Horizon X/a
Younger group
Early somites present

Stage 12 First Somites

8 Days, 1–7 Somites

The copulation age of this group ranges from 7 days 21 hours to 8 days 21 hours. The seven somite embryo was chosen as the most advanced in this stage because with the formation of the eighth somite, the embryo begins to rotate around its longitudinal axis. In the human, the corresponding age group, as described by Streeter [6], extends from 1 to 12 somites. The number of somites is the most reliable criterion to determine developmental age.

External Form

A conspicuous characteristic of this stage is the progressive deepening of the neural groove. There is a marked dorsal (lordotic) flexure, and rotation has not yet begun. The head fold will bulge within a few hours (Figs. 76 and 80). The *anterior intestinal portal* deepens simultaneously. The posterior intestinal portal is beginning to form. It should not be confused with the archenteron (Fig. 77).

The *allantois* has grown out far into the exocoelom toward the ectoplacental cone. In a specimen of 6 somites it was still unattached, whereas in a littermate of 7 somites (KT 639/b4) it had made firm contact with the developing chorion. Fig. 77 shows a contact already established in a 5-somite embryo. The allantois is continuous cranially with the *primitive streak*. The latter is limited anteriorly by a "quasi primitive knot," which is caused by the bulging of the underlying archenteron (Figs. 77 and 80). If the archenteron forms only a shallow groove, this prominence is not distinct (Fig. 82).

Circulatory System

Blood islets develop during the preceding stage (7 1/2 days) in the wall of the yolk sac (Fig. 69). They are arranged as a girdle encircling the exocoelom, and may be seen in each section. Fig. 83 shows the marked mitotic activity of the hemocytoblasts [46]. There is no vascular connection yet with the vessels developing in situ in the body of the embryo. The *A. vitellina* arises first as paired vascular islands in the wall of the posterior intestinal portal (Fig. 82). Later, these anlagen unite to form a single, unpaired vessel [49].

The *heart rudiment* develops rapidly as seen, for instance, in 6-somite embryos. The first visible sign is a thickening of the mesoderm surrounding, horseshoe-like, the front end of the embryo. This cellular strand can even be seen in sections of presomite stages (Fig. 74).

The pericardial cavity first develops as lateral clefts in the mesoderm. At the 2-somite stage these intercellular gaps are clearly visible on each side of the midline (Fig. 81). At the 6-somite stage a distinct lumen also appears in median sections (Fig. 82). At the same time, single mesodermal cells have joined to form an endocardial tube. This tube is continuous with the *first aortic arch*, which developed in situ along with the paired dorsal aortae.

The dorsal aorta originates bilaterally in the trunk region, beneath the somite stalks, and is visible in many cross sections (Fig. 79).

Intestinal Tract

The anlage of the foregut pouch has appeared in the preceding age group (Fig. 74). The epithelium of the gut is columnar in this area and adheres, for a short distance, to the high columnar epithelium in front of the neural plate. Both epithelial layers together form the *oral plate*. With the appearance of the first somite, the shallow groove quickly deepens to form a curved pocket (Fig. 82) narrowed ventrally by the prominent cardiac bulge. Most of the gut epithelium covering the bulge is cuboidal. The rudiment of the thyroid gland and of the liver develop here, but they cannot be distinguished yet with certainty. At the end of this period, the thyroid anlage appears as a distinct thick epithelial plate.

The notochord is situated in the dorsal wall of the foregut pocket. It is still intercalated in the entoderm, later it will become separated. It consists of a long strand of columnar cells (Fig. 78) and still has a shallow groove posteriorly (the archenteron). The gut epithelium is flattened where it joins the notochord. Anteriorly, the wide first branchial cleft forms in the foregut pocket.

At the 2-somite stage the *posterior intestinal portal* is visible as a slight depression (Fig. 80), which deepens more slowly than the anterior one. At the 6 somite stage, it is only a slight depression (Fig. 82). The lining entodermal cells are higher than other cells in the area. Further caudally, in the extraembryonic area, is the epithelium of the visceral yolk sac with its characteristic cylindrical cells with vacuolated cytoplasm and basally located nuclei (Fig. 83). The superficial layer of the cytoplasm is strongly PAS-positive. The *cloacal membrane*, in contrast to the comparable stage in human embryos, has not yet appeared.

