

Prenatal Development Timeline

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| ■ Nervous | ■ Cardiovascular | ■ Muscular | ■ Early Events |
| ■ Special Senses | ■ Respiratory | ■ Skeletal | ■ Growth Parameters |
| ■ Blood & Immune | ■ Gastrointestinal | ■ Endocrine | ■ General |
| ■ Skin/Integument | ■ Renal/Urinary | ■ Reproductive | ■ Movement |

Unit 1: The First Week

Day 0	—	■ Embryonic period begins
		■ Fertilization resulting in zygote formation
Day 1	—	■ Embryo is spherically shaped with 12 to 16 cells
Day 1 - Day 1	—	■ Fertilization - development begins with a single-cell embryo!!!
Day 2	—	■ Early pregnancy factor (EPF)
		■ Activation of the genome
		■ Zygote divides into two blastomeres (24 - 30 hours from start of fertilization)
Day 4	—	■ Embryonic disc
		■ Free floating blastocyst
		■ Hypoblast & epiblast
		■ Inner cell mass
		■ See where the back and chest will be
Day 5	—	■ Hatching blastocyst
Day 6	—	■ Embryo attaches to wall of uterus
1 week	—	■ Chorion
		■ Placenta begins to form
























Unit 2: 1 to 2 Weeks

1 week, 1 day	—	■ Amnioblasts present; amnion and amniotic cavity formation begins
		■ Positive pregnancy test
1 week, 2 days	—	■ Cells in womb engorged with nutrients
1 week, 4 days	—	■ Longitudinal axis
1 week, 5 days	—	■ Implantation complete
		■ Yolk sac
1 week, 6 days	—	■ Primordial blood vessels
		■ Amnion with single cell layer
		■ Chorionic villi
2 weeks	—	■ Yolk sac
		■ Yolk sac















Unit 3: 2 to 3 Weeks

2 weeks, 1 day	—	■ 3 germ layers
		■ Rostral-caudal orientation
2 weeks, 2 days	—	■ Erythroblasts in yolk sac
		■ Three types of blood-forming cells in yolk sac
		■ Amnion with two cell layers
		■ Secondary villi

2 weeks, 4 days	<ul style="list-style-type: none"> Foregut, midgut, and hindgut Brain is first organ to appear
	<ul style="list-style-type: none"> Neural plate induced by notochordal process Connecting stalk
2 weeks, 6 days	<ul style="list-style-type: none"> Numerous blood islands in umbilical vesicle Foregut Stomodeum forming Beginnings of the heart can be seen Blood vessels emerge simultaneously in umbilical vesicle, embryo proper, amnion, and connecting stalk Dorsal aortae (paired) Paired tubular heart Forebrain, midbrain, and hindbrain Neural groove deepens substantially Three main divisions of brain Neural crest: Rostral and facial
3 weeks	<ul style="list-style-type: none"> Blood and blood vessels
Unit 4: 3 to 4 Weeks	
3 weeks, 1 day	<ul style="list-style-type: none"> Midgut emerging Respiratory outgrowth Atria (right and left) far apart Circulatory system function begins Endocardial tubes fuse forming tubular heart Heart begins beating Pericardium Primary head vein Sinus venosus Tubular heart begins folding Umbilical arteries Umbilical veins (right and left) Neural tube Body cavities Hyoid arch
3 weeks, 3 days	<ul style="list-style-type: none"> Thyroid complete Cystic primordium Liver Membrane between future mouth and throat may begin to rupture Internal carotid arteries Neuropore (near brain) closes Notochord
3 weeks, 5 days	<ul style="list-style-type: none"> First part of pancreas Pharyngeal arch 3 Lung bud Descending aorta

	 Unidirectional circulation
	 Brain involves 40% of neural tube
	 Lowermost spinal cord formation begins
	 Neural tube closes (lower back)
	 Somites: Pairs 21 through 29
	 Upper limb primordium at level of somites 8 to 10
	 Progressively C-shaped embryo
4 weeks	 Skin is so thin, you can see through it!
	 Esophagus primordia
	 Intestines growing in length
	 Pancreas: Ventral pancreas
	 Pharynx
	 Small & large intestines
	 Bronchial buds
	 Lungs begin filling chest cavity
	 Trachea
	 Circulatory system "well established"
	 Functioning two-chamber heart
	 Heart chambers bulging with fluid
	 Heart now functions as two parallel pumps
	 Heart rate (about) 113 beats/min
	 Most cranial nerve ganglia
	 Cerebellum
	 Fourth ventricle
	 Amnion surrounds embryo
	 Limb buds - the first sign of arms and legs
	 Lower limb buds
	 Umbilical cord emerging
	 Upper and lower limb buds

