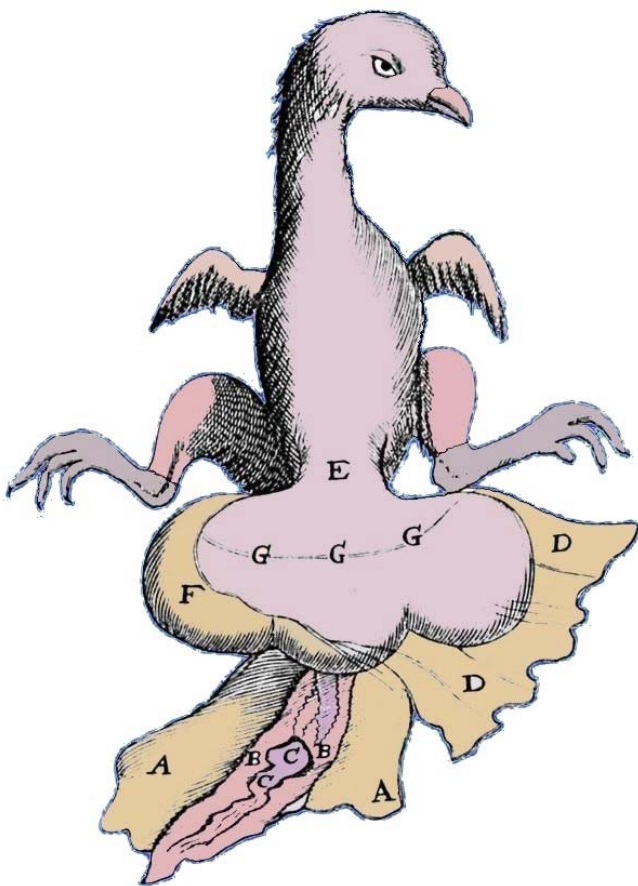


Elio Corti - Fernando Civardi
Roberto Ricciardi – Elly Vogelaar

Marcello Malpighi

Appendix De ovo incubato
Appendix on the incubated egg
October 1672



Transcribed
by
Fernando
Civardi

Translated
by
Elio
Corti

Reviewed
by
Roberto
Ricciardi

The second chick of Marcello Malpighi

English text reviewed by Elly Vogelaar

December 25 - 2010

Appendix De ovo incubato Appendix on the incubated egg

Transcribed by Fernando Civardi
translated by Elio Corti
translation reviewed by Roberto Ricciardi
English text reviewed by Elly Vogelaar
September 2010

The Latin text is drawn from
MARCELLI MALPIGHII OPERA OMNIA
Londini – apud Robertum Scott MDCLXXXVI
but because of some mistakes contained in it
it has been emended with the following source
MARCELLI MALPIGHII OPERA OMNIA
Lugduni Batavorum – apud Petrum Vander MDCLXXXVII

To access this edition
<http://shinku.nichibun.ac.jp/NOMA/new/books/11/suema00000003qu.html>

The footnotes mostly come from
OPERE SCELTE DI MARCELLO MALPIGHI a cura di Luigi Belloni - Torino UTET 1967
The asterisk indicates that the item is present in lexicon of Summa Gallicana

MARCELLI MALPIGHII
Philosophi et Medici BONONIENSIS
e SOCIETATE REGIA
APPENDIX,
Repetitas Auctasque De Ovo Incubato
Observationes continens.

MAGNAE SOCIETATI REGIAE ANGLICANAE
Marcellus Malpighius S.P.

By Marcello Malpighi
philosopher and physician from Bologna belonging to
the Royal Society
APPENDIX CONTAINING
THE REPEATED AND INCREASED
OBSERVATIONS ON THE INCUBATED EGG

Marcello Malpighi very cordially greets
the great Royal English Society.

[1] *Celebris*¹ apud Pictores mos est, *Doctissimi Sodales*, quo perficiendarum imaginum graphidem, primaque in tabulis lineamenta, illico ac e Materno phantasiae sinu excidunt, continuata intuitus irradiatione fovere abstinent, ne statim adolescent; verum ab oculis per longum tempus remota ferari iubent, donec inchoatae prolis in artifice species obliteretur, quam subita postmodum lustratione examinantes absolvunt. Simile quid nobis in contemplandis Naturae primis iconibus peragendum: mihiq; opportunum saltem et necessarium censeo. Sicut enim, eo temporis tractu, aberrationes, et incompta delineamenta, si quae in tabulis extant, illico phantasiam omnino praeiudicii denudatam movent, et ab ea (non adhuc in sui amorem obfirmata) severi iudicii imperio castigantur, et delentur, indeque Naturae magis consona depromuntur: Ita in meditandis Naturae tabulis, rara, sed repetita, indagine comptiora emergunt mysteria,

Very learned Colleagues, among the famous painters a custom is current, hence they abstain from brooding, with penetrating and incessant glances, the profile and the first sketches of the images to be completed in the pictures, as soon as they peep from the maternal womb of their fantasy, so that they don't become quickly adult; but the painters require that for a long time they are resting far from the eyes as long as in the artist is not cancelled the vision of the offspring he sketched, a vision they bring to conclusion examining it subsequently with a quick look. We have to do something similar in contemplating the first images of nature, and, at least for me, I reckon it opportune and necessary. In fact, as during that time the distractions and the unadorned profiles, if present in the paintings, immediately strike a fantasy entirely bare of prejudices, and by it (not yet stiffened in the proper pride) they are punished thanks to the supremacy of a rigorous judgment and are eliminated, and therefore they are brought forth so to be more consistent with

¹ Secondo Roberto Ricciardi questo *celebris* andrebbe associato a *Pictores* anziché a *mos*. Infatti l'aggettivo *celeber*, nominativo maschile, può anche trovarsi sotto la forma *celebris*, ma *celebris* oltre a essere il nominativo femminile di *celeber* potrebbe esserne l'accusativo plurale maschile, quindi da associare a *pictores*.

eliminatis antiquis conceptibus, qui olim *Palladis*² arcem occupabant. Prima igitur Pullorum delineamenta incubatis Ovis (Vobis ita consulentibus) singulo anno inquirenda mihi proposui; quaeque proinde in postrema aggressionem observare contigit, brevibus exarata hic [2] habebitis, pro maiori eorum, quae alias innui, dilucidatione: In re enim tam obscura, in re cui optica instrumenta parum prosunt, cum usus indicaverit rationem separandi cicatriculam a vitello et albumine³, exiguum subdubiae lucis in primorum staminum indagine effulsit.

nature: so when meditating the pictures of nature, with a rare but repeated search, more refined secrets emerge once have been eliminated the ancient concepts formerly occupying the summit of Pallas - the brain of Athena, goddess of the knowledge, then, our knowledge. Therefore (on your suggestion) I proposed to myself the task of investigating every year the first sketches of the chicks in incubated eggs. And what afterwards happened me to observe in the last investigation, you will have here its description in short words, for a larger explanation of what I mentioned another time. In fact in such a dark matter, in a field in which the optic tools are not much helping, since the experience has pointed out the technique to separate the cicatrice from the yolk and from the albumen, in the investigation of the first sketches a slim flash of light shined, on the other hand rather uncertain.

² **ATENA** era la dea greca della sapienza, particolarmente della saggezza, della tessitura, delle arti e, presumibilmente, degli aspetti più nobili della guerra, mentre la violenza e la crudeltà rientravano nel dominio di Ares. Pallade era l'epiteto di Atena, connesso con la sua raffigurazione a mezzo del palladio, specie di manichino porta-armi che nella religione greca arcaica era considerato provvisto di poteri divini, in funzione protettrice del palazzo (età micenea) o della città, e Atena, era la dea poliade, o protettrice della città, per eccellenza. § **ATENEO** deriva dal latino *Athenaeum*, che risale al greco *Athēnaion*, luogo sacro ad Atena, tempio di Atena intesa come dea della sapienza. Nome dato all'istituto per l'insegnamento superiore di alcune discipline umanistiche (filosofia, grammatica, retorica, diritto), fondato a Roma dall'imperatore Adriano (76-138), oggi usato comunemente come sinonimo di università. § **ARX PALLADIS – LA ROCCA DI PALLADE**: il punto di partenza di Arx Palladis sembra essere un'espressione con cui si designava l'ACROPOLI DI ATENE, il PARTENONE e, per estensione, la stessa ATENE: Lucrezio *De rerum natura* VI 749: arcis in ipso vertice, Palladis ad templum Tritonidis almae; Virgilio *Eneide* XI 477: summasque ad Palladis arces; Ovidio *Metamorfosi* VII 399: Palladiae arces (= Athenae); Tito Livio *Ab urbe condita* XXXI 30,8: arcis Minervam praesidens. Nel senso figurato di ECCELLENZA, PERFEZIONE, SOMMITÀ, il sostantivo *arx* è spesso usato, per esempio, in Stazio *Silvae* II 131: celsa tu mentis ab arce; Quintiliano *Institutio oratoria* XII 11,28: Cicerone arcem tenente. L'espressione ricompare nel filosofo Marsilio Ficino (1433-1499) *De vita triplici* I 2: Inde (dal sangue) creati spiritus cerebri et... Palladis arces (= cervello) ascendunt; *Apologia* (scritta contro le accuse di magia): § 6 Nunc vobis, amici, nunc, si nescitis, arx illa Palladis (quella cittadella di Pallade) necessaria fore videtur, qua procul a nobis saevum impiorum Gigantum impetum arceamus – dove, a detta dei commentatori, Ficino scherza con le associazioni di idee suggerite da 'arx Palladis' e che sarebbero le seguenti: 1) la rocca della dea della Saggezza, Pallade Atena, da cui gli 'spirituali' contemplano il movimento dei 'normali', e con la quale possono difendersi dai loro assalti; 2) la rocca di Atene, l'Acropoli; 3) l'Olimpo, in cui anche da Atena fu respinto l'assalto dei Giganti. Alla fine del 1500, forse in memoria di questa definizione, l'umanista olandese Erycius Puteanus (Eric van der Putte 1574-1646) chiamò 'Arx Palladis' il castello dove abitava, nel senso di 'scuola di saggezza', così come aveva chiamato 'palaestra bona mentis' l'accademia scientifica da lui fondata. Tuttavia va ricordato che - come possiamo leggere in *Encyclopédie* (Yvedon 1772) curata da Fortunato Bartolomeo De Felice - 'sacra Palladis arx' è in medicina la 'parte sacra del corpo', ossia LA TESTA, in connessione con la definizione di epilessia (*morbus sacer*) che colpiva appunto la testa. E questo in parte coincide con quanto osservato da Ficino nel *De vita triplici* I 2.

³ Per la tecnica di separazione cfr. GIOVANNI MARIA LANCISI, *De motu cordis et aneurysmatibus*, Roma, 1728, p. 41 (lib. I, sectio II, cap. I, propositio XXIV). – Referenza citata da Luigi Belloni in OPERE SCELTE DI MARCELLO MALPIGHI (Torino UTET 1967).

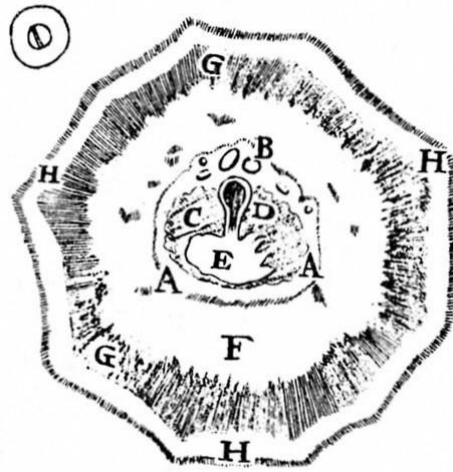


figura 1

Fig. 1. - In Ovo *nondum* incubato, foecundo tamen, non absimilis ab observatis alias et descriptis Cicatricula⁴ aderat, quae inter galazas⁵ collocata, medium locum inter bina Ovi cacumina sortiebatur, eiusque naturalis magnitudo lentem non excedebat. In huius itaque centro circulus candidus *A*, aggeris instar, deprehendebatur, qui superiora versus cum vesiculis *B*⁶ interdum continuari videbatur; in hoc colliquamentum *C* continebatur, in quo pulli carina *D*⁷ candidis delineata zonis⁸ innatabat, quae in summitate quandoque discontinuatae apparebant; contentum vero spatium plumbei coloris ichore⁹ replebatur. Carinae extremitatem sacculus *E*¹⁰ obscurabat.

In an egg not yet incubated, however fertile, a cicatrice was present non dissimilar from those observed other times and described, which, situated among the chalazas, occupied the area lying among the two poles of the egg, and its natural size was not greater than a lentil*. Therefore, in its centre - of cicatrice - a white circle *A* (fig. 1) was seen, like a bank that sometimes seemed to continue toward the upper part with the vesicles *B*. In the circle was contained the colliquation *C*, in which the carina *D* of the chick was floating, edged by candid bands, that sometimes at their summit appeared interrupted. Besides the contained space was full of ichor - of liquid - lead in colour. The pouch *E* was hiding the extremity of the carina. A kind of wide band *F* was

⁴ La cicatricola o cicatricula - piccola cicatrice - è anche detta discoblastula oppure blastoderma. Blastula deriva dal latino scientifico *blastula*, diminutivo del femminile greco *blástē* = germoglio, gemma, rampollo, germe, embrione; equivalente è il maschile *blástos* che ha lo stesso significato. § Cicatricola o cicatricula deriva dal latino tardo *cicatricula* = piccola cicatrice, diminutivo di *cicatrix* = cicatrice. Ristretta zona del polo dell'uovo degli uccelli, dove, subito sotto alla membrana vitellina, si trovano il citoplasma e il nucleo. Dalla cicatricola, detta anche discoblastula o disco germinativo, si svilupperà l'embrione.

⁵ In DE FORMATIONE PULLI IN OVO è presente un più corretto *chalazas/chalazarum*. § L'italiano calaza deriva dal greco *chálaza*, grandine, per l'aspetto particolare dei cordoncini che nell'uovo privato di guscio ricordano due chicchi di grandine; *chálaza* è derivato a sua volta da una radice indeuropea che significa ghiaccio. Le calaze si dipartono da ciascun polo della cellula uovo e sono dirette secondo l'asse maggiore del guscio. Si tratta di strutture cordoniformi avvolte su se stesse. Verso il polo ottuso si dirige una sola calaza, mentre dall'altro lato ne esistono due tra loro intimamente ritorte. Originano a livello dello strato calazifero e terminano da ciascun lato nella regione dei legamenti dell'albume.

⁶ Probabilmente, vacuoli formanti entro o sotto la periferia del germe, in rapporto, forse, col suo processo estensivo attorno al vitello. (Luigi Belloni, 1967)

⁷ Carena, dal latino *carina* (chiglia della nave, guscio della noce), per estensione significa organo animale o vegetale, o parte di esso, che richiama la forma della chiglia di una nave, elemento longitudinale dello scafo, facente parte della struttura del fondo.

⁸ Forse i labbri blastodermici che delimitano la stria primitiva. (Luigi Belloni, 1967)

⁹ Icore: dal greco *ichor, ichōros*. Secondo la mitologia greca, il purissimo sangue degli dei. Nel linguaggio medico, essudato, spesso purulento, secreto da ferite o piaghe infette.

¹⁰ È il nucleo del Pander, o parte svasata della latebra di vitello bianco che forma come un letto al disco germinativo. (Luigi Belloni, 1967) § Christian Heinrich PANDER naturalista ed embriologo nato in Lettonia da genitori tedeschi (Riga 1794 - Pietroburgo 1865). Allievo del medico e naturalista estone Karl Ernst von Baer (Piep 1792 - Dorpat 1876), dimostrò che lo sviluppo dell'embrione del pulcino procede attraverso la formazione di tre strati principali di tessuto, o foglietti germinali (ectoderma, entoderma, mesoderma), dai quali si formano i diversi organi. Si occupò anche di geologia e di paleontologia. Gli studi di embriologia sono contenuti in BEITRÄGE ZUR ENTWICKLUNGSGESCHICHTE DES HÜHNCHENS IM EYE (Contributi alla storia dell'evoluzione del pollo nell'uovo), Brönnner, Würzburg (1817). § Heinz Christian PANDER, name sometimes given as Christian Heinrich Pander (1794-1865) was a biologist and embryologist who was born in Riga. In 1817 he received his doctorate from the University of Würzburg, and spent

Succedebat lata quasi fascia *F*, quae tandem umbilicalis area evadit: Haec partim solida, hacque subvitellina, partim liquida et fusca integrabatur portione, et a colliquamento rivulo *G* ambiebatur, quem angularis zona candida *H* circumdabat.

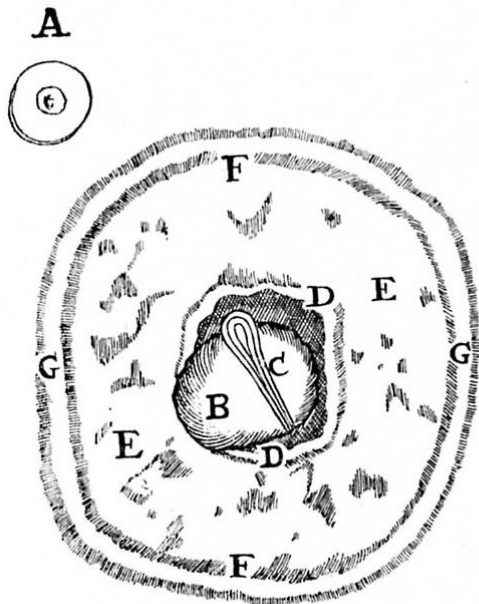


figura 2

Fig. 2. Fig. 3. - In Ovo, elapso *Iulii* mense ab *Indica gallina* incubato, post *horas sex* cicatricula naturalem hanc sortiebatur magnitudinem *A*, in cuius centro vesicula *B*¹¹ irregularibus interdum finibus terminata, diaphanoque turgida humore locabatur. Pulli carinae et capitis¹² inchoamenta zonae speciei *C*¹³ emergebant, in colliquamento plumbei coloris¹⁴ innatantia, quod circulo *D* quasi aggere coercebatur. Succedebat lata quaedam umbilicalis fascia *E*, sublutei coloris, quae interdum foraminulis pervia, pumicis instar, colliquamento madida reddebatur, cuius ambitum rivulus *F* alluebat, et tandem candidus circulus *G* omnia continebat. In aliis, umbilicalis area *H* in ichorem quasi fusa, fusca reddebatur, et plures circuli *I* interpositis alveolis *K* circumducebantur.

following, that finally becomes the umbilical area. It was composed partly of a solid and also yellowish portion, partly liquid and dark, and was wound by a rivulet *G* of colliquation, and the snow-white polygonal girdle *H* surrounded it.