The *coelom* originates in the trunk region within the thickened marginal band of mesoblastic cells. Vesicles appear between the mesoblastic cells, which coalesce to form a continuous mesoblastic cavity (Fig. 79). It is in open communication with the pericardiac cavity. In the older members of this group, it opens freely into the exocoelom on both sides.

Central Nervous System

In this stage, the brain plate develops very rapidly, and is the chief determiner of the embryonic form (Fig. 75). At 7 somites, the neural folds close at the level of the 4th and 5th somite, i.e., at the cervico-cranial boundary. From here, the closure proceeds both in anterior and posterior direction, in a zipper-like manner. Near the still widely open cranial end, a bilateral depression may be seen, the *optic evagination* (sulcus opticus, Fig. 75). Further caudally, two *neuromeres* [162] are visible. They are called "rhombomere *A* and *B*," homologous to the neuromeres in the human (Fig. 82). Rhombomere *B* is found at the level of the *otic placode*, which is visible at 4 or 5 somites.

In the area of the *cranial neural crest* [151] the trigeminal and facial crest are distinct.

Extraembryonic Membranes

In the preceding stage, three separate cavities were formed: amniotic cavity, exocoelom, and ectoplacental cavity (Fig. 64). During this period the exocoel and the amniotic cavity expand at the expense of the ectoplacental cavity. Toward the end of this period, both ectoplacental layers fuse in the middle (Fig. 84). Laterally, both layers (*laminae*) are still recognizable (Fig. 77). At the same time, the *allantois* grows rapidly across the exocoelom, toward the ectoplacental cone. The ectoplacental cells are delimited from the exocoelom only by a thin meso-

dermal lining. The first contact of the allantois is made with these cells which frequently, at the point of contact, are detached from the adjacent ectoplacental tissue. It appears as a bulge toward the approaching allantois (Fig. 80). A more laterally situated point of contact occurs rarely (for example, see Fig. 77). The time of fusion appears to vary also. It does not occur before the 5-somite stage, and is usually observed at 7–8 somites. The allantois itself transforms in its distal part into a loose meshwork of cells. Between them, endothelial-lined cavities develop, which are the forerunners of the allantoic vessels (umbilical artery and vein).

The *yolk sac* is composed primarily of two layers, the thin parietal (distal) and the thick visceral (proximal) entoderm. As described previously, only the vascular area of the visceral layer develops into the yolk sac proper. It enlarges now considerably. In later stages, this membrane can easily be recognized when the uterus is dissected. It is the inner lining of the narrow yolk sac cavity. Externally, the cavity is bound by the thin parietal layer and *Reichert's membrane* (Fig. 71). Adherent to Reichert's membrane is a layer of *trophoblastic giant cells*, which grows rapidly in thickness, and finally forms a loose network of cells (Fig. 84, indicated by *small circles*). This area attaches the embryonic to the maternal tissue.

The adjoining *endometrium* has some multinucleate giant cells, already seen in the previous stage (Fig. 55). The decidua capsularis contains only a few blood vessels, whereas the decidua basalis has large sinusoids.

In the *ectoplacental cone* a special zone of glycogen-containing cells [29] becomes visible after PAS-staining (Fig. 84, *eG*). The cells are also seen in the preceding stage, but they were less numerous (Fig. 51, 6 days). With H.-E.-staining, they are inconspicuous; however, they can be recognized by their numerous vacuoles in the faintly staining cytoplasm. Abundant storage of glycogen is characteristic of the cone cells, which are differentiating into trophospongium (junctional zone) [38].

