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 â€" 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 Hatching blastocyst Day 6 - Embryo attaches to wall of uterus - Chorion 1 week -Placenta begins to form Unit 2: 1 to 2 Weeks Amnioblasts present; amnion and amniotic cavity 1 week, 1 day 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 - Yolk sac 2 weeks -Yolk sac Unit 3: 2 to 3 Weeks 3 germ layers 2 weeks, 1 day -Rostral-caudal orientation 2 weeks, 2 days -Erythroblasts in yolk sac Three types of blood-forming cells in yolk sac

Secondary villi

Amnion with two cell layers

Poregut, midgut, and hindgut Brain is first organ to appear Neural plate induced by notochordal process Connecting stalk Numerous blood islands in umbilical vesicle Foregut Stomodeum forming	
Neural plate induced by notochordal process Connecting stalk 2 weeks, 6 days — Numerous blood islands in umbilical vesicle Foregut	
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2 weeks, 6 days — Numerous blood islands in umbilical vesicle Foregut	
Foregut	
Stomodeum forming	
Beginnings of the heart can be seen	
Blood vessels emerge simultaneously in umbilical vesicle, embryo proper, amnion, and connecting states.	
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	
Neural tube	
Body cavities	
Body cavities Hyoid arch	
Body cavities Hyoid arch Thyroid complete	
Body cavities Hyoid arch Thyroid complete Cystic primordium	
Body cavities Hyoid arch Thyroid complete Cystic primordium Liver	h a siin
Body cavities Hyoid arch Thyroid complete Cystic primordium Liver Membrane between future mouth and throat may to rupture	begin
Body cavities Hyoid arch Thyroid complete Cystic primordium Liver Membrane between future mouth and throat may to rupture Internal carotid arteries	begin
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	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)
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	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 —	— I 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
$5\frac{1}{2}$ 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	— Implication — 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

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	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 Ovaries
	Testes begin to differentiate
	Insulin in pancreas
	Foot plates notched
	Hiccups
	Tendons attach muscle to bone

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	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 —	— I 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
	Cccasional breathing motions begin
	Blood supply to the brain closely resembles adult pattern
	Cranial nerve distribution mimics adult pattern

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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 Sty 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
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Drinking fluid is becoming routing
Dilliking hald 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
Unit 11: 10 to 11 Weeks 10 weeks - 12 weeks — Langerhans cells enter epidermis 10½ weeks — Volar and plantar pads regress

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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
Unit 13: 3 to 4 Months	•
Unit 13: 3 to 4 Months	☐ Crown-heel length 12 cm ☐ Head circumference 10 cm
Unit 13: 3 to 4 Months 13 weeks —	☐ Crown-heel length 12 cm ☐ Head circumference 10 cm ☐ Teeth are growing
	☐ Crown-heel length 12 cm ☐ Head circumference 10 cm ☐ Teeth are growing ☐ Cilia lining airways
	Crown-heel length 12 cm Head circumference 10 cm Teeth are growing Cilia lining airways Most of body sensitive to touch
13 weeks —	☐ Crown-heel length 12 cm ☐ Head circumference 10 cm ☐ Teeth are growing ☐ Cilia lining airways ☐ Most of body sensitive to touch ☐ Crown-heel length 15 cm
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13 weeks —	 □ Crown-heel length 12 cm □ Head circumference 10 cm □ Teeth are growing □ Cilia lining airways ■ Most of body sensitive to touch □ Crown-heel length 15 cm □ 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
13 weeks —	 □ Crown-heel length 12 cm □ Head circumference 10 cm □ Teeth are growing □ Cilia lining airways □ Most of body sensitive to touch □ Crown-heel length 15 cm □ 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
13 weeks —	☐ Crown-heel length 12 cm ☐ Head circumference 10 cm ☐ Teeth are growing ☐ Cilia lining airways ☐ Most of body sensitive to touch ☐ Crown-heel length 15 cm ☐ 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
13 weeks —	 □ Crown-heel length 12 cm □ Head circumference 10 cm □ Teeth are growing □ Cilia lining airways □ Most of body sensitive to touch □ Crown-heel length 15 cm □ 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 □ Stem cells arrive in bone marrow
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13 weeks — 14 weeks —	 □ Crown-heel length 12 cm □ Head circumference 10 cm □ Teeth are growing □ Cilia lining airways ■ Most of body sensitive to touch □ Crown-heel length 15 cm ■ 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 ■ Stem cells arrive in bone marrow □ Body fat emerges throughout the body □ Glucagon in fetal bloodstream □ Digestive enzymes □ Crown-heel length 19.5 cm
13 weeks —	 □ Crown-heel length 12 cm □ Head circumference 10 cm □ Teeth are growing □ Cilia lining airways ■ Most of body sensitive to touch □ Crown-heel length 15 cm ■ 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 ■ Stem cells arrive in bone marrow □ Body fat emerges throughout the body □ Glucagon in fetal bloodstream □ Digestive enzymes □ Crown-heel length 19.5 cm ■ Quickening
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13 weeks — 14 weeks —	 □ Crown-heel length 12 cm □ Head circumference 10 cm □ Teeth are growing □ Cilia lining airways ■ Most of body sensitive to touch □ Crown-heel length 15 cm ■ 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 ■ Stem cells arrive in bone marrow □ Body fat emerges throughout the body □ Glucagon in fetal bloodstream □ Digestive enzymes □ Crown-heel length 19.5 cm ■ Quickening

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	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 —	— I Melanin production
	Number of oogonia peak (at about 7 million) within fetal ovaries
	Daily cycles in biological rhythms
20 weeks —	— I 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 —	—
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	2.3
30 weeks —	Breathing motions are common even though there is no air in the womb
	6-layered cerebral cortex
	☐ Head circumference 30 cm
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