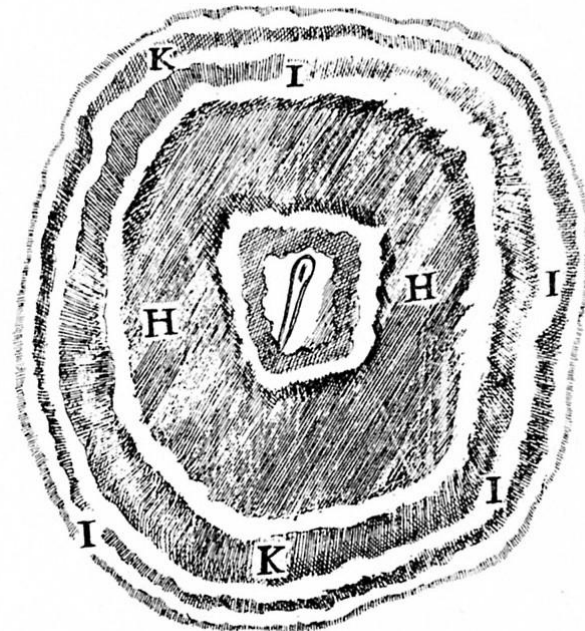


figura 3

In an egg brooded by a turkey hen in the last month of July - 1672, **after 6 hours** the cicatrice showed this natural size *A* (fig. 2) and at its centre was found the vesicle *B* sometimes bordered by irregular boundaries and full of diaphanous liquid. The sketches of carina and head of the chick clearly appeared shaped as belt *C* and they floated in a colliquation lead in colour delimited by the circle *D* as if being a bank. A wide yellowish umbilical band *E* was following, which, crossed at short intervals by little holes like pumice stone, appeared soaked of colliquation, and the rivulet *F* wetted its perimeter, and finally a snow-white circle *G* contained every thing. In other eggs the umbilical area *H* (fig. 3), almost fluidified into liquid, had become dark, and all around many circles *I* were elapsing with rivulets *K* interposed.

several years (1827-1842), performing scientific research from his estate near Riga. In 1820 he took part in a scientific expedition to Bokhara as a naturalist, and in 1826 became a member of the St. Petersburg Academy of Sciences. Pander studied the chick embryo and discovered the germ layers (i.e., three distinct regions of the embryo that give rise to the specific organ system). Because of these findings, he is considered by many to be the founder of embryology. His work in embryology was continued by Karl Ernst von Baer (1792-1876), who expanded Pander's concept of germ layers to include all vertebrates. Pander performed important studies in the field of paleontology, and was the first scientist to describe primitive creatures known as conodonts. He also did extensive research of fossils found in the Devonian and Silurian geological strata of the Baltic regions. (www.worldlingo.com)

¹¹ Il nucleo del Pander. (Luigi Belloni, 1967)

¹² Il nodo primitivo. (Luigi Belloni, 1967)

¹³ Forse i labbri blastodermici che delimitano la stria primitiva. (Luigi Belloni, 1967)

¹⁴ L'area pellucida e il fluido subgerminale. (Luigi Belloni, 1967)

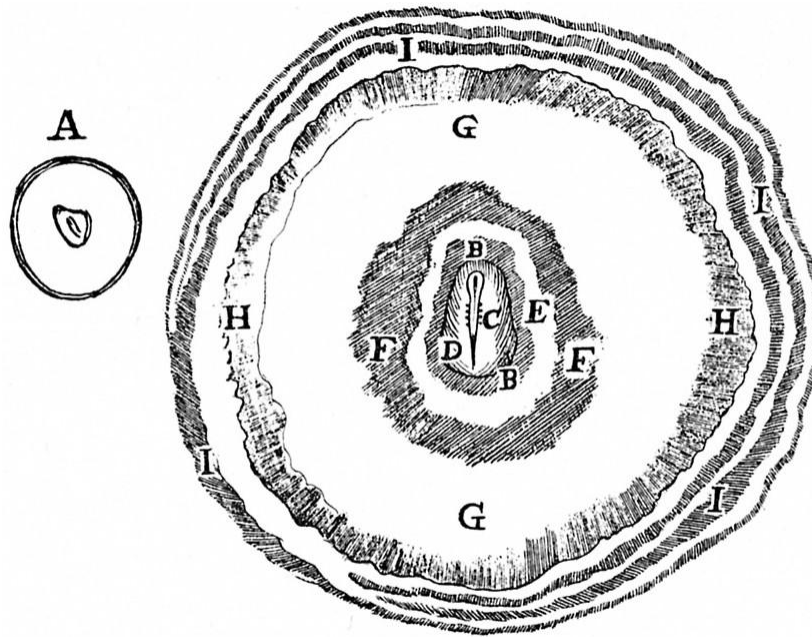


figura 4

Fig. 4. - Post *duodecim horarum* incubatum, cicatricula tali pollebat magnitudine *A*, in cuius centro colliquamentum *B* observabatur cum carina, quae candidis delineata zonis¹⁵ rotundum capitulum designabat, et ultra medietatem orbicularum vertebrarum vesiculas, hinc inde adstantes *C*¹⁶, primo exhibebat; huius tamen structura sacculo *D*¹⁷ frequentissime velabatur. Succedebat candidus de more circulus *E*, qui exterius copioso colliquamenti rivulo *F* ambiebatur; huic proxima extendebatur area umbilicalis *G*, quae lato rivulo *H* alluebatur. His addebantur quandoque plures circuli *I* taliter circumducti.

After an incubation of 12 hours the cicatrice had the size pointed out by *A* (fig. 4), at whose centre was observed the colliquation *B* with the carina, which, delimited by white bands, showed a small round head, and showed for the first time beyond the central part the vesicles *C* of the round vertebrae located at both sides. Nevertheless the structure of the carina very often was disguised by the pouch *D*. The circle *E* was following, snow-white as usual, surrounded at outside by an abundant rivulet *F* of colliquation, near which the umbilical area *G* was extending, wet by the ample rivulet *H*. To these structures sometimes many circles *I* were adding, arranged around as in the figure.

¹⁵ Si tratta qui, invece, delle pliche neurali. (Luigi Belloni, 1967)

¹⁶ I somiti. (Luigi Belloni, 1967) § Somite, singolare e maschile, deriva dal greco *sóma*, corpo+ite. In embriologia, un somite è ciascuno dei segmenti in cui si suddivide la parte dorsale del mesoderma (o epimero), a destra e a sinistra della corda dorsale. I somiti danno origine a elementi che formeranno il derma della cute del tronco (dermatomi), alle masse muscolari (miotomi) e allo scheletro assile (sclerotomi). Ogni somite è connesso al mesoderma insegmentato, posto ventralmente, da un peduncolo (peduncolo del somite). Nella zona caudale dell'embrione il mesoderma è costituito da una massa cellulare dalla quale hanno origine nuovi somiti per cui l'embrione può gradatamente allungarsi. Per alcuni embrioni l'età si indica con il numero dei somiti (per esempio, embrione umano e del pollo).

¹⁷ Il nucleo del Pander, meglio rappresentato nella fig. 5. (Luigi Belloni, 1967)

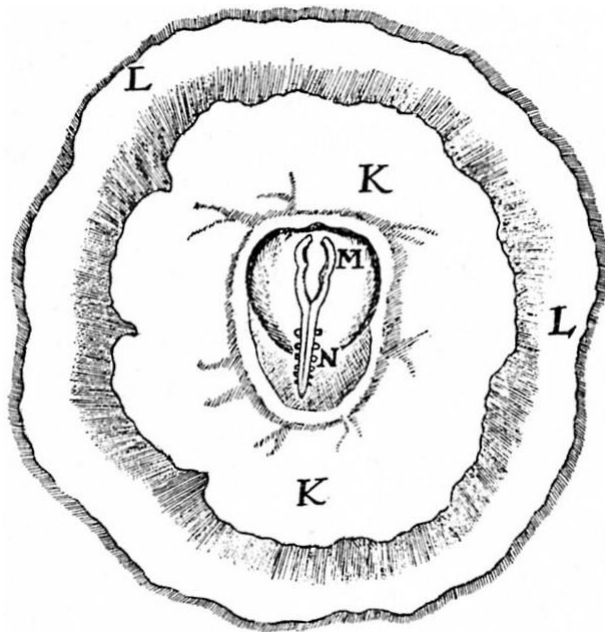


figura 5

Fig. 5. - In aliis cicatriculis ita incubatis simplicior emergebat configuratio in umbilicali area *K*, et ambiente circulo *L*, lato satis. Pulli carina candida quadam zona designabatur, quae duplici excrescens tumore capitis inchoamenta *M* indicabat, et vertebrarum globulos *N* hinc inde haerentes habebat.

In other cicatricles, incubated for the same time, in the umbilical area *K* (fig. 5) and in the surrounding circle *L*, enough wide, a simpler disposition was observed. The carina of the chick was delimited by a snow-white band, which, growing into two tumefactions, pointed out the sketches of the head *M*, and it had adherent at both sides the globules *N* of the vertebrae.

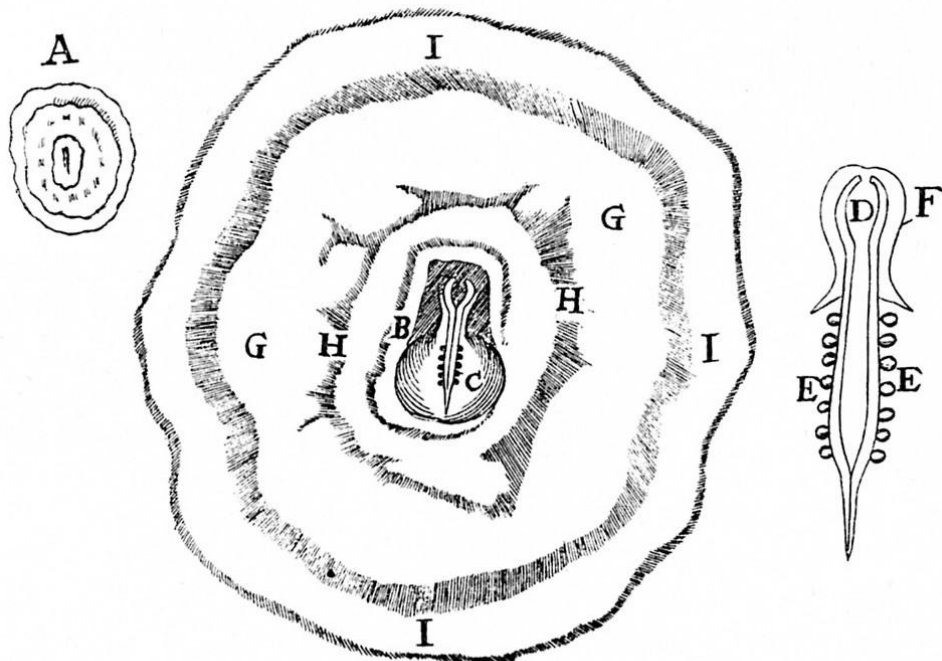


figura 6

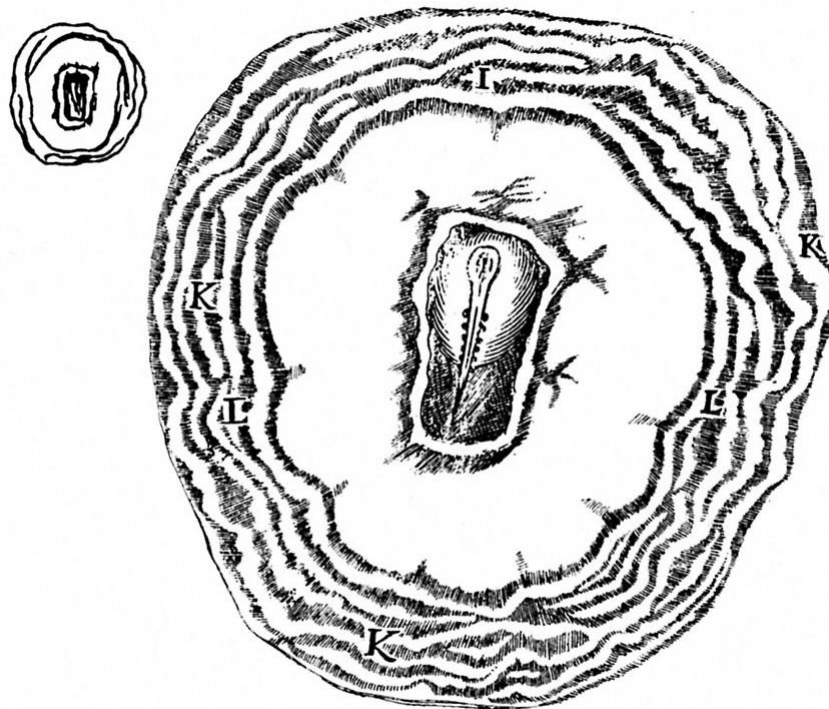


figura 7

Fig. 6. - Transacta *decima octava hora*, cicatricula huius latitudinis *A* versus obtusum Ovi cacumen ascendebat. In medio colliquamentum solito [3] aggere *B* coercitum, pulli carinam continebat, quae de more vesicula *C* obducebatur. Carinae structuram diu inquisitam, talem tenere videbar. Ex candida zona caput *D* designabatur, et spinae tractus cum appensis vertebrarum sacculis *E*; circa caput et collum, carnem *F* luxuriare non semel videbam, cum alarum inchoamentis¹⁸. Succedebat lata area *G*, colliquamenti alveolis *H* excavata; haec rivulo ambiebatur, qui candido erat circulo *I* obseptus. Umbilicalis haec area inter observandum evacuato albumine rugosas quasdam eminentias, veluti arborum radices, exhibebat, quae vasorum speciem mihi indicabant; quoniam tamen in exsiccata quacumque vitelli parte parum absimiles rugosas productiones excitari facile videbam, ideo adhuc haeret animus, an vasorum latentium rudimenta existant, an sicciscentis corporis rugae. Fig. 7. Cicatriculae extremus circulus seu zona *I*, ulteriori fermentatione in plures, hosque disparatos, solvebatur circulos *K*, quorum portiones, velut insulae, colliquamento *L* mergebantur.

When the 18th hour passed, the cicatrice, wide as showed in *A* (fig. 6), was rising toward the obtuse pole of the egg. In the middle, the colliquation, delimited by the usual bank *B*, contained the carina of the chick, covered as usual by the vesicle *C*. It seemed to me that the structure of the carina, investigated for a long time, had the following structure. The head *D* and the spinal tract, with the suspended pouches of the vertebrae *E*, were delimited by a snow-white band; around the head and in the neck not only once I have seen the flesh *F* to be lush with the sketches of the wings. A wide area *G* was following, dug by rivulets *H* of colliquation; it was surrounded by a rivulet delimited by the white circle *I*. This umbilical area, during the observation, when the albumen was evacuated, showed certain wrinkled prominences, as being roots of trees, that for me had the appearance of blood vessels. But since in any dried part of the yolk I easily saw the shaping of wrinkled not very dissimilar structures, still now I doubt if they are rudiments of latent vessels or wrinkles of a drying up body. The most external circle of the cicatrice, or band *I* (fig. 7), for further fermentation was turning into many and furthermore discontinuous *K* circles, fragments of which were immersed as islands in the colliquation *L*.

¹⁸ In realtà, i tronchi delle vene onfalo-mesenteriche. (Luigi Belloni, 1967)

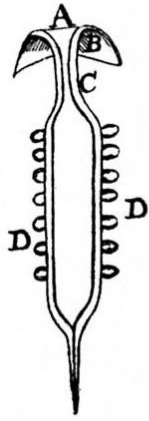


fig. 8

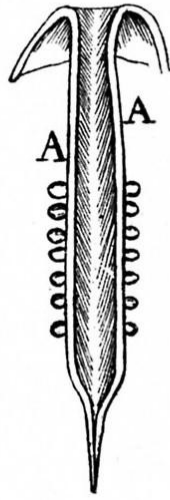


fig. 9

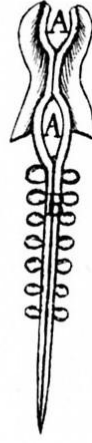


fig.10

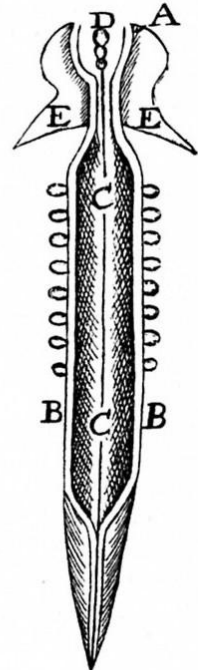


fig. 11

Placebat interea, ut Naturae methodum aliquantulum tenerem, carinam fusius prosequi; et quae variae species, usque ad integrae diei complementum occurrebant, prout in re tam obscura rudibus instrumentis mihi attingere licuit, hic exarabuntur. Fig. 8. In ovis itaque minus vegetis et infirmioribus carina taliter apparebat; geminae zonae, seu crassae candidaeque lineae *A*, in capite parum distantes, et quasi reflexae in posticam partem *B*, iterum approximatae, collum *C* efformabant; mox diductae, et quasi parallelae, in longum protractae, carinatum spatium efficiebant, et hinc inde vertebrarum sacculos numero septem *D* appensos servabant; iterum tandem coeuntes, Carinae extremum constituebant. Fig. 9. Quid simile miratus sum post diem integrum incubatus, dum zonae *A*, parum obliquatae, carinam constituebant. Fig. 10. In aliis gemina concavitas excitabatur *A*, et dorsi spatium, quod alias patebat, conniventibus zonis in *B* clauderetur; hoc enim familiare ipsi Naturae saepius observavi, in zonis motum adesse, ita ut suo accessu et recessu, areae et sinus excitarentur et tollerentur.

In the meantime, to understand somehow the procedure of nature, I decided to investigate more deeply the carina. And here will be described the various showing appearances until the ending of one whole day, as far as I was able to achieve with my rough tools in such a dark matter. Insofar in the less vigorous and weaker eggs the carina appeared as follows: the two bands, that is, the thick and white lines *A* (fig. 8), not very distant among them at head level and almost refolded toward the rear part *B*, after having drawn closer they gave shape to the neck *C*. Immediately spaced out and almost parallel, extending themselves in length, they gave place to a carinated space and at both sides they brought hung the pouches of the vertebrae *D* in number of 7, and newly connecting each other they constituted the extremity of the carina. I observed with astonishment something similar after one whole day of brooding, while the bands *A* (fig. 9), being a little bit obliqued, were constituting the carina. In other eggs a double cavity *A* was showing itself, and the space of the back, that other times was open, was closing because of the wrapping in *B* of the bands. In fact I observed rather often that what follows is very usual for nature: in the bands a movement is present, so that, by approaching and going away, areas and cavities would take shape and be removed.

