The plant is filled with an abundance of milky juice, contained in both stem and roots, which exudes either spontaneously or from punctures made by a beetle which feeds upon it. The sap, as it escapes, hardens and dries upon the stem, and flows or drops to the ground. It is collected in July and August, partly from the stems, partly from the ground, by Persian peasants, and exported to India, and from there to Europe.

Ammoniac consists of these hardened drops, or "tears," as they are technically called. In the best qualities they are separate, or only loosely stuck together in porous masses; in inferior grades they are embedded in a dark-brown resinous matrix. Fine specimens consist of rounded pieces from 1 mm. to 1 or 2 cm. (one twenty-fifth to three-quarters of an inch) in diameter. They are brownish cream-colored externally, darkening to cinnamon brown with age, creamy white, or pure white within. They break with a conchoidal fracture, disclosing a waxy, but shining surface. The odor is peculiar, rather disagreeable, but faint, excepting in masses or upon warming; the taste is bitter and rather acrid. Inferior specimens are those having a large proportion of the darker, homogeneous resins and extraneous substances, such as dirt, sticks, chaff, etc. It is a difficult drug to powder, unless very cold or very dry. When heated it softens, but does not melt. Alcohol dissolves about three-fourths of it. Water disintegrates it, and forms with it a milky emulsion.

Ammoniac consists of about seventy per cent. of resin, fifteen to eighteen per cent. of soluble gum, and the rest of insoluble gum, water, and a trace of essential oil. The latter, according to Flückiger, does not contain sulphur, and, therefore, is not similar to the oil of asafœtida.

Ammoniac is stimulant, expectorant, and antispasmodic, but is scarcely used now internally. The dose is stated to be 0.5 to 2 gm. (gr. viij.–xxx.) three or more times a day. An emulsion would be an eligible form, although a tincture would probably contain all that is active in it. The only official preparation is Ammoniac Plaster (*Emplastrum Ammoniaci*, U. S. P.), made by softening the ammoniac in diluted acetic acid, and evaporating to a suitable extent. It is a stimulating and rubefacient, sometimes blistering application, useful as a mild counter-irritant.

One other species of *Dorema*, according to the "Pharmacographia," yields ammoniac. Bentham and Hooker include only two species in the genus. The ammoniac of Dioscorides and Pliny, and other ancient writers, was obtained in Africa, and is a different article, namely, a gum resin obtained from *Ferula Tingitana* Linn. It is rarely found in European markets. *W. P. Bolles.*

AMMONOL.—A proprietary remedy stated to be ammonium phenylacetamide and recommended as antipyretic, analgesic, and antiseptic. Dose, gr. v.–xx.

Ammonol Salicylate.—A salicylic acid compound of ammonol, claimed to be especially useful in the headache of nervous and anæmic patients, and given in eight-grain doses. Both ammonol and its salicylate are white powders which lose ammonia on exposure to air.

W. A. Bastedo.

AMNESIA. See *Aphasia*.

AMNION.—The amnion is one of the fœtal appendages, being a thin membrane which is derived from the extra-embryonic portion of the somatopleure, and forms the innermost of the envelopes surrounding the fœtus. It occurs only in mammalia, birds, and reptiles (the amniota), and is absent in the amphibia and fishes (the anamniota). Among the invertebrates an amnion is developed by the embryos of many insects. The vertebrate animals which exhibit an amnion are also characterized by the possession of the allantois, another fœtal appendage. These two structures, the amnion and allantois, though associated together in existing species, are distinct in their histological origin and development.

The amnion is a thin, delicate membrane or sac which is situated next to the embryo, separated from it by a space or accumulation of fluid; outside the amnion are the chorion and allantois, and outside these (in mammals) the uterine walls. At an early period the amnion is a separate sac, distinct from the chorion, but later it comes into contact with and is loosely attached to the chorion. In the fully developed human afterbirth the amnion is a well-marked, thin, pellucid membrane lining the inner surface of the placenta and fœtal membranes, from which it can be easily stripped off. At the insertion of the umbilical cord into the placenta the amnion merges into the integument of the cord, which differs somewhat in character from the remainder of the amnion. At the junction of the cord with the abdominal wall, the superficial layers of the cord become continuous with the skin of the fœtus. Hence the amnion is a structure continuous (through the integument of the cord) with the skin, and in the main it is genetically as well as structurally homologous to the skin. The amnion possesses two layers: the superficial layer (that directed toward the fœtus) is of epiblastic origin and epithelial nature, and is the precise homologue of the epidermis; the deeper layer is a connective-tissue stratum of mesoblastic (somatopleural) origin, and corresponds in the main to the cutis vera. Within the amnion is a cavity, the amniotic cavity, which is filled with a fluid (the amniotic fluid), in which the fœtus is immersed.

