APPENDIX 1

THE CHRONOLOGICAL DEVELOPMENT OF THE UNBORN CHILD

	TIMING	SOURCE
AT CONCEPTION		
An embryo, or a new human, comes into existence when a zygote is produced at fertilization by the combination of a sperm with an ovum.	At conception	Moore, p.2
The sperm has 23 chromosomes and so does the ovum, but the zygote has 46 chromosomes. Although half of its chromosomes come from each parent, the zygote is genetically different than either of them, and is, in fact, genetically unique.	At fertilization	Moore, p 37
The sex of the embryo is determined genetically.	At fertilization	Sadler, p 319
Genetic sex is established.	At fertilization	Williams, p 180
The embryo's chromosomal sex is determined.	At fertilization	Moore, p 37
The difference between a male and a female is determined genetically at the time of conception.	At conception	Rugh, p 7
FIRST WEEK		
The beginnings of the various organs and systems are established, especially in the third week when certain key organs start to develop.	1st – 3rd weeks of development	O'Rahilly, p 23
THIRD WEEK		
The central nervous system appears.	Beginning of 3rd week	Sadler, p 411
Embryonic blood vessels begin developing.	3rd week after fertilization	Moore, p 76
Blood vessels appear.	3rd week after fertilization	Williams, p 161

Somites, which will develop into the 33 pairs of vertebrae in the spinal column, are growing.	3rd week after conception	Rugh, p 35
The vascular system appears.	Middle of the 3rd week	Sadler, p 208
Blood cells are developing.	End of 3rd week after fertilization	Moore, p 76
Blood cells and blood vessels are differentiated.	End of the 3rd week of development	Sadler, p 77
Embryoscopy can directly visualize the embryo/ fetus during the first trimester, paving the way to improved early prenatal diagnosis and treatment. Utilizing high-resolution fiberoptic endoscopy, testing can be done as early as 3 weeks after conception. The face can be visualized as early as 4 weeks. Numerous diagnoses have already been done but these just scratch the surface of the technology's potential.	3rd –4th weeks after conception	Reece, pages p 775, 777, & 778
Although the embryo begins developing immediately after conception, the most visible advances occur during the third to eighth weeks.	3rd – 8th weeks after fertilization	Moore, p 2
The most important features of the body's future form are determined at this time because of the many organs that are formed during this period.	3rd – 8th weeks	Sadler, p 108
Most major organs and organ systems are formed during the embryonic period. The mother may not be aware of her pregnancy during this critical period, especially in the third and fourth weeks when the embryo is quite vulnerable.	During 3rd – 8th weeks	Sadler, p 106 & p 107
The organs and systems of the body are formed.	From late in the 3rd week through the 8th week	Larsen, p 319
Blood and blood vessels begin to develop.	Days 13-15 after fertilization	England, p 110

The embryo begins to form blood cells.	Day 17 after conception	Rugh, p 17
The first blood vessels form.	Day 18 of development	Larsen, p 123
The embryo begins to form a heart.	Day 18 after conception	Rugh, p 17
The nervous system begins to form.	Day 18 after conception	Rugh, p 33
The brain's divisions – the forebrain, the midbrain, and the hindbrain – are demarcated.	Day 19	Larsen, p 275
The central nervous system begins to form.	Day 19 after fertilization	Sadler, front pages
The foundation of the brain, spinal cord and entire nervous system is established. The eyes also begin to be formed.	Day 20 after conception	Rugh, p 33
The thyroid gland starts to develop.	Day 20 after fertilization	Moore, p 5
Liver cells begin to draw together.	Day 21 after conception	Rugh, p 42

FOURTH WEEK

The eyes begin to develop.	Early in the 4th week	Larsen, p 252
The development of the eye is first evident.	Beginning of the 4th week after fertilization	Moore, p 492
The facial primordia begin to appear.	Early in 4th week after fertilization	Moore, p 236
The cardiovascular system has formed.	4th week after fertilization	Williams, p 161
The esophagus is developing.	4th week of development	Sadler, p 274

The gallbladder is developing.	4th week of development	Sadler, p 274
The heart begins to pump.	4th week of development	Sadler, p 77
The liver is developing.	4th week of development	Sadler, p 274
The liver bud sprouts.	4th week	Larsen, p 157
The lung bud develops.	4th week after fertilization	Moore, p 262
Heart activity can be measured with transvaginal ultrasonic scanning.	4th week after fertilization	Williams, p 1027
The pancreas is developing.	4th week of development	Sadler, p 274
The pharynx is developing.	4th week	Sadler, p 274
The stomach appears.	4th week of development	Sadler, p 276
The trachea is developing.	During the 4th week	Sadler, p 274
The thyroid gland primordium first appears.	Late in 4th week of development	Larsen, p 249
The anlage (i.e. the earliest discernible indication) of the central nervous system is present.	End of 4th week of development	Larsen, p 52
Limb buds become visible.	End of 4th week of development	Sadler, 7th edition, p 154
Nasal placodes – the primordia of the nose and the nasal cavities – have developed.	End of 4th week after fertilization	Moore, p 239
The beginnings of many of the organ systems, including the cardiovascular system, are established.	End of 4th week after fertilization	Moore, p 91

