Stage 28 Postnatal Development

Within 3 days, a fine fur appears and the *ears* are opening. The internal ear is still quite immature. The definitive histologic structure does not develop until 13 days. The *retina* is also immature.

The *eyes* open at 12 to 14 days.

At 6 weeks, the vagina opens, and females begin estrous cycles. The first successful mating takes place at 2 or 3 months of age.

The *skeleton* is used here as a convenient index of relative stages of postnatal development. Mice of 7 and 24 days were chosen arbitrarily to be described.

7 Days Post Partum

The linear length (head to base of the tail) is about 38 mm.

At 7 days the distal epiphyseal centers appear in the tibia and fibula (Fig. 315). In the tail, 24 *vertebrae* have ossification centers. Our adult hybrids have:

30–31 tail vertebrae
4 sacral vertebrae
6 lumbar vertebrae
13 thoracic vertebrae
7 cervical vertebrae

The neural arches of the sacral vertebrae are about to fuse, while the lumbar arches are still well separated (Fig. 314). The ossification centers of the vertebral bodies are separated throughout from the centers of the arches by narrow epiphyseal plates (Fig. 318). The discrete horizontal cleft separating the two centers of the axis (i.e., base of the body and base of the dens) is difficult to recognize (Fig. 314).

Extremities

Since birth, numerous ossification centers have appeared as seen in Figs. 315 and 317. The distal epiphyseal centers in the *tibia* and fibula are typical for 7-day mice. They appear shortly after the distal epiphyseal center of the femur.

In the tarsus, not only are the talus and calcaneus visible in alizarin-stained cleared preparations, but also the cuboid, 3 cuneiformia, and naviculare. The os tibiale, however, has not yet ossified.

In the *ovary*, there are abundant primary follicles in the cortical zone. In deeper areas, some (secondary) follicles are growing, but Graafian follicles are still lacking (Fig. 316).

There is little change in the *testis* since birth. Many cells have entered prophase. Spermiogenesis will start at 9 days of age.

In the *thymus* a few small Hassal's corpuscules can be seen (Fig. 319).

FIG. 313. 7-day old mouse female.
KT 893. 1.6:1

FIG. 314. Alizarin-cleared preparation, 7 days post partum, dorsal view.
S = supraoccipitale, *Ax* = 2 ossification centers of axis (axis body and basis of dens), *At* = processus transversus atlantis, *U* = ossification center in olecranon (ulna), L_2 = body of second lumbar vertebra, *OJ* = os ilii, *Is* = os ichii.
KT 893. 1.6:1

FIG. 315. Same skeleton as in Fig. 314, lateral view.
Fe = ossification center in distal epiphysis of femur; *TF* = ossification centers in distal epiphysis of tibia and fibula, having newly arisen; *Ta* = tarsalia (7 ossification centers, partially hidden). 1.6:1

FIG. 316. Ovary, showing secondary follicles, located near central region, 7 days post partum.
KT 892. 105:1

FIG. 317. Thorax, ventral view, 7 days post partum. Alizarin-cleared preparation.
Initial calcification of rib cartilage (*R*). *Tm* = apophyseal center in tuberculum maius, *E* = epiphyseal center in caput humeri, *Co* = ossification center in coracoid process (below clavicula), *Ma* = manubrium sterni, *Xi* = xiphoid process.
KT 893. 5:1

FIG. 318. Lumbar vertebrae, ventral view, Alizarin-cleared preparation, 7 days post partum.
L_2 = body of 2nd lumbar vertebra, *Ar* = arch-center of 2nd lumbar vertebra, *OJ* = os ilii, *Is* = os ischii, *P* = os pubis.
KT 893. 5:1