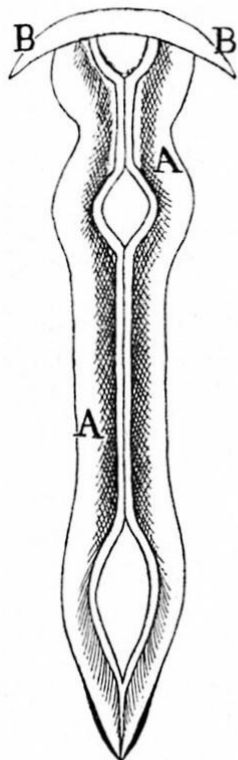


fig. 12

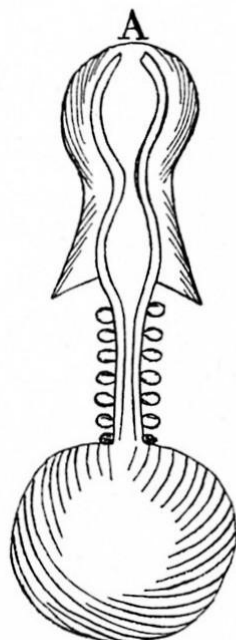


fig. 13

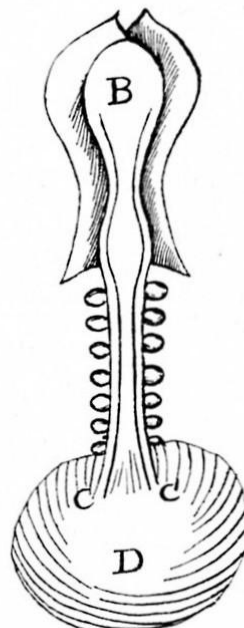


fig. 14



fig. 15

Fig. 11. - *Elabente die* saepius species haec occurrebat, qua capitis tumor *A* emergebat, et diductis in dorso zonis *B*, carinae concavitas efformabatur, quae spinali medullae *C*¹⁹ locum praebebat, cui vesiculae cerebri *D* appendebantur; colli, capitis, et alarum *E*²⁰, productiones magis manifestabantur. Crassae lineae, seu exaratae zonae, quae varias designabant iam expositas carinae species, erant extremitates et fines assurgentium quasi parietum; in extracta etenim cicatricula, et vitro imposita, zonarum latitudo *A* occurrebat, qua totus spinae tractus delineabatur cum alarum *B* inchoamentis. Fig. 12. Huiusmodi zonae non perpendiculariter elavabantur, sed inclinatae, carinae concavitatem producebant, quae crystallino quodam humore replebatur, qui interdum ita turgebat, ut continentes zonas disrumperet, et areas novas excitaret.

Fig. 13. Aliud insuper innuendum, zonas in apice *A* hiatus habere, qui quandoque et temporis tractu claudebatur; hoc autem forte Natura utitur pro colliquamenti ingressu. Nec reticendae sunt mutationes, quae [4] in eadem numero cicatricula et carina absque novo

When 1 day was passing, this appearance was mainly occurring: the cephalic increase *A* (fig. 11) was standing out, and the bands *B* at back level having split up, the cavity of the carina was taking shape, offering the place to the spinal marrow *C*, to which the brain vesicles *D* were suspended; the sketches of neck, head and wings *E* were more evident. The thick lines, that is, the described bands, delimiting the various aspects already described of the carina, were the extremities and the limits of almost vertical walls. In fact, in an extracted cicatrice and placed on a glass, the width of the bands *A* (fig. 12) was observed, by which the whole extension of the spinal column was delimited together with the sketches of the wings *B*. These bands didn't raise perpendicularly, but, inclined, they caused the concavity of the carina, which was full of a certain crystalline humour; this, meanwhile, was so swollen to lacerate the bands containing it and to cause the formation of new areas.

Besides another thing must be pointed out, that the bands present in the apex *A* (fig. 13) showed an opening, sometimes also closing after a certain time: perhaps nature uses it for the entry of the colliquation. Neither have to be kept silent the changes that quickly were showing themselves,

¹⁹ Ossia la notocorda, affiancata dai cercini midollari *B* e, più esternamente, dai somiti. (Luigi Belloni, 1967)

²⁰ In realtà, i tronchi delle vene onfalo-mesenteriche. (Luigi Belloni, 1967)

incubatu manifestabantur; nam expositus hiatus in eodem Ovo, per sex horas aeri relicto, clauderetur, Fig. 14. et capitis concavitas B candida tota reddebatur, et carinae extremitas ex diductis zonis C, non obstante sacco D, emergere incipiebat: Ulterior succedebat, *elapso die* a prima Ovi lustratione mutatio; Fig. 15. clausis namque zonis²¹ geminus observabatur tumor E²², circa dorsum²³ curvabantur zonae F, et carinae ovalis area patebat.

without further brooding, in the same cicatrice and carina. In fact the described opening, in the same egg left to the air for six hours, was closing, and the whole cephalic cavity B (fig. 14) became white, and the extremity of the carina, despite the pouch D, started to become evident for the divarication of the bands C. When one day passed from the first observation of the egg, a further change was happening: in fact, the bands having closed, a double swelling E (fig. 15) was observed, the bands F were bending around the back and the oval area of the carina was appearing.

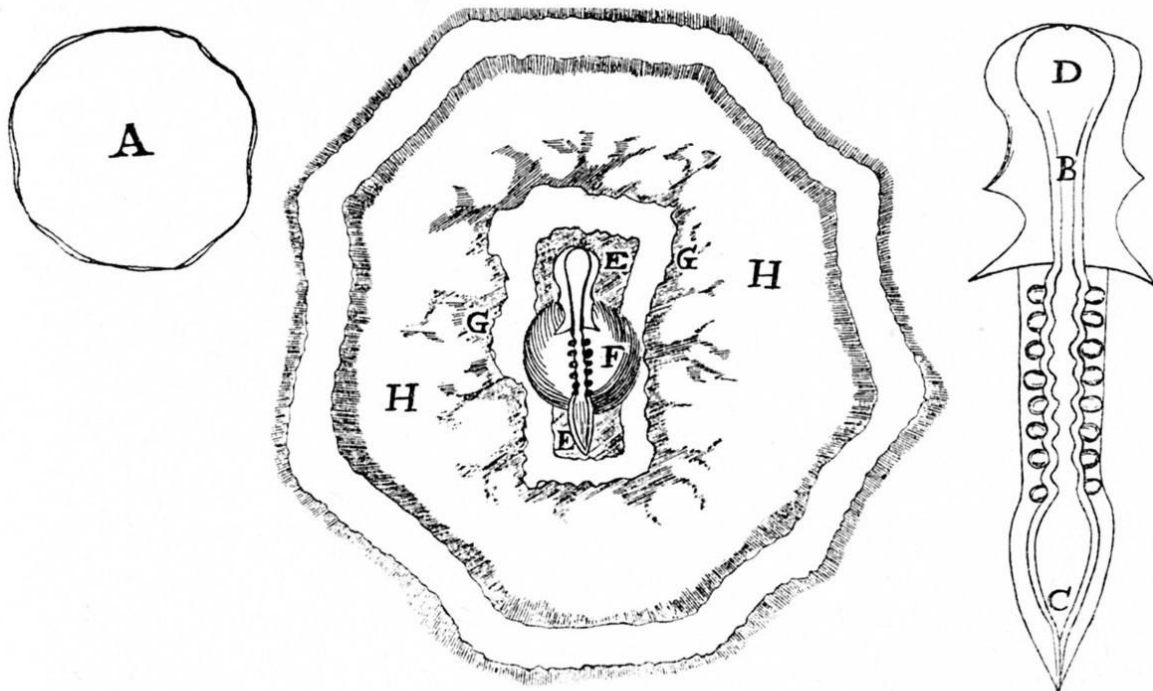


figura 16

Fig. 16. *Transacta die*, cicatricula hanc servabat magnitudinem A, et in sui centro carina locabatur, cuius zonae parallelae ductae, colli B situm designabant; mox vertebrae haerentes, dorsum constituebant, et tandem dilatatae carinae extremum C claudebant; in capite vero D hiabant, et tota area candida erat: In aliis autem, rudimenta vesicularum cerebri et spinalis medullae emergebant. Carina haec, in colliquamento E degens, proxima erat sacco F, qui diaphano turgere videbatur succo. Lata sequebatur zona, quae irruenti colliquamento G obstat; unde umbilicalis area H, quasi tot excurrentibus rivulis interrompebatur; postremo latus circulus candidus cicatriculam claudebat.

When 1 day passed, the cicatrice maintained this size A (fig. 16), and at its centre was located the carina, whose bands, flowing side by side, delimited the region of the neck B, then, sticking to the vertebrae, they constituted the back, and finally, dilated, closed the extremity C of the carina. But they opened at head D level and the whole area was white. On the contrary in other cases the sketches of brain vesicles and spinal marrow were standing out. This carina, located in the colliquation E, was near the pouch F, which appeared swollen of transparent liquid. A wide band was following, that was opposed to the intrusive colliquation G, thus the umbilical area H was interrupted as by many out flowing rivulets. Finally a wide white circle closed the cicatrice.

²¹ In corrispondenza del neuroporo anteriore. (Luigi Belloni, 1967)

²² Proencefalo e mesencefalo. (Luigi Belloni, 1967)

²³ Il seno romboidale. (Luigi Belloni, 1967)

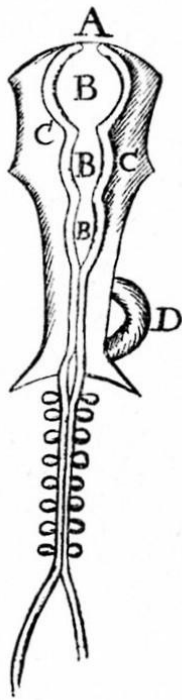


fig. 17

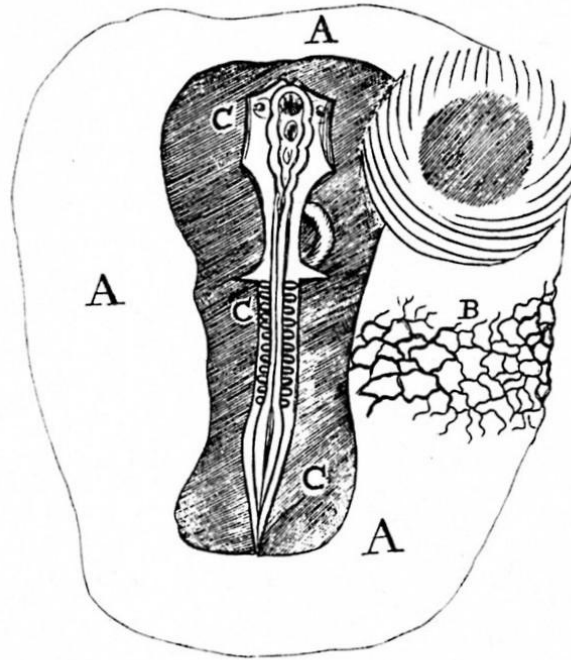


fig. 18

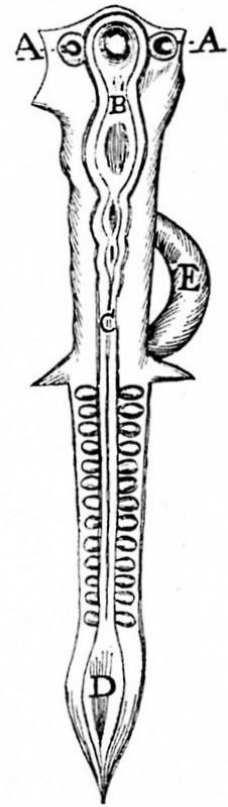


fig. 19

Fig. 17. Interea progrediente incubatu, carina tumores circa caput multiplicabat; zonae etenim in apice *A* hiatus adhuc servantes tres areas *B* constituebant, quibus vesicularum cerebri²⁴ inchoamenta custodiebantur. Caro *C* circum adstabat, et vertebrarum globuli dorso haerebant; cordis pariter portio *D* manifestabatur, et in umbilicali area varicosa vasa prodibant, pallido et subvitellino turgida icore.

Fig. 18. Post *triginta horas* cicatriculae circuli multiplicati, soluti et infracti observabantur. Umbilicalis area *A* varicosis vasculis *B* contegebatur, quae ab elatis solidis portionibus subpallearis substantiae ambiebantur. Vasorum color primo vitellinus, mox rubiginosus erat. In eadem area vesicula²⁵ deprehendebatur. Pullus in colliquamento *C* degens, talem sortiebatur configurationem. Fig. 19. In capite, ubi geminae observabantur appendices, oculi *A* emergebant; zonae unitae, variis excitatis areis, quinque cerebri vesiculas *B* ambiebant, et inde productam spinalem medullam *C*; in extremitate angularis dilatata area *D*, locum laxatae medullae praebebat; vertebrarum sacculi

In the meantime, with the progress of incubation, the carina multiplied the swellings around the head. In fact the bands, still keeping their opening at the apex *A* (fig. 17), delimited three areas *B*, by which the sketches of the brain vesicles were kept. All around the flesh *C* was situated and the vertebral globules were sticking to the back. Also a part *D* of the heart was showing itself and in the umbilical area were sprouting some varicose vessels, turgid of pale and yellowish liquid.

After 30 hours, the multiplied circles of the cicatrice were seen, loose and fragmented. The umbilical area *A* (fig. 18) was covered by varicose small vessels *B* wound by high and solid portions of a straw-yellow substance. The colour of the vessels, at first yellow as the yolk, subsequently was rusty. In the same area a vesicle was observed. The chick, laying in the colliquation *C*, showed the following appearance. In the head, where two appendixes were observed, the eyes *A* (fig. 19) were standing out; the bands were united and, after having created many areas, were surrounding the five brain vesicles *B*, and then the spinal marrow *C* that was its prolongation. The pointed and expanded area *D* was housing at its extremity the expanded marrow; on the sides the

²⁴ Al proencefalo e mesencefalo si è aggiunto il metencefalo. (Luigi Belloni, 1967)

²⁵ Il nucleo del Pander. (Luigi Belloni, 1967)

adstabant. Hoc eodem etiam tempore Cor *E* certo deprehendebatur: Et adhuc cicatriculas in vitris exsiccatas servo, in quibus illud prostat.

Adhuc haeret animus in determinanda *Cordis* vel *Sanguinis* *prioritate*, cum repetitis observationibus sensuum ministerio ea nequaquam firmetur. Illud certo constat, ante incubatum, carinae stamina observari; deinde incubatu vertebrae, cerebri et spinalis medullae inchoamenta cum alis, et inducta carnea portione manifestari, corde, vasis, et sanguine latitantibus: Apparentibus autem rivulis in umbilicali area, probabile est, Cor etiam carinae appendi; cum ante *trigesimam horam* cordis structuram certo deprehenderim. Plurimum autem temporis intercedit, quo Cor et Vasa ichor pervadit, modo lutei coloris, modo rubiginosi, rubescente postremo sanguine; unde adhuc coniecturam foveo, [5] quam alias innui, succum, Vasa et Cor forte praexistere, et sensim manifestari, ut in arborum *Ovis* observamus.

vertebral pouches were located. In this same moment it was possible to clearly observe also the heart *E*, and I still keep some cicatricles dried on glasses, in which it sticks out.

My mind is still uncertain in establishing the priority of the heart or of the blood, since none of both hypotheses can be confirmed by the repeated observations done by using of the senses. One thing is certain: before the brooding the sketches of the carina are visible, and then with the brooding they are showing themselves the vertebrae, the sketches of brain and spinal marrow together with the wings and the superimposed fleshy part, while the heart, the vessels and the blood are hidden. With the appearing of the rivulets in the umbilical area it is probable that also the heart is hanging on the carina, since I have surely recognized the structure of the heart before the 30th hour of incubation. Effectually a lot of time is passing before a liquid, now yellow now rusty, and finally with red blood pervades the heart and the vessels. Insofar I still claim the hypothesis, elsewhere mentioned by me, that the liquid, the vessels and the heart perhaps are pre-existing and are gradually showing themselves, as we observe in the eggs of the plants.

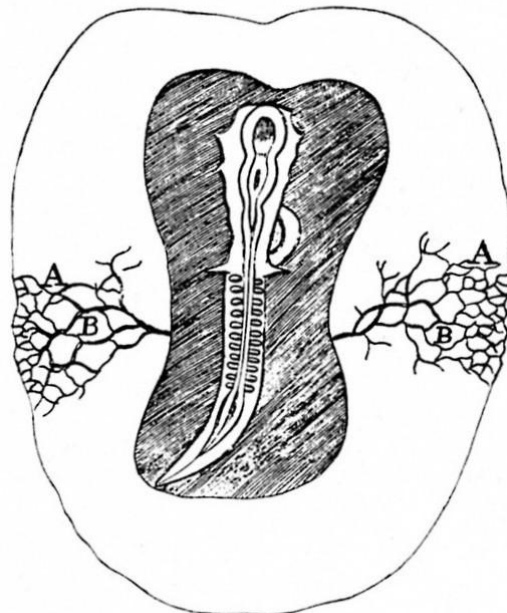


fig. 20

Fig. 20. Auctiora sensim reddebantur singula circa horas *triginta sex* incubatus, grandior etenim reddita cicatricula, umbilicalem aream

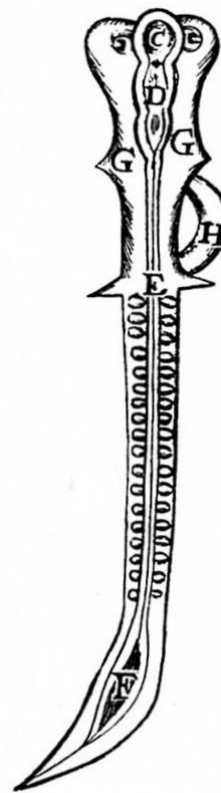


fig. 21

Each structure had moderately increased **around 36 hours of incubation**. In fact the cicatrice, having become greater, was showing the umbilical area

vasculis *A* coopertam exhibebat; reticulare opus vasorum grandioribus interdum spatiis *B*, quandoque minoribus distinguebatur, et rami aliqui alias oblique ducti, nunc aliqualem rectitudinem adepti, quasi trunci dirigebantur. Iterum suspicor, quin, ut olim innui, plexus integri vasorum umbilicalium praeexistant in cicatricula, et subintrantis ichoris turgentia et motu manifestantur, ipsorum areae extendantur, truncique erigantur; cum in plantarum *Ovis gemina foliola*²⁶, quae analogae fortasse albumini et vitello sunt, vasorum plexus, tum aeris tum alimenti, possideant. Fig. 21. Carinae structura talis videbatur: In capite suprema vesicula *C* plumbeo ichore turgebat, reliquae *D*, frequentius minores, diaphano scatebant humore, et continuata medulla *E* in *F* aequaliter dilatabatur, ut in adultis etiam observatur; caro *G* circa luxuriabat, et cor *H* parum eminebat.

covered with small vessels *A* (fig. 20). The vascular net was sometimes characterized by greater spaces *B*, sometimes smaller, and some branches, otherwise obliquely directed, having now assumed a course somehow rectilinear, proceeded as if being trunks. Again I suspect, as I mentioned before, that whole plexuses of umbilical vessels are pre-existing in the cicatrice and that they show themselves turgid of liquid that seeps and because of its movement, hence their areas are extending and some trunks are created, since in the eggs of the plants the two leaflets, perhaps analogous to albumen and yolk, have plexuses of vessels both for air and food. The structure of carina appeared this way: on the head the tallest vesicle *C* (fig. 21) was bulging with liquid lead in colour, the remaining vesicles *D*, generally smaller, were full of transparent liquid, and the marrow *E* continuing in *F* was rather expanded, as it is observed also in adults. All around, the flesh *G* was very abundant and the heart *H* was not very projecting.