The development of the tongue begins.	Late in 4th week of development	Larsen, p 247
The first sign of the tongue's development appears, the median tongue bud.	End of 4th week after fertilization	Moore, p 233
The lung bud appears.	Approximately 4th week of development	Sadler, p 260
The tongue appears.	Approximately 4th week	Sadler, p 362
Facial development mostly occurs.	4th-8th weeks after fertilization	Moore, p 236
Tooth buds form from dental lamina.	4th – 8th weeks of development	Larsen, p 304
The first sign of the developing internal ear occurs.	Approximately day 22	Sadler, p 382
The developing eye appears.	Day 22	Sadler, p 394
The heart begins to pump.	Day 22 after fertilization	Larsen, p xi
The heart begins to beat.	Day 22 after fertilization	Moore, p 5; Larsen, p 104
The heart begins to beat.	Day 22 after fertilization	England, p 104
The lung bud is present.	Day 22	Sadler, p 210
The lung bud appears.	Days 22-24	Larsen, p 82
The primordia of the ears are present.	Day 23 after fertilization	Moore, p 5
The primordia of the eyes are present.	Day 23 after fertilization	Moore, p 5
The heart starts to beat.	Day 24 after fertilization	Rugh, p 17

Blood begins to circulate throughout the embryo.	Day 24	Larsen, p 104
Upper limb buds appear.	Day 24 of development	Larsen, p 209
Otic placodes appear.	Days 24-25	Sadler, p 110
The liver bud is present.	Approximately day 25	Sadler, p 281
The stomach is developing.	Approximately day 25	Sadler, p 281
Upper limb buds appear.	Day 26 after fertilization	Larsen, p xi
The forebrain is developing.	Day 26 after fertilization	Moore, p 95
The otic pit, a sign of the first development of the internal ear, is present.	Day 26 after fertilization	Moore, p 95
Upper limb buds are present.	Day 26 after fertilization	Moore, p 5
The dorsal pancreatic bud begins to grow.	Day 26	Larsen, p 158
Arm buds are present.	Day 26 +/- 1 of development	Williams, p 153
Upper limb buds appear.	Days 26-27 of development	Sadler, p 110
The lung bud branches into left and right bronchial buds.	Days 26-28	Larsen, p 82
Lung buds may be seen.	Day 27 after conception	Rugh, p 43
The gallbladder appears.	Days 27-30 after conception	Rugh, p 42
Liver cells can be recognized as the liver.	Days 27-30 after conception	Rugh, p 42

The embryo grows in length from 5 millimeters to approximately 16 to 17 millimeters.	Day 27 to day 37 of development	Sadler, p 220
The ear placode is present.	Day 28 after fertilization	Sadler, front pages
The lens placode is present.	Day 28	Sadler, p 90
The lens placode (the primordium of the lens) is present.	Day 28 after fertilization	Moore, p 92
The eye anlage is present.	Day 28 after fertilization	Sadler, front pages
Upper limb buds are present.	Day 28 after fertilization	Moore, p 92
Arm buds are present.	Day 28 after fertilization	Sadler, front pages
The separation of the heart into a primordial atrium and ventricle can be seen.	Day 28 after fertilization	Moore, p 95
Lower limb buds appear.	Day 28 of development	Larsen, p 209
The mouth opens for the first time.	Day 28 after conception	Rugh, p 42
Building blocks are present for 40 pairs of muscles, which are located from the base of the skull to the bottom of the spinal column.	Day 28 after conception	Rugh, p 35
The spleen appears.	Day 28 after fertilization	Larsen, p xi
The spinal cord is developing.	About day 28 after fertilization	Moore, p 97
The stomach is forming.	About day 28 after fertilization	Moore, p 97
Leg buds are present.	Day 28 +/- 1 after fertilization	Williams, p 153

Lower limb buds appear.	Days 28-30 after fertilization	Moore, p 91
Hindlimb buds appear.	Days 28-30 of development	Sadler, p 110

FIFTH WEEK

The esophagus is developing.	Early in the 5th week of development	Larsen, p 249
The kidneys begin to develop.	Early in 5th week after fertilization	England, p 153
The trachea is developing.	Early in the 5th week of development	Larsen, p 249
The forelimbs and hindlimbs appear as paddle-shaped buds.	Beginning of 5th week	Sadler, p 106
The face begins to look human.	5th week after conception	Rugh, p 45
Pain pathways run from sensory receptors in the skin to those in the brain. Nerve endings that sense pain are at least as dense in the skin of a newborn as in an adult. Such receptors appear around the mouth in the 5th week after conception, and are present in the face, the palms, and the soles of the feet by the 9th week, spreading to the trunk, arms, and legs by the 13th week, and to all areas of the skin by the 18th week. The development of the neocortex, the largest part of the brain, begins at 6 weeks after conception, and by 18 weeks a full complement of nerve cells is present. The evidence thus suggests that by late in gestation the fetus has developed sufficiently to sense pain.	from 5th week after conception	Anand and Hickey, p 1322 & p 1326
The jaws are forming.	5th week after conception	Rugh, p 45
The permanent kidneys appear.	5th week	Sadler, p 305
The pharynx is present.	5th week after fertilization	Rugh, p 45

Liver ducts are forming.	5th week after conception	Rugh, p 46
The pituitary gland is developing.	5th week after fertilization	Williams, p 178; Rugh, p 45
The spleen is forming.	5th week after conception	Rugh, p 46
The spleen is formed.	5th week	Larsen, p 159
The trachea is developing.	5th week after fertilization	Moore, p 262
The thyroid is developing.	Late in 5th week	Larsen, p 249
The tongue is developing.	Late in 5th week	Larsen, p 249
The penis and scrotum form.	5th – 6th weeks	Larsen, p 175
Limb development takes place.	5th – 8th weeks of development	Larsen, p 209
Leg buds are present.	Day 29 after fertilization	Sadler, front pages
The three primary parts of the brain are present.	Day 30 after conception	Rugh, p 41
The ears have started to form.	Day 30 after conception	Rugh, p 41
The eyes have started to form.	Day 30 after conception	Rugh, p 41
The lens pits and optic cups are forming.	Day 30 after fertilization	Moore, p 5
The face is developing.	Day 30 after fertilization	Sadler, front pages
The gallbladder is developing.	Day 30 of development	Larsen, p 155
Nasal placodes are present.	Day 30 after fertilization	Sadler, front pages