A distinction is sometimes made between the true amnion and the false amnion. The true amnion is the amnion proper, the innermost of the fœtal envelopes. The false amnion, or "membrana serosa," consists of that portion of the extra-embryonic somatopleure which enters into the formation of the chorion; the chorion is formed by the fusion of the false amnion and the allantois.

Development of the Amnion.—The ontogenetic development of the amnion in all reptiles and birds (which together are often called the sauropsida) appears to take place by substantially the same process, which is well exemplified in the classical case of the chick. In the mammalia, however, there are several important differences and variations in the mode of amnion formation, though in many of the mammals the process is similar to that in the sauropsida.

The development of the amnion is in some cases associated and complicated with that of another membrane, the proamnion; this is a fold of epiblast and hypoblast which covers the anterior portion of the embryo, and is usually a transient structure. It differs from the amnion in consisting of ectoderm and entoderm without intervening mesoderm or cœlom, while the amnion is formed from the somatopleure. It is considered in a separate article.

Preliminary to considering the development of the amnion, it will be convenient to recall some of the features of the early embryo. At a certain early period the embryo exhibits three layers, the epiblast (ectoderm), mesoblast (mesoderm), and hypoblast (entoderm), from without inward. Outside the epiblast there is also another layer, known chiefly under the German term *Deckschicht*, or Rauber's layer, probably to be regarded as a portion of the epiblast. In many cases this outer layer early disappears and may be disregarded; but in numerous species the *Deckschicht* plays a very important part in the formation of the amnion. The mesoblast early splits into two layers, the cleft beginning near the longitudinal axis of the embryo and extending laterally outward. The outer layer thus formed is called the somatic layer of the mesoblast, and it with the epiblast are together termed the somatopleure. The inner layer is the splanchnic layer of the mesoblast, and with the hypoblast forms the splanchnopleure. The cleft or space between the two layers of the mesoblast is called the cœlom or pleuroperitoneal cavity. The layer of cells lining the cœlom has been termed (Minot) the mesothelium, while the rest of the mesoblastic tissue has been called the mesenchyma.

Amnion Formation in Reptiles and Birds.—The de-

velopment of the amnion appears to take place in substantially the same manner in all birds and reptiles, practically as exemplified in the chick.

In the chick, as typical of the sauropsida, the formation of the amnion begins with the growth of a crescentic fold of the somatopleure upward in front and at the sides of the cephalic extremity of the embryo, which becomes sharply flexed on the body of the embryo. This fold grows up over the head as a sort of hood, and gradually extends backward. Later a similar but smaller somatopleural fold grows up over and envelops the posterior end of the embryo.

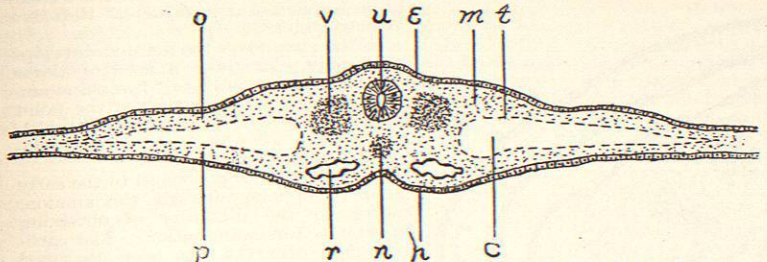

FIG. 94.—Early Development of Embryo, Prior to Beginning of Amnion Formation.

The fœtal body at the same time sinks downward and lateral folds grow up at its sides. As the cephalic somatopleural fold grows backward, the posterior fold forward, and the lateral folds upward and inward, the margins of these folds finally come to meet in a line over the dorsum of the embryo. The edges of the folds then grow together; first the epiblastic cells unite, then by the extension of the mesoblast and the cœlom complete union is effected, and two complete and separate membranes are formed over the dorsum of the embryo. The inner of these is the amnion; the outer (the "false amnion" or membrana serosa) enters into the formation of the chorion, and comes into vascular connection with the embryo by means of the allantois. This process is gone through during about the second, third, and fourth days of incubation, and is illustrated by the accompanying figures (Figs. 94 to 98). Later, the amniotic cavity extends underneath the embryo, so that the fœtal body comes to be completely enveloped in the amniotic membrane.

