

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	½ ½	Embryonic period begins	
		Fertilization resulting in zygote formation	
Day 1	½ ½	Embryo is spherically shaped with 12 to 16 cells	
Day 1 - Day 1	½ ½	Fertilization - development begins with a single-cell embryo!!!	
Day 2	½ ½	Early pregnancy factor (EPF)	
		Activation of the genome	
		Zygote divides into two blastomeres (24 - 30 hours from start of fertilization)	
Day 4	½ ½	Embryonic disc	
		Free floating blastocyst	
		Hypoblast & epiblast	
		Inner cell mass	
		See where the back and chest will be	
Day 5	½ ½	Hatching blastocyst	
Day 6	½ ½	Embryo attaches to wall of uterus	
1 week	½ ½	Chorion	
		Placenta begins to form	
Unit 2: 1 to 2 Weeks			
1 week, 1 day	½ ½	Amnioblasts present; amnion and amniotic cavity formation begins	
		Positive pregnancy test	
1 week, 2 days	½ ½	Cells in womb engorged with nutrients	

1 week, 4 days $\frac{1}{2}$ $\frac{1}{2}$	Longitudinal axis
1 week, 5 days $\frac{1}{2}$ $\frac{1}{2}$	Implantation complete
	Yolk sac
1 week, 6 days $\frac{1}{2}$ $\frac{1}{2}$	Primordial blood vessels
	Amnion with single cell layer
	Chorionic villi
2 weeks $\frac{1}{2}$ $\frac{1}{2}$	Yolk sac
	Yolk sac
Unit 3: 2 to 3 Weeks	
2 weeks, 1 day $\frac{1}{2}$ $\frac{1}{2}$	3 germ layers
	Rostral-caudal orientation
2 weeks, 2 days $\frac{1}{2}$ $\frac{1}{2}$	Erythroblasts in yolk sac
	Three types of blood-forming cells in yolk sac
	Amnion with two cell layers
	Secondary villi
2 weeks, 4 days $\frac{1}{2}$ $\frac{1}{2}$	Foregut, midgut, and hindgut
	Brain is first organ to appear
	Neural plate induced by notochordal process
	Connecting stalk
2 weeks, 6 days $\frac{1}{2}$ $\frac{1}{2}$	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 $\frac{1}{2}$ $\frac{1}{2}$	Blood and blood vessels
Unit 4: 3 to 4 Weeks	
3 weeks, 1 day $\frac{1}{2}$ $\frac{1}{2}$	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 $\frac{1}{2}$ $\frac{1}{2}$	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 $\frac{1}{2}$ $\frac{1}{2}$	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 $\frac{1}{2}$ $\frac{1}{2}$	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 $\frac{1}{2}$ $\frac{1}{2}$	 Early eyes
4 weeks, 3 days - 5 weeks $\frac{1}{2}$ $\frac{1}{2}$	 Germ cells migrate to gonads
4 weeks, 4 days $\frac{1}{2}$ $\frac{1}{2}$	 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 $\frac{1}{2}$ $\frac{1}{2}$	 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 $\frac{1}{2}$ $\frac{1}{2}$	 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 $\frac{1}{2}$ $\frac{1}{2}$	 Wrist joints are forming
5 weeks, 2 days $\frac{1}{2}$ $\frac{1}{2}$	 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
5 $\frac{1}{2}$ weeks $\frac{1}{2}$ $\frac{1}{2}$	 Initial tooth formation
5 $\frac{1}{2}$ weeks - 6 weeks $\frac{1}{2}$ $\frac{1}{2}$	 Subtle movement begins
5 weeks, 4 days $\frac{1}{2}$ $\frac{1}{2}$	 Cartilage formation
5 weeks, 5 days $\frac{1}{2}$ $\frac{1}{2}$	 Nerve cells differentiating
5 weeks, 5 days - 7 weeks, 1 day $\frac{1}{2}$ $\frac{1}{2}$	 Melanocytes in epidermis
5 weeks, 6 days $\frac{1}{2}$ $\frac{1}{2}$	 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 ½ ½	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 ½ ½	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 ½ ½	The hands begin to move
	Volar pads on palms
	Bones first form in the collar bones and lower jaw
6 weeks, 5 days ½ ½	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 $\frac{1}{2}$ $\frac{1}{2}$	The fingers are free
7 weeks, 5 days $\frac{1}{2}$ $\frac{1}{2}$	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 $\frac{1}{2}$ $\frac{1}{2}$	The toes are free
8 weeks $\frac{1}{2}$ $\frac{1}{2}$	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 ½ ½	Eyelids completely fused
	Neurons synapse in cerebral cortex (marginal zone)
9 weeks ½ ½	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 ½ ½	Early vocal cords
	My weight will rise more than 75% this week
9½ weeks ½ ½	I yawn when I want
9 weeks, 4 days ½ ½	Yawns
10 weeks ½ ½	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 ½ ½	Langerhans cells enter epidermis
10½ weeks ½ ½	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