Unit 5: 4 to 5 Weeks

4 weeks, 3 days	 Early eyes
4 weeks, 3 days - 5 weeks	 Germ cells migrate to gonads
4 weeks, 4 days	 Lungs: Right and left primary (or main stem) bronchi
	 Sinu-atrial (SA) node
	 Eyes located on sides of head
	 Lens pits
	 Nose: Nasal pits
	 Brain enlarges 50% since Carnegie Stage 13
	 Brain: Cerebral hemispheres appear and begin rapid growth
	 Brain: Lateral ventricles
	 Hypothalamus
4 weeks, 5 days	 Caecum
	 Blood vessels penetrate diencephalon
	 Coronary arteries (terminal end)

	Optic chiasm
	Brain with five main sections
	First nerve fibers
	Most cranial nerves seen
	Synapses among motor neurons in spinal cord
	Third ventricle
5 weeks	ACTH [adrenocorticotropin hormone]
	Growth hormone
	Pituitary gland
	Limb buds form hand plates
	Permanent kidneys
	Bronchial tree branching accelerates
	Lobar pattern mimics adult pattern
	Pacemaker cells
	Head is one third of entire embryo

Unit 6: 5 to 6 Weeks

5 weeks, 1 day	Wrist joints are forming
5 weeks, 2 days	Thyroid detaches from pharynx
	Atrioventricular (AV) node
	Circle of Willis almost complete
	Cochlear nerve present
	Musculocutaneous, radial, ulna, and median nerves enter upper limb bud
	All cranial nerves identifiable
5½ weeks	Initial tooth formation
5½ weeks - 6 weeks	Subtle movement begins
5 weeks, 4 days	Cartilage formation
5 weeks, 5 days	Nerve cells differentiating
5 weeks, 5 days - 7 weeks, 1 day	Melanocytes in epidermis
5 weeks, 6 days	Cartilage in occipital sclerotomes (1-4)
	Primordial vermiform appendix
	All spinal nerves present
	Dura begins forming in basal area
	Frontal and temporal poles of cerebral hemispheres
	Somites: Pairs 38 and 39
	Synapses in spinal cord between interneurons and primary afferent neurons
6 weeks	Face withdraws from light touch around mouth
	Blood forming in liver
	Nipples along side of trunk
	Adrenal glands
	Glucagon in pancreas
	Handplates develop subtle flattening
	Joints

	Tooth buds (primary teeth)
	Diaphragm is largely formed
	Intestines fill base of umbilical cord
	External ears
	Synapses form in spinal cord
	Crown-heel length 1.6 cm

Unit 7: 6 to 7 Weeks

6 weeks, 2 days	Elbow regions sometimes identifiable
	Hands polygon-shaped
	Humerus, radius, and ulna
	Toe rays sometimes present
	Deltoid muscle
	Submandibular gland primordia
	Inferior vena cava
	Left coronary artery arises from aorta
	Optic fibers
	Eyelid folds sometimes present
	Brainwave activity has begun
	Cerebrospinal fluid production begins
6½ weeks	The hands begin to move
	Volar pads on palms
	Bones first form in the collar bones and lower jaw
6 weeks, 5 days	Beginnings of occipital and sphenoid bones
	Cartilaginous styloid process
	Limbs point forward (ventrally)
	Anal membrane
	Lung, left: Oblique fissure defines upper and lower lobes
	Circulus arteriosus (Circle of Willis) complete
	Right coronary artery arises from aorta
	Tricuspid and mitral valves
	Primitive nasal cavity
	Eyelids: Upper and lower lids present and growing
	Occipital pole of cerebral hemispheres
6 weeks, 6 days	Feet polygon-shaped
	Cloacal membrane ruptures
7 weeks	Head rotates
	Leg movements
	B lymphocytes in liver
	Ovaries
	Testes begin to differentiate
	Insulin in pancreas
	Foot plates notched
	Hiccups
	Tendons attach muscle to bone

	<ul style="list-style-type: none"> ■ The heart has four chambers and is nearly complete. ■ The heart rate peaks at 165 to 170 beats per minute. Crown-heel length 2.2 cm
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Unit 8: 7 to 8 Weeks