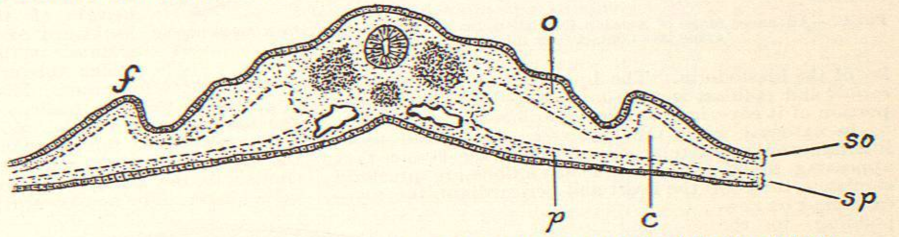

FIG. 95.—Beginning of Formation of Amnion by Upward Growth of Folds of the Somatopleure.

In the ova of *insects* an epiblastic membrane, corresponding closely to and probably analogous with the amnion of the vertebrate amniota, develops so as to envelop more or less of the embryo and enclose a small cavity. This membrane is formed by the growing up and coalescence of folds in a manner strikingly similar to that exhibited by the chick.

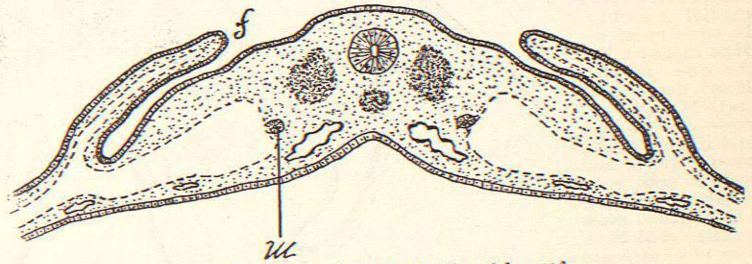

FIG. 96.—Amnion Formation Further Advanced.

Amnion Formation in Mammalia.—There is considerable variety and diversity in the details and the general features of the process of amnion formation in the different varieties of mammalia. In many mammals the process is, in the main, similar to that exhibited by the sauropsida, though with differences in the details; but in other species there is a wide departure from the type presented in the chick. The process is not even uniform within the same orders of mammals, but great differences may occur between allied genera. While the embryology of many species has been worked out, it will still require extensive researches among different varieties of mammals to determine all the forms of amnion development. A few of these forms are briefly described below.

In the *rabbit* the amnion is derived from a somatopleural fold like that in the chick, which begins, however, only at the caudal extremity and gradually grows forward over the embryo (Fig. 99). The anterior end of the embryo becomes covered by a large proamnion, but by the forward growth of the posterior amniotic fold the proamnion is ultimately obliterated and replaced by the true amnion.

In the *opossum* a similar caudal amnion fold grows up at first, but this disappears and is replaced by proamnion, which ultimately covers the entire embryo.

In the *hedgehog*, according to A. A. W. Hubrecht ("Die Phylogenese des Amnions und die Bedeutung des Trophoblasts," Amsterdam, 1895), the *Deckschicht* (or "trophoblast") plays an important part in the formation of the amnion. A space (*a*, Fig. 100) early appears between the formative epiblast (*e*), or epiblast that is to take part in the formation of the embryo, and the overlying portion of the *Deckschicht* (*b*); this space is to develop into the amniotic cavity. From the inner surface of this overlying portion of the *Deckschicht* (*b*) a layer then splits off, beginning at the margin of the formative epiblast, and the cœlom and somatic layer of the mesoblast at the same time grow into the cleft thus formed. By the complete splitting off of this inner layer (*n*, Fig. 101) from the *Deckschicht* the amnion is formed, the *Deckschicht* remaining to take part in the formation of the chorion.

Hubrecht also describes modifications of this process of amnion formation in other animals.