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 $\frac{1}{2}$ $\frac{1}{2}$	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 $\frac{1}{2}$ $\frac{1}{2}$	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 $\frac{1}{2}$ $\frac{1}{2}$	Retina has discrete layers
18 weeks $\frac{1}{2}$ $\frac{1}{2}$	Cream-like substance protects skin
	Sweat glands
	Insulin secretion
	Speaking motion of larynx
	Corpus callosum complete
19 weeks $\frac{1}{2}$ $\frac{1}{2}$	Melanin production
	Number of oogonia peak (at about 7 million) within fetal ovaries
	Daily cycles in biological rhythms
20 weeks $\frac{1}{2}$ $\frac{1}{2}$	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 $\frac{1}{2}$ $\frac{1}{2}$	Eyelids separate, eyes open and close
21 weeks $\frac{1}{2}$ $\frac{1}{2}$	Stratum corneum

21 weeks - 22 weeks $\frac{1}{2}$ $\frac{1}{2}$	If born prematurely from this point on, survival is possible
22 weeks $\frac{1}{2}$ $\frac{1}{2}$	Cornea structure
	Behavioral states
23 weeks $\frac{1}{2}$ $\frac{1}{2}$	Brain weight 100 grams
24 weeks $\frac{1}{2}$ $\frac{1}{2}$	Blink-startle response; females before males
	Crown-heel length 34.5 cm
Unit 16: 6 to 7 Months	
25 weeks $\frac{1}{2}$ $\frac{1}{2}$	Intestinal lining contains all adult cell types
	Rods & cones
	The ability to taste
26 weeks $\frac{1}{2}$ $\frac{1}{2}$	Additional fat deposits decrease wrinkles
	Tear production
	The ability to smell has arrived
26 weeks - 38 weeks $\frac{1}{2}$ $\frac{1}{2}$	Brain weight increases 400% to 500%
27 weeks $\frac{1}{2}$ $\frac{1}{2}$	Pupils react to light
28 weeks $\frac{1}{2}$ $\frac{1}{2}$	Distinguishes sounds of different frequencies
	Crown-heel length 39.5 cm
Unit 17: 7 to 8 Months	
30 weeks $\frac{1}{2}$ $\frac{1}{2}$	Breathing motions are common even though there is no air in the womb
	6-layered cerebral cortex
	Head circumference 30 cm
32 weeks $\frac{1}{2}$ $\frac{1}{2}$	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 $\frac{1}{2}$ $\frac{1}{2}$	 Prenatal food affects newborn taste preferences
34 weeks $\frac{1}{2}$ $\frac{1}{2}$	 Rapid weight gain
35 weeks $\frac{1}{2}$ $\frac{1}{2}$	 Firm grip
	 Amniotic fluid volume peaks
36 weeks $\frac{1}{2}$ $\frac{1}{2}$	 Surfactant production accelerates
	 Brain weight 300 grams
	 Crown-heel length 48.5 cm
Unit 19: 9 Months to Birth	
37 weeks $\frac{1}{2}$ $\frac{1}{2}$	 Fetus drinks an estimated 15 oz (or 450cc) of amniotic fluid/day
38 weeks $\frac{1}{2}$ $\frac{1}{2}$	 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!