The nasal pits, which are the primordia of the nostrils and the nasal cavities, are forming.	Day 30 after fertilization	Moore, p 5 & p 239
The nasal organs have begun forming.	Day 30 after conception	Rugh, p 41
The stomach is forming.	Day 30	Larsen, p 157
The trachea is developing.	Approximately day 30 after fertilization	Rugh, p 43
The intestines are defined.	End of 1st month after conception	Rugh, p 43
The pancreas is defined.	End of 1st month after conception	Rugh, p 43
The liver bud is present.	End of 1st month	Sadler, p 271
The thyroid gland, which plays a critical role in metabolism, begins developing.	End of month 1 after conception	Rugh, p 42
The nervous, muscular, vascular, digestive, and skeletal systems are in an incipient state.	End of 1st month after conception	Rugh, p 35,
The ears are forming.	During the 2nd month	Sadler, p 106
The face is unmistakably human.	2nd month after conception	Rugh, p 54
The nose is forming.	During the 2nd month	Sadler, p 106
The skeleton is developing.	2nd month after conception	Rugh, p 52
The face is forming.	During 2nd month	Sadler, p 106
The limbs are forming.	2nd month	Sadler, p 106

Great changes occur in appearance because of the emergence of a disproportionately large head and the formation of the limbs, face, ears, nose, and eyes.	During the 2nd month	Sadler, p 106
The esophagus (the food tube leading to the stomach) begins to form.	Day 31 after conception	Rugh, p 43
Leg buds begin to form.	Day 31 after conception	Rugh, p 43
The primitive mouth is forming.	Day 31 after fertilization	Moore, p 5
Muscles appear in the pelvic region.	Day 31 after conception	Rugh, p 43
The stomach begins to form.	Day 31 after conception	Rugh, p 43
The nasal pits are visible.	Days 31-32 after fertilization	Moore, p 91
Forelimbs are paddle-shaped.	Days 31-35 of development	Sadler, p 110
The nasal pits are formed.	Days 31-35 of development	Sadler, p 110
Coronary vessels appear.	Day 32 after fertilization	Larsen, p xi
The primary intestinal loop forms.	Day 32 after fertilization	Larsen, p xi
The ventral pancreatic bud is present.	Day 32	Larsen, p 157
Spinal nerves begin to sprout.	Day 32 after fertilization	Larsen, p xi
The primary intestinal loop is forming.	Approximately day 32	Sadler, p 281
The larynx is developing.	Approximately day 32	Sadler, p 281

The palate is developing.	About day 32 after fertilization	Moore, p 98
The pharynx is developing.	About day 32 after fertilization	Moore, p 98
The cerebral cortex, the part of the brain that controls the intellect and motor activity, begins to differentiate.	Day 33 after conception	Rugh, p 44
Melanin first appears in the cells of the developing pigment retina.	Day 33	Larsen, p 257
The forearm region can be distinguished.	Day 33 of development	Larsen, p 209
Hand plates are present.	Day 33 after fertilization	Moore, p 5
Hand plates are developing.	Day 33 after fertilization	Larsen, p xii
The shoulder region can be distinguished.	Day 33 of development	Larsen, p 209
Hand plates are formed and digital rays are present.	Days 33-36 after fertilization	Moore, p 91
The cerebral vesicles are distinct.	Day 34 after fertilization	Moore, p 5
The elbows are developing.	Day 34 after fertilization	Sadler, front pages
Foot plates are developing.	Day 34 after fertilization	Moore, p 5; Sadler, front pages
Hand plates are developing.	Day 34 after fertilization	Sadler, front pages
Echocardiography can detect heart movements.	About day 34 after fertilization	Williams, p 30

The ribs begin to form and lengthen.	Day 35 of development	Larsen, p 48
The olfactory lobe, which is related to the sense of smell, is present in the brain.	Day 35 after conception	Rugh, p 44
The nasal pits deepen to form the nasal cavity.	Days 35-42	Larsen, p 230
The external ears are developing.	Days 35-49	Larsen, p 261

SIXTH WEEK

The upper and lower lips are forming.	Early in 6th week after fertilization	Moore, p 523
The tongue is developing.	Early in 6th week after fertilization	Moore, p 533
The eye is obvious, reflecting the fact that the retinal pigment has formed.	6th week after fertilization	Moore, p 94
The upper and lower eyelid primordia appear.	6th week of development	Larsen, p 259
The primordia of the fingers, called digital rays, start to develop.	6th week after fertilization	Moore, p 94
Hiccups first occur.	6th week after conception	Roodenburg, p 32
The ends of the limb buds become flattened to form foot plates.	6th week of development	Sadler, p 172
The oral cavity is developing.	6th week	Sadler, p 376
Spontaneous movements, such as twitching of the trunk and limbs, have been reported.	6th week after fertilization	Moore, p 94
The pelvis is developing.	6th week	Sadler, p 308
Movement of the muscles is being controlled by the nervous system.	6th week after conception	Rugh, p 34
It is believed that the majority of women do not realize they are pregnant during the first six weeks after conception.	6th week after conception	Rugh, p 54

In a study of 12 fetuses, the longest median period of inactivity was 260 seconds.	6th week after conception	de Vries (1985), p 102
The testes become identifiable.	6th week	O'Rahilly, p 210
The ureter is developing.	6th week	Sadler, p 308
Some salivary glands appear.	About 6th week after fertilization	Moore, p 236
General movements first occur.	6th – 7th weeks after conception	Roodenburg, p 31
The heart is contracting at a rate of 40 to 80 beats per minute, as measured with an electrocardiogram.	6th – 7th weeks after conception	Rugh, p 53
The salivary glands begin to develop.	6th-7th weeks after fertilization	England, p 90
The uterus forms.	6th – 7th weeks	Larsen, p 175
The vagina forms.	6th – 7th weeks	Larsen, p 175
Startles first occur.	6 – 7 _ weeks after conception	Nijhuis/de Vries, p 5
General movements first occur.	6 _ - 7 _ weeks after conception	Nijhuis/de Vries, p 5
The fetus normally moves spontaneously.	6th –8th weeks after conception	de Vries (1982), p 318
Hiccups first occur.	6 _ - 8 _ weeks after conception	Nijhuis/de Vries, p 5
The aorta is developing.	Day 36 of development	Larsen, p 156
Ear swelling is present.	Day 36 after fertilization	Sadler, front pages
The oral and nasal cavities are confluent.	Day 36 after fertilization	Moore, p 5