In many of the *rodents* (but not all) a peculiar process occurs, known as the "inversion of the germ layers," in which the *Deckschicht* plays an important part. A proliferation of cells takes place at one point of the *Deckschicht*, forming a cellular mass known as the *Träger*, and which ultimately takes part in the formation of the placenta. The epiblastic cells beneath the *Träger* also accumulate in a mass, so that the two masses of cells, those of the *Träger* and those of the epiblast, together form a sort of plug, which projects into and fills the cavity of the blastoderm. The hypoblast lining the *Deckschicht* and epiblast is thus invaginated into itself; that portion of it covering the mass of epiblastic cells appears to be external while the epiblastic cells seem to be internal, the usual relations of these two layers thus appearing to be reversed. The relations are precisely similar to those of the heart and pericardium, the myocardium corresponding to the *Träger* and epiblast, the pericardium to the hypoblast; while the myocardium appears to be inside the pericardium, it is really outside the pericardial cavity. In some species—Mus musculus (house mouse), Mus decumanus (rat), Mus sylvaticus—the *Träger* and the epiblastic mass coalesce and merge into one another, forming a cylindrical mass within which a cavity appears (Fig. 102). In the epiblastic portion of this cylindrical mass the embryo develops, and by the growing together of folds or constrictions above the embryo a portion of the cylinder is cut off to form the amnion and amniotic cavity.

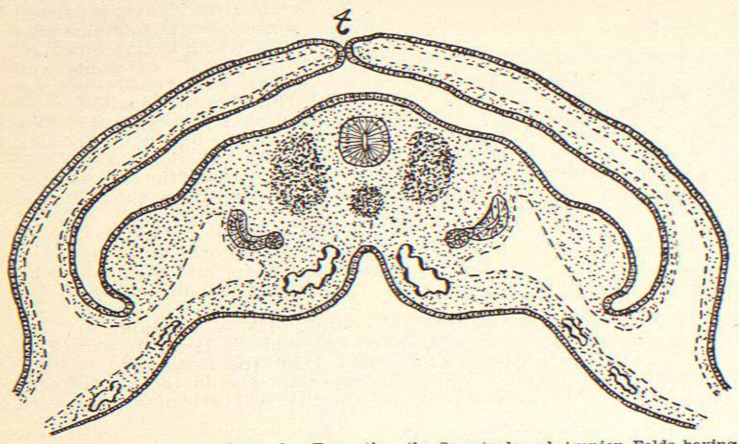

FIG. 97.—Advanced Stage of Amnion Formation, the Somatopleural Amnion Folds having Come into Contact Over the Dorsum of the Embryo.

Similar modes of amnion formation, but differing in certain particulars, are exhibited by other rodents, as in arvicola (field mouse) and the guinea-pig. For detailed illustrations and descriptions of the development of the amnion in various rodents, reference may be made to E. Selenka's "Studien über Entwickelungsgeschichte der Thiere," Heft iii., Wiesbaden, 1884.

In the *ruminants* the amnion develops very early. In these a cord of tissue (the "amniotic cord" or "funiculus amnii") persists for some time at the point of final closure of the amnion and chorion (*t*, Fig. 97) and forms a band connecting the two membranes.

In *man* little is known as to the early mode of development of the amnion, owing to the difficulty of obtaining specimens for examination. The earliest stage observed has been described by His, and as interpreted by him is diagrammatically represented in Fig. 103. Beneath the embryo was the yolk sac, and posteriorly an allantoic stalk (the future umbilical cord) connected the embryo with the chorion. The amnion was given off from beneath the cephalic extremity of the embryo, at the margin of the yolk sac, and passed backward over the embryo to join the allantoic stalk. The precise mode by which this arrangement of the amnion is attained is unknown. His's theory, illustrated by Fig. 104, is that the embryo sinks from the surface of the blastodermic vesicle, and a somatopleural amnion fold grows from the anterior extremity backward over the embryo. Spee has conjectured that some process similar to the inversion of the germ layers in rodents takes place. The amnion springs from the sides of the

