicular section of that portion of the ovary which is called the calyx, and its contents. *d.* The yelk surrounded by its proper membrane, *e*; *h.* lining membrane of the calyx. (This lining membrane of the calyx was originally the independent ovisac.) *i.* Vascular covering or tunic of *h.* (By the union of *h* and *i* there is constituted *h i*, that portion (capsule) of a calyx which is analogous to the Graafian vesicle of Mammals.) *k.* Substance of the ovary; *l.* peritoneum; *i*, *k*, and *l* are reflected off from *h*, thus forming a pedicle *i k l.* This pedicle is comparatively hollow, so that when the calyx is crushed, a portion of the yelk (meeting with least resistance at the point where the reflection above-mentioned takes place,) escapes into it.

Fig. 39. Dog (*Canis familiaris*, Linn.). Granules (*g*) of the Graafian vesicle circumscribed by a distinct line (central portion of the retinaeula?). *g**. Isolated spots; g^3. membrana granulosa; g^1. tunica granulosa; *h i.* Graafian vesicle. 60 *diam.*

Fig. 40. Mole (*Talpa europæa*, Linn.). The same objects with the exception of *g**.

Fig. 41. Ditto. The tunica granulosa (g^1) in the course of formation (68.). *h.* Ovisac; *i.* blood-vessels; *b.* germinal spot (of a yellowish colour); *c.* germinal vesicle; *d.* yelk; *f.* chorion. 440 *diam.*

Fig. 42. Ditto. The tunica granulosa (g^1) removed entire from the Graafian vesicle. *c.* Germinal vesicle in the centre of (*d*) the yelk; *f.* chorion.

Fig. 43. Sheep (*Ovis Aries*, Linn.). The tunica granulosa removed almost entire from the ovisac. *b.* Germinal spot; *c.* germinal vesicle; *d.* yelk; *f.* chorion. 240 *diam.*

Fig. 44. Dog (*Canis familiaris*, Linn.). The tunica granulosa (g^1) very highly magnified; most of its granules presenting very distinctly a nucleus, and some of them being very globular in form (9.). *d.* Yelk; *f.* chorion. At

one part of the surface of the yelk is seen a pellucid space, which is the situation of the germinal vesicle. This figure presents the state of the ovum when absorption is commencing (60. Note.). 440 *diam.*

Fig. 45. Hog (*Sus Scrofa*, Linn.). The tunica granulosa (g^1) removed entire from the ovisac, with some adherent granules, which form part of the ruptured retinacula (g^2). *b.* Germinal spot; *c.* germinal vesicle; *d.* yelk; *f.* chorion. 150 *diam.*

Fig. 46. Ditto. The tunica granulosa (g^1) relatively thicker than the last, from a loosening of its granules by incipient liquefaction (g^2). Adherent granules of the ruptured retinacula. A pellucid space is seen at one part of the surface of (*d*) the yelk, which is the situation of the germinal vesicle. This figure presents an early stage in the absorption of the ovum (60. Note.).

Fig. 47. Dog (*Canis familiaris*, Linn.). The tunica granulosa (g^1) removed entire from the ovisac, with part of the ruptured retinacula (g^2) adherent. *d.* yelk; *f.* chorion. 150 *diam.*

PLATE VII.

Fig. 48. Dog (*Canis familiaris*, Linn.). Incipient separation of the granules from the fluid of the ovisac (78.). g^2. First appearance of the retinacula; *d.* yelk, the only portion of the ovum in this instance visible from the exterior of (*h i*) the Graafian vesicle. 60 *diam.*

Fig. 49. Guinea Pig (*Cobaya Aperea*, Cuv.). The same objects in a stage more advanced (78.). g^1. Tunica granulosa. 150 *diam.*

Fig. 50. Rabbit (*Lepus Cuniculus*, Linn.). A stage still more advanced (79.). The peculiar granules of the Graafian vesicle (*h i*) are now seen to have become arranged into three incipient structures, viz. g^1. the tunica granulosa (64.); g^2. the retinacula (80.); g^3. the membrana granulosa (72.); *f.* the chorion. 100 (?) *diam.*