All of the muscle blocks have appeared.	Day 36 after conception	Rugh, p 46
The pancreas is developing.	Approximately day 36	Sadler, p 281
The thyroid is developing.	Approximately day 36	Sadler, p 281
Digital rays are present in the foot plates.	Days 36-42 of development	Sadler, p 110
Digital rays are present in the hand plates.	Days 36-42 of development	Sadler, p 110
The feet have become distinct.	Day 37 of development	Larsen, p 209
Foot plates are formed on the lower limb buds.	Day 37 after fertilization	Larsen, p xii
The legs have become distinct.	Day 37 of development	Larsen, p 209
The thigh has become distinct.	Day 37 of development	Larsen, p 209
Pigment can be seen in the retina.	Days 37-40 after fertilization	Moore, p 91
The eye muscles begin to form.	Day 38 after conception	Rugh, p 47
Finger rays are visible.	Day 38 of development	Larsen, p 209
Finger rays are developing.	Day 38 after fertilization	Sadler, front pages
The upper and lower jaws begin to fuse in the midline of the face.	Day 38 after conception	Rugh, p 47
The nose is formed.	Day 38 after fertilization	Moore, p 5

It is probable that the heartbeat of the embryo is similar to an adult's heartbeat.	Week 5 _ after conception	Rugh, p 53
The urinary bladder is developing.	Day 39 after fertilization	Sadler, front pages
The pancreas is developing.	Day 39 after fertilization	Sadler, front pages
The liver is developing.	Day 39 after fertilization	Sadler, front pages
The foundation of the sense of smell is established when nerve fibers connect with the olfactory lobe in the brain.	Day 39 after conception	Rugh, p 47
The eyelids are developing.	Day 40 after fertilization	Moore, p 238
The eyes become pigmented.	Day 40 after conception	Rugh, p 47
The diaphragm forms.	Day 40 after conception	Rugh, p 47
The forehead is developing.	Day 40 after fertilization	Moore, p 238
The jaws are well-formed.	Day 40 after conception	Rugh, p 47
The lower jaw is developing.	Day 40 after fertilization	Moore, p 238
The kidneys are forming.	Day 40 of development	Larsen, p 156
The nostrils are developing.	Day 40 after fertilization	Moore, p 238
The teeth begin to form.	Day 40 after conception	Rugh, p 47
Digital rays are clearly visible in the hand plates.	Days 41-43 after fertilization	Moore, p 91

The rudiments of the fingers become evident.	Day 42 after conception	Rugh, p 47
The earliest reflexes begin.	Day 42 after conception	Rugh, p 47
The penis begins to form.	Day 42 after conception	Rugh, p 47
The rudiments of the toes become evident.	Day 42 after conception	Rugh, p 47
The eye is obvious.	About day 42 after fertilization	Moore, p 99
The pigmented eye is developing.	About 42 days after fertilization	Moore, p 99

SEVENTH WEEK

The eyes are developing rapidly.	7th week after conception	Rugh, p 52
The ears are developing rapidly.	7th week after conception	Rugh, p 52
Thumbs and fingers with pads are present.	7th week after conception	Rugh, p 44
All the fingers are present.	7th week after conception	Rugh, p 52
The jaws, ribs, and vertebrae are changing from cartilage to bone.	7th week after conception	Rugh, p 52
The fetal heart is functionally complete and normal.	7th week after conception	Rugh, p 53
The heels are developing.	7th week after conception	Rugh, p 44
Bronchi begin to form in the right and left lung.	7th week after fertilization	Moore, p 262

The first indication of limb musculature is observed.	7th week of development	Sadler, 7th ed., p 168
A distinct neck connects the head with the body.	7th week after conception	Rugh, p 51
The nasal chamber is developing.	7th week	Sadler, p 376
The primary palate is developing.	7th week	Sadler, p 376
The anorectal canal is developing.	7th week	Sadler, p 316
The gonads acquire male or female characteristics.	7th week of development	Sadler, p 319
Neck and trunk muscles start contracting spontaneously.	7th week after fertilization	England, p 206
Startles first occur.	7th week after conception	Roodenburg, p 33
Startles were observed in 12 of 12 fetuses studied, with a median number of about 42 per hour.	7th week after conception	de Vries (1985), p 104
Isolated arm movements first occur.	About 7 _ to 8 _ weeks after con-ception	de Vries (1982), p 311
Isolated leg movements first occur.	About 7 _ - 10 _ weeks after conception	de Vries (1982), p 311
Backwards head movements first occur.	7 _ - 10 _ weeks after conception	Nijhuis/de Vries, p 5
Head rotations first occur.	7 _ - 10 _ weeks after conception	Nijhuis/de Vries, p 5
Ossification of the bones of the upper limbs has begun.	End of the 7th week after fertilization	Moore, p 96
The toes are well-formed.	7th – 8th weeks	Sadler, p 108