Figs. 75–81: First somites, 8 days

FIG. 75. Dorsal view of 7-somite embryo.
Arrow marks the optic sulcus, *So5* = somite 5. 63:1

FIG. 76. Low magnification of uterus, cross section.
M = mesometrium.
KT 957/4, 7 days 21 h, 5 somites. 18:1

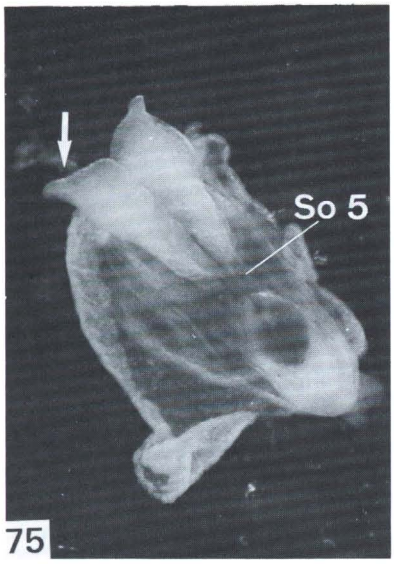
FIG. 77. Detail of Fig. 76.
All = allantois, *Ar* = archenteron, *P* = primitive streak, *V* = foregut pocket. 54:1

FIG. 78. Cross section posterior to the second somite.
Beginning of somite formation, *Ch* = notochordal plate.
KT 984/3, 2 somites. 270:1

FIG. 79. Cross section through the 5th somite, narrowest region of the neural groove.
Ch = notochord, *Ao* = dorsal aorta, *So 5* = somite 5.
KT 939/b5, 7 somites, 8 days 1 h. 560:1

FIG. 80. Low magnification of uterus, cross section, containing 2-somite embryo, cut longitudinally.
U = remnant of uterine lumen.
KT 984/2, 8 days 4 h. 22:1

FIG. 81. Detail of Fig. 80 with front end of embryo.
Arrow in foregut pocket, *He* = heart rudiment, *Ra* = oral plate. 560:1



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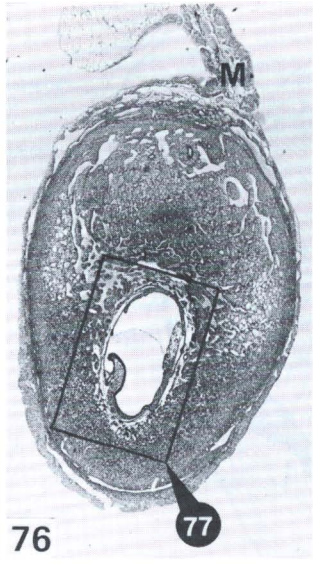

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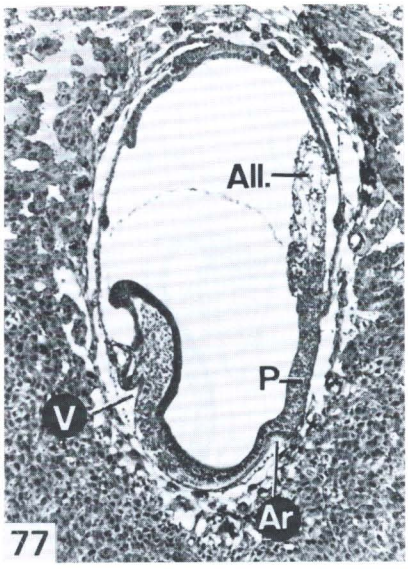

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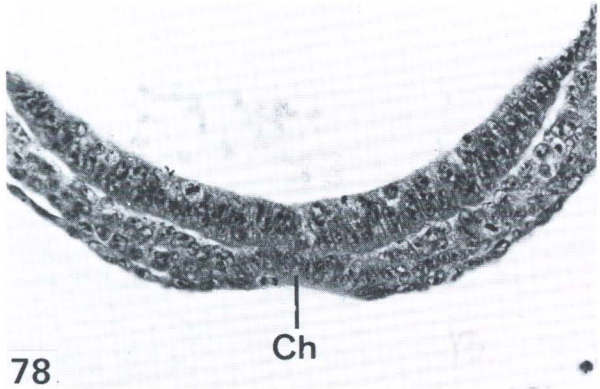