Fig. 51. Sheep (*Ovis Aries*, Linn.). The retinacula (g^2) supporting the ovum (*f*) in the centre of (*h i*) the Graafian vesicle (80.). The tunica granulosa, though probably formed, is not distinctly visible. 60 *diam.*

Fig. 52. Ox (*Bos Taurus*, Linn.). The same objects, together with (g^1) the tunica granulosa. 100 *diam.*

Fig. 53. Ditto. The retinacula (g^2) removed from the Graafian vesicle. g^1. Tunica granulosa; *f.* chorion (ovum). 100 *diam.*

Fig. 54. Dog (*Canis familiaris*, Linn.). The same objects, though in this figure the membrane of the central portion of the retinacula (g^2) is closely applied to, and hence scarcely distinguishable from, the tunica granulosa (g^1) (88. Note). *c.* Germinal vesicle in the centre of the yelk. 100 *diam.*

Fig. 55. Ox (*Bos Taurus*, Linn.). The ovum (*f*) approaching the periphery of

(*h i*) the Graafian vesicle, being conveyed by (g^2) the retinacula. g^1. Tunica granulosa; g^3. membrana granulosa. Contrast with fig. 62. Plate VII. and with fig. 80. Plate VIII. from Baer (62. 63. 91.). The "cumulus" of Baer (central portion of the retinacula) is well seen in this figure. 60 *diam.*

Fig. 56. Ox (*Bos Taurus*, Linn.). The ovum (*f*) (in its tunica granulosa) at the periphery of (*h i*) the Graafian vesicle, being retained there by (g^2) the retinacula (86.). The other objects as in the last figure. It is the *under* surface of the ovum, &c. that is here seen. 60 *diam.*

Fig. 57. Dog (*Canis familiaris*, Linn.). The ovum (*f*) apparently just reaching the periphery of (*h i*) (a portion of) the Graafian vesicle. g^2. Retinacula; g^1. tunica granulosa; g^3. membrana granulosa, part of which has been removed (86.). 100 *diam.*

Fig. 58. Ferret (*Mustela Furo*, Linn.). The ovum (*f*) at the periphery of (*h i*) the Graafian vesicle. g^2. Retinacula (80.); g^1. tunica granulosa; *c*. germinal vesicle. 100 *diam.*

Fig. 59. Rabbit (*Lepus Cuniculus*, Linn.). The same objects. g^3. Membrana granulosa, part of which has been removed (86.).

Fig. 60. Ox (*Bos Taurus*, Linn.). The under surface of the central portion of the retinacula (g^2) ("*cumulus*" of Baer) at the periphery of (*h i*) the Graafian vesicle. *k*. Adherent stroma.

Fig. 61. Ditto. Fragment of the central portion of the retinacula (g^2), from which the granulous bands have been broken off, yet still containing the ovum in its tunica granulosa (g^1); the latter adherent to the walls of the cavity in which it lies. (The drawing was taken as the object lay under the microscope in a watch-glass.)

Fig. 62. From Baer, "Vésicule de De Graaf (24. 25.) (de grandeur moyenne) d'une truie, grossie dix fois; dissequée suivant son axe.

1. Surtout péritonéal (*l*).
2. Tissu cellulaire (le *stroma*) (*k*).
3. Couche externe (*i*)
4. Couche interne (*h*)
   x. *x*. Stigmate

} de la capsule de la vésicule de De Graaf.

5. Membrane granuleuse (g^3)
6. Fluide contenu
7. Disque proligère (g^2)
8. Ovule (*f*)

} du noyau de la vésicule de De Graaf."

This figure, from Baer, is lettered so as to correspond with the other figures.