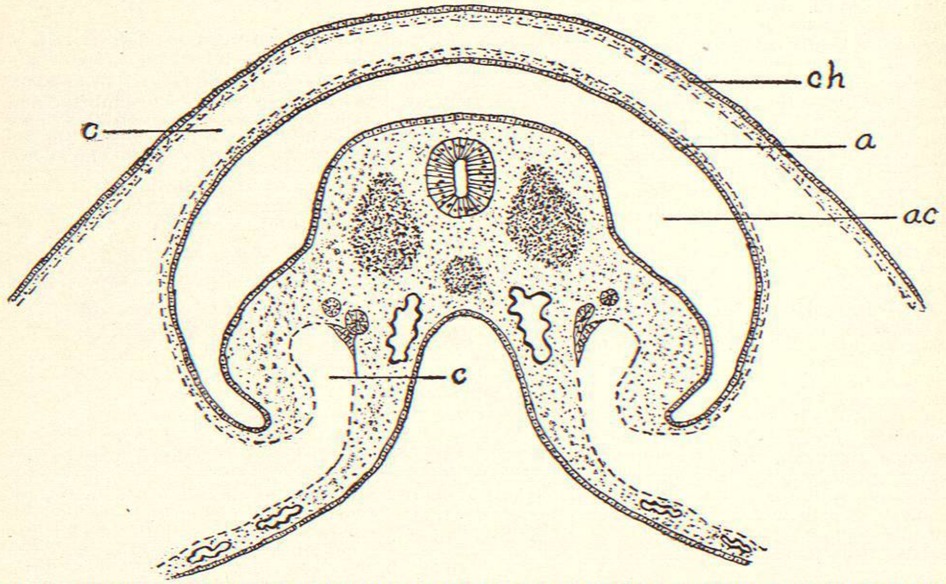

FIG. 98.—Amnion Formation Completed, the Folds having Coalesced Over the Embryo, Leaving the Amnion and Chorion Complete and Distinct.

FIGS. 94 TO 98.—Schematic Cross-Sections of Embryo Chick in Dorsal Region, to Illustrate the Formation of the Amnion. *e*, Epiblast; *h*, hypoblast; *m*, *t*, mesoblast; *m* (stippling), mesenchyma; *t* (broken line), mesothelial lining of cœlom; *c*, cœlom; *o*, somatic layer of mesoblast; *p*, splanchnic layer of mesoblast; *so*, somatopleure; *sp*, splanchnopleure; *f*, amnion fold of somatopleure; *a*, completely formed amnion; *ac*, amniotic cavity; *t*, point of union of amnion folds and site of the "amniotic cord"; *ch*, chorion (or "false amnion"); *v*, primitive vertebra; *n*, notochord; *u*, neural canal; *r*, aorta; *w*, Wolffian body.

allantoic stalk, as well as from the sides of the embryo, and by its further expansion it comes to envelop the entire umbilical cord.

THE PHYLOGENETIC DEVELOPMENT OF THE AMNION.—The evolutionary or phylogenetic course and cause by which the amnion, absent in the amphibia and fishes, was developed in the sauropsida and mammalia, is an interesting subject about which little is really known. While birds are regarded by biologists as having phylogenetically descended from reptiles, mammalia are considered to have descended not from a sauropsidan form, but from a more remote ancestral form from which the sauropsida also descended; in other words, mammalia and sauropsida have the relationship of brothers descended and diverging from a common parent. To this parent stock the appellation of protamniota is applied. The first amniote animal was probably a type just emerging from the amphibian group, which existed in past geologic time and became extinct long ago.

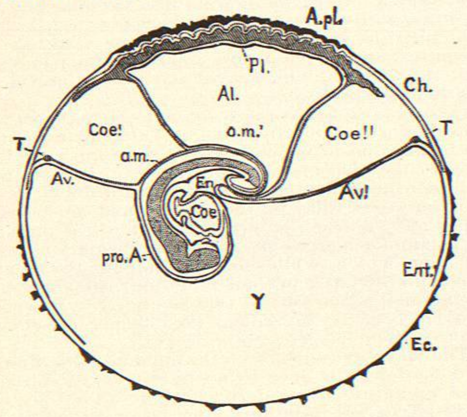

FIG. 99.—Fœtal Envelopes of a Rabbit; Embryo of Eleven Days. (From Minot, after Van Beneden and Julin.) *A.pl.*, area placentalis; *Pl.*, placenta; *Al.*, allantois; *Ch.*, chorion; *a.m.*, amnion; *a.m.'*, portion of the amnion united with the walls of the allantois; *Av.*, *Av.'*, area vasculosa; *T.* sinus terminalis; *Coe*, cœlom, or body cavity. *Coe.'*, *Coe.''*, extra-embryonic portion of the body cavity; *En*, entodermic canal of the embryo; *Ent.'*, entoderm of the blastodermic vesicle; *Y*, cavity of the blastodermic vesicle; *Ec*, ectoderm; *pro-A.*, pro-amnion.

One noteworthy feature in which the ova of the amniota differ more or less from those of the amphibia and fishes consists in the fact that the eggs of reptiles and birds contain a very large yolk, and those of the placental mammals develop into blastodermic vesicles containing an accumulation of fluid (the ova of the two lower sub-classes of mammals, the ornithodelphia and didelphia, containing a certain amount of yolk). The eggs of insects also contain considerable yolk. The yolkless eggs of the placental mammals, in which a comparatively useless vestigial umbilical vesicle develops, are commonly regarded as a secondary modification from the sauropsidan large-yolked type of egg, the yolk having been lost and a serous vesicle developing instead; it is possible, however, that the serous vesicle is the older type and the type of the protamniota, of which the large sauropsidan yolk is a secondary and modified form.