7 weeks, 1 day	<ul style="list-style-type: none"> Upper limbs with slightly flexed elbows ■ Sacrocaudal spinal cord formation (secondary neurulation) complete
7 weeks, 1 day - 8 weeks	<ul style="list-style-type: none"> ■ Stomach: Folds in stomach wall
7 weeks, 2 days	<ul style="list-style-type: none"> ■ Arteries and veins of heart complete
7 weeks, 3 days	<ul style="list-style-type: none"> The knee joints have arrived Wrists slightly flexed ■ Eyelids growing rapidly ■ Cerebral hemispheres cover more than half of diencephalon
7½ weeks	<ul style="list-style-type: none"> ■ Hands begin to touch face ■ The hands touch each other as do the feet! Fingertips thicken Plantar pads toes ■ EKG pattern similar to adult
7 weeks, 4 days	<ul style="list-style-type: none"> The fingers are free
7 weeks, 5 days	<ul style="list-style-type: none"> Bone-forming cells called osteoblasts emerge Hands can reach one another and fingers can overlap ■ Brain: Internal capsule with connections to epithalamus, dorsal thalamus, and mesencephalon ■ Cerebral hemispheres cover 75% of diencephalon ■ Cortical plate expanding rapidly
7 weeks, 6 days	<ul style="list-style-type: none"> The toes are free
8 weeks	<ul style="list-style-type: none"> ■ Complex response to touch ■ More frequent hand-to-face contact ■ Mouth opens & closes ■ Squinting ■ The embryo floats and rolls over in the womb Hairs first appear in eyebrows & around mouth Skin multi-layered, loses transparency ■ Male embryos are making testosterone already! The embryo's joints are similar to adult joints ■ Diaphragm complete ■ Esophagus: Longitudinal muscles ■ Urethra ■ Urine production and release ■ Peristalsis in large intestine ■ Occasional breathing motions begin ■ Blood supply to the brain closely resembles adult pattern ■ Cranial nerve distribution mimics adult pattern

	<ul style="list-style-type: none"> ■ Retina: Four of the ten adult layers present ■ Tympanic membrane
	<ul style="list-style-type: none"> ■ "The hindbrain "presents striking resemblance to that of the newborn." ■ Brain represents 43% of embryo ■ Grey and white matter ■ Right- and left-handedness emerges
	<ul style="list-style-type: none"> □ Crown-heel length 4.3 cm □ Embryo contains approximately 1 billion (10⁹) cells □ Embryonic Period Ends □ The 8-week embryo has formed more than 4,000 permanent body parts.

Unit 9: 8 to 9 Weeks

8½ weeks	<ul style="list-style-type: none"> ■ Eyelids completely fused ■ Neurons synapse in cerebral cortex (marginal zone)
9 weeks	<ul style="list-style-type: none"> ■ Bends hip & knee if sole of foot touched ■ Drinking fluid is becoming routine ■ Sucking the thumb ■ The young fetus now sighs, stretches, moves the head, opens the mouth, and moves the tongue ■ Tongue movement ■ Female fetuses have early reproductive cells in their ovaries ■ Thyroid gland weighs 2 grams ■ Small intestine peristalsis ■ Face, hands, and feet sense light touch

Unit 10: 9 to 10 Weeks

9 weeks - 10 weeks	<ul style="list-style-type: none"> ■ Early vocal cords □ My weight will rise more than 75% this week
9½ weeks	<ul style="list-style-type: none"> ■ I yawn when I want
9 weeks, 4 days	<ul style="list-style-type: none"> ■ Yawns
10 weeks	<ul style="list-style-type: none"> ■ Eyes roll downward reflexively ■ Palatine tonsils ■ Fingernails and toenails begin to grow! ■ Three-layered epidermis ■ Tiny unique fingerprints have arrived! ■ Now, all the bones are getting harder ■ Tooth buds (secondary teeth) ■ Glomeruli formation begins ■ Physiologic herniation ends ■ Corpus callosum begins □ Crown-heel length 7.5 cm

Unit 11: 10 to 11 Weeks

10 weeks - 12 weeks	<ul style="list-style-type: none"> ■ Langerhans cells enter epidermis
10½ weeks	<ul style="list-style-type: none"> ■ Volar and plantar pads regress

11 weeks	<ul style="list-style-type: none"> ■ The face now makes complex expressions ■ Immunological competence ■ Intermediate layer ■ Nose & lips completely formed ■ Now you can tell if your baby is a girl or a boy! ■ Thyroid gland weighs 12 grams ■ Intestines absorb water & glucose ■ Auditory cells: inner & outer hair cells □ Crown-heel length
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Unit 12: 11 to 12 Weeks

11 weeks - 12 weeks	□ Weight increases by 60% this week
12 weeks	<ul style="list-style-type: none"> ■ Hands touch the mouth up to 50 times per hour ■ T lymphocytes leave thymus ■ Many different hormones are present in pituitary gland ■ Thyroid gland produces hormone ■ Palate fuses ■ Upper limbs reach final proportion ■ Bladder resembles smooth muscle ■ Bowel movements ■ Liver: Bile production begins ■ There are taste buds all over the mouth ■ Corpus callosum □ Crown-heel length 12 cm □ Head circumference 10 cm