Fig. 63. Rabbit (*Lepus Cuniculus*, Linn.). The retinacula (g^2), with their membrane, removed from the Graafian vesicle. g^1. Tunica granulosa, with its tail-like appendages (65.); *f*. chorion (ovum); *d*. yelk; *c*. germinal vesicle; *b*. germinal spot. 240 *diam.*

PLATE VIII.

Fig. 64. Hog (*Sus Scrofa*, Linn.). The ovum in its tunica granulosa (g^1) at the periphery of (*h i*) the Graafian vesicle, retained in this situation by (g^2) the retinacula (86.). 100 *diam.*

Fig. 65. Mouse (*Mus Musculus*, Linn.). The same objects; but the ovum (*f*) in this instance has not reached the periphery of (*h i*) the Graafian vesicle. *c*. The germinal vesicle, relatively very large; *b*. the germinal spot.

Fig. 66. Dog (*Canis familiaris*, Linn.). Four ova in one Graafian vesicle (88. Note), and at or near to its periphery. g^2. Retinacula; the central portion of the retinacula (g^2) reduced to little more than a membrane, which closely surrounds (g^1) the tunica granulosa, and appears to be the cause of the well-defined contour of the latter, as seen *in situ* in this animal (88. Note). g^*. Isolated spots (59.), consisting chiefly of extremely minute oil-like globules accumulated on the peculiar granules of the Graafian vesicle. In this instance these spots were seen to be most numerous around some of the ova. (Plate V. fig. $26\frac{1}{2}$. presents these spots in close aggregation.)

Fig. 67. Rabbit (*Lepus Cuniculus*, Linn.). An appearance frequent in this animal, probably denoting a stage in the absorption of the ovum (60.). *f*. Distended chorion; *d*. altered yelk; *c*. the enlarged germinal vesicle; *b*. the enlarged germinal spot; *h i*. Graafian vesicle. (The tunica granulosa and retinacula have disappeared.) 100 *diam.*

Fig. 68. Dog (*Canis familiaris*, Linn.). A patch of ovisacs (*h*) $\frac{1}{360}'''$ to $\frac{1}{5}'''$ in length, some of them passing into the state of Graafian vesicles, and among these two (*h i*) that have become opake from the coverings acquired. One of the ovisacs contains two ova (88. Note). *g*. Granules of the ovisac (incipient retinacula?).

Fig. 69. Sheep (*Ovis Aries*, Linn.). The cavity in which the ovisac is often found (6.). The ovisac (*h*) having been ruptured, the ovum (*f*) has escaped, and is seen to have become flattened by pressure. The ovum bursting before its exit, left behind its germinal vesicle (*c*). *b*. Germinal spot; *g*. peculiar granules of the ovisac; *k*. substance in which the ovisac is imbedded. 60 *diam.*

Fig. 70. Cat (*Felis Catus*, Linn.). The chorion (*f*) not yet of such consistence as to resist even very gentle pressure, which, applied on one side, has forced the now semifluid substance of the chorion to the other side (53.). *e*. Membrana vitelli (49. 53.); *d*. the yelk in an incipient state. 440 *diam.*

Fig. 71. Hog (*Sus Scrofa*, Linn.). Portion of the membrana granulosa (g^3) removed from the Graafian vesicle (73.). 100 *diam.*

Fig. 72. Man (from Bernhardt). An ovum after maceration (50. 56.). *d*. The yelk; *f*. the chorion. The internal surface of the latter is the "mem-

brana ovuli externa" of BERNHARDT, and its transparent substance is the "spatium pellucidum" of this author. g^1. Ruptured tunica granulosa, the "zona granulosa" of BERNHARDT (Symbolæ, &c., fig. xxiii. pp. 45. 46.).