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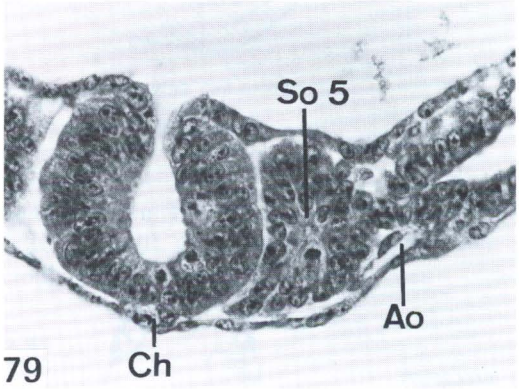

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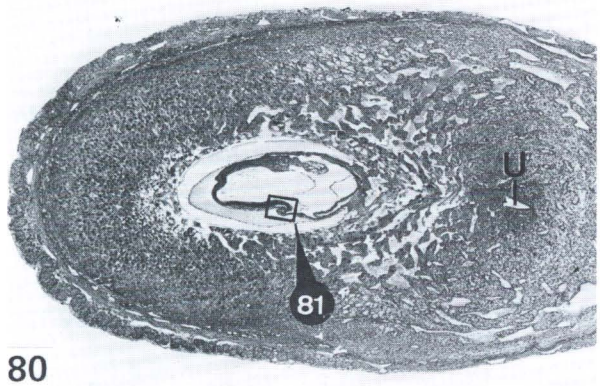

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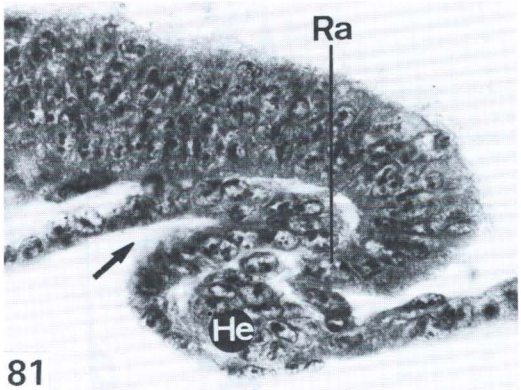

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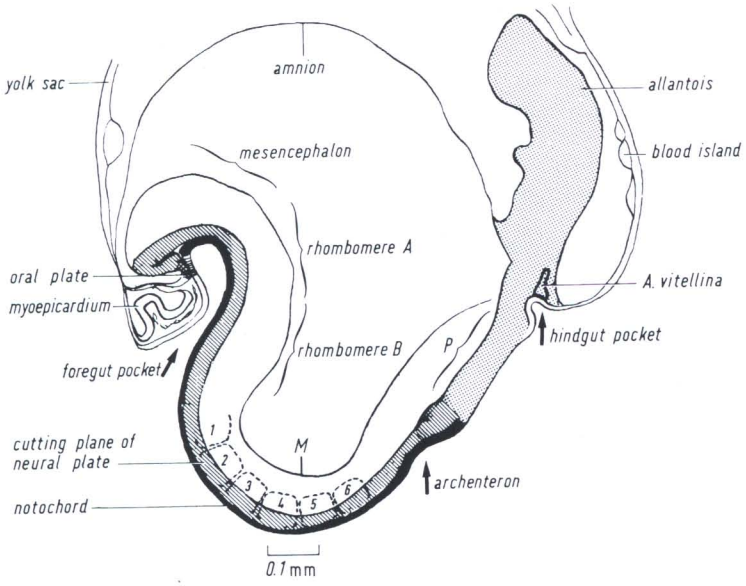

FIG. 82. Reconstruction of specimen, 8 days 1 h, 6 somites (numbered), in sagittal plane.
M = contour of right neural fold, *P* = primitive streak.
KT 639/b 15

