

## Stage 17 Deep Lens Indentation

10 1/2 Days, 35–39 Somites, 3.5–4.9 mm (fresh)

### External Shape

The *extremities* and *tail* are enlarging rapidly. They are no longer simple ridges and a short stump. Instead, they are projecting appendages and curve forward or inward. The tail is considerably longer now than in the human of this stage.

The *olfactory discs* are also more advanced, forming a distinct marginal lip. The *lens vesicles* form deep pockets (in younger embryos) or pore-like openings (older) to the surface. This is one of the best characteristics to use for assigning an embryo to this stage.

The first branchial bar is divided into large conspicuous maxillary and mandibular processes. The most cranial *somites* are becoming more and more indistinct. On the other hand, the most cranial *spinal ganglia* are easily recognized in transparent specimens. They are still completely lacking in the tail, where only somites are visible.

Behind the cloacal membrane, a short *ventral ectodermal ridge* (Grüneberg [195]) is recognizable (Fig. 146).

*Length.* The overall length of unfixed embryos varies from 3.5 to 4.9 mm.

*Sagittal section* (Fig. 145). The most prominent feature is again the advanced development of the *brain tube*. The *optic recess* (groove) is a conspicuous depression, situated just posterior to the thick commissural field and anterior to the thin optic chiasma. *Rathke's pouch* is narrowed and the median thyroid is deepened. It is shown at higher magnification in Fig. 141.

### Circulatory System

With the development of the yolk sac and the placenta, two complete *extraembryonic circuits* have been established: the yolk sac and the placental circulation. The yolk sac vessels, passing along the obliterated yolk sac stalk (Fig. 137), separate distally. Only in the region close to the embryo does the vitelline vein course parallel to the vitelline artery. It separates from it distally and independently proceeds to the yolk sac (Fig. 147).

The *aorta abdominalis*, now a single unpaired vessel, forks into two branches at the level of the hind limb buds. These branches are the two umbilical arteries, and the left one is larger than the right one. The actual continuation of the original dorsal aortae is represented by two slender vessels proceeding in the dorsal body wall into the tail, nearly to its tip.

Both *umbilical arteries* unite ventral to the gut tube at the base of the umbilical ring to form an unpaired vessel.

The (unpaired) *vitelline artery* branches off from the aorta as a conspicuous vessel in the middle region of the trunk [49]. It passes cranially beside the head to the yolk sac (Fig. 147).

Both umbilical veins unite in the region of the umbilical ring by anastomoses, caudal to the umbilical and vitelline arteries. Distally, a large venous stem branches within the

placenta into smaller vessels. Proximally, however, there are two asymmetrical umbilical veins which pass within the left and right body walls. The right umbilical vein is more than twice as large as the left.

The *heart* is still a single, curved tube. It has two distinct constrictions: the sulcus atrioventricularis and the sulcus sinu-atrialis (Fig. 148). The termination of the above-mentioned vitelline and umbilical veins is reconstructed in Fig. 147.

*Aortic arches.* The first and second arch are greatly reduced compared to the previous stage. The sixth is developing and sends a branch to the lung primordium.

## Intestinal Tract

In the midline of the *pharyngeal region*, the *thyroid rudiment* is represented by a narrow diverticulum (Fig. 141). Laterally, all *pharyngeal pouches* may be seen.

The *lung bud* is rapidly elongating. The left primary bronchus is shown in Fig. 143 as a small tube.

The short *esophagus* continues into the large eccentric *stomach* anlage. This asymmetric development results in the formation of the coelomic pockets, which are conspicuous in microscopic sections (Fig. 145).

In the region of the *hepatic diverticulum*, the evaginations of the ventral pancreas and the gall bladder primordium are distinctly visible (Fig. 144). The hepatic cords are invading the mesenchyme of the septum transversum. Future erythropoietic cells seem to stem from this mesenchyme and now join these epithelial cords. The dorsal pancreas begins to constrict at its base. It grows both caudally and toward the left. In Fig. 144 (marked *P.d.*) the wall of the basal constriction is cut tangentially.