Fig. 73. Ox (*Bos Taurus*, LINN.). *g*. Some of the peculiar granules of the ovisac with their nucleus. In one instance a single granule presents two nuclei (8. 10.). This granule measured $\frac{1}{1500}$th Paris line in length. 800 *diam.*

Fig. 74. Hog (*Sus Scrofa*, LINN.). A patch of parasitic ovisacs (*h*) (57.) in (*h i*) the parietes of a Graafian vesicle. There is seen in several a tapering at one end (3.). They are all more spherical than when first formed (3.). *f*. The ovum. 60 *diam.*

Fig. 75. Dog (*Canis familiaris*, LINN.). Part of a Graafian vesicle (*h i*), with parasitic ovisacs (57.) (*h*) in its parietes. Compare with fig. 76. from the Pigeon. 100 *diam.*

Fig. 76. Pigeon (*Columba livia*, LINN.). Ovisac with its vascular covering; the union of these two presenting (*h i*) a structure analogous to the Graafian vesicle of Mammals (47.). In the parietes of this structure, and probably *included* (57.) on the acquisition by the ovisac of its covering, are several parasitic ovisacs (*h*). The vesicle has been crushed, but the minute parasitic ovisacs remain unmoved. The yelk has escaped. *g*. Peculiar granules passing slowly out of the vesicle. Compare these with the corresponding granules in Mammalia (8—10.); and compare the parasitic ovisacs in this figure with those in fig. 75. from the Dog. 60 *diam.*

Fig. 77. Ox, Heifer (*Bos Taurus*, LINN.). Ovary, with the outer third of a Graafian vesicle reflected. In the parietes of the Graafian vesicle there is seen transversely divided (*h*) a parasitic ovisac (58.), or incipient Graafian vesicle. *Actual size.*

Fig. 78. Ditto. Enlarged view of the two halves of the divided parasitic ovisac, or incipient Graafian vesicle, seen in fig. 77. *f*. Ovum; g^3. membrana granulosa; *h*. proper membrane of the parasitic ovisac.

Fig. 79. Ditto. Transverse section of the proper membrane (*h*) of the parasitic ovisac, or incipient Graafian vesicle, shown in figs. 77. and 78, here removed from its proper cavity (6.). The membrana granulosa (g^3) has fallen down. 25 *diam.*

Fig. 80. (from BAER). "Ovule avec le disque proligère (g^2) d'une vache, grossie dix fois." Contrast with fig. 55. Plate VI.

PLATE V.