Unit 13: 3 to 4 Months

13 weeks	<ul style="list-style-type: none"> ■ Teeth are growing ■ Cilia lining airways ■ Most of body sensitive to touch □ Crown-heel length 15 cm
14 weeks	<ul style="list-style-type: none"> ■ Girls move their jaws more than the boys do ■ Light touch to mouth evokes turn toward stimulus ■ 4-lobed cerebral cortex ■ Cerebellum resembles adult structure □ Crown-heel length 17 cm □ Fat deposits in cheeks
15 weeks	<ul style="list-style-type: none"> ■ Stem cells arrive in bone marrow ■ Body fat emerges throughout the body ■ Glucagon in fetal bloodstream ■ Digestive enzymes □ Crown-heel length 19.5 cm
16 weeks	<ul style="list-style-type: none"> ■ Quickening ■ Fat deposits upper & lower limbs ■ Tooth enamel ■ Bronchial tree nearly complete

	<ul style="list-style-type: none"> Hormonal stress response to invasive procedures Crown-heel length 21 cm
Unit 14: 4 to 5 Months	
17 weeks	<ul style="list-style-type: none"> Retina has discrete layers
18 weeks	<ul style="list-style-type: none"> Cream-like substance protects skin Sweat glands Insulin secretion Speaking motion of larynx Corpus callosum complete
19 weeks	<ul style="list-style-type: none"> Melanin production Number of oogonia peak (at about 7 million) within fetal ovaries Daily cycles in biological rhythms
20 weeks	<ul style="list-style-type: none"> All skin layers and structures Surfactant production (low levels) Hearing and responding to sound begins Hearing and responding to sound begins Crown-heel length 28 cm Head circumference 20 cm
Unit 15: 5 to 6 Months	
20 weeks - 24 weeks	<ul style="list-style-type: none"> Eyelids separate, eyes open and close
21 weeks	<ul style="list-style-type: none"> Stratum corneum
21 weeks - 22 weeks	<ul style="list-style-type: none"> If born prematurely from this point on, survival is possible
22 weeks	<ul style="list-style-type: none"> Cornea structure Behavioral states
23 weeks	<ul style="list-style-type: none"> Brain weight 100 grams
24 weeks	<ul style="list-style-type: none"> Blink-startle response; females before males Crown-heel length 34.5 cm
Unit 16: 6 to 7 Months	
25 weeks	<ul style="list-style-type: none"> Intestinal lining contains all adult cell types Rods & cones The ability to taste
26 weeks	<ul style="list-style-type: none"> Additional fat deposits decrease wrinkles Tear production The ability to smell has arrived
26 weeks - 38 weeks	<ul style="list-style-type: none"> Brain weight increases 400% to 500%
27 weeks	<ul style="list-style-type: none"> Pupils react to light
28 weeks	<ul style="list-style-type: none"> Distinguishes sounds of different frequencies Crown-heel length 39.5 cm
Unit 17: 7 to 8 Months	
30 weeks	<ul style="list-style-type: none"> Breathing motions are common even though there is no air in the womb 6-layered cerebral cortex Head circumference 30 cm

32 weeks	<ul style="list-style-type: none"> Esophagus: Lower esophagus muscles functional Glomeruli formation complete Alveoli Memory - music preferences <input type="checkbox"/> Crown-heel length 45 cm
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Unit 18: 8 to 9 Months

32 weeks - 36 weeks	<ul style="list-style-type: none"> Prenatal food affects newborn taste preferences
34 weeks	<ul style="list-style-type: none"> <input type="checkbox"/> Rapid weight gain
35 weeks	<ul style="list-style-type: none"> Firm grip <input type="checkbox"/> Amniotic fluid volume peaks
36 weeks	<ul style="list-style-type: none"> Surfactant production accelerates <input type="checkbox"/> Brain weight 300 grams <input type="checkbox"/> Crown-heel length 48.5 cm

Unit 19: 9 Months to Birth

37 weeks	<ul style="list-style-type: none"> Fetus drinks an estimated 15 oz (or 450cc) of amniotic fluid/day
38 weeks	<ul style="list-style-type: none"> Air breathing begins By term, the typical umbilical cord measures 20 to 24 inches (50 to 60 cm) Heart beats 54 million times before birth Major circulatory changes Spinal cord ends at third lumbar vertebrae <input type="checkbox"/> Brain weight 350 grams <input type="checkbox"/> Crown-heel length 50 cm <input type="checkbox"/> Fetus initiates labor <input type="checkbox"/> Head circumference 35 cm <input type="checkbox"/> Time to be born!