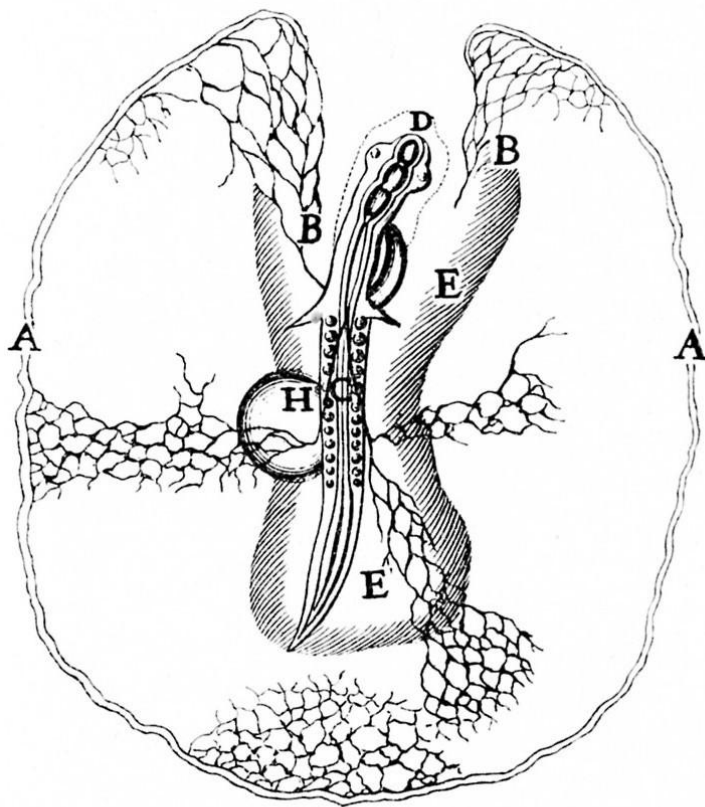


fig. 22

Fig. 22. Superatis *quadraginta horis*, in cicatricula evidetiores redditi venarum surculi ab extremo limbo *A* in cor productionibus *B* deducebantur, a quo umbilicalia vasa, angulum *C* efformantia, reticulares ramos promebant, nondum perpetuo in grandiores propagines distinctos. Carina in

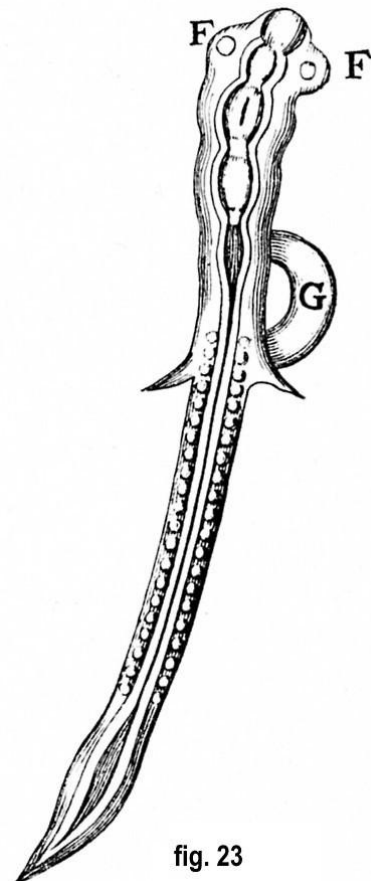


fig. 23

When 40 hours passed, the twigs of the veins, having become more evident in the cicatrice, were going towards the heart from the extreme border *A* (fig. 22) through the prolongations *B*. From the heart the umbilical vessels, forming the angle *C*, sent forth reticular branches, not yet distinct in greater

²⁶ I cotiledoni. (Luigi Belloni, 1967)

colliquamento innatabat, et circa ipsam sacculus *D* parum distans, futurum amnion²⁷, emergebat, reliquus amplior *E*, chorion²⁸ erat: Fig. 23. Pulli carina talis erat: In capite solitae vesiculae cerebri turgebant, quarum prima, vitrum referens, reliquis innatare videbatur: Solita zona arctior reddita, cerebrum et spinalem medullam ambebat: Hinc inde oculi *F* locabantur: Cor *G* turgidum pulsabat ea ratione et rythmo, prout alias descripsi, et fusius infra habebitur. Hac eadem hora sacculus *H* variato Ovi situ movebatur; perpetuo enim summitatem tenere tentabat. Diu etiam hesitavi, an infra an supra carinam locaretur huiusmodi vesicula *H*, cum diaphano turgeret humore; tandem, cum ipsam in separata a vitello cicatricula nequaquam inclusam deprehenderem, in subiecta vitelli fovea²⁹ locari coniectatus sum.

ramifications without interruptions. The carina floated in the colligation and around it was emerging, at a short distance, the pouch *D*, the future amnion, and the remainder sack *E*, wider, was the chorion. The carina of the chick was appearing this way: on the head the usual brain vesicles were swollen, the first one, similar to glass, seemed to float on the others; the usual band, having become more compact, was enveloping the brain and the spinal marrow; at both sides the eyes *F* were lying (fig. 23); the heart *G*, turgid, pulsated in the manner and with the rhythm as I described elsewhere, and it will be treated in a wider manner afterwards. In this same moment the pouch *H* (fig. 22) was moving with the change of egg's position, in fact it always tried to maintain a high position. I also hesitated for a long time if this vesicle *H*, being turgid of transparent liquid, was situated under or above the carina. Finally, never having observed it included in the cicatrice separated from the yolk, I supposed that it was situated in the underlying pit of the yolk.

²⁷ Per la prima volta il Malpighi interpreta correttamente l'amnion. (Luigi Belloni, 1967) § Amnio, amnion o amnios: dal greco *amnion*, vaso in cui si raccoglieva il sangue delle vittime. Annesso embrionale costituito da un sacco che si sviluppa a spese di una parte dei tessuti formati dall'uovo fecondato (sacco amniotico), contenente – in quantità variabile nei diversi animali e nei vari stadi di sviluppo – un liquido sieroso (liquido amniotico) nel quale è immerso l'embrione ancorato al cordone ombelicale.

²⁸ In realtà, l'area pellucida. (Luigi Belloni, 1967) § Còrion: dal greco *chòrion* = membrana, membrana che avvolge il feto, membrana dell'uovo. Annesso embrionale degli Amnioti, costituito da una membrana che, avvolgendo l'embrione (racchiuso nell'amnios), l'allantoide e il sacco del tuorlo, delimita con la propria parete anche la cavità del celoma extraembrionario. Nei rettili, negli uccelli e nei mammiferi lo sviluppo embrionale è caratterizzato da aree extra-embriionali dette annessi embrionali. Si tratta di amnios, corion, sacco vitellino, allantoide e placenta, quest'ultima presente nei soli mammiferi placentati.

²⁹ Ed è infatti il nucleo del Pander. (Luigi Belloni, 1967)

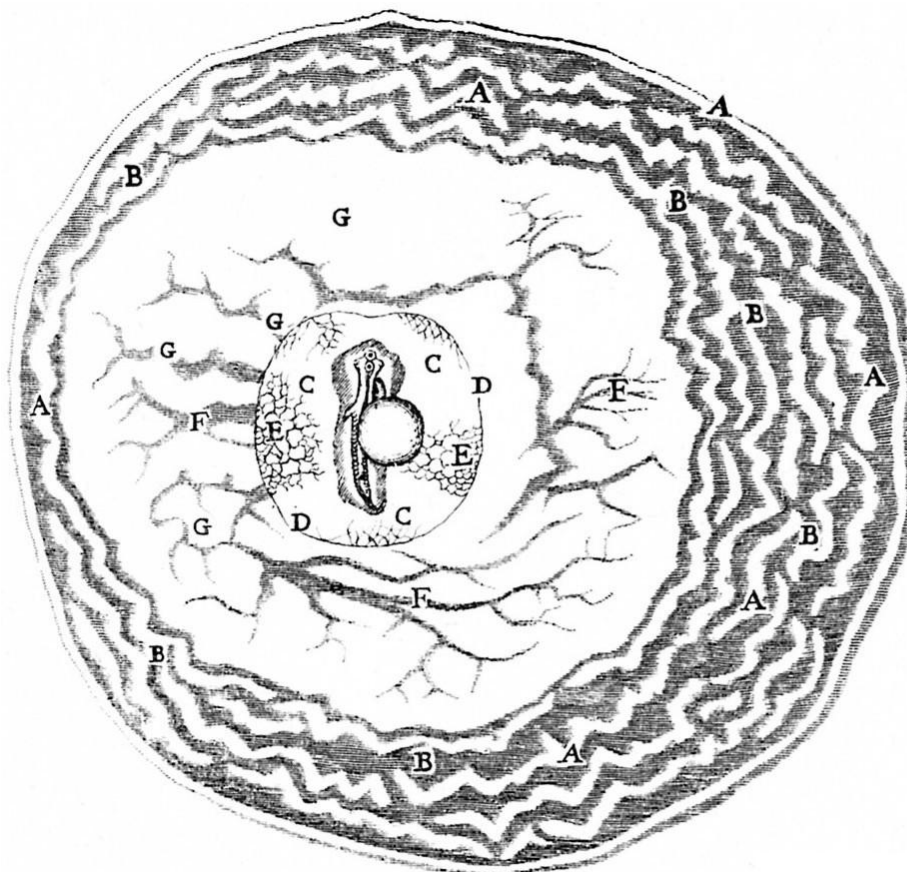


fig. 24

Postremae observationi *Cicatriculam* addam, quae licet *binis diebus* incubata fuisset, quoniam tamen Ovum reliquis tegebatur, et humiliori loco condebatur, ideo frigidum, dum auferretur, erat, et ignavum valde. Fig. 24. In hac itaque ambientes circuli *A* fracti erant, colorisque subvitellini, et mergebantur in colliquamento *B*. In medio umbilicalis area *C* locabatur, quae limbi *D* loco zonam albam habebat, et convexa ibidem reddebatur: Haec reticulari vasorum opere *E* contegebatur, in quibus rubiginosus humor turgebat. Carina, solitis praedita vesiculis et corde, innatabat in colliquamento. Spatium, quod inter circulos *A* et umbilicalem aream *C* extendebatur, insignibus rivulis *F* alluebatur; in dextro³⁰ enim latere veluti a tot distinctis fontibus deducebantur alveoli *G*, qui ampliores redditi sub area umbilicali ultimum sortiebantur terminum: Contentus ichor rubiginosus erat, et eiusdem pene [6] naturae ac in corde et vasis observabatur; unde pulcherrimum occurrebat spectaculum.

Subsequentibus horis usque ad complementum alterius diei umbilicalia vasa varicosa, coloris primo sublutei, mox rubiginosi, et postremo

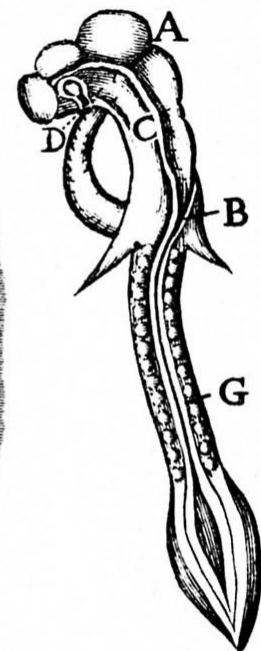


fig. 25

To this last observation I will add that of a cicatrice, which, although **brooded for 2 days**, being that however the egg was covered by the other eggs and it was lying more below, therefore it was cold when removed - from brooding - and very inactive. Insofar in this cicatrice the enveloping circles *A* (fig. 24) were interrupted and yellowish, and they were soaked in the colliquation *B*. At the centre was lying the umbilical area *C* showing in correspondence of the edge *D* a white band and just here it was becoming convex. It was covered by a reticular formation *E* of vessels swollen with rusty liquid. The carina, endowed with usual vesicles and heart, floated in the colliquation. The space extending between the circles *A* and the umbilical area *C* was irrigated by evident rivulets *F*: in fact on the right side were flowing, as from several distinct sources, the rivulets *G*, which, having become wider, went to end under the umbilical area. The contained liquid was rusty and was observed, almost with the same appearance, also in heart and vessels, hence a very beautiful spectacle was occurring.

In the following hours until the completion of the 2nd day the umbilical vessels appeared varicose, at first yellowish, then rusty, and finally blood-red. The

³⁰ Ossia alla sinistra di chi guarda la figura. (Luigi Belloni, 1967)

sanguinei, reddebantur. Fig. 25. Extractus pullus hac pollebat figura: Cerebri vesiculae *A*, turgidae cum spinali medulla *B* continuabantur, quae zonis *C*, adhuc existentibus, ambiebatur; circulus niger patenti hiato *D* solutus, oculi ambitum constituebat et custodiebat.

chick, extracted, was enriched by this appearance: the brain vesicles *A* (fig. 25), turgid, were continuing with the spinal marrow *B*, enveloped by the bands *C* still present; a black circle, interrupted by a well visible fissure *D*, constituted and kept the contour of the eye.

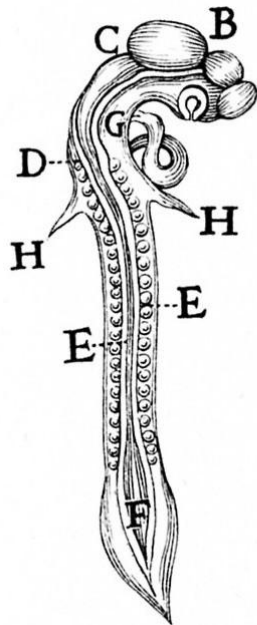


fig. 26

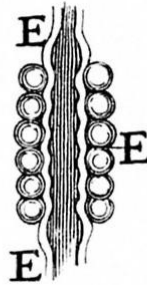


fig. 27



fig. 28

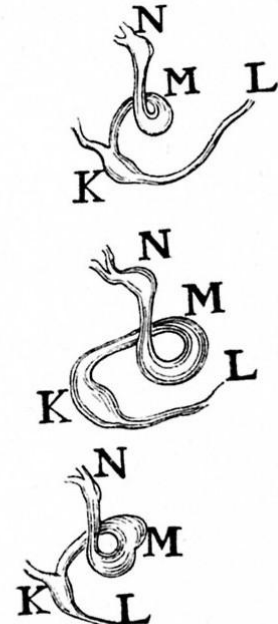


fig. 29

Fig. 26. Post *binos dies* cicatrix lateraliter vitello haerens, sensim horizontalis fiebat, cuius naturalis magnitudo erat *A*, et in ipsius centro in colliquamento natans pullus locabatur, qui vesiculis *B*, cerebrum integrantibus, ditabatur: Fig. 27. His cerebellum *C* cum spinali medulla *D* addebatur, quae zonis *E* custodiebatur. Huiusmodi vero curvatae interdum, et varicosae redditae, vertebrarum sacculis haerebant. Fig. 28. Prope extremitatem carinae amplior reddita medulla in ovale extendebatur corpus *F*; circa collum et caput caro *G* luxuriabat, et alae *H* pendebant; bini pariter oculi circulo *I* excitati eminebant, quo crystallini humoris inchoamentum ambiebatur. Fig. 29. Cor evidentissime pulsabat; nam auricula *K*³¹ receptum a venis *L*³² sanguinem pulsu propellebat in dextrum cordis ventriculum *M*³³, a quo iterum protrudebatur in sinistram eiusdem sinum *N*³⁴; Fig. 30. inde in arterias³⁵, a

After 2 days the cicatrice, sticking sideways to the yolk, gradually became horizontal, whose natural size was *A* (fig. 30), and at its centre was situated the chick floating in the colliquation, endowed with the vesicles *B* (fig. 26) pertaining to the brain. To these vesicles the cerebellum *C* was adding itself with the spinal marrow *D*, protected by the circles *E*. Sometimes, bent in this way and become varicose, they stuck to the vertebral pouches. Near the extremity of the carina the marrow, become wider, enlarged itself in the oval structure *F* (fig. 26). Around the neck and the head the flesh *G* abounded and the wings *H* were hanging. Item the two eyes constituted by the circle *I* (fig. 28) were projecting, by which the sketch of crystalline's fluid structure was surrounded. The heart pulsated in a very evident way: in fact the auricle *K* (fig. 29) with the pulsations pushed in the right ventricle *M* of the heart the blood received from the veins *L*, and by the ventricle it was again pushed with force in its left cavity *N*, hence in the arteries, and

³¹ L'atrio indiviso. (Luigi Belloni, 1967)

³² Le vene vitelline anteriori. (Luigi Belloni, 1967)

³³ Il ventricolo primitivo indiviso. (Luigi Belloni, 1967)

³⁴ Il *bulbus cordis*. (Luigi Belloni, 1967)

³⁵ Gli archi aortici. (Luigi Belloni, 1967)

quibus in truncum³⁶, qui deorsum productus
geminabatur in ramos O;

from them in a trunk that, prolonging downward, was
subdividing into the two branches O (fig. 30).