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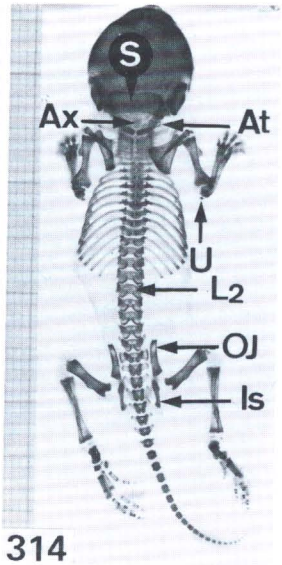

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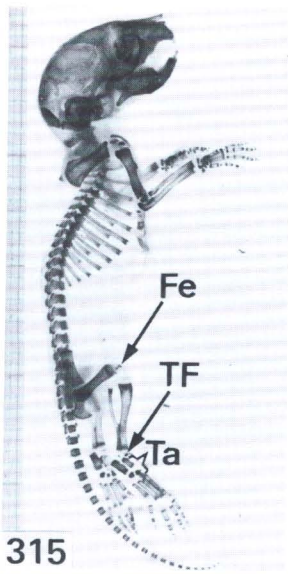

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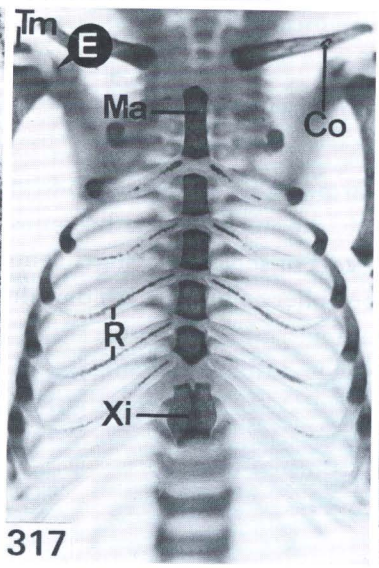

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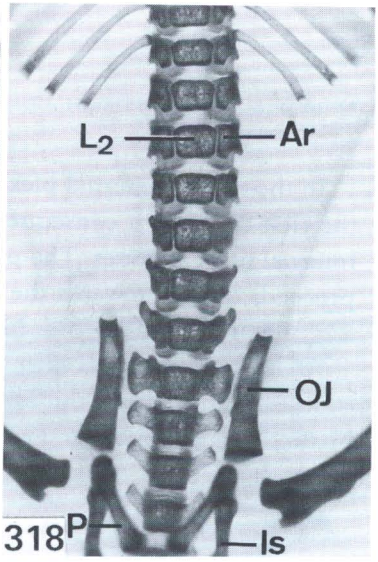

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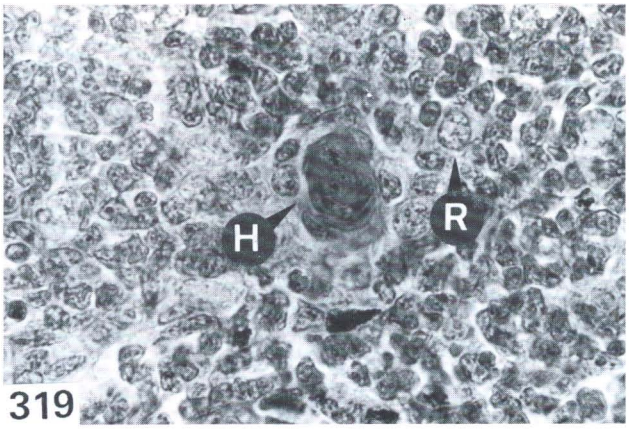

FIG. 319. Hassal's corpuscule (*H*) within thymus of 7-day-old mouse.
R = reticulum cell.
KT 892. 700:1

In the *eye*, the external plexiform layer is beginning to form, and it can be recognized for the first time. As a consequence, the nuclear zone becomes subdivided into external and internal nuclear zones. The process of separation starts centrally, near the optic nerve, and proceeds quickly towards the periphery. On the 11th day after birth, the outer segments of the photoreceptor cells are forming.

At 14 days, the rods have attained their final length.

