



Biology Data Book

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28. CHARACTERIZATION OF DEVELOPMENTAL STAGES

Part IV. Chick

Stage ^{1/}	Age	Identification of Stage	Stage ^{1/}	Age	Identification of Stage
40 33	7.5-8.0 da	Web on radial margin of forelimb (wing) & its 1st digit	47 40	14 da	Beak, 4.0 mm long; 3rd toe, 12.7 ± 0.5 mm long
41 34	8 da	Nictitating membrane	48 41	15 da	Beak, from anterior angle of nostril to tip of upper bill, 4.5 mm long; 3rd toe, 14.9 ± 0.8 mm long
42 35	8.5-9.0 da	Phalanges in toes	49 42	16 da	Beak, 4.8 mm long; 3rd toe, 16.7 ± 0.8 mm long
43 36	10 da	Beak, from anterior angle of nostril to tip of bill, 2.5 mm long; 3rd toe, from tip to middle of metatarsal, 5.4 ± 0.3 mm long; primordium of comb; labial groove; uropygial gland	50 43	17 da	Beak, 5.0 mm long; 3rd toe, 18.6 ± 0.8 mm long
44 37	11 da	Beak, 3.0 mm long; 3rd toe, 7.4 ± 0.3 mm long	51 44	18 da	Beak, 5.7 mm long; 3rd toe, 20.4 ± 0.8 mm long
45 38	12 da	Beak, 3.1 mm long; 3rd toe, 8.4 ± 0.3 mm long	52 45	19-20 da	Yolk sac half-enclosed in body cavity; less blood contained in chorioallantoic membrane (membrane "sticky" in living embryo)
46 39	13 da	Beak, 3.5 mm long; 3rd toe, 9.8 ± 0.3 mm long	53 46	20-21 da	Newly hatched chick

^{1/} As described in reference 1.

Contributor: Hamilton, Howard L.

References

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Part V. Frog

Data are principally for *Rana pipiens*. At a given stage, age and size can be expected to vary widely with differences in geographic strains and culture conditions. Stage: Those stages designated by Arabic numerals are for the embryo

(adapted from Shumway [19]); those designated by Roman numerals are for the larva (adapted from Taylor and Kollros [23]). Data in brackets refer to the column heading in brackets.

Stage	Age at 20°C [at 18°C]	Size mm	Identification of Stage	Reference
Cleavage & Blastula				
1 1	[0 hr]	1.5-2.0	Unfertilized egg	19
2 2	0.5 hr [1 hr]	1.5-2.0	Zygote; gray crescent	19
3 3	2.3 hr [3.5 hr]	.....	2 cells	19
4 4	3.2 hr [4.5 hr]	.....	4 cells	19
5 5	4.0 hr [5.7 hr]	.....	8 cells	19
6 6	4.8 hr [6.5 hr]	.....	16 cells	19
7 7	5.6 hr [7.5 hr]	.....	32 cells	19
8 8	7 hr [16 hr]	.....	Middle blastula	19
9 9	17 hr [21 hr]	.....	Late blastula	19
Gastrula				
10 10	22 hr [26 hr]	.....	Early gastrula (dorsal lip stage)	19
11 11	28 hr [34 hr]	.....	Middle gastrula: C- or U-shaped blastopore	19
12 12	30 hr [42 hr]	.....	Late gastrula: yolk plug; primitive gut	17,19