The occurrence of a large fluid mass in the early embryos of amniote animals—yolk in sauropsida, blastodermic vesicle in mammalia—together with the presence of a resisting vitelline envelope, afford opportunity for the operation of mechanical factors and influences in the development of the amnion, and have given rise to explanations of amnion formation on mechanical grounds. The weight of the developing embryo tends to cause it to sink into the soft yolk substance or the fluid blastodermic vesicle, thus leaving somatopleural folds projecting upward about the embryo; the condition can thus be regarded as not so much a growing upward of the amnion folds as a downward sinking of the embryo. Again, by the growth of the somatopleure within a resistant vitelline membrane or *Deckschicht*, the somatopleure is forced to become folded or invaginated within itself, the embryo being forced downward and the folds around it developing into the amnion. Or the rapid growth of the embryo in all directions, aided by its weight and the resistance of the vitelline membrane, may force it toward the centre of the vesicle, where it has more room to expand. The sharp flexion of the head on the body of the embryo, which early appears, is another factor which promotes the formation of folds over the head; the cause of this flexion then remains to be considered, though it may be partially due to the increase in length of the embryo and the resistance of the vitelline membrane in front causing the head to bend downward. These mechanical factors may have some share and influence in the formation of the amnion, but they are not the only factors. There is a real proliferation of the somatopleure and expansion of the cœlom which is of the greatest consequence in the development of the amnion, and which can not be explained on any mechanical grounds that we can now appreciate. Besides, the growth of the allantois has to be taken into account. It would seem, therefore, that we cannot fully explain the

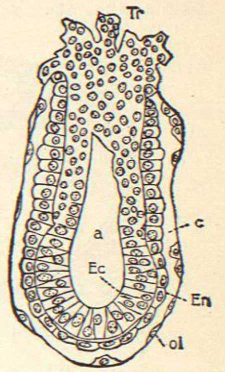

FIG. 102.—Early Embryo of Mus Sylvaticus. *En*, hypoblast; *c*, cavity of umbilical vesicle; *ol*, *Deckschicht*; *Tr*, Träger; *Ec*, epiblast, merging into the cells of the Träger; *a*, cavity of Träger and epiblast, the lower portion of which is afterward cut off to form the amniotic cavity. (From Minot, after Selenka.)

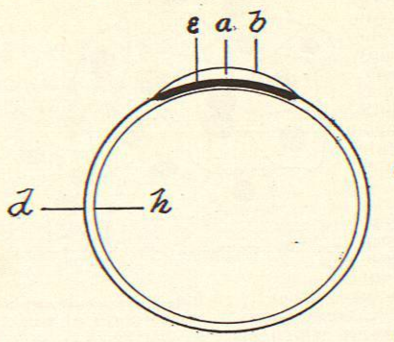

FIG. 100.—Early Stage of Embryonic Development. *a*, Space between formative epiblast and overlying portion of *Deckschicht*—the future amniotic cavity; *b*, portion of *Deckschicht* overlying formative epiblast; *d*, *Deckschicht*; *e*, formative epiblast; *h*, hypoblast.

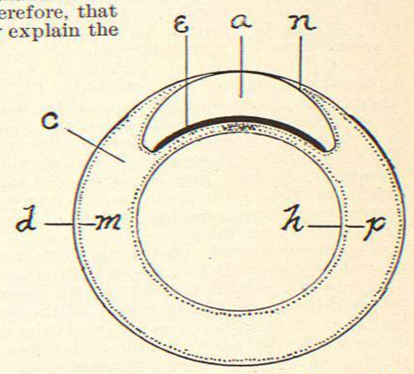

FIG. 101.—Later Stage, Showing Splitting Off of Amnion Nearly Completed. *a*, Amniotic cavity; *c*, cœlom; *d*, *Deckschicht*; *e*, formative epiblast (epiblast of embryo); *h*, hypoblast; *n*, inner layer of *Deckschicht* splitting off to form the amnion; *m*, somatic layer of mesoblast; *p*, splanchnic layer of mesoblast.

FIGS. 100 AND 101.—Diagrammatic Representation of Amnion Formation in Hedgehog, According to Hubrecht.