In the internal *ear*, the organ of Corti is differentiating [180]. Differentiation starts at birth and is complete at 13 days (Figs. 324–326).

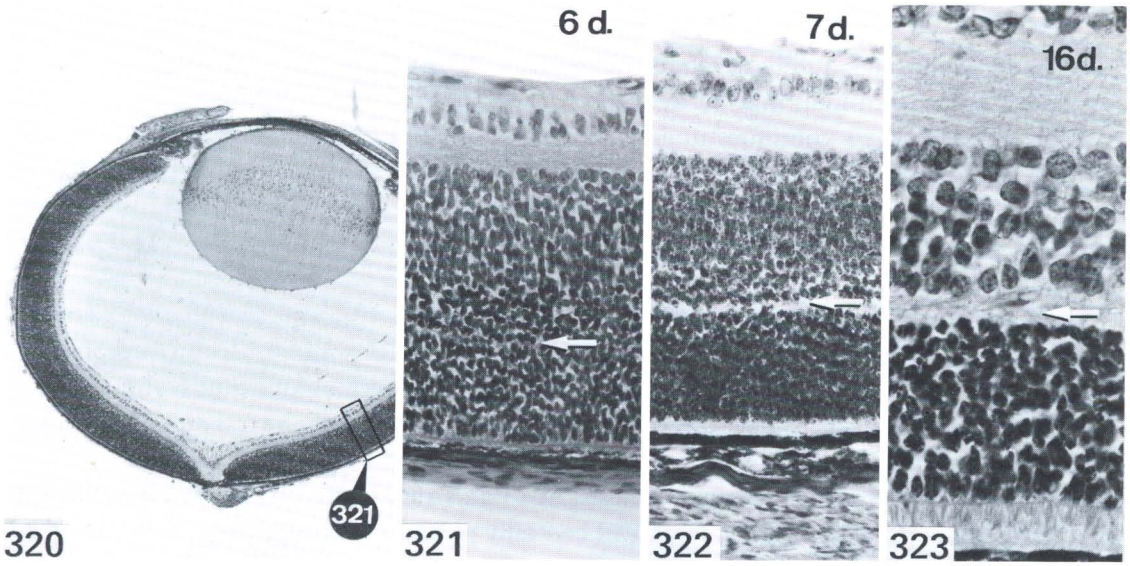

FIG. 320. Low power view of eye, 6 days post partum, horizontal section. 28:1

FIG. 321. High power view of retina of Fig. 320.
Arrows in Figs. 321–323 indicate development of outer plexiform layer, separating inner and outer nuclear layers. 240:1