The *umbilical loop* is only slightly curved and is clearly visible in Fig. 137. The obliterated vitello-intestinal duct (yolk stalk) is attached to its apex. The vitelline vessels described previously pass through its walls to the yolk sac.

The *cloacal membrane* has not yet ruptured.

## Urogenital System

The Wolffian duct has now reached the cloacal wall, where it ends blindly. The ureteric bud is forming. The mesonephric tubules are longer and more numerous than in the previous stage. However, there are no mesonephric glomeruli.

## Central Nervous System

The cerebral vesicles appear as distinct bulges. The *rhombencephalic* portion of the brain is relatively large. It has an extremely thin transparent roof and a thick and wide floor with marked neuromeric elevations [162] (Fig. 143, *upper left*).

In the floor of the third ventricle, the optic recess is distinctly visible. In the *roof* of the *diencephalon*, some pycnotic cells can be regularly observed [158]. Later, at 11 or 12 days, there is a pronounced degeneration of cells [166].

The *deep lens pocket* [181] (Fig. 140), which will develop into a pore-like opening of the lens vesicle, is a characteristic of this age group.

The *otic vesicle* has developed a short endolymphatic duct (Fig. 149).

The *olfactory plate* is broad, but relatively flat, with a distinct rim (Fig. 140).

The *ganglia of the branchial nerves* are now well formed. The dorsal ganglion of the glossopharyngeal nerve is visible in Fig. 142, below the otic vesicle, close to the anterior cardinal vein (later to become the anterior jugular vein).

In the trunk region, the most anterior spinal ganglia may be seen lateral to the somites in transparent specimens.

Material	Age	
KT 909	10 days	4 embryos (all well developed), 3.3–4.4 mm.
KT 944–46	10 days 23 h	5 embryos + 1 resorption, 3.5–4.5 mm, 33–35 somites.
KT 999–1000	10 days 9 1/2 h	3 embryos + 2 resorptions, 4.0–4.5 mm.

#### Figs. 137–144:

FIG. 137. Embryo of approximately 36 somites.

*N* = umbilical loop with projecting yolk sac stalk (obliterated), 11:1

FIG. 138. Embryo, formalin fixed, nominal age 10 days, but actually further developed.

See Fig. 139 for explanation.

KT 909. 20:1

FIG. 139. Drawing of embryo (Fig. 138).

*Tel* = cerebral hemisphere, *L* = lens invagination, *Hl* = hindlimb bud, *Aa* = forelimb bud, *O* = otic vesicle, *Ri* = olfactory pit, *He* = heart, *So* = somite 4, *C<sub>2</sub>* = ganglion cervicale 2. Branchial bars are indicated by 1 and 2.

KT 909

FIG. 140. Cross section through eye and olfactory pit.

*L* = lens pocket, *Ri* = olfactory placode, *3.V.* = 3rd ventricle.

KT 909. 100:1

FIG. 141. Thyroid primordium, sagittal section.

*Tb* = thyroid pocket, *T.a.* = truncus arteriosus.

KT 999, 10 days 9 1/2 h 350:1

FIG. 142. Otic vesicle (*O*), oblique section (transverse-frontal).

*Rb* = rhombencephalon.

KT 909. 130:1

FIG. 143. Paramedian section.

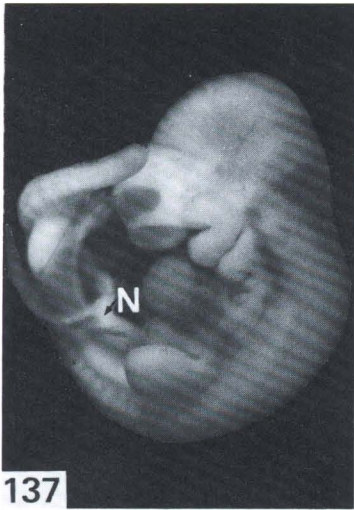
*Lu* = lung bud (left stem bronchus), *Ao* = aorta dorsalis, *S.v.* = sinus venosus, *Coe* = coelomic pockets, \* = stomach. *Arrow* indicates neural crest.