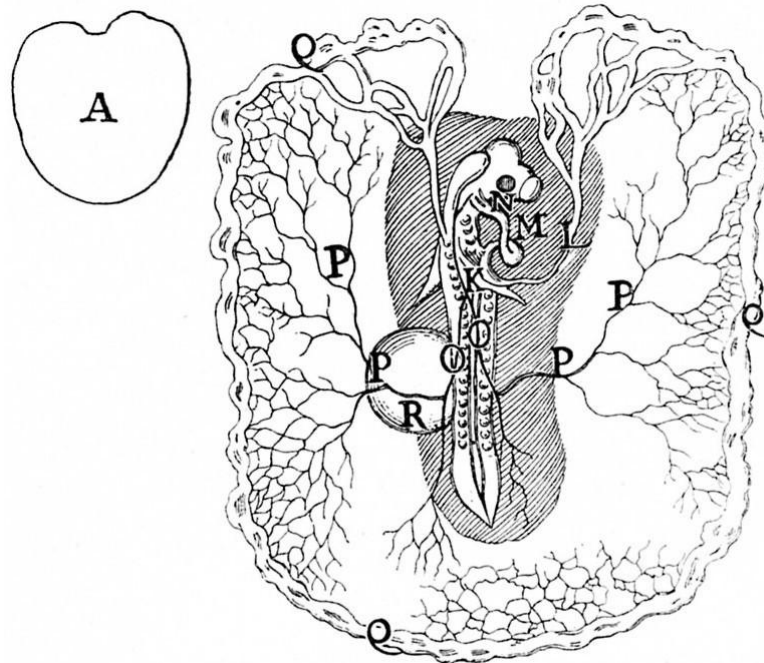


figura 30

hi, umbilicales arterias P^{37} prominentes, in aream
producebantur, et tandem reticulari excitato
plexu, in limbum desinebant, qui quandoque
quasi trunco Q excitabatur, quandoque reticulari
plexu³⁸ ex superpositis arteriae et venae
reticularibus implicationibus. In cicatriculis
ignavioribus loco umbilicalium ramorum P rete
observabatur, cum areae surculis continuatum;
quod post *quadragesimam quartam* horam
frequenter accidebat. Humoris per vasa fluentis
color primo subvitellinus, mox fuscus et
rubiginosus, postremo ad sanguinem tendebat.
Vesicula R^{39} , diaphano turgida humore, prope
umbilicalem ramum P dextrum locabatur.

These branches O (fig. 30), sending forth the
umbilical arteries P, were stretching in the area -
umbilical, and finally, after having made a reticular
plexus, ended in the edge sometimes almost made by
a piece Q and sometimes by a reticular plexus,
deriving from reticular arterial and venous
superimposed weaves. In the less luxuriant cicatrices
instead of the umbilical branches P a net was
observed continuing with the sprigs of the area,
which frequently happened after the 44th hour. The
colour of the liquid circulating through the vessels
at first was yellowish, then dark and rusty, finally
verged to the colour of the blood. The vesicle R,
turgid of a transparent liquid, was situated near the
right branch P of the umbilical artery.

³⁶ L'aorta. (Luigi Belloni, 1967)

³⁷ Le arterie onfalo-mesenteriche. (Luigi Belloni, 1967)

³⁸ Il seno terminale. (Luigi Belloni, 1967)

³⁹ Nella fig. 30, a sinistra di chi guarda. (Luigi Belloni, 1967)

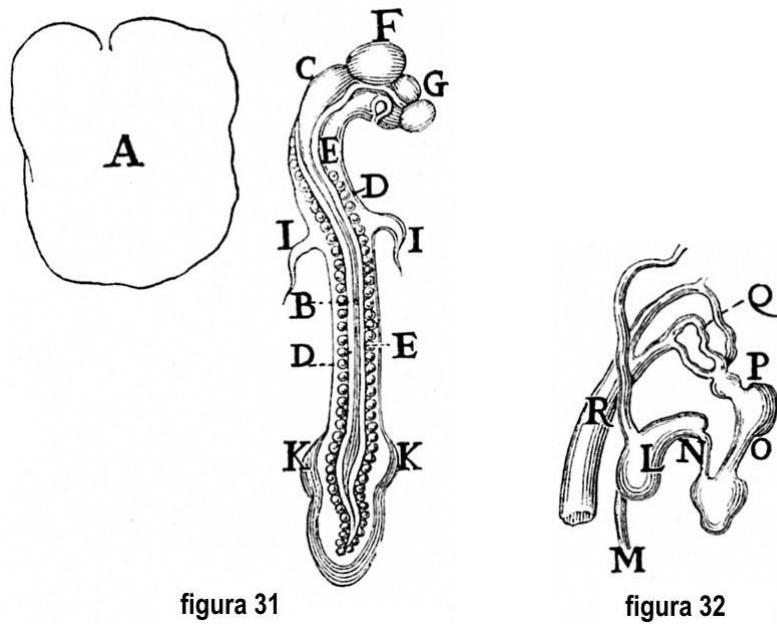


figura 31

figura 32

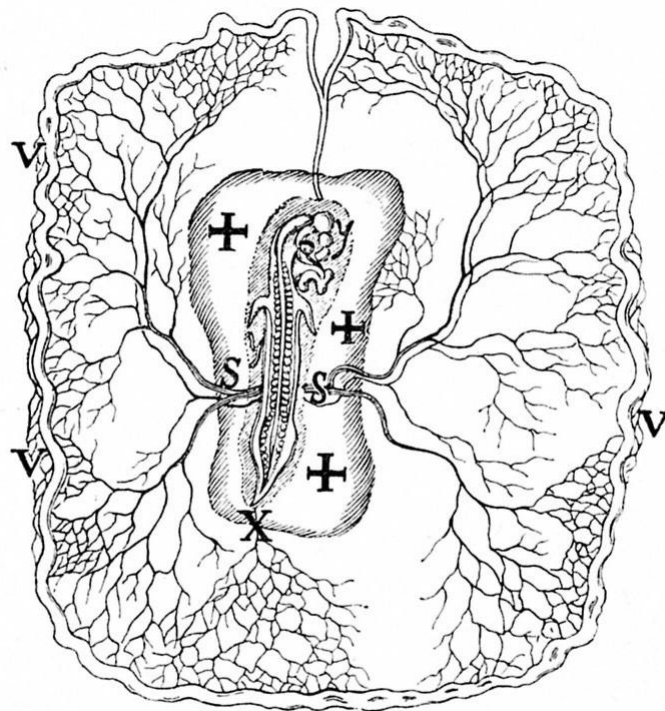


figura 33

Fig. 31. *Triduo* elapso, cicatricula parum deficiebat ab horizontali situ, eiusque magnitudo naturalis non excedebat *A*. Pullus in ventrem iacebat, ita ut spinae *B* tractus a cerebello *C* deductus pateret, vertebrae *D* hinc inde una cum zonis *E* adstantibus. Cerebri cristata vesicula *F* prae caeteris emergebat diaphana, turgidaque humore; reliquae *G* et ipsae manifestae erant. Oculorum circuli adhuc patentes erant; alae *I* extendebantur, crurumque *K* et uropygii⁴⁰ inchoamenta apparebant. Fig. 32. Cor auctius erat, unde receptus ab auricula

When 3 days passed, the cicatrice went a little away from the horizontal position and its natural size was not superior to *A* (fig. 31). The chick was lying on the abdomen, so that the spinal tract *B* deriving from the cerebellum was visible, having alongside at both sides the vertebrae *D* with the bands *E*. The helmet-shaped vesicle *F* of the brain was more prominent than the others, transparent and turgid of liquid. Also the remaining vesicles *G* were evident. The circles of the eyes were still open, the wings *I* were broad, the sketches of legs *K* and uropygial gland were visible. The heart was greater, and from here the blood,

⁴⁰ Non l'uropygio, ma probabilmente il nodo primitivo. (Luigi Belloni, 1967)

L sanguis, a vena *M* per ductum *N* in dextrum cordis ventriculum, indeque per *O* in sinistrum *P*, tandem in arterias *Q* propellebatur, a quibus in truncum *R*: Fig. 33. Ab hoc erumpebant umbilicales rami *S*, qui productis surculis in limbum desinebant, reticulari efformato plexu.

received from the auricle *L* (fig. 32), and coming from the vein *M*, was pushed through the duct *N* in the right ventricle of the heart and from here through *O* in the left ventricle *P*, and finally in the arteries *Q*, and from them in the trunk *R*. From this trunk the umbilical branches *S* (fig. 33) sprouted, which, after having produced some small branches, ended in the edge, a reticular plexus being formed.

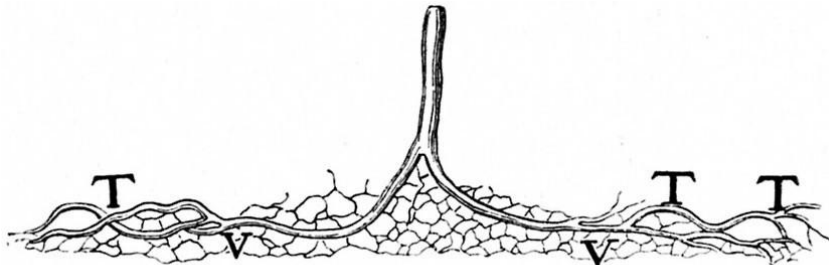


figura 34

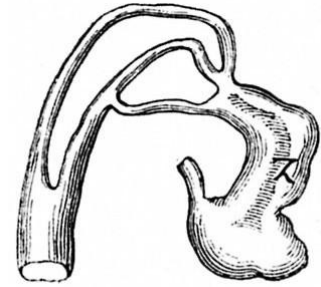


figura 35

Fig. 34. Interdum umbilicales [7] rami geminis finibus *T*, supra limbum inclinati, reticulare venarum opus *V* cooperiebant. Ab extremo carinae erumpebat venosus ramus *X*⁴¹, qui cum limbo continuatus sanguinem revehebat, non dispari ritu ac in superioribus accidit. Fig. 35. Extracti interdum cordis hanc licuit observare structuram, in qua crassior meatus⁴² a dextro in sinistrum cordis sinum apparebat, circumposita carne *Z*. Taliter constructus pullus in arcto amnii receptaculo *Y* morabatur, quod a chorio + ambiebatur.

Sometimes the umbilical branches, inclined above the edge, were covering the venous net *V* (fig. 34) with two terminations *T*. From the extremity of the carina went out the venous branch *X* (fig. 35), which, in continuity with the edge, brought reflux blood, not otherwise from what is happening also in the upper vessels. Sometimes it has been possible to observe the following structure of the extracted heart: in the structure the passage from the right ventricle to the left of the heart appeared more thick, thanks to the flesh *Z* settled around. The chick so shaped was in the narrow receptacle *Y* (fig. 33) of the amnion enveloped by the chorion +.

⁴¹ La vena vitellina posteriore. (Luigi Belloni, 1967)

⁴² Ossia il *fretum Halleri* tra il ventricolo indiviso e il *bulbus cordis*. (Luigi Belloni, 1967) § *Fretum* in latino significa stretto di mare. Il *fretum Halleri* è il restringimento presente nel cuore fetale tra le orecchiette e il ventricolo. In corrispondenza del *fretum* si formeranno le valvole semilunari aortiche e polmonari. § Albrecht von Haller fisiologo e poeta svizzero (Berna 1708-1777). Allievo a Leida di Hermannus Boerhaave, si dedicò a studi botanici e anatomici. Nelle *ICONES ANATOMICAЕ* descrisse per primo (1743-1756) la circolazione arteriosa nel corpo umano e pubblicò i suoi *PRIMI LINEAMENTI DI FISILOGIA* nel 1747; studiò le proprietà del sistema nervoso e muscolare nel *DE PARTIBUS CORPORIS HUMANI SENSIBILIBUS ET IRRITABILIBUS*, del 1752, respingendo le interpretazioni materialistiche di Julien Offray de La Mettrie; studiò anche lo sviluppo degli embrioni; nel 1766 pubblicò gli *ELEMENTA PHYSIOLOGIAE CORPORIS HUMANI*.

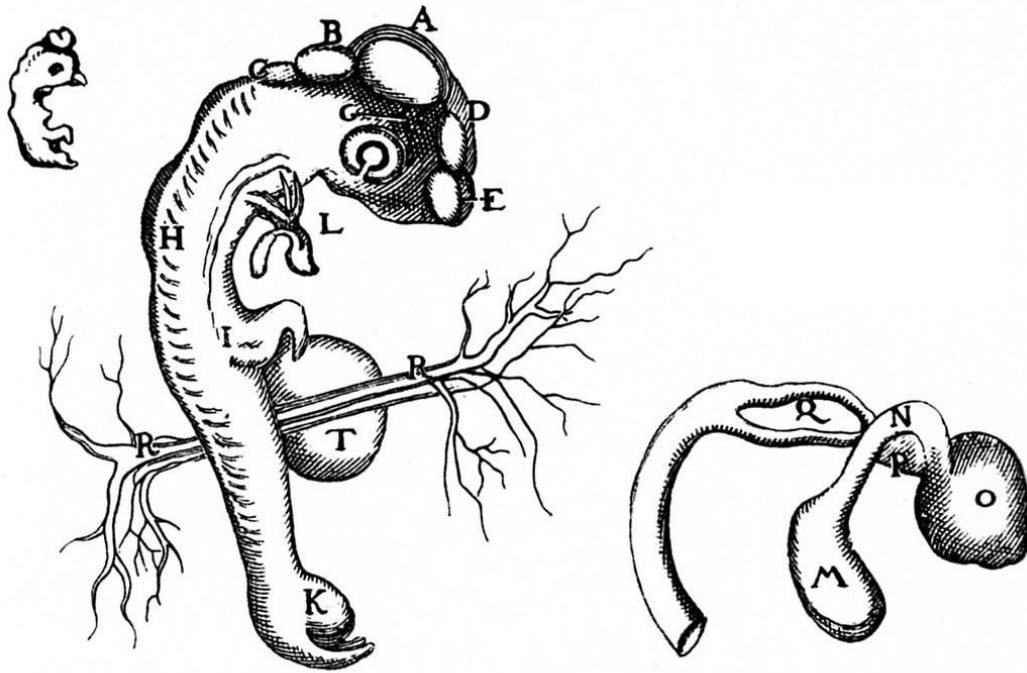


figura 36

Post *quartam diem* longe auctior cicatricula, non adhuc ex toto horizontalis erat: Vitelli substantia valde palearis, albumenque fustum erat: Sanguinea vasa ampla, et venae, ut plurimum, latiores, limbum praecipue amplo trunco pervadebant, excurrente sanguine una cum subluteo humore. Fig. 36. In amnio pullus curvo corpore taliter iacebat: Caput praeter caeteris turgebat; vesicula enim cristata *A*, quae in geminas videbatur dividi partes, cinerea parumque concreta replebatur substantia: Non longe in occipite secunda locabatur cerebelli vesicula *B*, parum profunda, cui subiecta erat portio spinalis medullae *C*: In anteriori parte profundius custodiebatur *D*, et apicem binas pariter terminabant vesiculae *E*: Oculi cum nigro circulo *F*, et contentis humoribus, eminebant; inter hos et cristatam vesiculam sanguineum vas *G* amplum excurrente. Carina subcinerea molli carne tegebatur, ita tamen ut vertebrarum ossa *H* parum elevarentur. Alae *I* et crura *K* elongabantur. Non longe a capite exhiante pectore Cor *L* erumpebat, cuius forma erat haec: Primo itaque sanguis ab auricula *M* propellebatur per canalem subalbum *N* in cordis dextrum *O*, a quo in sinistrum *P*, indeque in continuatas arterias *Q*: Cordis structura carne muscolosa evidenter excitabatur. Ab abdomine umbilicalia vasa prodibant, et arteria *R* latior erat, rubicundoque turgebat sanguine; vena vero inferior et arctior subluteo scatebat humore.

After the 4th day the cicatrice, much greater, was not yet quite horizontal. The substance of the yolk was very straw-yellow and the albumen was liquid. Wide blood vessels and the veins, generally greater, reached the peripheral edge above all with a wide trunk where the blood flowed together with a yellowish liquid. The chick was laying in the amnion with the bent body and appeared this way: the head was more swollen than the remaining parts, in fact the helmet-shaped vesicle *A* (fig. 36), that seemed to be divided into two parts, was full of an ashy substance and not very dense. Not far, in occipital place, there was the second cerebellar vesicle *B*, not very deep, under which a part of the spinal marrow *C* was lying. In the anterior part the vesicle *D* was guarded at greater depth, and likewise the two vesicles *E* marked the limits of the top of the head. The eyes were sticking out with the black circle *F* and the liquids in them contained; between them and the helmet-shaped vesicle a wide blood vessel *G* flowed. The carina was covered by ashy and soft flesh, nevertheless so that the bones of the vertebrae *H* lifted not much. The wings *I* and the legs *K* lengthened. Not far from the head escaped from the opened breast the heart *L*, whose shape was the following: insofar at first the blood was pushed by the auricle *M*, through the whitish channel *N*, in the right part *O* of the heart, hence in the left part *P* and then in the following arteries *Q*. The structure of the heart was clearly made by muscular flesh. From the abdomen went out the umbilical vessels and the artery *R* was wider and

Prope umbilicalia vasa, vesicula T^{43} figebatur ichore plena. Intus partium rudimenta condebantur, quae candida et mollia rudem sacculorum exhibebant speciem. Contentus in chorio humor, veluti lactis serum, igne nequaquam concresebat, sed excitata pellicula in bullas resolvebatur.

was swollen of red blood. On the contrary the vein, situated more below and being more narrow, was full of yellowish liquid. Near the umbilical vessels there was the vesicle T full of liquid. Internally there were the sketches of the parts, which, white and soft, were roughly similar to small sacks. The liquid contained in the chorion didn't coagulate at all, as the milk's serum, in contact with the fire, but, after having made a film, it was dissolving into bubbles.

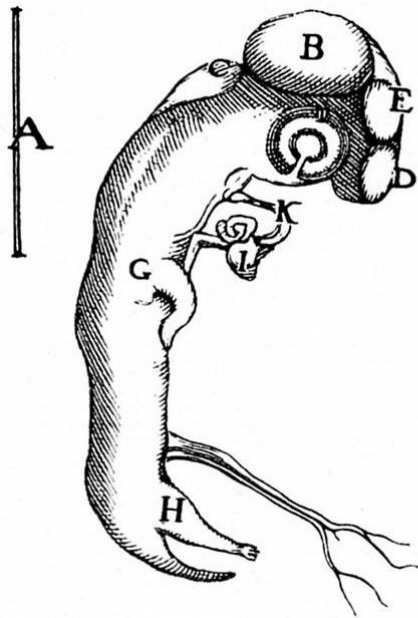


fig. 38

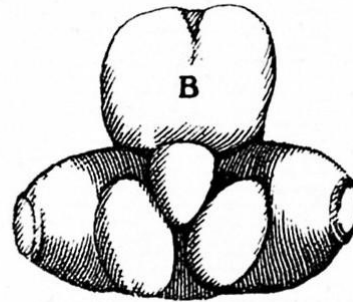


fig. 37

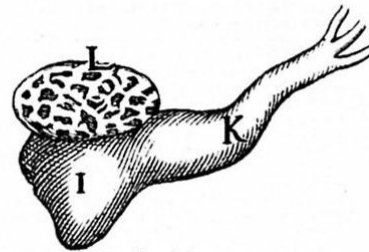


fig. 39

Fig. 37. Fig. 38. *Quinta transacta die* auctior erat cicatricula, et pullus in colliquamento degens curvabatur et convellebatur; eius naturalis magnitudo erat A. Amplum erat caput, quod cristata vesicula B integrabatur; haec filamentosa replebatur substantia; huic haerebat cerebellum C; anterieus geminae eminebant vesiculae D, et superius profundior locabatur vesicula E; hinc inde oculi F adstabant: Reliquum corporis carne tegebatur, alis G et cruribus H extra pendentibus. Fig. 39. Patente thorace cor extra locabatur, quod ventriculo dextro I, et sinistro K, componebatur, superposita pariter auricula L. Viscera magis patebant, praecipue Pulmones rubiginosi coloris, diluti tamen. Umbilicalibus vasis vitellum penetrantibus vitellinae substantiae haerebant.