The fingers are developing.	Day 43 after fertilization	Sadler, front pages
Toe rays are developing.	Day 43 after fertilization	Sadler, front pages
The eyelids are formed.	Days 43-49 of development	Sadler, p 110
Pigmentation of the retina can be seen.	Days 43-49 of development	Sadler, p 110
Digital foot rays are separating.	Days 43-49	Sadler, p 110
Digital rays are separating.	Days 43-49 of development	Sadler, p 110
The upper lip is forming.	Days 43-49 of development	Sadler, p 110
The elbows appear.	Day 44 after fertilization	Larsen, p xii
The palate is forming.	Day 44 after conception	Rugh, p 50
Nipples are formed.	Days 43-49 of development	Sadler, p 110
The eyelids form in the face.	Day 44 after fertilization	Larsen, p xii
The nerve cells of the retina form.	Day 44 after conception	Rugh, p 50
The first hair follicles appear.	Day 44 after fertilization	Larsen, p xii
Nipples appear.	Day 44 after fertilization	Larsen, p xii
Toe rays appear.	Day 44 after fertilization	Larsen, p xii

The elbow region is visible.	Days 44-46 after fertilization	Moore, p 91
Digital rays can be seen clearly in the foot plates.	Days 44-46 after fertilization	Moore, p 91
Notches are present between the digital rays in the hand.	Days 44-46 after fertilization	Moore, p 91
Nipples are visible.	Days 44-46 after fertilization	Moore, p 91
The nasal passages open to the outside.	Day 46 after conception	Rugh, p 51
Microscopic examination can identify the embryo's sex because the ovaries and testes have differentiated.	Day 46 after conception	Rugh, p 51
The bridge of the nose is visible.	Days 47-48 after fertilization	England, p 78
The cheek is visible.	Days 47-48 after fertilization	England, p 83
The knees are developing.	Days 47-48 after fertilization	England, p 180
The nerve connections from the retina to the brain are established.	Day 48 after conception	Rugh, p 51
The face becomes fuller and starts to look human.	Day 48 after conception	Rugh, p 51
The stomach is a scale model of what it will be at the time of birth.	Day 48 after conception	Rugh, p 52
The toes are developing.	Day 48 after fertilization	Sadler, front pages
The tongue forms from the floor of the mouth.	Day 48 after conception	Rugh, p 51
The liver is developing.	About 48 days after fertilization	Moore, p 99

The wrist is developing.	About day 48 after fertilization	Moore, p 99
Upper limbs are longer and bent at the elbows.	Days 49-51 after fertilization	Moore, p 91
Notches appear between the digital rays in the feet	Days 49-51 after fertilization	Moore, p 91
The upper limbs are longer and bent at the elbows.	Days 49-51 after fertilization	Moore, p 91
The rudiment of the face is created.	Days 49 – 63	Larsen, p 230

EIGHTH WEEK

The adrenal glands are developing.	8th week after conception	Rugh, p 53
By using Doppler or real-time ultrasonic measurements, the brain can be visualized.	8th week after fertilization	Williams, p 30
The chin is visible.	8th week after fertilization	England, p 81
Ossification begins in the lower limbs, and is first recognizable in the femur.	8th week after fertilization	Moore, p 97
The feet are well-formed and distinctly human.	8th week after conception	Rugh, p 53
Local stimuli may induce partial closing of the fingers.	8th week after fertilization	Williams, p 169
The hands are well-formed and distinctly human.	8th week after conception	Rugh, p 53
Hiccups were observed in 12 of 12 fetuses studied, with a median frequency of about 50 hiccups per hour.	8th week after conception	de Vries (1985), p 108
The permanent kidneys are forming.	8th week after conception	Rugh, p 54
The lungs have lobes and many-branched bronchioles.	8th week after Conception	Rugh, p 53

Purposeful limb movements first occur.	8th week after fertilization	Moore, p 97
Local stimuli may evoke opening the mouth.	8th week after fertilization	Williams, p 169
If the fetus is removed from the uterus, spontaneous movements may be observed.	8th week after fertilization	Williams, p 169
The beginnings of all essential structures are present.	8th week after fertilization	Williams, p 154
Local stimuli may evoke squinting.	8th week after fertilization	Williams, p 169
Taste buds begin to form.	8th week after conception	Rugh, p 53
The ovary is present.	8th week after fertilization	England, p 167
Breathing movements are first seen.	8th week after conception	Roodenburg, p 32
A single, large displacement of the diaphragm is sometimes similar to a sigh.	8th week after conception	Nijhuis/de Vries, p 6
Insertion of the fingers into the mouth has been observed.	8th week after conception.	Nijhuis/de Vries, p 7
Stretches first occur.	8th week after conception	Roodenburg, p 33
Dental buds are present.	8th week	Sadler, 7th edition, p 341
Jaw openings first occur.	8 _ - 10 _ weeks after conception	Nijhuis/de Vries, p 5
Forward head movements first occur.	8 _ - 12 _ weeks after conception	Nijhuis/de Vries, p 5
Stretches first occur.	8 _ - 13 _ weeks after conception	Nijhuis/de Vries, p 5

The auricles of the external ear start to take on their final shape.	End of 8th week after fertilization	Moore, p 100
The eyelids are closing.	End of 8th week after fertilization	Moore, p 99-100
By the end of the 8th week after conception, the face clearly looks human.	End of 8th week after fertilization	Moore, p 239
All areas of the limbs are apparent. In addition, the digits have lengthened and are completely separated.	End of week 8 after fertilization	Moore, p 97
The neck region is established.	End of 8th week after fertilization	Moore, p 99
The neck is developed.	End of 8th week after fertilization	England, p 96
The term embryo refers to the developing human being during the first eight weeks after conception. At the end of this period, all major structures have started to form.	End of 8th week after fertilization	Moore, p 3
The embryonic period concludes at the end of the 8th week after fertilization and the fetal period begins. Few, if any, new structures are are formed after this time. Development during the fetal period involves growth and maturation of structures that are already present.	End of 8th week after fertilization	Williams, p 153
The embryonic period consists of the first eight weeks after the last ovulation. During this time, the overwhelming majority (several thousand) of the named human structures appear, and the embryo is about 30 millimeters in length.	End of 8th week	O'Rahilly, p 55
Scientists have examined the embryonic period in far greater detail than the fetal period, which begins in the ninth week and continues until birth. Few new features appear during the fetal period. Instead, the structures that are already present continue to develop.	End of 8th week	O'Rahilly. p 55