a *Fluid, or granulous Fluid of the Germinal Vesicle.*

b *Germinal Spot.*

c *Germinal Vesicle.*

d *Yelk.*

e *Membrane of the Yelk.*

f *Chorion.*

g *Peculiar Granules of the Ovisac.*

h *Ovisac.*

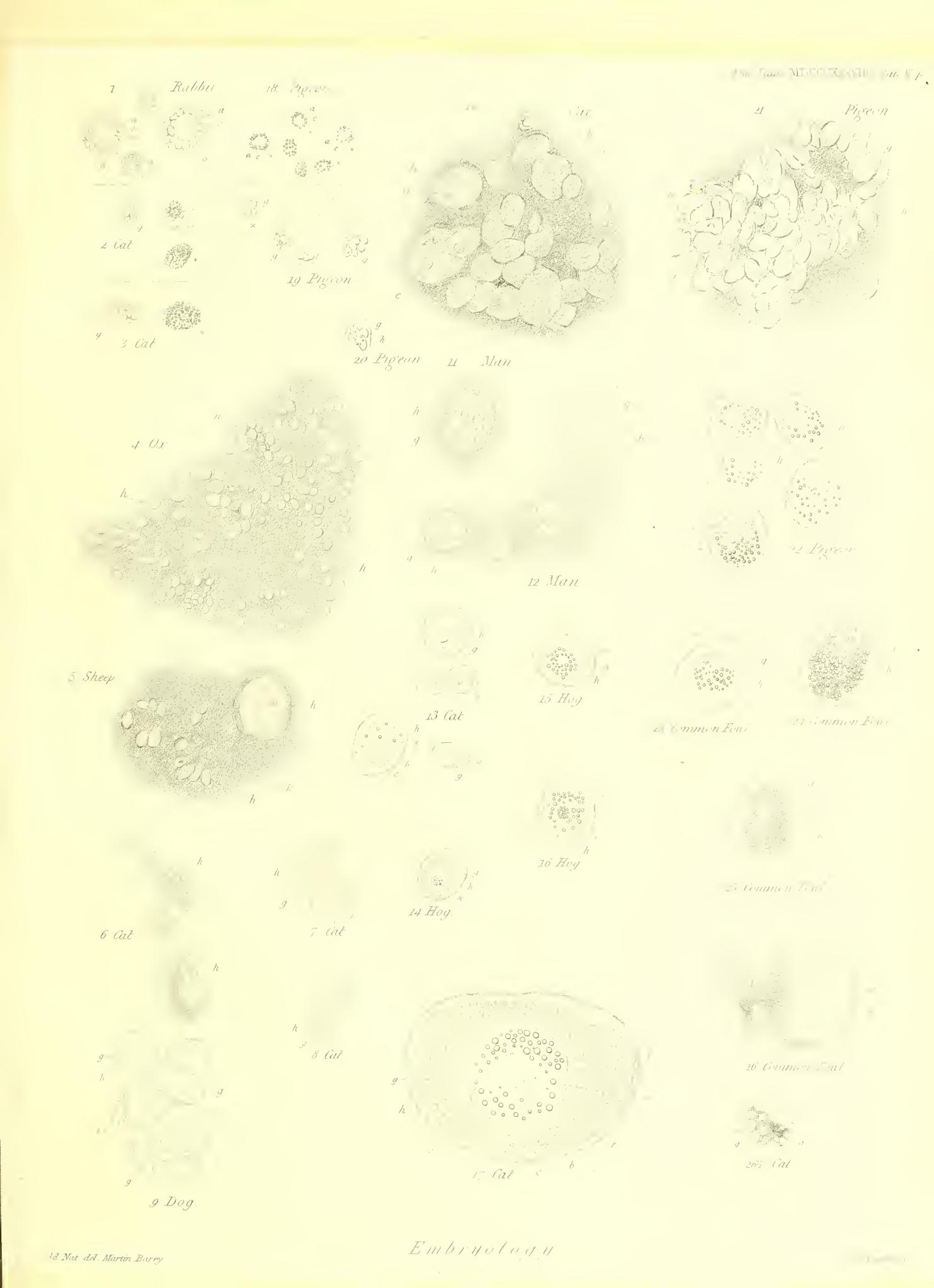
hi *Structure in Birds (Capsule) analogous to the Graafian Vesicle in Mammals.*

k *Stroma.*

※ *Oil-like globules.*

For farther particulars, see

"Description of the Plates."



Embryology

Ad Nat. del. Martin Barry

PLATE VI.

a *Granulous Fluid of the Germinal Vesicle.*

b *Germinal Spot, or Germinal Spots.*

c *Germinal Vesicle.*

d *Yelk.*

e *Membrane of the Yelk.*

f *Chorion.*

g *Peculiar Granules of the Ovisac.*

g[1] *Tunica granulosa.*

g[2] *Retinacula.*

g[3] *Membrana granulosa.*

h *Ovisac ("Chorion" of Wagner in figs. 27 & 27½).*

i *Proper covering of the Ovisac.*

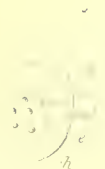
hi *Graafian Vesicle in Mammals, or analogous structure (Capsule) in Fishes.*

k *Stroma.*

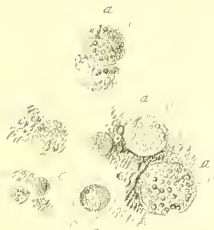
l *Peritoneum.*

※ *Oil-like globules.*

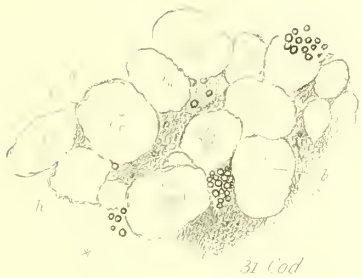
For farther particulars, see
"Description of the Plates."