When the 5th day passed, the cicatrice was greater and the chick soaked in the colliquation was bent and showed some contractions. Its natural size was A. The head was big, formed by the vesicle helmet-shaped B (fig. 37 and 38) full of a filamentous substance. The cerebellum C stuck to it, at the front they stuck out two vesicles D and above, more deeply placed, the vesicle E was located. At both sides there were the eyes F. The remainder of the body was covered by flesh, with wings G and legs H leaning outside. The heart was located outside the thorax, that was open, and was composed of the right ventricle I and left K, as well as of the superposed auricle L. The entrails were more evident, above all the lungs rust in colour but diluted. Substances of the yolk stuck to the umbilical vessels penetrating in the yolk.

⁴³ Forse il nucleo del Pander, che fa la sua ultima comparsa. (Luigi Belloni, 1967)

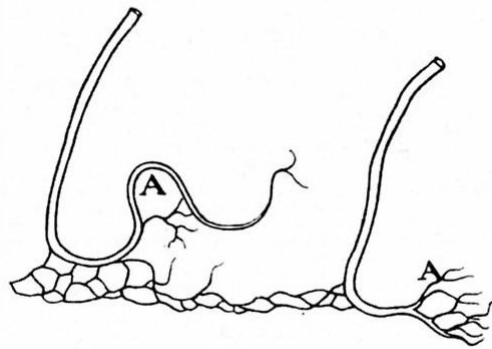


fig. 40

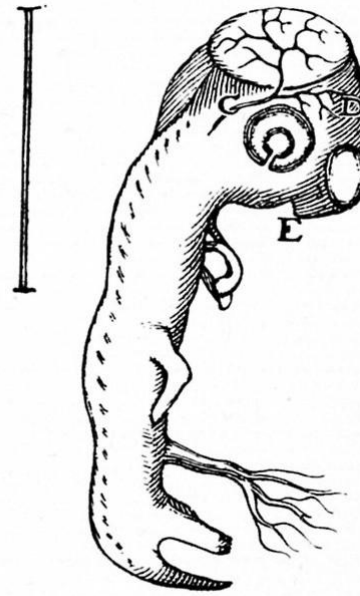


fig. 41



fig. 42

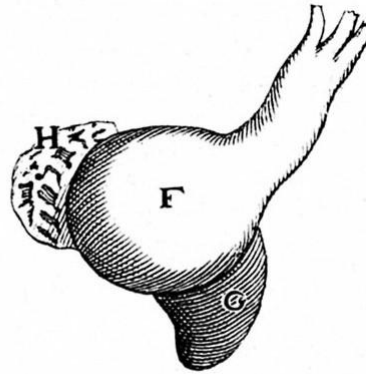


fig. 43

Fig. 40. [8] *Sexta completa die* albumen colliquatum erat; umbilicalium area duas vitelli tertias occupabat. Vasorum fines *A* in limbo frequenter reflectebantur, et inequale rete mutua anastomosi efformabant. Fig. 41. Fig. 42. Pullus in amnio crystallino cubabat: Solita aderat vesicularum cerebri structura, et amplo vase *C* cristata irrigabatur vesicula, eique proxima *D* obscurabatur, nec patebat nisi denudato et divulso cerebro. Rostris principium *E* emergebat. Fig. 43. Patente adhuc thorace Cor apparebat, cuius sinister ventriculus *F* deorsum retractus, et dilatatus, consocio incumbabat ventriculo *G*, superextensa auricula *H*. Interius iecur, renes, et pulmones magis patebant.

When the 6th day passed, the albumen melted. The umbilical area occupied two thirds of the yolk. The vascular extremities *A* (fig. 40) often were bending in correspondence of the peripheral edge and by mutual anastomosis produced an irregular net. The chick was laying in the crystalline amnion. The usual structure of brain vesicles was present, and the helmet-shaped vesicle was permeated by the wide vessel *C* (fig. 41) and the vesicle *D*, located nearby, was hidden, and became visible only after having bared and removed the brain. The sketch *E* (fig. 41) of the beak was sprouting. Being the chest still open, the heart was visible: its left ventricle *F* (fig. 43), stretched downward and dilated, was above the companion ventricle *G*, and above them the auricle *H* was stretching. Internally, liver, kidneys and lungs were better evident.

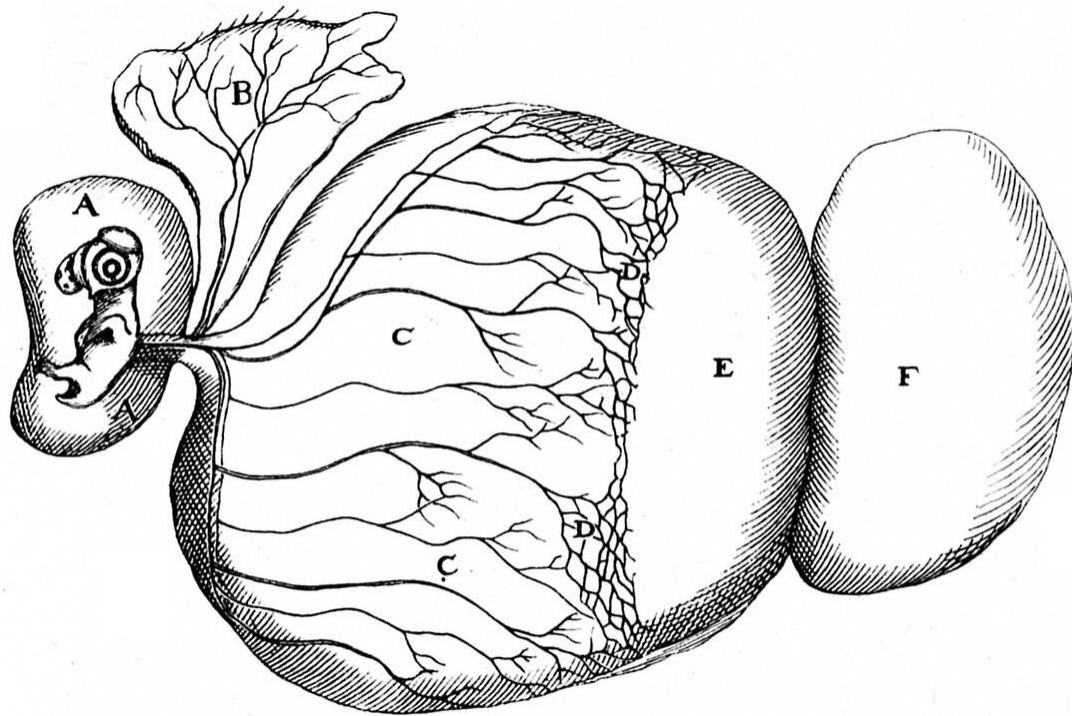


figura 44



fig. 45

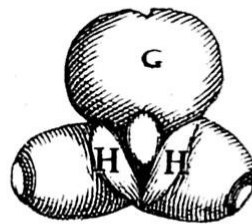


fig. 46

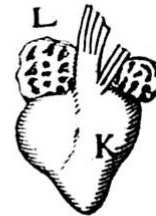


fig. 47

Fig. 44. Manifestiora singula reddebantur superata *septima die*: Cubabat etenim pullus in amnio *A*, quod a chorio hic disrupto *B*⁴⁴ ambiebatur; nectebatur autem chorion vitelli membranae prope limbum umbilicalium, quae a pullo derivata, et in amnion, chorion et vitellum *C* producta, inclinatis finibus *D* limbum efformabant. Fig. 45. Fig. 46. Reliquum vitelli *E* appensam servabat glutinosam albuminis *F* partem. Pullus solita pollens figura, capite et oculis constabat insignibus, et cristatae vesiculae *G* exterius fibrosa integrabantur substantia; interior vero ipsarum cavitas ichore turgebat: Anteriores pariter vesiculae *H*, curvatae, sursum retrahebantur, sub quibus rostrum *I* pendeat;

When the 7th day passed, each structure was better visible. In fact the chick was laying in the amnion *A* (fig. 44) enveloped by the chorion *B* here represented lacerated. And besides the chorion was connected to the membrane of the yolk near the girdle of the umbilical vessels, which, coming from the chick and pushing themselves toward amnion, chorion and yolk *C*, formed the peripheral edge with their refolded terminations *D*. The remaining yolk *E* was keeping hung the sticky part of albumen *F*. The chick, endowed with the usual shape, showed very great head and eyes, and the vesicles helmet-shaped *G* (fig. 45) were externally enriched by fibrous substance, while their inside cavity was bulgy of liquid. Item the anterior vesicles *H*, bent, withdrew upward and under

⁴⁴ L'allantoide (allantocorio). (Luigi Belloni, 1967) § Allantoide: dal greco *allantoeidēs*, che ha la forma di salsiccia, essendo *allās* la salsiccia, il sanguinaccio. In embriologia, uno degli annessi fetali che, negli animali amniotici, ha funzione respiratoria, nutritizia ed escretoria per l'embrione.

cerebellum cum principio spinalis medullae iam solidefactum erat. Thorax acuminatus erat, in quo levi tectum pellicula Cor pulsabat, in hanc redactum formam; gemini enim ventriculi iuxta locabantur, et sinister *K* amplior et rubicundior erat, dextra vero auricula *L* capacior. Ventriculus carnosus, cum intestinis candidus, rite conformatus observabatur; costulae niveae, et adhuc molles, iecurque mucosum erat, oblongis glandulis constans.

Interea usque ad *nonam diem* firmiora reddebantur viscera, et Cor solita gaudebat forma: Iecur xerampelinum⁴⁵, glandulosis utriculis constans observabatur, qui distinctis areis, alias expositis, continebantur. Chorion⁴⁶ ichor, relicta crusta, igne in bullas resolvebatur, quod idem amnii humori accidebat.

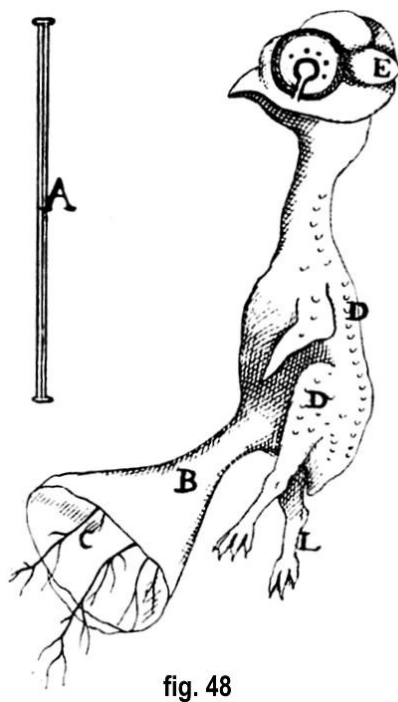


Fig. 48. Post *nonam* vero *diem* pullus longitudinis *A* in amnio, quod exiguum adhuc erat, innatabat; chorion autem auctius erat. Umbilicalia vasa, in vitello per superiorem partem producta, venosa erant, haecque lata; arteriae autem arctiores, vitelli tunicam profunde penetrabant. Umbilicus *B* latus continuata et elongata cute excitabatur; eius concavitas *C*, ab umbilicalibus vasculis et

them the beak *I* was hanging; the cerebellum was already consolidated together with the initial part of the spinal marrow. The thorax was sharp and in it the heart, covered by a thin membrane, pulsated and had acquired the following shape: then, the two ventricles were juxtaposed and the left *K* (fig. 47) was wider and more red, while the right auricle *L* was more capacious. Together with the bowels the muscular stomach was seen that was white and regularly conformed, the ribs were snow white and still soft, and the liver was mucous and constituted by lengthened glands.

In the meantime, until 9th day, the entrails were growing stronger. The heart maintained the usual shape. The liver was seen, endowed with the colour of a drying leaf of vine, and formed by small glandular cavities contained in distinct areas, described elsewhere. The liquid of the chorion, using the fire, was dissolving in bubbles, leaving a crust, and the same thing happened for the amniotic liquid.

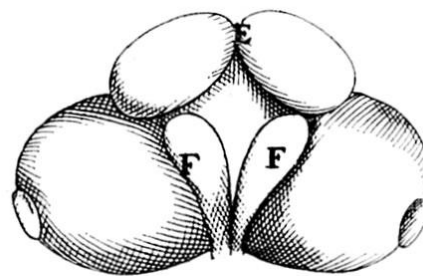


fig. 49

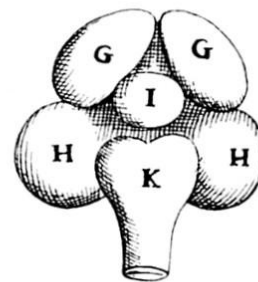


fig. 50

After the 9th day the chick, of the length *A* (fig. 48), was floating in the amnion that was still not many, while the chorion was more abundant. The umbilical vessels, branching off in the yolk through the superior part, were venous and wide, while the arteries, more narrow, deeply penetrated the membrane of the yolk. The wide navel *B* was formed by a continuous cutaneous prolongation: its concavity *C* was occupied by umbilical small vessels and by

⁴⁵ *Xerampelinus* deriva dal greco *xērampélinos*, da *xērós* = secco e *ámpelos* = vite, quindi un colore che richiama quello di una foglia di vite che sta seccando.

⁴⁶ Il liquido allantoideo. (Luigi Belloni, 1967)

pendentibus intestinis occupabatur. Fig. 49 Exterior corporis habitus tumoribus D^{47} , pro futuris pennis exasperabatur. Cerebri cristatae vesiculae E , quae in opticorum nervorum exortum desinunt, minores et profundiores redditae, ad latera inclinabantur: Idem accidebat anterioribus vesiculis F . Fig. 50. Cerebri quoque basis iam pene solidefacti talis erat; anteriores vesiculae G^{48} patebant, nervorum pariter opticorum exortus a cristatis [9] vesiculis H^{49} in oculos incurrebat; infundibuli portio I , a contigua excitata vesicula, cerebri continuitatem fulciebat, et non longe spinalis medullae principium K^{50} pendebat. Pedes lati L observabantur, et rostrum osseum producebatur.

hanging intestines. The external covering of the body was made irregular by the swellings D , that would give the feathers. The helmet-shaped brain vesicles E , ending in correspondence of the origin of the optic nerves, became smaller and deeper, and were tilting sideways. The same thing happened to the anterior vesicles F . Also the base of the brain already almost solidified was showing itself this way: the anterior vesicles G (fig. 50) were evident and likewise the origin of the optic nerves from the helmet-shaped vesicles H was penetrating in the eyes; the funnel-shaped portion I , formed by the adjacent vesicle, assured the continuity of the brain, and not far the beginning K (fig. 50) of the spinal marrow was hanging. Wide feet L (fig. 48) were seen and the bony beak was sticking out.

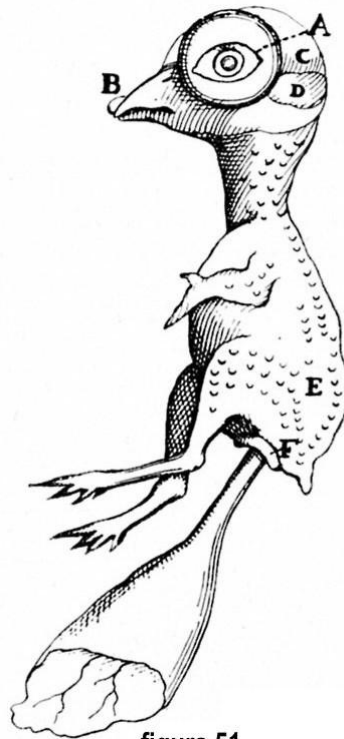


figura 51

Circa *decimam diem* chorii latitudo usque ad crassum albumen extendebatur; fusa valde erat vitelli substantia. Fig. 51. Pullus curvo corpore iacebat, insigniter protuberantibus oculis, qui nictitante membrana A muniebantur. Rostris apex B osseus extuberabat, cerebri vesiculae anteriores C , et cristatae D solidefactae sensim obscurabantur. Corporis habitus tuberculis E^{51} tegebatur. Circa umbilici exitum obducebatur labium F . Iecur rubiginosi coloris cum

Around the 10th day the width of the chorion was extending until the dense albumen, and the substance of the yolk was notably liquefied. The chick was laying with the bent body and with the eyes that stuck out quite a lot, endowed with the nictitating membrane A (fig. 51). The bony apex B of the beak was swollen, the anterior brain vesicles C and those helmet-shaped D were consolidated and little by little were hiding themselves. The surface of the body was covered by the tubercles E . Around the umbilical

⁴⁷ I follicoli delle piume.

⁴⁸ Gli emisferi cerebrali. (Luigi Belloni, 1967)

⁴⁹ I lobi ottici del mesencefalo. (Luigi Belloni, 1967)

⁵⁰ Il midollo allungato. (Luigi Belloni, 1967)

⁵¹ I follicoli delle piume.

glandulis, vasis haerentibus, excitabatur, turgente bilis folliculo.

hole the lip F was located. The rusty liver was well visible with the glands adherent to the vessels, and the gall bladder was full of bile.