KT 999, 10 days 9 1/2 h. 40:1

FIG. 144. Detail of Fig. 142.

*Lz* = hepatic cell cords, *G* = anlage of gall bladder, *P.v.* = pancreas ventral, *P.d.* = pancreas dorsal (tangential section). 270:1

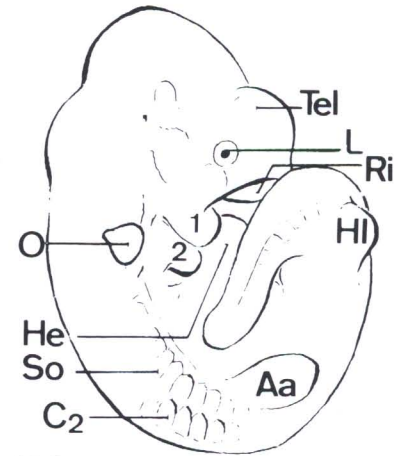




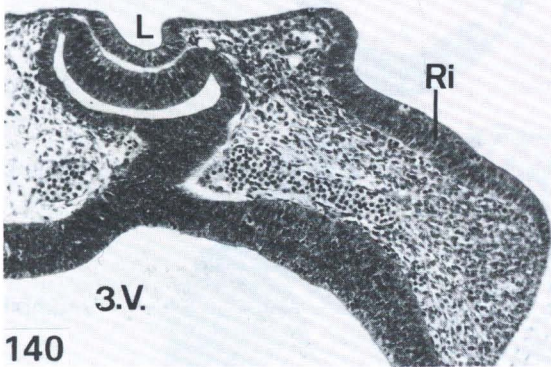
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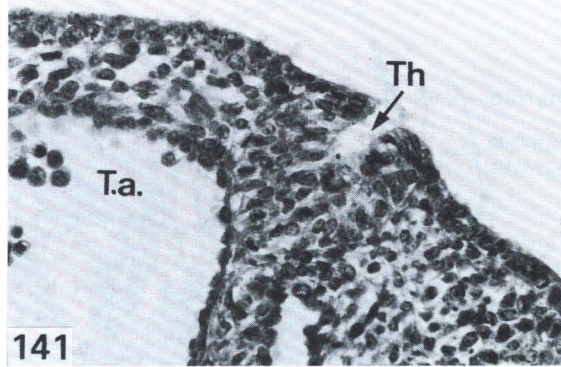