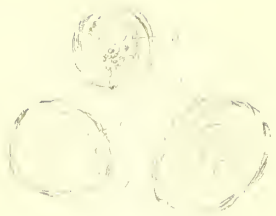
27 Frog (R Wagner)



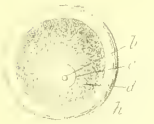
30 Salmon



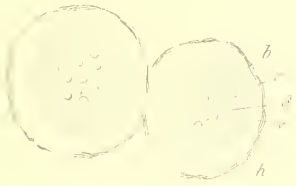
31 Cod



32 Whiting



27t Coluber Natrix (R. Wagner)



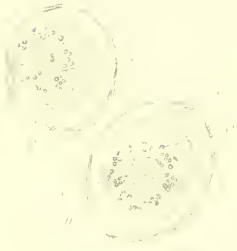
33 Haddock

37 Salmon

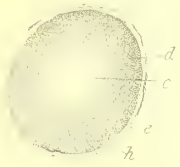
34 Turbot

28 Frog

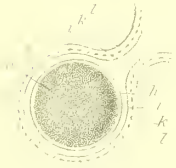
36 Salmon



35 Salmon

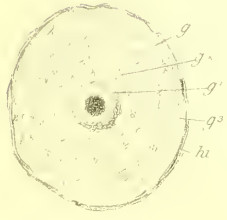


29 Frog

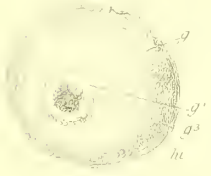


38t Bird &c (Ideal)

38 Salmon

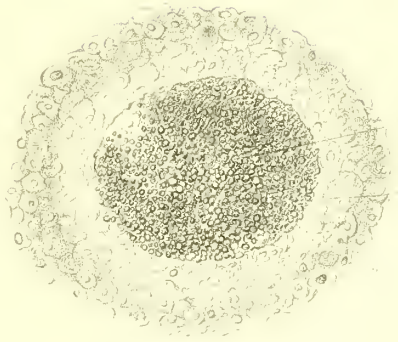


39 Dog

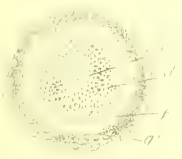


40 Mole

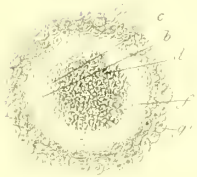
41 Mole



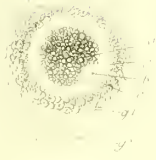
44 Dog



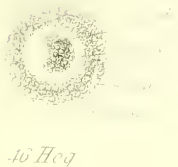
42 Mole



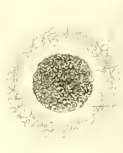
43 Sheep



45 Hog



46 Hog



47 Dog

Embryology.

PLATE VII.

b Germinal Spot.

c Germinal Vesicle.

d Yelk.

f Chorion ("Ovule" of Baer in fig. 62).

g' Tunica granulosa.

g² Retinacula.

g³ Membrana granulosa.

h Ovisac ("Couche interne" of the Graafian Vesicle of Baer in fig. 62).