continued

28. CHARACTERIZATION OF DEVELOPMENTAL STAGES

Part V. Frog

Stage	Age at 20°C [at 18°C]	Size mm	Identification of Stage	Reference
Neurula				
13	13	38 hr [50 hr]	..... Early neurula: medullary plate defined; placodal thickenings	10,17,19
14	14	43 hr [62 hr]	..... Midneurula: well-defined neural folds approaching each other; oral plate; anal plate; post-anal gut; adenohypophyseal placode	9,10,19
15	15	49 hr [67 hr]	..... Late neurula: neural folds touching each other over most of their length; neureneric canal; rotation of embryo in jelly	9,19
16	16	52 hr [72 hr]	3 Neural tube, with ectoderm fused over tube; oral sucker	19,20
Tail-Bud Embryo				
17	17	61 hr [84 hr]	3.5 Tail bud; nasal pit; dorsal aorta; 1st peritoneal funnels	10,14,19
18	18	76 hr [96 hr]	4 Muscular response to stimulation of myotome; lens placode	19,20
19	19	88 hr [118 hr]	5 Heart beats; pronephros functional; thyroid diverticulum; pineal body; giant ganglion (Rohon-Beard) cells in spinal cord; 5 gill pouches	12,14,15,19
20	20	96 hr [140 hr]	6 Embryo hatched; gill circulation; lens vesicle	19,20
21	21	[162 hr]	7 Mouth open; free-swimming; cornea becoming transparent; olfactory nerve; right & left ventral pancreatic buds; lung primordia	14,19
22	22	[192 hr]	8 Circulation in tail fin; cartilaginous trabeculae; 2 gill slits perforate; trabeculae carnae; rudiments of oral fringes	14
23	23	[216 hr]	8-9 Opercular folds; labial teeth; beginning of spontaneous respiratory activity of mouth; basal plate	6,14,19
24	24	[240 hr]	9-10 Operculum closed on right side; primordia of suprarenal cortex; beginning of respiratory rhythm; lens cavity obliterated	6,19-21
25	25	[284 hr]	10-11 Operculum closed except for spiracle; rods & cones in eye; gonadal ridge; sucker regressed; primordia of mesonephric tubules	4,17,19,20
Tadpole to Adult (Metamorphosis)				
26	I	3 da	13 Beginning of feeding; primordia of suprarenal medulla; hindlimb buds	18,23
27	II	6 da	17 Lagena; neurohypophysis; bronchial columella	1,24,26
28	III	11 da	23 Limb-bud length & diameter equal	23
29	IV	19 da	33 Ovarian sac; cartilage in synotic tectum ^{1/} ; lateral motor column	3,14,16
30	V	23 da	39 Limb-bud length twice breadth, distal half bent ventrally; cortex & medulla of gonads differentiated	14,23
31	VI	26 da	43 Flattened paddle at distal end of limb-bud; cartilage in scapula; testes & ovaries distinguishable; thigh muscles striated	4,14,23,25
32	VII	31 da	50 Foot paddle indented between 4th & 5th toes	23
33	VIII	34 da	53 Primordium of urinary bladder; measurable hormone output by thyroid gland	2,12,14
34	IX	36 da	56 Separation of fat body from gonad; spontaneous limb twitches	14,23
35	X	40 da	58 Toe margins delimited by indentations; primordia of fungiform papillae of tongue	7,23
36	XI	43 da	61 Margin of 5th toe web directed toward 2nd toe	23
37	XII	47 da	64 Margin of 5th toe web directed toward 1st toe	23
38	XIII	52 da	67 Margin of 5th toe web directed toward prehallux	23
39	XIV	58 da	70 Primordia of harderian glands & of skin glands	13,14
40	XV	62 da	72 1st toe pads; hindlimbs take part in swimming	12,23
41	XVI	64 da	73 Nictitating membrane a low fold anterior to eyeball	12
42	XVII	67 da	73 Some skin glands patent; peritoneal thickening presages oviduct	3,13
43	XVIII	70 da	74 ^{2/} Cloacal tail piece resorbed; corneal reflex	11,23
44	XIX	72 da	73 Beginning of tail regression; formation of skin windows	5,23
45	XX	74 da	70 Skin windows perforate; emergence of forelimbs; oral beaks lost	5,23
46	XXI	76 da	63 Formation of upper lid; 1st molt	5,8

^{1/} A small fraction of the chondrocranium which is the roof between the two otic capsules. ^{2/} Maximum size highly variable; tadpoles >100 mm long have been collected.

continued

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Part V. Frog

Stage	Age at 20°C [at 18°C]	Size mm	Identification of Stage	Reference
47	XXII	79 da	44	Conjunctival sac complete; regression of lateral lines
48	XXIII	81 da	33	Labial fringes completely lost; efferent ductules
49	XXIV	84 da	26 ^{3/}	Tympanic membrane outlined; tail stub, 1-2 mm long
50	XXV	88 da	25	Tail stub fully resorbed; oviduct extending nearly to cloaca
51	Juvenile	90+ da	25-70	Fully metamorphosed; gonads immature; urostyle
52	Adult	1-3 yr	60-110	Sexually mature

^{3/} Size upon completion of metamorphosis highly variable (16-30 mm).

Contributor: Kollros, Jerry J.

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Part VI. Salamander

Data are for *Ambystoma maculatum*. For information on other caudates, consult references 4, 5, 8, 9, and 11.
Temp = temperature at which salamanders were maintained.

Age = time from fertilization. For additional information, consult references 7 and 10.

Stage	Temp °C	Age	Length mm	Identification of Stage	Réf- er- ence
Cleavage & Blastula					
1	1	.....	.....	Fertilization to 1st cleavage	6
2	20	6 hr	2 cells	3,6
3	10, 20	8 hr	4 cells	1,3,6
4	10, 20	10 hr	8 cells	1,3,6
5	10 20	13 hr 12 hr	16 cells	1,3,6

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