FIG. 322. At 7 days, the nuclear layers are distinctly separated.
KT 892. 240:1

FIG. 323. Fully differentiated retina, 16 days post partum. 500:1

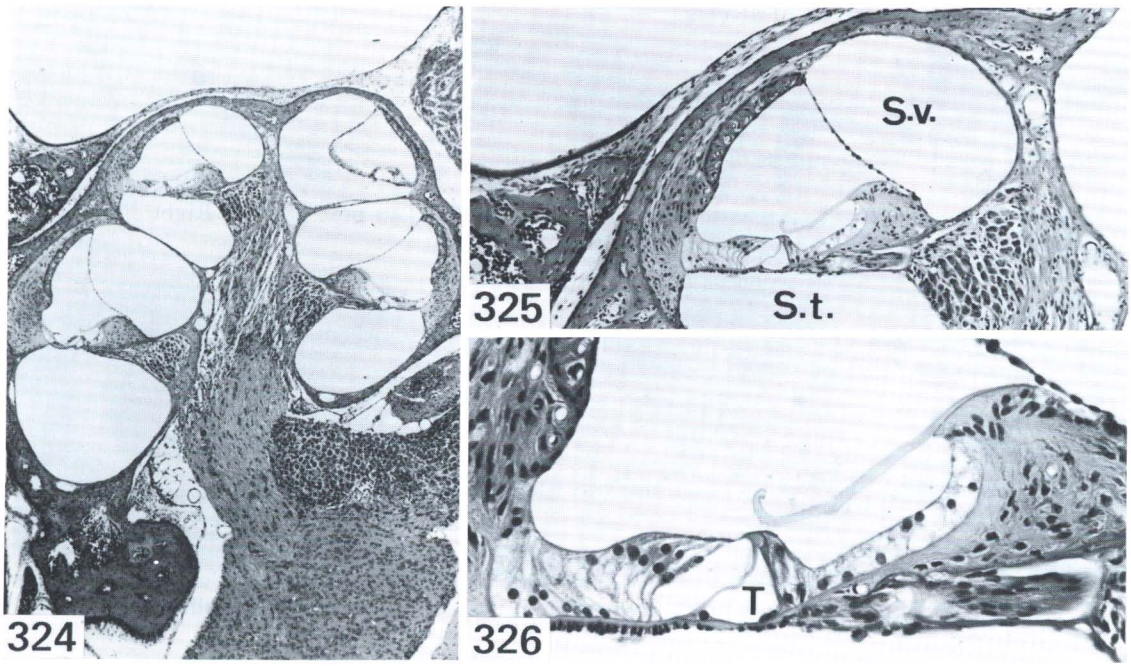

FIG. 324. Longitudinal section through axis of cochlea, 16 days post partum, low power view. 40:1

FIG. 325. High power view of cochlear duct (apical part) of Fig. 324.
S.v. = scala vestibuli, *S.t.* = scala tympani. 150:1

FIG. 326. High power view of organ of Corti of Fig. 325.
T = inner tunnel. 270:1

24 Days Post Partum

The linear length (head to base of tail) ranges from 50–60 mm.

At this age, the animals may be weaned.

The *vertebral column* continues to grow. In microscopic preparations, large cartilaginous growth zones are visible. The tail has attained its full number of 30 osseous vertebrae. There are only 4 pairs of hemal arch bones. These are small spherical pieces of bone bilaterally situated ventral to the caudal intervertebral discs. They develop first in the proximal part of the tail.

In the tarsus, the appearance of the apophysis of the tuber calcanei is a characteristic of this age (Fig. 329). In the lower and upper thigh of cleared animals, distinct epiphyseal plates can be seen. There are also epiphyseal plates in the acetabulum (Fig. 330).

Numerous blood vessels have grown into the flat epiphyses of the sacral and of the adjacent caudal vertebrae (Fig. 332).

In the *testes* there is active spermatogenesis. At 13 days after birth, differentiated *Sertoli cells* may be recognized. The original large and centrally placed primordial germ cells give rise to smaller, peripherally situated *spermatogonia*.

Many gonocytes have entered meiotic prophase. At the same time, the seminiferous tubules are developing lumina.

At 24 days there are no spermatozoa, but some tubules contain numerous young spermatids. Some peritubular cells are now transforming into smooth muscle cells (M.H. Ross [106]). In the *ovary*, primary, secondary (growing) and tertiary (Graafian) follicles can be recognized (Fig. 331). The oocytes are in dictyotene stage. Occasionally, multinucleate eggs may be seen. I have seen them only in follicles containing numerous pycnotic and degenerating granulosa cells. These follicles will probably soon degenerate. The growing follicle in Fig. 331 also shows signs of atresia.

FIG. 327. Hybrid female mouse, 24 days post partum.