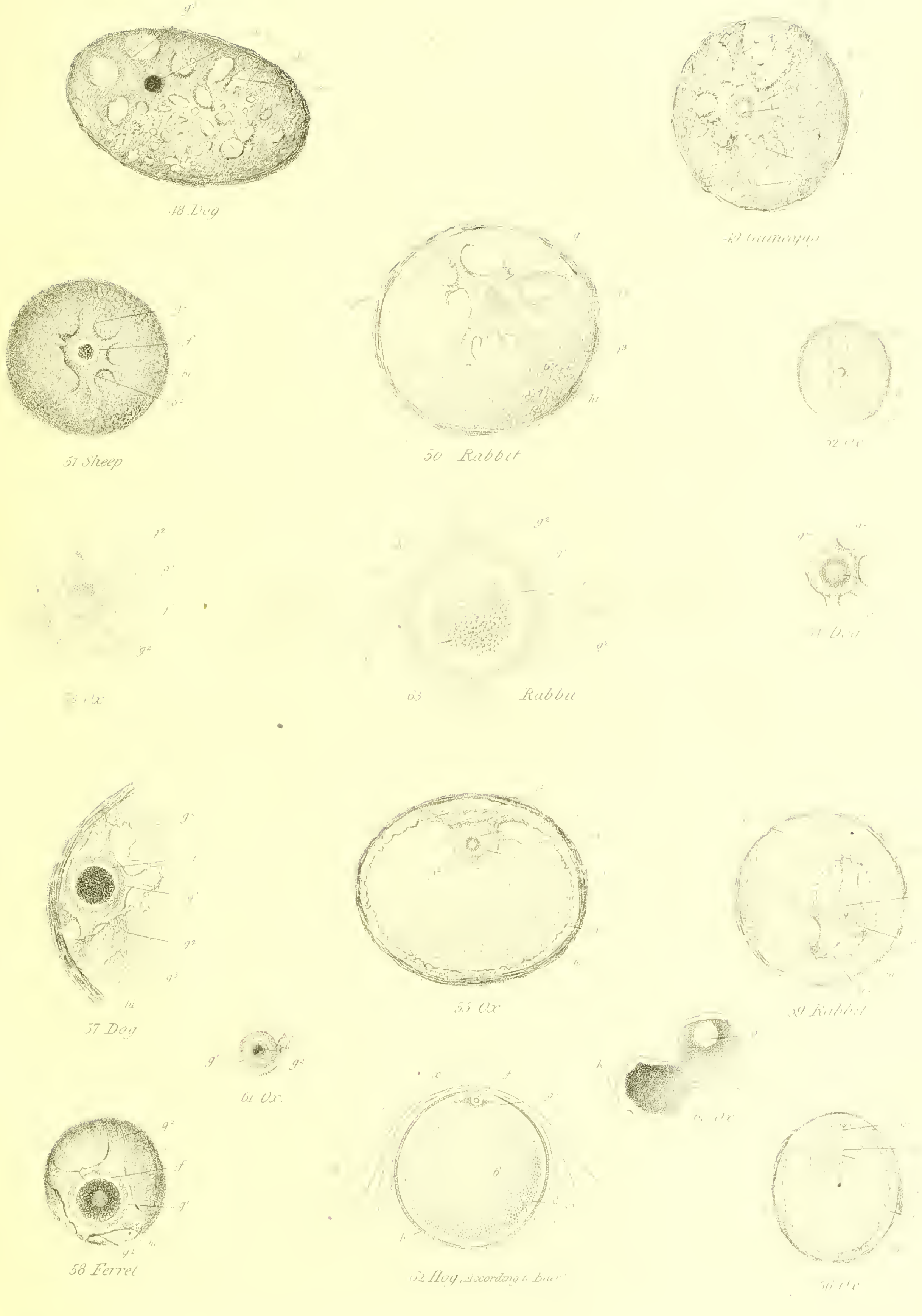
i Proper Covering of the Ovisac ("Couche externe" of the Graafian Vesicle of Baer in fig. 62.)

hi Graafian Vesicle.

k Stroma.

l Peritoneum.

For farther particulars, see "Description of the Plates."



Nat. del. Martin Barry

Embryology.

PLATE VIII.

b Germinal Spot.

c Germinal Vesicle.

d Yelk.

e Membrane of the Yelk.

f Chorion. (Its external surface was mistaken by Baer for a distinct membrane,—"Membrane corticale." Its internal surface in fig. 72 was mistaken by Bernhardt for a distinct membrane,—"Membrana ovuli externa." The substance of the Chorion is the "Halo" of Baer, and the "Spatium pellucidum" of Bernhardt.

g Peculiar Granules of the Ovisac.