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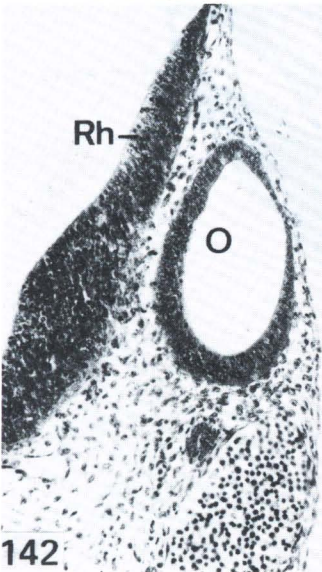
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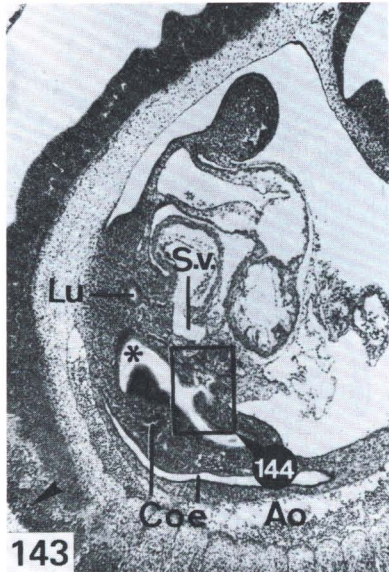
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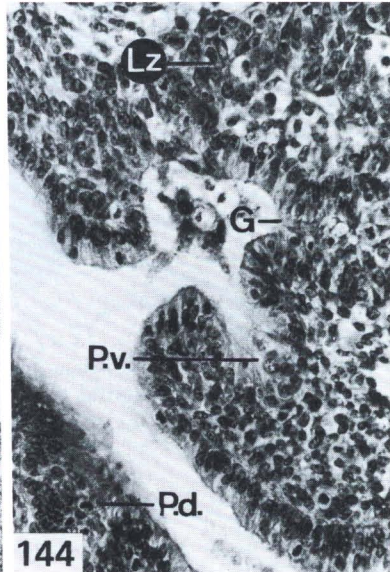
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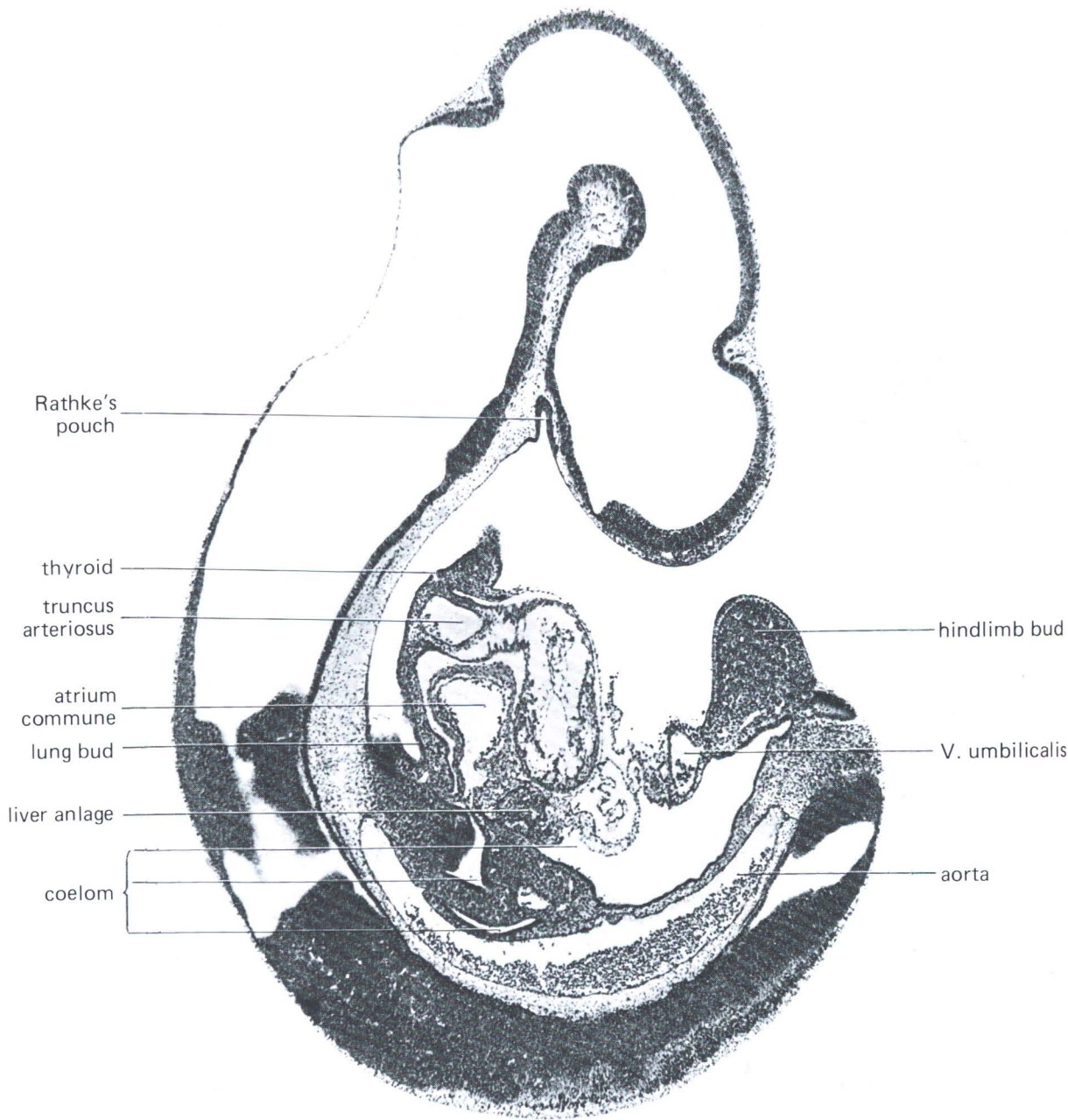