The initial formation and development of nearly all of the organs is complete and the organs can be identified in a grossly recognizable state.	End of 8th week of pregnancy	Carlson, p 407
The head is disproportionately large compared with the rest of the body.	End of 8th week of pregnancy	Carlson, p 407
The embryo has human characteristics. The neck area is established and the eyelids are obvious and are closing. The auricles of the external ears begin to take their final shape.	End of 8th week after fertilization	Moore, p 99
The face is unmistakably human.	2nd month after conception	Rugh, p 54
Breathing movements are first seen.	8-9 _ weeks after conception	Nijhuis/de Vries, p 5
Hand-to-face contacts first occur.	8-10 _ weeks after conception	Nijhuis/de Vries, p 5
The hand touches the face slowly and the fingers often open and close.	8-10 _ weeks after conception	de Vries (1982), p 309 & p 311
Limb movements first occur during the 8th week. By the 14th week, they become coordinated.	8th –14th weeks after fertilization	Moore, p 112
External examination can reveal whether the embryo is male or female.	Day 50 after conception	Rugh, p 7
The face is more human-like.	Days 50-56 after fertilizaton	Sadler, p 110
The fingers are free.	Days 50-56	Sadler, p 110
The limbs are long and bent at the elbows and knees.	Days 50-56 of development	Sadler, p 110
The toes are free.	Days 50-56	Sadler, p 110
The hand plates are slightly flexed at the wrists.	Day 52 of development	Larsen, p 209

The upper limbs are slightly bent at the elbows.	Day 52 of development	Larsen, p 209
The eye is heavily pigmented.	About 52 days after fertilization	Moore, p 100
The fingers are separated.	About day 52 after fertilization	Moore, p 100
The nose is stubby.	About day 52 after fertilization	Moore, p 100
The toes are beginning to separate.	About day 52 after fertilization	Moore, p 100
The fingers are free and longer.	Days 52-53 after fertilization	Moore, p 91
The auricle, or external ear, is visible.	Day 54 after fertilization	England, p 92
The ankles are present.	Day 54 after fertilization	England, p 181
The toes are free and longer.	Days 54-55 after fertilization	Moore, p 91
The major blood vessels of the body take on their final scheme.	Day 56 after conception	Rugh, p 53
The face appears to be quite human.	Day 56 after conception	Rugh, p 53
The fingers of both hands are usually found close to the nose.	Day 56 after conception	Rugh, p 53
Digit separation in the hand is complete.	Day 56	Sadler, p 175
All regions of the arms and legs are well-developed, including the toes.	Day 56 of development	Larsen, p 213
Muscular layers of the stomach, esophagus, and intestines begin to proliferate.	Day 56 after conception	Rugh, p 53

The primary teeth are at the cap stage.	Day 56 after Fertilization	Larsen, p xii
The embryo has a distinct human appearance.	About day 56 after fertilization	Moore, p 100
The mouth is present.	About day 56 after fertilization	Moore, p 100
The lower jaw is developing.	About day 56 after fertilization	Moore, p 100
The shoulders are developing.	About day 56 after fertilization	Moore, p 100
The toes are separated.	About day 56 after fertilization	Moore, p 100

57TH DAY

The fetal period begins on day 57 after fertilization and ends at birth. The tissues and organs that were formed during the embryonic period continue to grow during the fetal period, but the changes aren't as pronounced. Ultrasonic measurements are used to measure embryonic growth.	Day 57	Moore, p 3

NINTH WEEK

Hair follicles first appear on the eyebrows, eyelids, upper lip, and chin.	End of 2nd month	Larsen, p 309
The legs are short and the thighs are relatively small.	Beginning of the 9th week after fertilization	Moore, p 111
Breathing movements have been detected.	9th week after fertilization	Boddy, p 4
Breathing movements were observed in 10 of 12 fetuses studied, with a median frequency of about 30 movements per hour.	9th week after conception	de Vries (1985), p 106
The eyes are closing or closed.	9th week after fertilization	Moore, p 109; Williams, p 155

The small intestine undergoes peristalsis.	9th week after fertilization	Williams, p 169
The upper and lower lips are forming.	9th week	Sadler, p 376
Red blood cells are formed primarily in the liver.	9th week after fertilization	Moore, p 112
The face is broad, the eyes are widely separated, the ears are low-set, and the eyelids are fused.	9th week after fertilization	Moore, p 110
The anus is present.	9th week after fertilization	England, p 146
The buttocks are present.	9th week after fertilization	England, p 146
Tongue movements first occur.	9th week after conception	Nijhuis/de Vries, p 5
Yawning has been observed.	9th week after conception	de Vries (1985), p 116
Hair begins to develop.	9th – 12th weeks after fertilization	Moore, p 517
Yawning first occurs.	9 _ - 13 _ weeks after conception	Nijhuis/de Vries, p 5

TENTH WEEK

The eyelids are closed.	10th week after fertilization	Moore, p 238
The intestines are developing in the abdomen.	10th week after fertilization	Moore, p 109; Williams, p 155
The fingernails are present.	10th week after fertilization	England, p 173
Stretching an arm is frequently accompanied by extending the fingers.	From 10th week after conception	de Vries (1982), p 307
Finger movements first occur.	10th week after conception	Nijhuis/de Vries, p 5