*g*¹ Tunica granulosa. } ("Disque proligère" and "Cumulus" of Baer, "Zona granulosa" of Bernhardt.)
*g*² Retinacula. }

*g*³ Membrana granulosa.

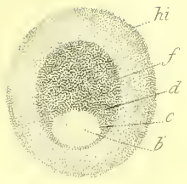
*g** Isolated Spots.

h Ovisac.

hi Graafian Vesicle in Mammals, or analogous Structure (Capsule) in Birds.

k Substance in which the Ovisac is imbedded.

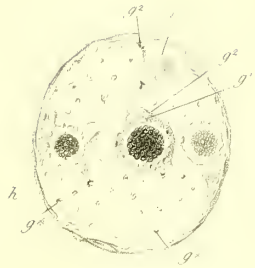
For farther particulars, see "Description of the Plates."



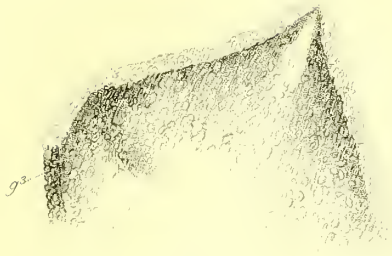
67 Rabbit.

64 Hog.

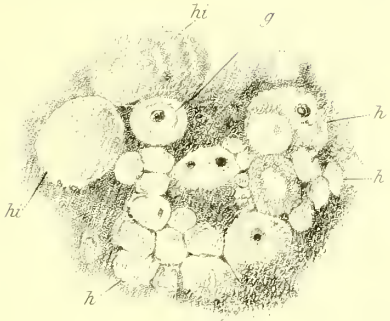
65 Mouse.



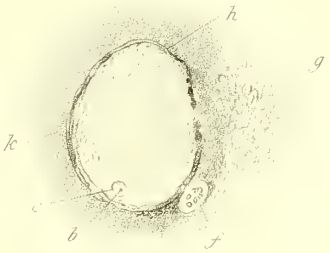
66 Dog.



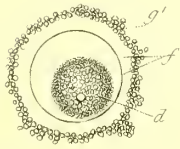
71 Hog.



68 Dog.

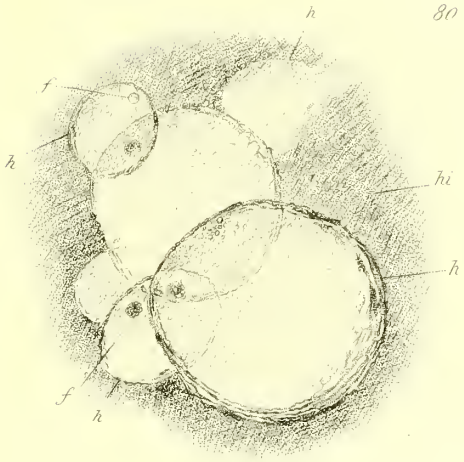


69 Sheep

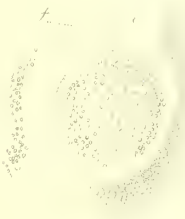


72 Man (Bernhardt.)

80 Ox (According to Baer)



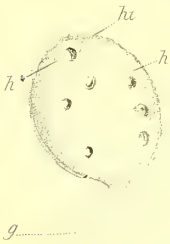
74 Hog



70 Cat

75 Dog.

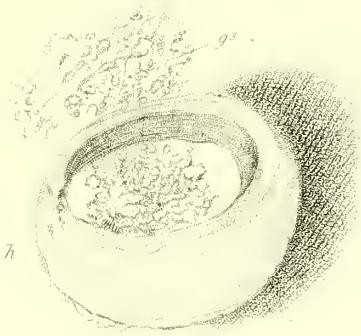
73 Ox.



76 Pigeon.

78 Ox

77 Ox.



79 Ox.

Ad. Nat. del. Martin Barry.

Embryology.