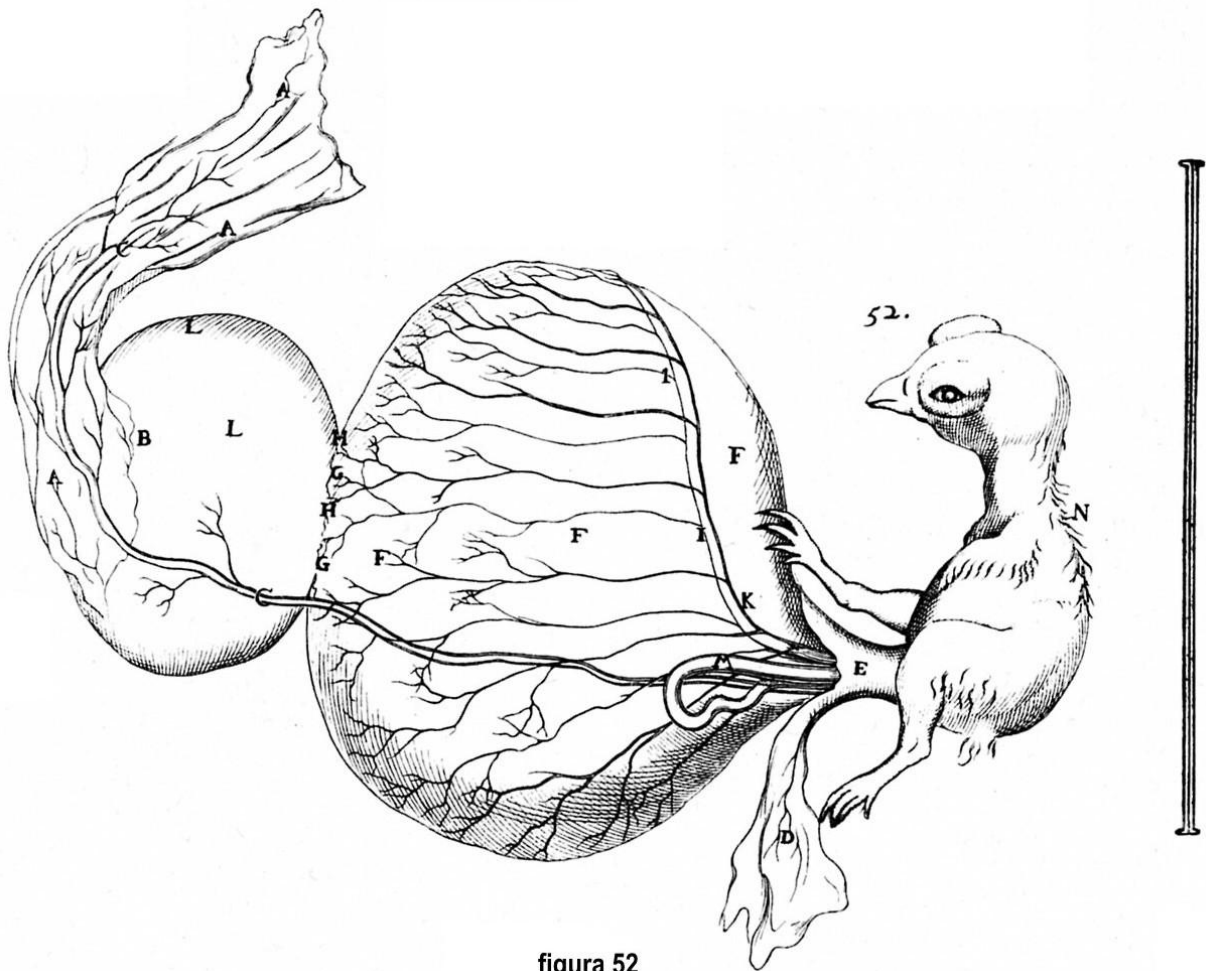


figura 52



figura 53

Fig. 52. Absoluta *duodecima die* chorion *A*, sanguineis vasculis irrigatum, paucoscebat succo, qui igne evanescebat in bullas; nectebatur vero membranæ *B*, crassum albumen investienti, recipiebatque sanguinea vasa *C*, venam scilicet et arteriam, ab umbilico. Succedebat pullus, amnio *D* circumdatus, quod ab umbilico *E* producebatur; ab eodem etiam derivabatur vitellus *F*, cuius laxa erat membrana, oleosam et glutinosam continens substantiam. Haec vitelli membrana undequaque libera erat, soloque limbo *G*, veluti ciliari ligamento, crassiori albumini in situ *H*

When the 12th day passed, the chorion *A* (fig. 52), irrigated by little blood vessels, contained little juice that at the fire was dissolving into bubbles, but it was connected with the membrane *B* winding the dense albumen and receiving from the navel the blood vessels *C*, that is, a vein and an artery. The chick was following, wound by the amnion *D* coming from the navel *E*, from which derived also the yolk *F*, whose membrane was loose and contained an oily and sticky substance. This membrane of the yolk was free at each side and was connected with the more dense albumen in the area *H* only with the edge *G*, as being a ligament shaped as a rima palpebrarum. Through

nectebatur: Per hanc vena *I* et arteria *K* ramificabatur usque ad limbum. Crassum albumen *L* diaphanum propria donabatur tunica, et venas et arterias umbilicales recipiebat. Umbilicus *E*, quasi intestinum, laxata et tubulosa cute componebatur, et intestina *M*, foras erumpentia, aliaque insuper sanguinea et varicosa vasa continebat. Fig. 53. Exterius plumae erumpebant *N*. Cor hanc speciem prae se ferebat; protuberante ventriculo sinistro *O*, superpositis auriculis geminis, dextra inquam *P*, et sinistra *Q*. Iecur, debita constans forma, vesiculam, viridi turgidam bile, appensam habebat, cuius portio in carnosum ventriculum deducebatur.

this membrane were branching off the vein *I* and the artery *K* until the external edge. The dense albumen *L*, transparent, was endowed with a proper membrane and was housing the umbilical veins and arteries. The navel *E*, composed of loose skin and full of small tubes, as being a bowel, contained the prolapsed intestines *M*, as well as other blood and varicose vessels. Outside, the feathers *N* (fig. 52) were sprouting. The heart showed this appearance: the left ventricle *O* (fig. 53) was sticking out and above it there were the two auricles, that is, the right *P* and the left *Q*. The liver, duly shaped, brought hung a vesicle turgid of green bile, that partly flowed in the muscular stomach.

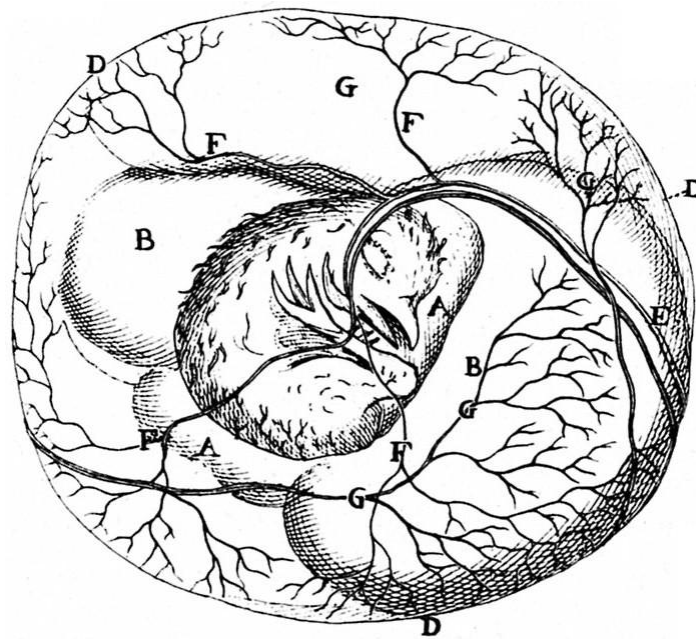


figura 54

Fig. 54. *Decima quarta* elapsa die, pullus flexa carina in amnio *A* innatabat, quod gracillimis et pene inconspicuis vasculis irrigabatur: Eius succus adauctus, veluti sanguinis serum, concresebat. Circumlocabatur vitelli moles *B*, cui haerebat crassius albumen *C*; haec omnia chorii tunica *D* ambiebantur: Per hanc producebantur sanguinea Vasa, quorum amplum *E*, ab umbilico emergens, tortuosum et varicosum redditum, ramos *F* progignens, in reticulare opus desinebat: Proxime alterum excurrerat vasculum rubicundius, easdem ramificationes sortitum. Alia pariter sanguinea vascula *G*, ab umbilico exorta, graciliora, inter exaratas productiones *F* propagabantur. Pulli habitus totus fere plumis contegebatur. Ungues et rostrum solidam acquisierant naturam. Interius pulmones subalbi; ventriculus carnosus,

When the 14th day passed, the chick with the bent carina floated in the amnion *A* (fig. 54) bedewed by very thin small vessels and almost invisible. Its liquid, increased, coagulated as haematic liquid. All around the mass of the yolk *B* was present, to which the rather dense albumen *C* was sticking, and the whole was enveloped by the membrane *D* of the chorion. Through this membrane blood vessels were branching off, and that great *E* of them, going out of the navel, had become tortuous and varicose, sent forth the branches *F* and ended in a reticular structure. Very near, another small vessel flowed, redder in colour, that branched in the same way. Likewise other small blood vessel *G* coming from the navel, more frail, were spreading among the described ramifications *F*. The whole external surface of the chick was almost covered of feathers. The toenails and the beak had acquired a solid structure. There

auctus, lacte replebatur; intestina extra in [10] umbilico pendeant; fellis vesicula, ad caeruleum tendens, iecori appendebatur.

were internally the whitish lungs; the muscular stomach, enlarged, was full of milky substance; the bowels hung outside at navel level; the gall bladder verging to blue was hung on the liver.

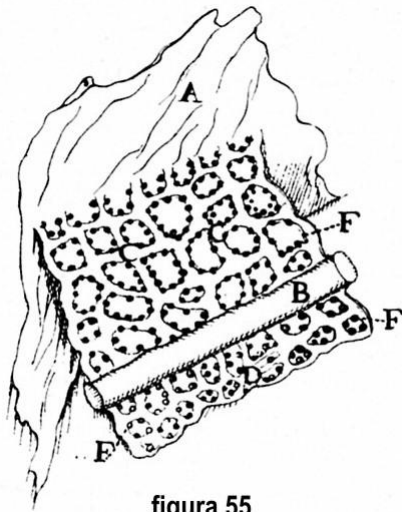


figura 55

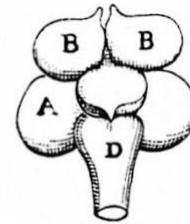
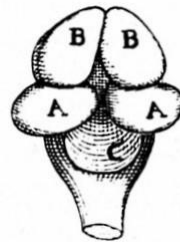


figura 56

Subsequentibus diebus singula firmabantur, et sensim chorii humor absumebatur, qui igne frequenter non concrecebat; amnii vero humor tenuis et diaphanus in candidam interdum sapidamque cogebatur substantiam. Umbilicus carneus, crassefacta cute, extra pendula intestina cum sanguineis Vasis continebat. A vitelli tunica in tenue intestinum brevis meatus aperiebatur. Fig. 55. Vas sanguineum, quod alte penetrabat vitellum, relicta eiusdem tunica A, insigni ramo B pendulum, vitelli profunditatem occupabat, et reticularibus productionibus C eidem tunicae A nectebatur; reliquis vero D, in fluida oleosaque substantia vitelli mergebatur. Circa huiusmodi reticulares ramos C et D pinguedinis sacculi F haerebant, qui venae ramulis irrigabantur. In chorii cavitate Allantoides tunica⁵² sensim manifestabatur; laevis enim mucosaque extendebatur bicornis membrana, in modum sacculi, et subalbam candidamque continebat urinam, quae interdum filamentosa, reticulare opus efficiebat; huius exortus postremis diebus praecipue patebat. Ventriculus cum continuatis intestinis solo turgebat lacte. Iecur postremo, ex rubiginoso subluteum acquirebat colorem, et bilis caerulea erat. Fig. 56. Cerebrum iam solidum factum in superiori parte nervorum opticorum radices A, graciliores redditas, anteriores ventriculos B, Cerebellum C, et principium spinalis medullae D exhibebat; in basi vero, ultra exarata, infundibuli regio

In the following days each and every structure was consolidating and slowly the liquid of the chorion was consuming itself, which often didn't coagulate at fire, while the liquid of the amnion was thin and transparent and sometimes thickened in a white and tasty substance. The fleshy navel, the skin being thickened, contained, together with the blood vessels, the bowels hanging outside. From the membrane of the yolk a short meatus was opening toward the small intestine. The blood vessel deeply penetrating in the yolk, after abandoned its membrane A (fig. 55) and hanging with the big branch B, occupied the depth of the yolk and with the reticular ramifications C was joining with the same membrane A, while with the other ramifications D dipped into the fluid and oily substance of the yolk. Around these reticular branches C and D, pouches of fat F were sticking, irrigated by small venous branches. In the cavity of the chorion slowly the allantois membrane was showing itself: in fact it was extending, as being a small sack, a very thin and mucous two-horned membrane, and it contained a whitish and snow-white urine, which, being sometimes filamentous, formed a reticular structure. Its formation was particularly evident in the last days. The stomach, with the bowels continuing from it, was swollen only of milky substance. Finally the liver, from rusty, acquired a yellowish colour and the bile was blue. The brain, already consolidated, was showing, in the upper part, the roots A (fig. 56) of the optic nerves that became thinner, the anterior ventricles B, the cerebellum C

⁵² Allantoide: dal greco *allantoeidēs*, che ha la forma di salsiccia, essendo *allās* la salsiccia, il sanguinaccio. In embriologia, uno degli annessi fetali che, negli animali amniotici, ha funzione respiratoria, nutritizia ed escretoria per l'embrione.

assurgebat.

and the beginning of the spinal marrow D; at its base, on the contrary, besides the described parts, was rising the region of the infundibulum - perhaps hypothalamic.

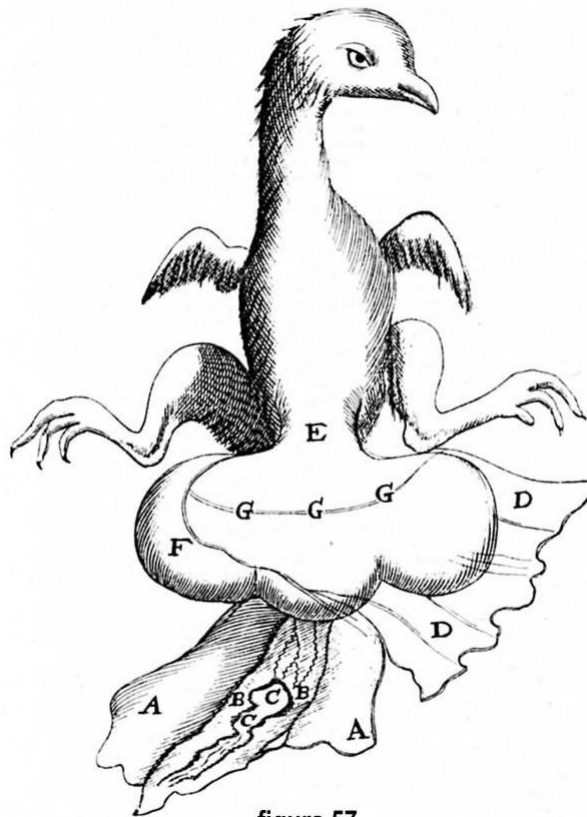


figura 57

Fig. 57. Transacta *decima nona*, chorii substantia *A* crassior reddita quasi carnea, exiguum continebat humorem, eiusque concavitatem Allantoides tunica *B* fere ex toto occupabat, mucosa referta urina *C*. Pullus calcitrabat, amnio *D* contentus. Umbilicus *E* amplus erat, et turgidus ex retracto interiora versus vitello *F*, et ab ipso, amnii *D* tunica in situ *G* producebatur. Intra umbilicum, ultra sanguinea Vasa, intestina mesaraicis irrigata condebantur.

When the 19th day passed, the substance *A* of the chorion (fig. 57), become denser and almost fleshy, contained scarce liquid and the allantois tunica *B*, full of mucous urine *C*, almost entirely occupied its cavity. The chick, contained in the amnion *D*, kicked. The navel *E* was wide and stretched by the yolk *F* that withdrew toward the inside, and from it the membrane *D* of the amnion advanced in the area *G*. Within the navel they were gathered, besides the blood vessels, the bowels, irrigated by the mesenteric vessels.

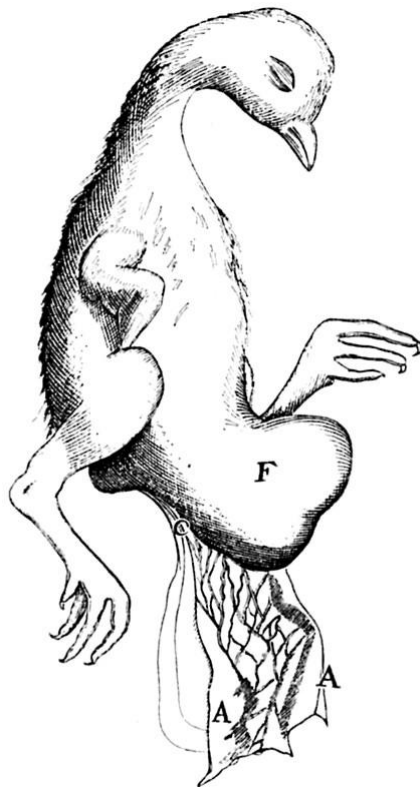


figura 58

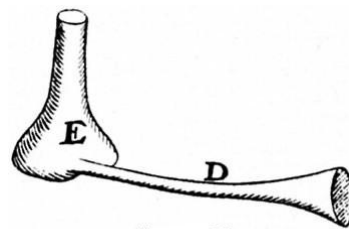


figura 59

Vigesima completa die, Ovi cortex de facili friabilis erat; crassum item chorion, et fere sanguineum, non tamen fibrosum, et succo undequaque vacuum, Fig. 58. solaque Allantoides tunica *A* continebatur, quae urinae striae *B* reticulariter ita ductas et implicatas, ut naturae mysterium crederetis, includebat; Fig. 59. et tandem versus umbilicum *C* deducta, et ventrem subingressa, efformato Uracho⁵³ *D*, in extremum intestini *E* hiabat. Vitelli corpus in ventrem retractum, exteriorem abdominis formam *F* excitabat. Iecur perpetuo lutei coloris erat, quasi vitello turgeret; eius vero fel caeruleum, materia in carnosio ventriculo et tenuibus intestinis contenta lactea erat.

When the 20th day was completed, the shell of the egg was easily friable. Likewise the chorion was thick and almost blood in colour, nevertheless not fibrous and wholly emptied of liquid. Only the allantois tunic *A* (fig. 58) was contained, that included striae of urine *B* so fishnet traced and tangled that you would believe them a mystery of nature. And finally it was going toward the navel *C*, penetrated in the abdomen, made the urachus *D* (fig. 59) and was opening in the extremity *E* of the bowel. The mass of the yolk, withdrawn into the abdomen, caused the external shape *F* (fig. 58) of the abdomen. The liver was always yellow as if turgid of yolk, while its bile was blue. The material contained in muscular stomach and in small intestines was milky.

⁵³ Ùraco: dal greco *ourachós*, uretere del feto o sostituto embrionale della vescica, derivato dal greco *ourá* che significa coda. Canale presente nell'embrione dei vertebrati amnioti, che mette in comunicazione la cloaca con l'allantoide.

