

This glossary is intended to trace the roots of the often-confusing terms used in placental pathology and perinatal development. The accents are placed for pronunciation.

Gk. = Greek; **L.** = Latin; **Fr.** = French; **OE** = Old English; **ME** = Middle English.

Abrúptio (placéntae): detachment of placenta [L. *abrumpere* = to break away]

Acárdius: malformed twin without heart, invariably one of monozygotic twins [Gk. *a* = without, not + *kardia* = heart]

Adventítia: outer layer of vessel wall [L. *advenire* = to add]

Allántois (allantóic): designation of one type of placenta, because of its roots in other mammals; thin membrane between amnion and chorion [Gk. *allantos* = sausage]

Ámniion: thin membrane surrounding the fetus; lamb's caul [Gk. *amnos* = lamb] **Note:** Because we use chorionic and not choriotic, it is here preferred to speak of amnionic, rather than amniotic. Hyrtl (1880) explored the various terminology used to describe placental structures. He concluded that amnios and amnion were both correct. It was first used by Galen, referring to skin. The reference to lamb comes from Vesalius.

Androgénesis: development of male gender [Gk. *andros* = man + *gennan* = produce]

Anídián monster: a hideous fetus with peculiar features; a form of acardiac twin [Gk. *an* = not + *idios* = peculiar + L. *monstrum*]

Artiodáctyla: order of mammals, the even-hoofed animals, e.g., cow, deer [Gk. *artios* = even + *daktylos* = toe]

Báttledore (placenta): marginal insertion of cord [OE = flat, wooden paddle used in the game of battledore to hit the shuttlecock]

Blástocyst: early germinative vesicle [Gk. *blaste* = germ + *kystis* = vesicle]

Bosselátion: surface granulation of placenta [Fr. *bosseler* = to ornament with bosses; from *bosse* = knob]

Capillary: hair-fine blood vessel [L. *capilla* = hair]

Céllular: belonging to the cell [L. *cellula* = small cabin, cell]

Extracéllular: outside the cell

Intercéllular: between cells

Intracéllular: within cells

Transcélular: across cells

Chiméra (Chímerism): the composite of several genotypes [Gk. *chimaira* = a monstrous beast. In Greek mythology a monster made of the head of a lion, body of a goat, and tail of a dragon.]

Chiráility: the quality of being chiral [Gk. *chiro* = the hand; a three-dimensional form, as a molecule, that cannot be superimposed on its mirror image; used in designating the twist of the umbilical cord; its first usage was discussed by McManus (2002)]

Chorioangiópagus parasíticus: a fetus, connected by blood vessels to another fetus [Gk. *chorion* = “little gut” = outer membranes around embryo + *angeios* = vessel + *pagos* = something set or fixed; *para* = next to + *sitos* = food]

Chóriion: outer membrane around embryo [Gk. *chorion* = “little gut”; according to Hyrtl (1880) the term was also used by Galen as the outer shell of the membranes]

frondósum: the placenta proper [L. *frondosus* = richly covered with leaves, as in tree]

laéve: the membranous portion of the chorionic sac [L. *levis* = smooth, without villi]

Chorionepithelióma: malignant tumor of trophoblast = chorionepithelioma or choriocarcinoma [Gk. *chorion* = “little gut” (outer membrane enclosing an embryo) + *epi* = on + *thele* = nipple + *oma* = tumor]

Circumvállate (placenta): an abnormal form of placenta with circumferential, old hemorrhages [L. *circum* + *vallare* = to wall around]

Cirsoíd: aneurysmal dilatation of vessel [Gk. *kirsos* = enlarged vein]

Cotylédón: originally name for the single spots of placental tissue in the ruminants; lobe of the human placenta [Gk. *kotyle* = cup]

Cytotrophoblast: cellular type of the trophoblast [Gk. *kytos* = cell + *trephein* = to nourish + *blaste* = germ]