Opening and closing one or more fingers can be seen.	10th week after conception	Nijhuis/de Vries, p 6
Hand-to-face contacts were observed in 12 of 12 fetuses studied with a median frequency of about 25 contacts per hour.	10th week after conception	de Vries (1985), p 113
Jaw openings were observed in 10 of 12 fetuses studied with a median rate of about 18 per hour.	10th week after conception	de Vries (1985), p 114
The most common movement patterns have emerged.	10th week after conception	de Vries (1988), p 87
Fingernails begin to develop at the end of the digits.	About 10th week after fertilization	Moore, p 519
Fingernail anlagen first appear.	About 10th week	Larsen, p 311
The tooth buds for permanent teeth begin to appear.	About 10th week after fertilization	Moore, p 523
Toenails begin to develop at the tips of the digits.	About 10th week after fertilization	Moore, p 519
Sucking first occurs.	10 _ - 12 _ weeks after conception	Nijhuis/de Vries, p 5
Swallowing first occurs.	10 _ - 12 _ weeks after conception	Nijhuis/de Vries, p 5
Fingernails are present.	End of 10th week after fertilization	Williams, p 154
The fingers are differentiated.	End of 10th week after fertilization	Williams, p 154
Scattered rudiments of hair appear.	End of 10th week after fertilization	Williams, p 154
External genitalia are starting to indicate whether the fetus will be male or female.	End of 10th week after fertilization	Williams p 154
The toes are differentiated.	End of 10th week after fertilization	Williams, p 154

Toenails are forming.	End of 10th week after fertilization	Williams, p 154
The prostate and seminal vesicles develop in males.	10th – 13th weeks	Larsen, p 175
The fetus responds to sound.	10th – 14th weeks after conception	Nijhuis/Hepper, p 133

ELEVENTH WEEK

If the region near the mouth is stimulated, the fetus will open its mouth and such a finger.	11th week after fertilization	England, p 206
Breathing movements were observed in 12 of 12 fetuses studied, with a median frequency of about 60 movements per hour.	11th week after conception	de Vries (1985), p 106
Head rotations were observed in 12 of 12 fetuses studied, with a median rate of about 5 rotations per hour.	11th week after conception	de Vries (1985), p 113
Taste buds are developing.	11th – 13th weeks after fertilization	Moore, p 234

TWELFTH WEEK

The face has all the human characteristics.	12th week	Sadler, p 116
Movements begin, but are usually not felt by by the mother.	12th week after fertilization	Sadler, p 116
Jaw openings were observed in 12 of 12 fetuses studied with a median rate of about 30 per hour.	12th week after conception	de Vries (1985), p 114
The neck is well-defined.	12th week after fertilization	Moore, p 109; Williams, p 155
The sex can be established by ultrasonic measurement of the external genitalia.	12th week after fertilization	Sadler, p 113
The sex can be determined from external examination.	12th week after fertilization	Moore, p 109

The fetus responds to stimulation of the skin.	12th week after fertilization	England, p 206
Red blood cells are forming in the spleen.	End of 12th week after fertilization	Moore, p 112
Primary ossification centers appear in the skeleton, especially in the skull and long bones.	End of 12th week after fertilization	Moore, p 110, Sadler, p 113
Hair grows on the eyebrows and the upper lip.	End of 12th week after fertilization	Moore, p 517
Stroking the lips causes the fetus to suck and stroking the eyelids results in a reflex response.	End of 12th week after fertilization	Moore, 4th edition, p 91
The sex is clearly distinguishable.	End of 12th week after fertilization	Williams, p 154
The upper limbs have almost reached their final relative lengths and are a bit better developed than the lower limbs.	End of the 12th week after fertilization	Moore, p 111
Respiration is evident.	12th – 14th weeks after fertilization	Williams, p 169
Swallowing is evident.	12th – 14th weeks after fertilization	Williams, p 169
Palm creases appear.	3rd month	Rugh, p 217
The spinal cord extends the entire length of the embryo.	3rd month of development	Sadler, p 422
Taste buds are evident.	3rd lunar month	Williams, p 169
The first hairs appear in the region of the eyebrows and upper lip.	End of 3rd month	Sadler, p 407
Reflex activity can be evoked in aborted fetuses, indicating muscular activity.	End of 3rd month after fertilization	Sadler, p 114
The penile urethra is forming.	End of 3rd month	Sadler, 7th edition p 298

THIRTEENTH WEEK

Respiratory movements can transport amniotic fluid in and out of the respiratory tract	Beginning of the 4th month	Williams, p 177
Eyebrows are present.	13th week after fertilization	England, p 209
The fetus can accomplish a complete change in position, usually with a backwards somersault.	By 13th week after conception	de Vries (1982), p 301 & p 309

FOURTEENTH WEEK

Slow eye movements occur.	14th week after fertilization	Moore, p 112
Scalp hair patterning is determined.	14th week after fertilization	Moore, p 112
The lower limbs are well-developed.	14th week after fertilization	Williams, p 155; Moore, p 109
Toenails are present.	14th week after fertilization	England, p 173
Slow eye movements first occur.	14th week after conception	Nijhuis/de Vries, p 5; Birnholz, p 679
Eye movements are first seen.	About 14th week conception	Inoue, p 172
The nail anlagen form on the toes.	About 14th week	Larsen, p 311
Eye movements are first seen.	14th – 16th weeks after conception	Roodenburg, p 33
The first day that movement is noticed by the pregnant woman is called “quickening”.	14th – 18th weeks after fertilization	Williams, p 23

SIXTEENTH WEEK

Bones are clearly visible in ultrasound images.	Beginning of the 16th week after fertilization	Moore, p 112
The ears stand out from the head.	16th week after fertilization	Williams, p 155; Moore, p 109
The ovaries are differentiated.	16th week after fertilization	Moore, p 112 & p 113
The appearance is human. The eyes face anteriorly. The ears have almost reached their final position on the sides of the head.	16th week after fertilization	Moore, p 113
Fine palm lines have formed, which can be used to permanently identify the fetus. Finger, palm, and footprints are never duplicated among individuals.	4th month	Rugh, p 217