FIG. 328. Alizarin-cleared preparation, lateral view, male, 24 days post partum. Right extremities removed, millimeter scale.
KT 899

FIG. 329. Dorsal view of skeleton, before removing right extremities.
Ap = apophyseal center in tuber calcanei.
KT 899. 1.5:1

FIG. 330. Ventral view of skeleton, enlarged, 24 days post partum.
M = manubrium sterni, *H* = acetabulum with epiphyseal plates.
KT 899. 2.7:1

FIG. 331. Section through ovary, 24 days post partum. Hematoxylin-Eosin.
T = tertiary follicle (Graafian follicle), *P* = polynucleate oocyte, in secondary follicle.
KT 1071. 105:1

FIG. 332. Intervertebral disc of proximal tail. Frontal section at 4 weeks.
CH = notochordal sheath within epiphyseal plate of 2nd caudal vertebra, *G* = blood vessels in epiphyseal plate of first caudal vertebra.
KT 787a. 105:1

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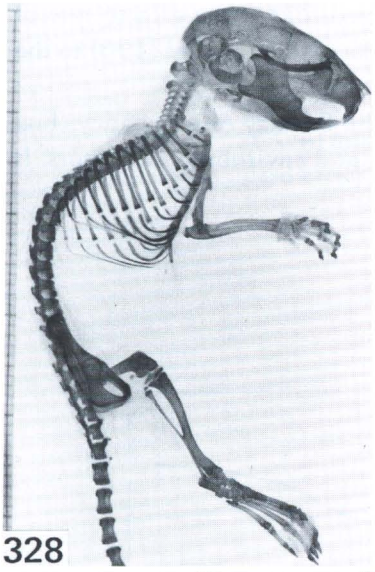

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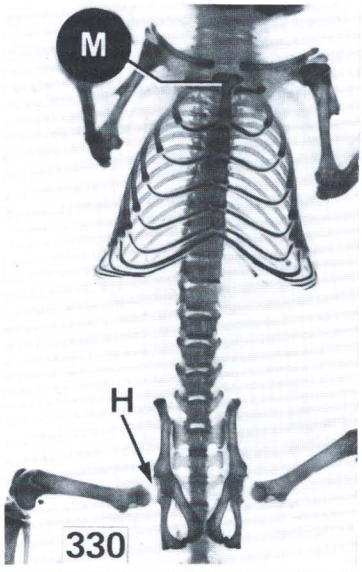

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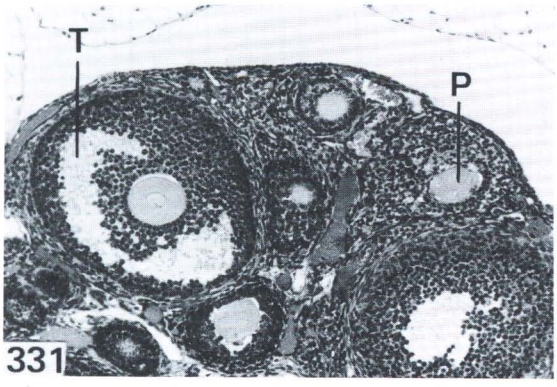

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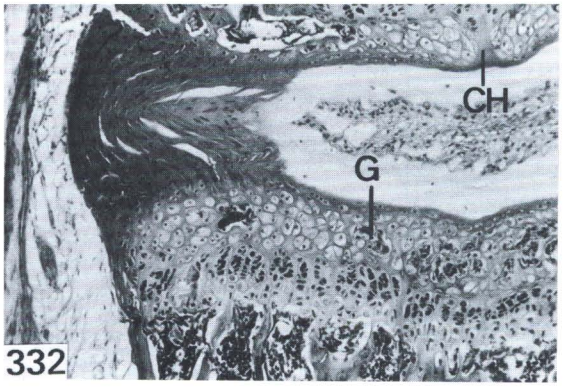

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29 Weight Curves

The mouse has reached its full size at 3–4 months. The growth curve is dependent on genetic (Fig. 333) and environmental [3] factors, especially the amount of milk available [198]. The temperature also has some influence on growth [201].

The males become heavier than the females at the age of 4 weeks.