FIG. 145. Sagittal section, 10 days 9 1/2 h.  
 KT 999



FIG. 146. Proximal tail in cross section.  
KT 909

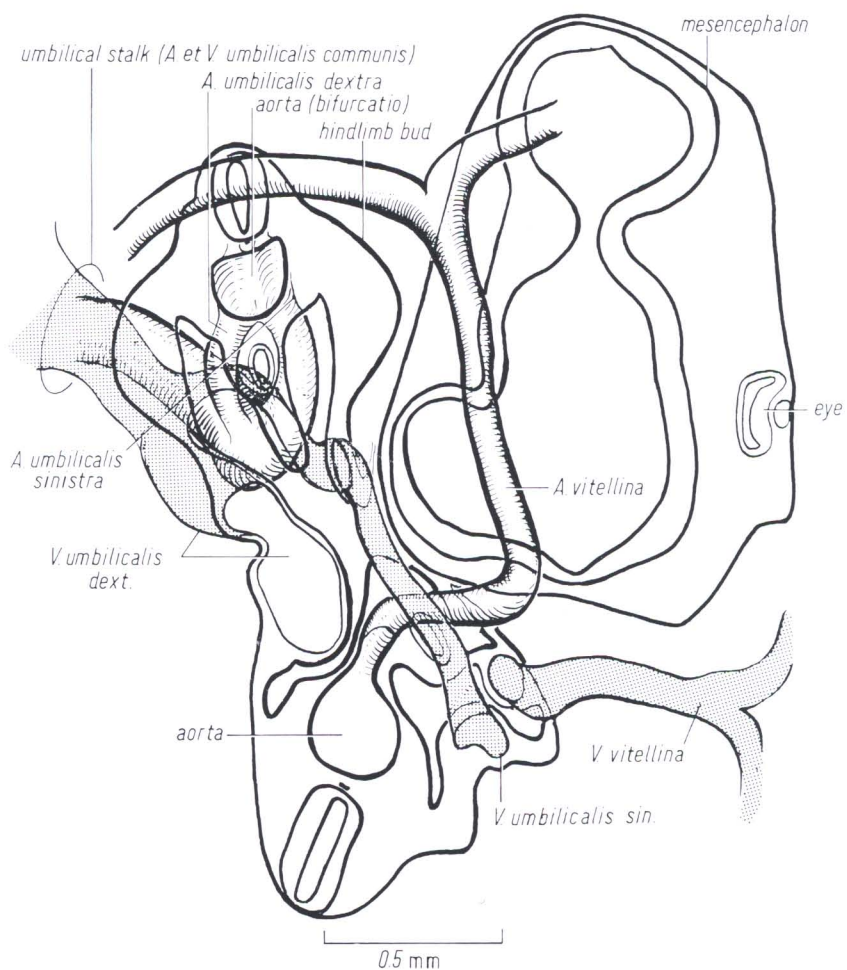
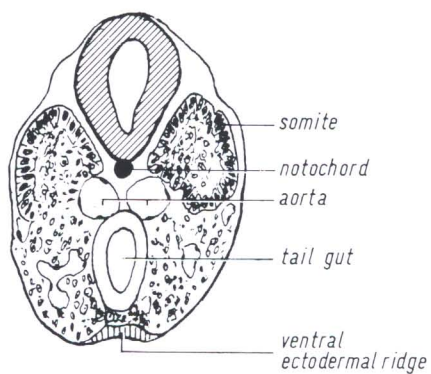


