

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 - Day 1 | ■ Embryonic Period Begins |
| Day 1 - Day 1 | ■ Fertilization - development begins with a single-cell embryo!!! |
| | ■ Fertilization resulting in zygote formation |
| Day 2 | ■ Activation of the genome |
| | ■ Zygote divides into two blastomeres (perhaps 30 hours or so after fertilization) |
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| Day 2 - Day 2 | ■ Early pregnancy factor (EPF) |
| Day 3 | ■ Embryo is spherically shaped with 12 to 16 cells |
| Day 4 | ■ Embryonic disc |
| | ■ Free floating blastocyst |
| | ■ Inner cell mass |
| | ■ See where the back and chest will be |
| Day 5 | ■ Hatching |
| Day 6 | ■ The embryo implants into wall of womb |
| 1 week | ■ Chorion |
| | ■ Hypoblast & epiblast |
| | ■ Placenta begins to form |

Unit 2: 1 to 2 Weeks

| | |
|----------------|--|
| 1 week, 1 day | ■ Positive pregnancy test |
| | ■ Amnioblasts present; amnion and amniotic cavity formation begins |
| 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 |
| | Connecting stalk |
| 2 weeks, 5 days | Neural plate induced by notochordal process |
| 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 |
| | Neuropore (near brain) closes |
| | Notochord |
| 3 weeks, 5 days | First part of pancreas |
| | Pharyngeal arch 3 |
| | Lung bud |

























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|----------------|---|
| |  Descending aorta |
| |  Internal carotid arteries |
| |  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 |
| |  Brain enlarges 50% since Carnegie Stage 13 |
| |  Brain: Cerebral hemispheres appear and begin rapid growth |
| |  Brain: Lateral ventricles |
| 4 weeks, 5 days |  Caecum |
| |  Blood vessels penetrate diencephalon |
| |  Coronary arteries (terminal end) |

| | |
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| |  Nose: Nasal pits |
| |  Optic chiasm |
| |  Brain with five main sections |
| |  First nerve fibers |
| |  Hypothalamus |
| |  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

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|---|---|
| 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 |

| | |
|--|--|
| | <input type="checkbox"/> Handplates develop subtle flattening |
| | <input type="checkbox"/> Joints |
| | <input type="checkbox"/> Tooth buds (primary teeth) |
| | <input checked="" type="checkbox"/> Diaphragm is largely formed |
| | <input checked="" type="checkbox"/> Intestines fill base of umbilical cord |
| | <input checked="" type="checkbox"/> External ears |
| | <input checked="" type="checkbox"/> Synapses form in spinal cord |
| | <input type="checkbox"/> Crown-heel length 1.6 cm |

Unit 7: 6 to 7 Weeks

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

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|--|---|
| | <ul style="list-style-type: none"> ■ 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 | <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"> □ 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 □ The knee joints have arrived ■ 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 |

| | |
|--|---|
| | <input type="checkbox"/> Cranial nerve distribution mimics adult pattern |
| | <input type="checkbox"/> Retina: Four of the ten adult layers present |
| | <input type="checkbox"/> Tympanic membrane |
| | <input type="checkbox"/> "The hindbrain "presents striking resemblance to that of the newborn." |
| | <input type="checkbox"/> Brain represents 43% of embryo |
| | <input type="checkbox"/> Grey and white matter |
| | <input type="checkbox"/> Right- and left-handedness emerges |
| | <input type="checkbox"/> Crown-heel length 4.3 cm |
| | <input type="checkbox"/> Embryo contains approximately 1 billion (10 ⁹) cells |
| | <input type="checkbox"/> Embryonic Period Ends |
| | <input type="checkbox"/> The embryo has more than 4,000 parts (adults have about 4,500) |