Specific pathogen-free (SPF) animals seem to grow faster than conventionally reared mice. Before we established our SPF colony, our CBAs had a considerably lower growth rate than the C57BL/6J animals. Now, in pathogen-free colonies, the CBAs grow faster than the C57BL/6J mice. Environmental factors may play an unexpected role in the growth rate of mice. They are difficult to take into account in applying a mathematical model [196] to the growth of inbred mice (Fig. 334).

Pregnant females begin to gain appreciable weight from the 8th day of pregnancy (Fig. 335). Like growth rate, *life span* is influenced by many genetic and environmental factors. It may vary between 1 and 3 years [2].

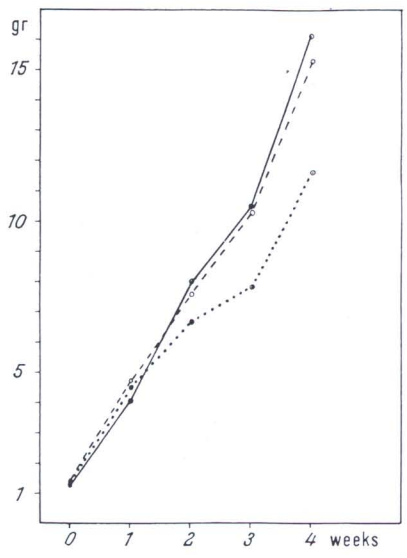

FIG. 333. Mean weights of our growing inbred and hybrid mice. Hybrids (*full line*) show maximum increase in weight. *Broken line* indicates CBA; *stippled line* indicates C57BL/6.

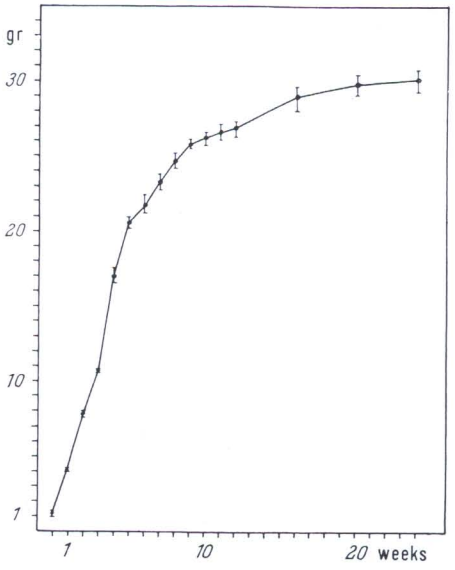

FIG. 334. Postnatal increase in weight of our hybrid males. *Short perpendicular lines* indicate standard errors.

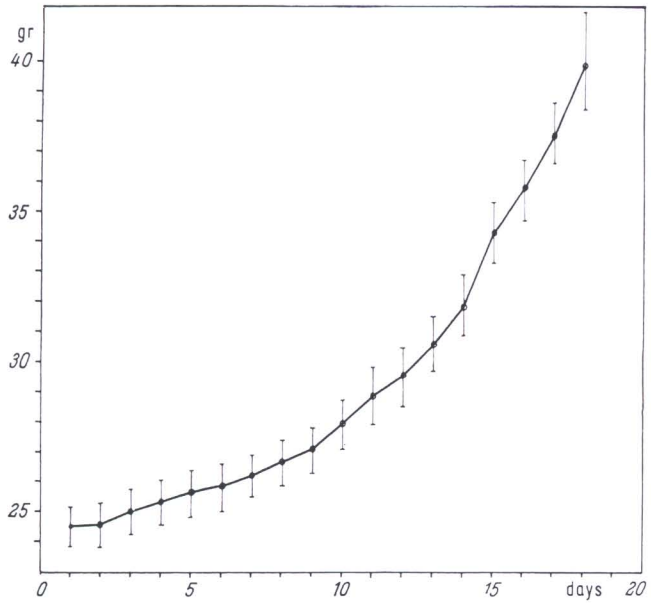

FIG. 335. Increase in weight of pregnant hybrids (C57BL/6-females). *Short perpendicular lines* indicate standard errors.