SEVENTEENTH WEEK

The median breathing movement rate was 208 per hour in12 fetuses studied.	17th week after conception	de Vries (1985), p 105

EIGHTEENTH WEEK

Signs of life (i.e. quickening) are felt by the mother.	18th week after fertilization	Moore, p 109
The uterus is formed.	18th week after fertilization	Moore, p 113
Canalization of the vagina has begun.	18th week after fertilization	Moore, p 113
In nine fetuses studied, there were a median of 57general movements per hour, which were present during 24% of the observation time.	18th week after conception	Roodenburg, p 23
In a study of 9 fetuses, the median number of hand-to-face contacts was 95 per hour.	18th week after conception	Roodenburg, p 33

In a study of 9 fetuses, the median number of head rotations was 63 per hour.	18th week after conception	Roodenburg, p 33
Jaw movements include isolated jaw movements, sucking, swallowing, yawning, and tongue movements. In 9 fetuses studied, the median frequency of any kind of jaw movements was 142 per hour.	18th week after conception	Roodenburg, p 28 & p 29
In a study of 9 fetuses, the median number of stretches were 6 per hour.	18th week after conception	Roodenburg, p 28
Some scalp hair is visible.	End of 18th week after fertilization	Williams, p 154
The rate of breathing movements was much higher during the second hour after the mother's breakfast or lunch than during the third hour.	20th –22nd weeks after conception	de Vries (1987), p 337
Breathing movements occurred most often right after the mother's meal at noon.	20th –22nd weeks after conception	de Vries (1987), p 337
The frequency of breathing movements changes during the day. In a study of 10 fetuses, such movements increased from a median of 2% of the observation time in the morning to 13% in the afternoon, and then fell to 11% in the evening.	20th –22nd weeks after conception	de Vries (1987), p 337
The fetal heart rate decreases overnight.	20th – 22nd weeks after conception	de Vries (1987), p 341
The daily pattern of changes in the fetal heart rate follows the changes in the maternal heart rate.	20th –22nd weeks after conception	de Vries (1987), p 345 & p 346
The frequency of hiccupping changes during the day. In a study of 10 fetuses, the median number of hiccups during 8 AM to 10 AM was 28 per hour, decreasing to 12 per hour during 1 PM to 3 PM.	20th – 22nd weeks after conception	de Vries (1987), p 338
The frequency of jaw openings changes during day. In a study of 10 fetuses, the median rate was 51 per hour during 8 AM to 10 AM, increasing to 97 per hour during 1 PM to 3 PM.	20th – 22nd weeks after conception	de Vries (1987), p 338

In a study of 10 fetuses, the majority of movements occurred more frequently in the afternoon and evening than in the morning.	20th –22nd weeks after conception	de Vries (1987), p 337
In 9 fetuses studied, the median number of eye movements at 18 weeks after conception were 25 per hour, increasing to 101 per hour at 34 weeks.	18th - 34th weeks after conception	Roodenburg, p 28

TWENTIETH WEEK

Eyebrows are visible.	20th week after fertilization	Moore, p 113
Head and body hair is visible.	20th week after fertilization	Williams, p 155
The testes have begun to descend.	20th week after fertilization	Moore, p 113
The fetus is viable.	20th week after fertilization	Moore, p 3
Hair becomes easily recognizable.	About week 20 after fertilization	Moore, p 517
Sweat glands are developing.	About 20 weeks after fertilization	Moore, p 517
Sweat glands first appear.	About 20 weeks	Larsen, p 311
Eyebrows are visible.	By the 5th month after fertilization	Sadler, p 114
Head hair is visible.	By the 5th month after fertilization	Sadler, p 114
Movement is usually recognized by the mother.	During the 5th month after fertilization	Sadler, p 114

TWENTY FIRST WEEK

Rapid eye movements begin.	21st week after fertilization	Moore, p 114

Rapid eye movements first occur.	21st week after conception	Nijhuis/de Vries, 5; Birnholz, p 679

TWENTY SECOND WEEK

A significant increase in fetal breathing occurred after giving glucose to the mother.	22nd week after conception	Nijhuis/Visser, p 19
A fetus born at this time will attempt to breathe.	22nd week after fertilization	Williams, p 154
Eyebrows are usually recognizable.	End of 22nd week after fertilization	Williams, p 154
Eyelashes are usually recognizable.	End of 22nd week after fertilization	Williams, p 154
"Blink-startle" responses have been reported.	22nd-23rd weeks after fertilization	Moore, p 114
"Blink-startle" responses to vibroacoustic stimulation have been observed.	22nd & 23rd weeks after concepton	Birnholz & Benacerraf, p 516
The fetus apparently hears some sounds in utero.	22nd – 24th weeks after fertilization	Williams, p 169
A premature fetus born at this time may survive if given intensive care.	22nd – 25th weeks after fertilization	Moore, p 114
The skin of the fetus is reddish and has a wrinkled appearance.	During the 6th month after fertilization	Sadler, p 114

TWENTY SIXTH WEEK

Eyelashes are present.	26th week after fertilization	Moore, p 109
The eyes are open.	26th week after fertilization	Moore, p 114
A facial response occurs when the fetus is given bitter-tasting substances. Reflexes between the taste buds and facial muscles are in place.	26th – 28th weeks after fertilization	Moore, p 234

The lungs are capable of breathing air. The central nervous system can direct rhythmic breathing and control body temperature.	26^{th} – 29^{th} weeks after fertilization	Moore, p 114

AT BIRTH

The tooth buds for the second and third permanent molars are developing.	At birth	Moore, p 523