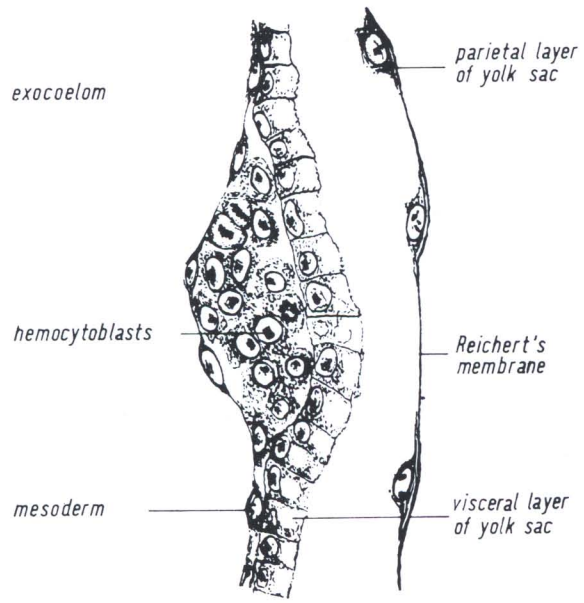

FIG. 83. Blood islet at 7 days 21 h, 5 somites.
Numerous mitoses.
KT 957/4

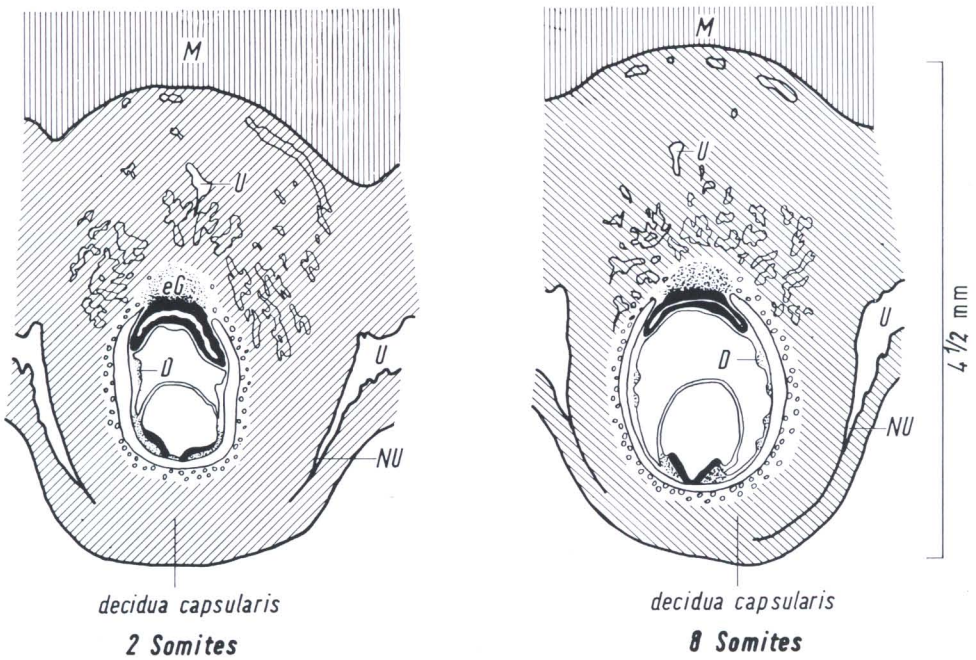

FIG. 84. Endometrium and embryonic membranes.
Maternal tissue shaded, *M* = mesometrium, *U* = old uterine lumen. The new lumen, *NU*, advances toward the antimesometrial pole, *eG* = ectoplacental glycogen cells. *Circles* = trophoblastic giant cells. Enlargement of the vascularized yolk sac (*D*). Ectoplacental cavity disappears.

Material	Age	
KT 956/57	7 days 21 h	2 with 5 somites
		5 with 5–8 somites
		1 resorption
KT 639	8 days 1 h	6 with 5–9 somites
KT 880/81	8 days 1 h	7 early somite stages (5 somites)
KT 983/84	8 days 4 h	1 presomite neurula
		2 with 1 somite
		1 with 2 somites
		2 with 3 somites
		2 with 4 somites
KT 958/59	8 days 4 h	2 presomite neurulae
		4 with 4–6 somites
		3 resorptions
KT 637	8 days 21 h	3 with 4–5 somites