

Prenatal Development Timeline

■ 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	- Foregut, midgut, and hindgut - Brain is first organ to appear - Neural plate induced by notochordal process - Connecting stalk
2 weeks, 6 days	- 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	Blood and blood vessels
Unit 4: 3 to 4 Weeks	
3 weeks, 1 day	- 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	- 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	- 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

	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
Unit 8: 7 to 8 Weeks	
7 weeks, 1 day	Upper limbs with slightly flexed elbows
	Sacrocaudal spinal cord formation (secondary neurulation) complete
7 weeks, 1 day - 8 weeks	Stomach: Folds in stomach wall
7 weeks, 2 days	Arteries and veins of heart complete
7 weeks, 3 days	The knee joints have arrived
	Wrists slightly flexed
	Eyelids growing rapidly
	Cerebral hemispheres cover more than half of diencephalon
7½ weeks	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	The fingers are free
7 weeks, 5 days	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	The toes are free
8 weeks	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

	 Retina: Four of the ten adult layers present
	 Tympanic membrane
	 "The hindbrain "presents striking resemblance to that of the newborn."
	 Brain represents 43% of embryo
	 Grey and white matter
	 Right- and left-handedness emerges
	 Crown-heel length 4.3 cm
	 Embryo contains approximately 1 billion (10 ⁹) 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	 Eyelids completely fused
	 Neurons synapse in cerebral cortex (marginal zone)
9 weeks	 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	 Early vocal cords
	 My weight will rise more than 75% this week
9½ weeks	 I yawn when I want
9 weeks, 4 days	 Yawns
10 weeks	 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	 Langerhans cells enter epidermis
10½ weeks	 Volar and plantar pads regress

11 weeks	- 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	- 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	- Teeth are growing - Cilia lining airways - Most of body sensitive to touch - Crown-heel length 15 cm
14 weeks	- 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	- 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	- Quickening - Fat deposits upper & lower limbs - Tooth enamel - Bronchial tree nearly complete

	Hormonal stress response to invasive procedures Crown-heel length 21 cm
Unit 14: 4 to 5 Months	
17 weeks	Retina has discrete layers
18 weeks	Cream-like substance protects skin Sweat glands Insulin secretion Speaking motion of larynx Corpus callosum complete
19 weeks	Melanin production Number of oogonia peak (at about 7 million) within fetal ovaries Daily cycles in biological rhythms
20 weeks	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	Eyelids separate, eyes open and close
21 weeks	Stratum corneum
21 weeks - 22 weeks	If born prematurely from this point on, survival is possible
22 weeks	Cornea structure Behavioral states
23 weeks	Brain weight 100 grams
24 weeks	Blink-startle response; females before males Crown-heel length 34.5 cm
Unit 16: 6 to 7 Months	
25 weeks	Intestinal lining contains all adult cell types Rods & cones The ability to taste
26 weeks	Additional fat deposits decrease wrinkles Tear production The ability to smell has arrived
26 weeks - 38 weeks	Brain weight increases 400% to 500%
27 weeks	Pupils react to light
28 weeks	Distinguishes sounds of different frequencies Crown-heel length 39.5 cm
Unit 17: 7 to 8 Months	
30 weeks	Breathing motions are common even though there is no air in the womb 6-layered cerebral cortex Head circumference 30 cm

32 weeks	- Esophagus: Lower esophagus muscles functional - Glomeruli formation complete - Alveoli - Memory - music preferences - Crown-heel length 45 cm
Unit 18: 8 to 9 Months	
32 weeks - 36 weeks	Prenatal food affects newborn taste preferences
34 weeks	Rapid weight gain
35 weeks	- Firm grip - Amniotic fluid volume peaks
36 weeks	- Surfactant production accelerates - Brain weight 300 grams - Crown-heel length 48.5 cm
Unit 19: 9 Months to Birth	
37 weeks	Fetus drinks an estimated 15 oz (or 450cc) of amniotic fluid/day
38 weeks	- 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 - Brain weight 350 grams - Crown-heel length 50 cm - Fetus initiates labor - Head circumference 35 cm - Time to be born!