



# Biology Data Book

Second Edition

VOLUME I

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Part II. Rat

Age = days after fertilization, calculated from copulation age minus eight hours; numbers in brackets are corresponding ages of mouse embryos at same stage, based chiefly on references 7 and 8. Size = largest dimension of embryo in

natural position, unless otherwise indicated; numbers in brackets are largest and smallest dimensions of blastocysts and chorionic vesicles.

Standard Stage (Witschi)	Age da	Size mm	Identification of Stage
Cleavage & Blastula			
1	1	0.07	1 cell (located in oviduct)
2	2 [1]	0.08 × 0.06	2 cells (located in oviduct)
3	3	.....	4 cells (located in oviduct)
4	3.25 [2]	0.08 × 0.05	8-12 cells (located in oviduct)
5	3.5	0.08 × 0.04	Morula (located in uterus)
6	4	[0.08 × 0.03]	Early blastocyst (located in uterus)
7	5 [4]	[0.12 × 0.05]	Free blastocyst (located in uterus)
Gastrula			
8	6 [4.5]	[0.28 × 0.07]	Implanting blastocyst with trophoblastic cone & inner cell mass; extraembryonic hypoblast (outgrowth of endoderm)
9	6.75 [5]	.....	Trophectoderm; inner cell mass (pendant) covered with endoderm
10	7.25 [5.5]	[0.3 × 0.1]	Implantation near completion; inner cell mass beginning differentiation into embryonic & extraembryonic parts
11	7.75 [6.5]	[0.5 × 0.1]	Implantation complete; primary amniotic cyst; ectoplacental cone
Primitive Streak			
12	8.5 [7]	[1.04 × 0.26]	Connecting ectochorionic & amniotic cavities; rudiments of amniotic folds; primitive streak; start of 3rd layer formation; primordia of heart & pericardium

*continued*

## 28. CHARACTERIZATION OF DEVELOPMENTAL STAGES

## Part II. Rat

Standard Stage (Witschi)	Age da	Size mm	Identification of Stage
Neurula			
13	9[7.5]	1.0[1.40 × 0.45]	Presomite neurula: fusion of chorioamniotic folds, chorioamniotic stalk; neural plate; embryo bent dorsally; bud of allantoic sac
14	9.5[7.75]	1.5[1.8 × 1.1]	Occipital somites 1-4; neurula plus 3 cavities (ectochorionic cyst, exocoelom, & amniotic cavity); collapsing ectochorionic cyst; allantoic stalk projecting into exocoelom; embryo bent dorsally
15	10[8.0-8.5]	2	Cervical somites 5-12; 1st branchial arch; ectochorionic cyst fused with ectoplacenta & allantoic stalk; regression of distal (peripheral) yolk sac & trophoctoderm; Reichert's membrane; primordial germ cells in endoderm; embryo bent dorsally
16	10.5[8.5-9.0]	2.4[3.4 × 2.2]	Upper thoracic somites 13-20; 2 branchial arches; disk & yolk sac placentas; appendicular folds; embryo reversing, curving ventrally
17	11[9.5]	3.3	Lower thoracic somites 21-25; yolk stalk closes at level of 15th somite; primordial germ cells in mesentery; disappearance of primitive streak; organization of tail bud; forelimb & hindlimb buds recognizable
Tail-Bud Embryo			
18	11.5[10]	3.8	Upper lumbar somites 26-28; 3 branchial arches; forelimb buds recognizable
19	11.75 [10.25]	4.2	Lower lumbar somites 29-31; 1st-4th branchial arches; cervical folds; appendicular folds & buds
20	11.875	5[5.2 × 4.7]	Upper sacral somites 32 & 33
21	12	5.1	Lower sacral somites 34 & 35; deep cervical sinuses
22	12.125 [10.5]	5.2	1st caudal somite 36; nasal pits
23	12.25	5.6[5.8 × 4.5]	Caudal somites 37 & 38; start of umbilical herniation
24	12.375	6	Caudal somites 39 & 40
Complete Embryo			
25	12.5[11]	6.2	Caudal somites 41 & 42; dispersing of occipital somites; 4 branchial arches; deep cervical sinuses; forelimb buds at level of somites 8-14, about as high as long; hindlimb buds at level of somites 28-31, smaller; body forms spiral of ~1½ turns, left face & trunk applied to yolk sac, right side turned toward placenta; tail & allantoic stalk rise to placenta
Metamorphosing Embryo			
26	12.75	7	Caudal somites 43-45; mandibular, maxillary, & frontonasal processes; closing of cervical sinuses; mammary welts; differentiation of hand plates; forelimb buds vascularized, brachial nerves ending; beginning of umbilical hernia
27	13[12]	8	Caudal somites 46-48; prominent facial processes & clefts; projecting nose; cervical sinuses closed; primordia of mammary glands; round hand plates & foot plates; larger umbilical hernia
28	13.5[12.5]	8.5	Caudal somites 49-51; 1st branchial groove transforms into external acoustic meatus; precartilaginous condensations in hand plates
29	14	9.5	Caudal somites 52-55; ear hillocks on 1st & 2nd branchial arches
30	14.5[13]	10.5	Caudal somites 56-60; body uncoils; mandibular precartilagae; nearly round opening of external acoustic meatus; pleuroperitoneal canal very narrow
31	15	12	Caudal somites 61-63; facial clefts closed; pleuroperitoneal canal closed; complete diaphragm
32	15.5[14.5]	14.2[14.3 × 8.0]	Caudal somite 64; pinna turns forward; maximal size of umbilical hernia
33	16[15]	15.5	Caudal somite 65 (usually last); snout lifts off chest; last stage of metamorphosis

continued

## 28. CHARACTERIZATION OF DEVELOPMENTAL STAGES

## Part II. Rat

Standard Stage (Witschi)	Age da	Size mm	Identification of Stage	
Fetus				
34	34	17-18 [16.0-16.5]	16-20	1st fetal stage: rapid growth of eyelids (entirely covered at end of 18th da); palate complete; pinna covers external acoustic meatus; umbilical hernia withdraws
35	35 ante-natal	19-22 [17-19]	20-40	2nd fetal stage: sealed eyelids; fetal membranes & placenta reach peak of development; tail grows to 10 mm; birth occurs (22nd da in rat, 19th da in mouse)
36	35 post-natal	1-16 [1-20] postpartum	40-100 <sup>1/</sup>	After birth fetus becomes breathing, suckling nestling <sup>2/</sup> ; during 1st 16 da (total age, 22-38 da), eyelids remain sealed & external acoustic meatuses plugged with periderm
37	36 post-natal	17+ [21+] postpartum	100+ <sup>1/</sup>	Periderm seals of ears & eyelids vanish; active feeding begins within next 3 da & weaning after 1 wk (total weaning age, 45-48 da for rats & mice)

<sup>1/</sup> Body length from nose to root of tail. During preimplantation stages, mouse development gains a lead of 1.5-2 da and maintains it until birth; its nestling period is correspond-

ingly longer so that the average total age at weaning is nearly the same for the two species. <sup>2/</sup> Developmentally, nestling period belongs to second fetal stage.

Contributor: Witschi, Emil

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