Unit 9: 8 to 9 Weeks

| | |
|-----------------|--|
| 8½ weeks | <input type="checkbox"/> Eyelids completely fused |
| | <input type="checkbox"/> Neurons synapse in cerebral cortex (marginal zone) |
| 9 weeks | <input type="checkbox"/> Bends hip & knee if sole of foot touched |
| | <input type="checkbox"/> Drinking fluid is becoming routine |
| | <input type="checkbox"/> Sucking the thumb |
| | <input type="checkbox"/> The young fetus now sighs, stretches, moves the head, opens the mouth, and moves the tongue |
| | <input type="checkbox"/> Tongue movement |
| | <input type="checkbox"/> Female fetuses have early reproductive cells in their ovaries |
| | <input type="checkbox"/> Thyroid gland weighs 2 grams |
| | <input type="checkbox"/> Small intestine peristalsis |
| | <input type="checkbox"/> Face, hands, and feet sense light touch |

Unit 10: 9 to 10 Weeks

| | |
|---------------------------|--|
| 9 weeks - 10 weeks | <input type="checkbox"/> Early vocal cords |
| | <input type="checkbox"/> My weight will rise more than 75% this week |
| 9½ weeks | <input type="checkbox"/> I yawn when I want |
| 9 weeks, 4 days | <input type="checkbox"/> Yawns |
| 10 weeks | <input type="checkbox"/> Eyes roll downward reflexively |
| | <input type="checkbox"/> Palatine tonsils |
| | <input type="checkbox"/> Fingernails and toenails begin to grow! |
| | <input type="checkbox"/> Three-layered epidermis |
| | <input type="checkbox"/> Tiny unique fingerprints have arrived! |
| | <input type="checkbox"/> Now, all the bones are getting harder |
| | <input type="checkbox"/> Tooth buds (secondary teeth) |
| | <input type="checkbox"/> Glomeruli formation begins |
| | <input type="checkbox"/> Physiologic herniation ends |
| | <input type="checkbox"/> Corpus callosum begins |
| | <input type="checkbox"/> Crown-heel length 7.5 cm |

Unit 11: 10 to 11 Weeks

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|----------------------------|---|
| 10 weeks - 12 weeks | <input type="checkbox"/> Langerhans cells enter epidermis |
|----------------------------|---|

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|------------------|---|--|
| 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 it's a girl or 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 |
| | | ■ Bile production begins in liver |
| | | ■ Bowel movements |
| | | ■ 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 |

| | |
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| | <ul style="list-style-type: none"> Bronchial tree nearly complete 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 Cerebral cortex activity |
| 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 |
|-----------------|---|

| | |
|-----------------|---|
| | <input checked="" type="checkbox"/> 6-layered cerebral cortex |
| | <input type="checkbox"/> Head circumference 30 cm |
| 32 weeks | <input checked="" type="checkbox"/> Esophagus: Lower esophagus muscles functional |
| | <input checked="" type="checkbox"/> Glomeruli formation complete |
| | <input checked="" type="checkbox"/> Alveoli |
| | <input checked="" type="checkbox"/> Memory - music preferences |
| | <input type="checkbox"/> Crown-heel length 45 cm |

Unit 18: 8 to 9 Months

| | |
|----------------------------|---|
| 32 weeks - 36 weeks | <input checked="" type="checkbox"/> Prenatal food affects newborn taste preferences |
| 34 weeks | <input type="checkbox"/> Rapid weight gain |
| 35 weeks | <input checked="" type="checkbox"/> Firm grip |
| | <input type="checkbox"/> Amniotic fluid volume peaks |
| 36 weeks | <input checked="" type="checkbox"/> 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 | <input checked="" type="checkbox"/> Fetus drinks an estimated 15 oz (or 450cc) of amniotic fluid/day |
| 38 weeks | <input checked="" type="checkbox"/> Air breathing begins |
| | <input checked="" type="checkbox"/> By term, the typical umbilical cord measures 20 to 24 inches (50 to 60 cm) |
| | <input checked="" type="checkbox"/> Heart beats 54 million times before birth |
| | <input checked="" type="checkbox"/> Major circulatory changes |
| | <input checked="" type="checkbox"/> 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! |