FIG. 147. Vascular connection with yolk sac and placenta. Reconstruction, starting from cross section through embryo.  
KT 909

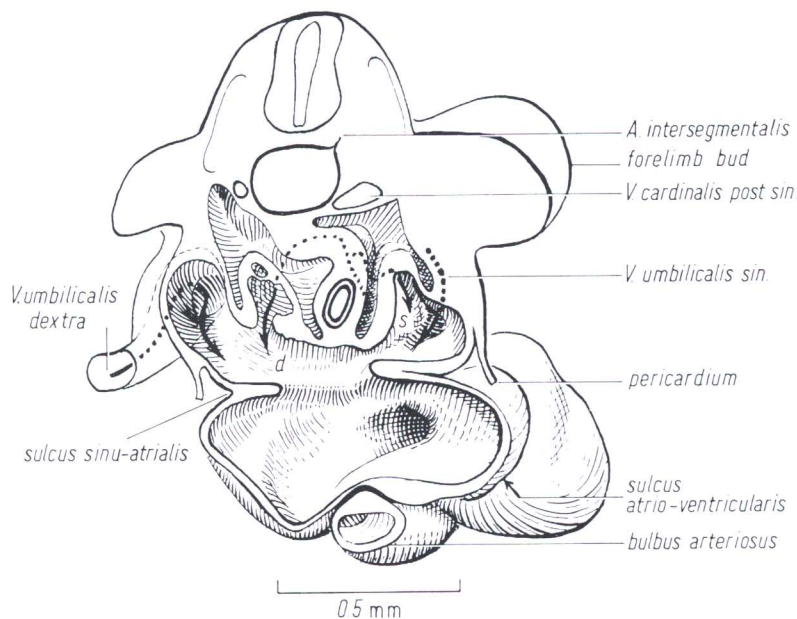


FIG. 148. Sinus venosus, cross section. Reconstruction. View from cranial: *d* = vena vitellina dextra, *s* = vena vitellina sinistra. KT 909

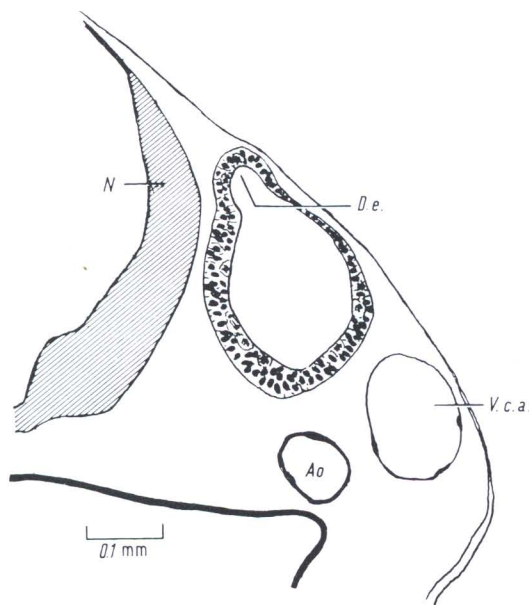


FIG. 149. Otic vesicle with endolymphatic duct (*D.e.*). *N* = neural tube (rhombencephalon), *V.c.a.* = vena cardinalis anterior, *Ao* = aorta dorsalis. KT 909, approximately 36 somites