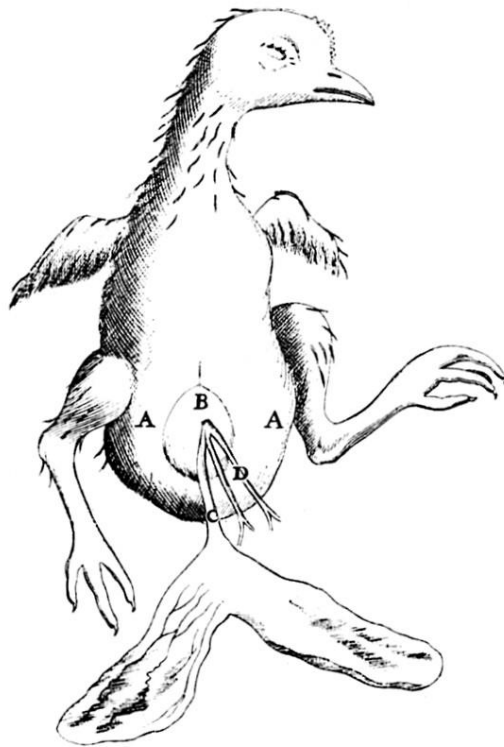


figura 60

Postremo pullus prope exitum pipiebat, et interdum ictu rostri [11] friabilem urgebat corticem; eius venter *A*, turgidus et fere rotundus ex condito vitello reddebatur; Fig. 60. scissura tamen *B* observabatur ex retracto umbilico, a quo Urachus *C* et umbilicalia Vasa *D* prodibant. In aperto pullo vitellus *E* huius magnitudinis⁵⁴, intestinis *F* brevi ductu *G* continuabatur; Fig. 61. haec a carnosio orta ventriculo *H*, versus extremitatem caecales appendices *I* promebant, et dilatata sui portione cloacam *K* efficiebant, a qua erumpebat Urachus. Vitelli substantia viscida et oleosa erat. Iecur adhuc luteum prae se ferebat colorem.

Haec sunt quae Vobis imperantibus in tam profundo naturae mysterio anniversaria hac aggressionem visus sum attigisse, quae licet rudi mea delineata manu, incomptoque exarata stylo extent, pro integro tamen animi voto penes Vos erunt, et fortasse ulterioribus subsequenti-um annorum firmata observationibus, naturae normam in ducendis primis pulli staminibus adumbrabunt.

Dabam Bononiae die Octob. 1672.

FINIS.

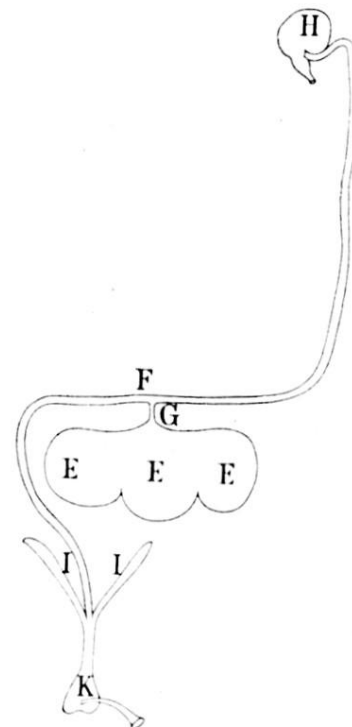


figura 61

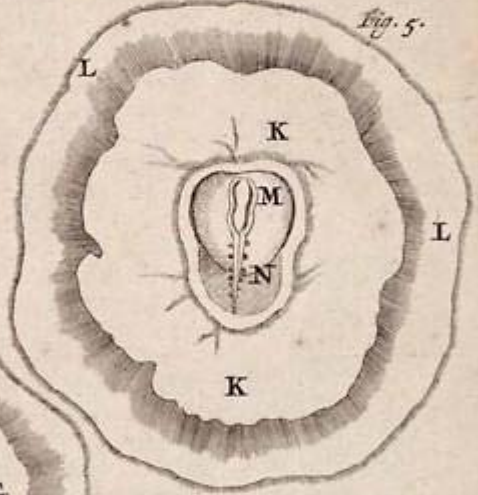
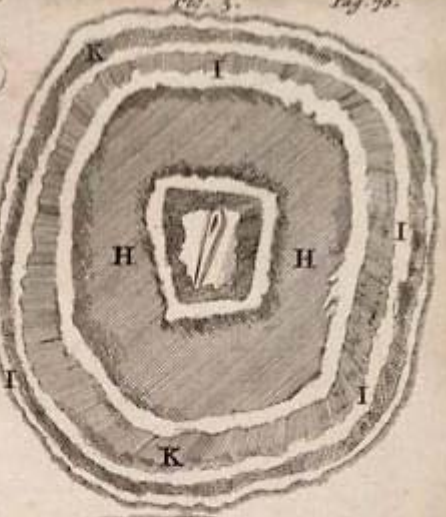
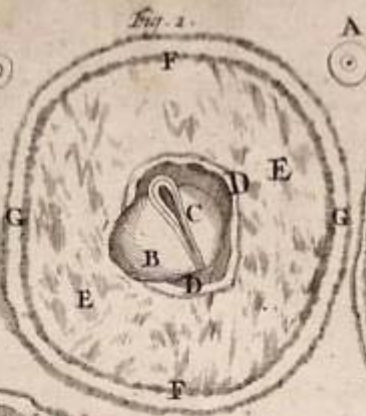
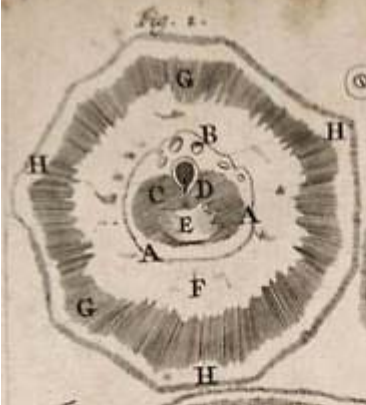
At the end, the chick, very near to go out, peeped and every now and then attacked with hits of beak the friable shell. Its abdomen *A* (fig. 60) was made swollen and almost round by the hidden yolk. Nevertheless the opening *B* was observed, produced by the retreated navel from which the urachus *C* and the umbilical vessels *D* went out. In the sectioned chick the yolk *E* (fig. 61), that had this size, was continuing with the intestines *F* through the short duct *G*. The bowels, coming from the muscular stomach *H*, sent forth toward the extremity the caecal appendixes *I*, and with their dilated part *K* formed the cloaca, from which the urachus came out. The substance of the yolk was viscid and oily. The liver still showed a yellow colour.

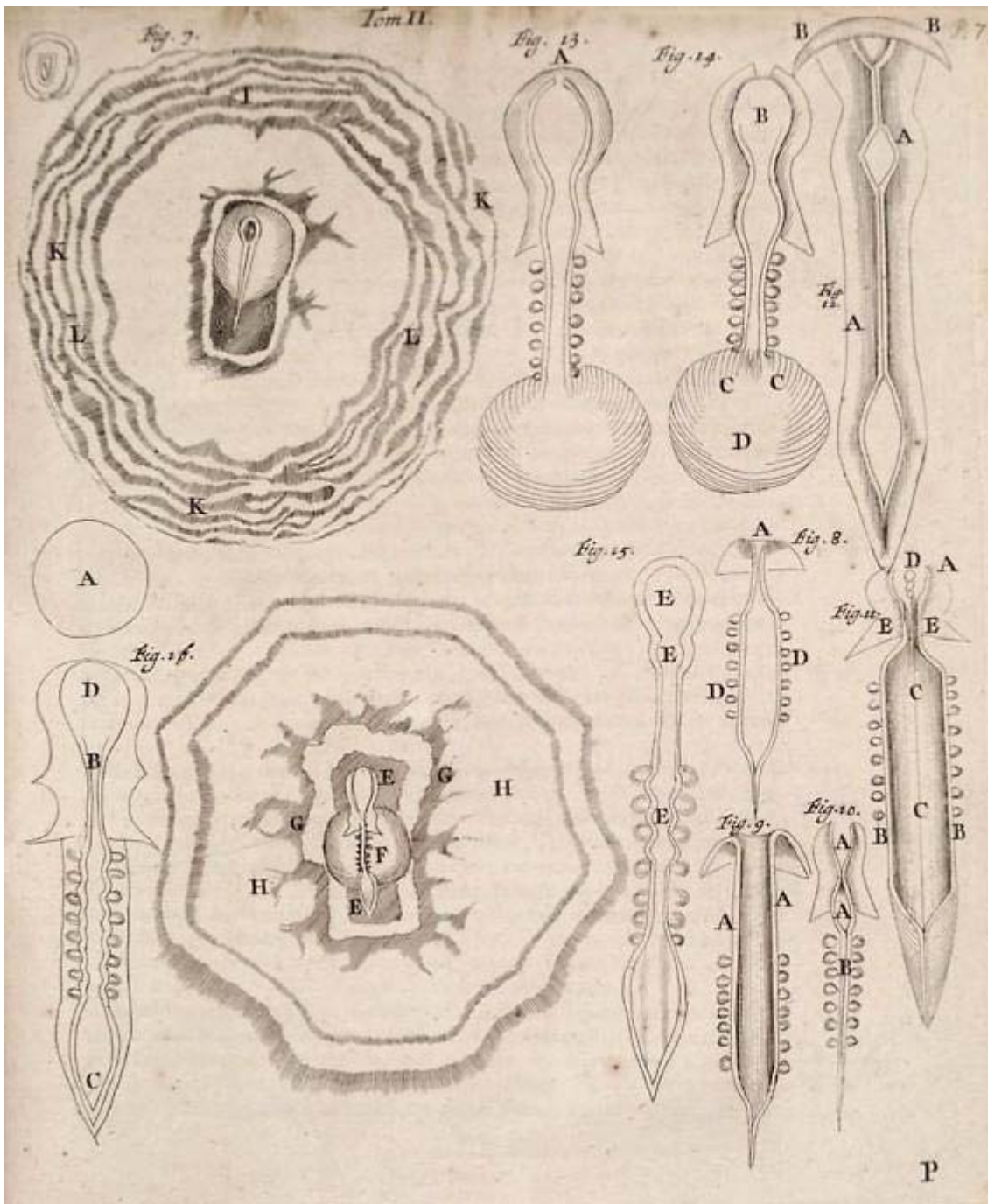
These are the things that on your order seemed me to have examined with this annual assault in a so deep mystery of nature. Although drawn by my rough hand and explained by a bare style, these findings nevertheless will be at your disposal with the wish that they are welcome, and perhaps confirmed by further observations of the coming years, and they will be a sketch of the rule of nature in weaving the first sketches of the chick.

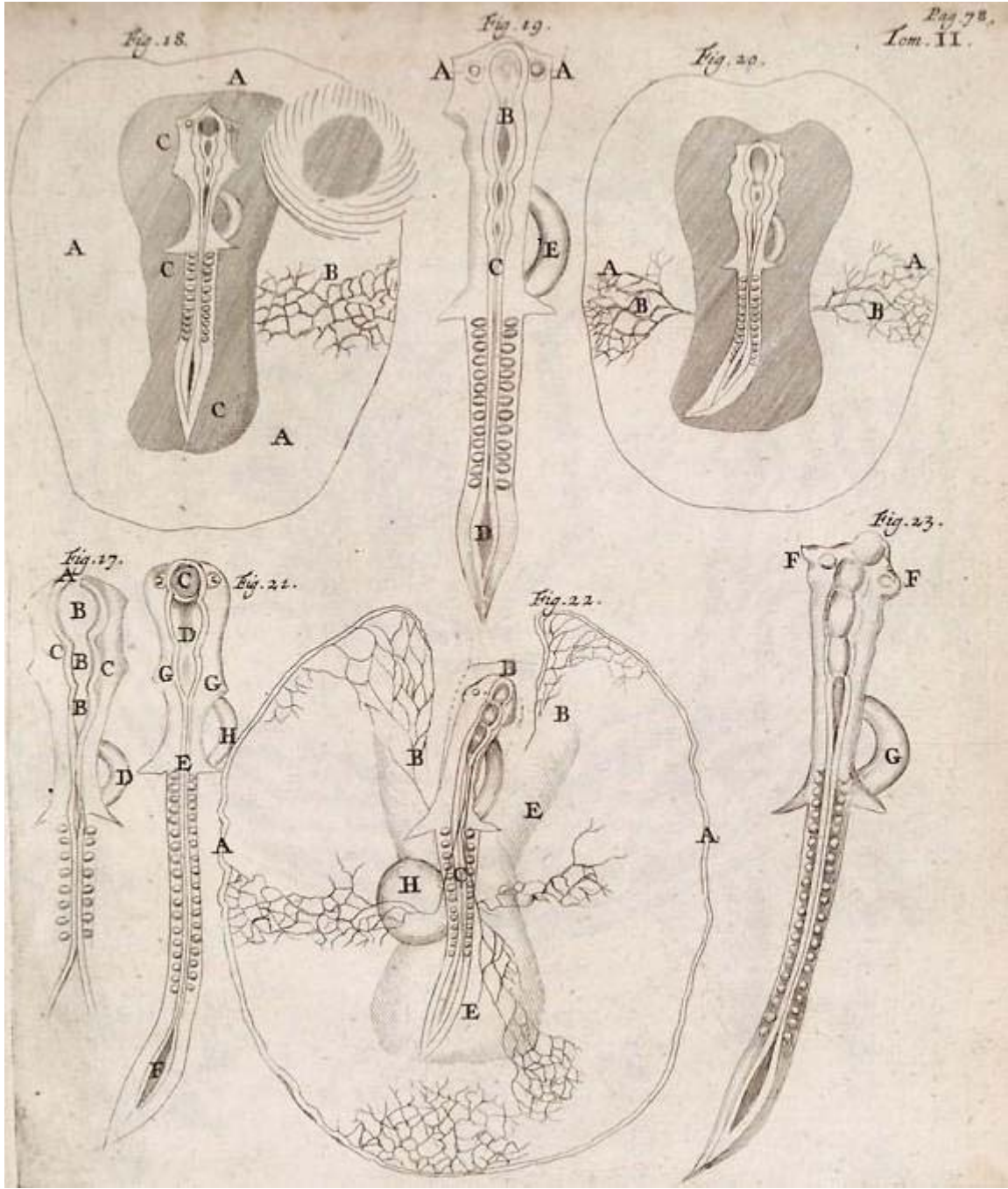
I was delivering in Bologna
on one day of October 1672.

THE END

⁵⁴ Previa riduzione a circa 1:4. (Luigi Belloni, 1967)







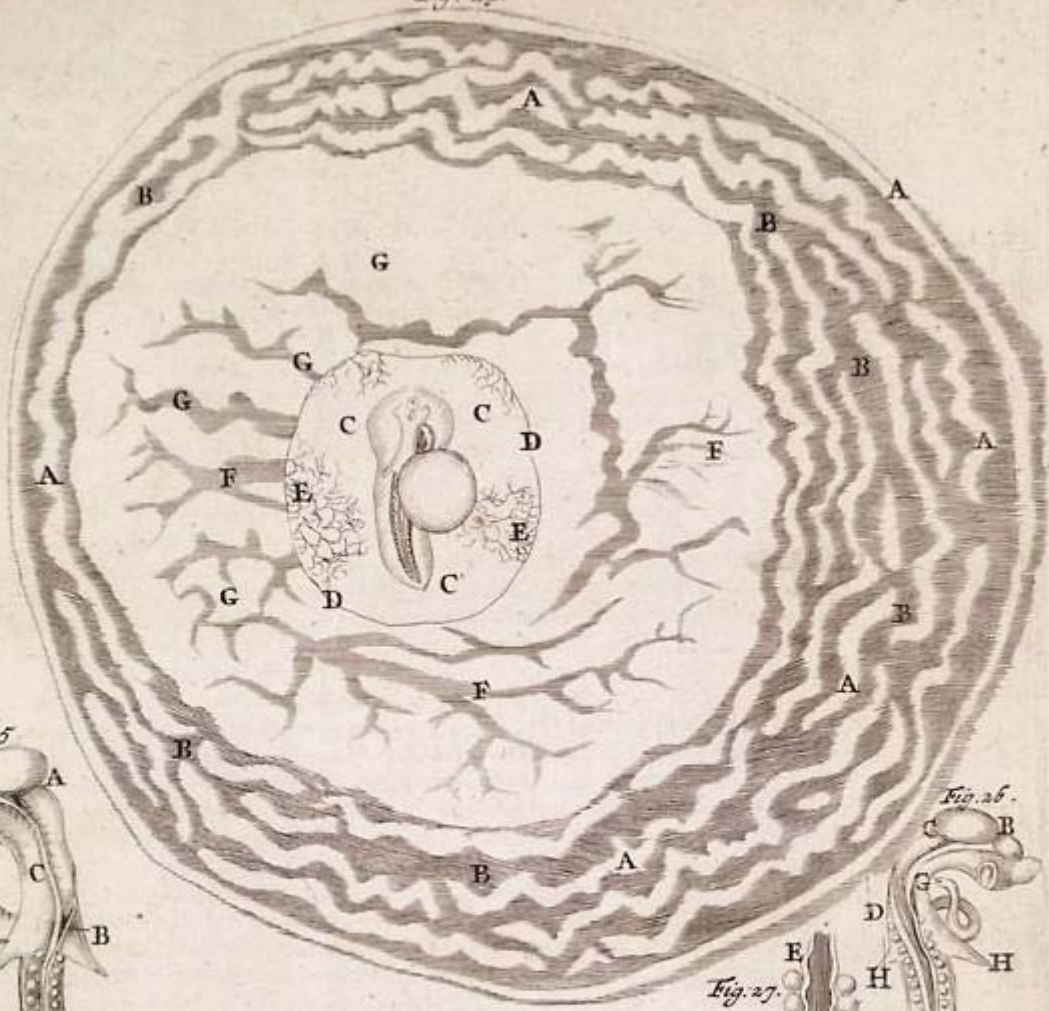


Fig. 25

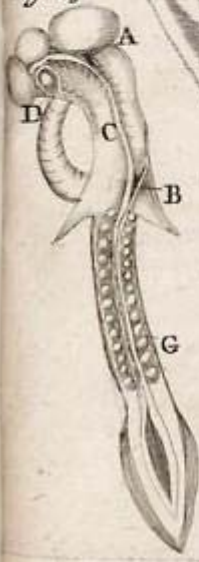


Fig. 26



Fig. 27



Fig. 29

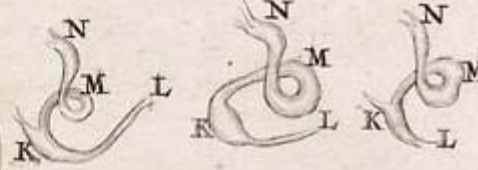


Fig. 28