Decídúa: the endometrium at end of the luteal phase [L. *decidere* = fall, die]

basális: basal portion of placenta [Gk. *basis* = base]

- capsuláris:** outer portion of membranes [L. *capsula* = little box]
- parietális:** endometrium of pregnancy, covering wall portion of uterus [L. *paries* = wall; *parietalis* = pertaining to wall]
- véra:** uterine decidua, contrasting it to pseudodecidua, outside of uterus, as in endometriosis [L. *verus* = true]
- Désmosome:** intercellular junction [Gk. *desmos* = Ligament + *soma* = body]
- Dizygótic:** twins of two ova, “fraternal twins” [Gk. *dis* = twice, two + *zygon* = yoke]
- Eclámpsia:** coma and convulsive seizure in pregnancy [Gk. *eklampsis* = shining forth; or *ek* = out + *lampein* = to shine]
- Émbryoblast:** embryo-forming cells of the blastocyst [Gk. *embryon* = unborn child + *blaste* = germ]
- Endométrium:** innermost layer of the uterus [Gk. *endon* = inside + *metra* = uterus]
- Endoplásmic reticulum:** a net-like, membrane-lined cell organelle [Gk. *endon* = inside + *plasma* = juice; L. *reticulum* = small net]
- Endothélium:** innermost layer of blood vessels [Gk. *endon* = inside + *thela* = mamilla]
- Epígnathus:** tumorous mass in mouth, affixed to jaw and possibly a twin [Gk. *epi* = upon, at, over + *gnathos* = jaw]
- Epithelium:** superficial cellular layer [Gk. *epi* = upon + *thela* = mamilla]
- Fétus papyráceus:** paper-like, macerated, compressed (“compressed”) fetus [L. *papyrus* = plant from which paper is made]
- Fibrin:** blood clot product [L. *fibra* = fiber]
- Fibrinoid:** a substance similar to but not identical with fibrin [Gk. . . . *eides* = looking like]
- Fibroblast:** connective tissue cell [Gk. *blaste* = germ]
- Freemártin:** the female of fraternal cattle twins, sterilized in utero by the male co-twin with whose placental vessels she is joined; the term presumably comes from the St. Martin’s feast in England, when these animals were consumed
- Funiculópagous (twins):** twins joined at umbilical cord [L. *funis* = rope, cord + Gk. *pagos* = fixed]
- Fúnis (funiculus):** umbilical cord [L. *funis* = rope, cord]
- Funisítis:** inflammation of umbilical cord [L. *funis* = rope]
- Fúrcate (cord) (“insértio funiculi furcáta”):** forked insertion of the little rope [L. *furca* = fork]
- Glycocálix:** superficial layer of polysaccharides, covering the cell surface [Gk. *glycos* = sweet + *kalyx* = goblet]
- Granulomatósis infantiséptica:** neonatal disseminated listeriosis [L. *granulum* = little grain + Gk. *oma* = tumor]
- Gynogénesis:** female development [Gk. *gyne* = woman + *gennan* = produce]
- Hemiacárdius:** acardiac monster in which remnants of heart may be found [L. *hemi* = a half]
- Holoacárdius:** completely heartless monster (twin) [Gk. *holos* = whole]
- Hydatídiform (mole):** severely hydropic placenta with bulbous, villous enlargement [Gk. *hydatis* = watery vesicle + L. *forma* = shape; L. *mola* = false conception; mass]
- Hydrámnios:** excessive amount of amniotic fluid [Gk. *hydor* = water (*hydros* = sweat; some early authors believed that amniotic fluid was fetal sweat) + *amnion* = lamb’s caul]
- Implantáció:** establishing of intimate fetomaternal contact in the uterus [L. *implantare* = to embed]
- Intervillous:** between the placental villi, i.e., in the maternal blood space [L. *inter* = between]
- Intravillous:** within a villus [L. *intra* = in]
- Lacúna:** [L. = hole, gap]
- Lithopédion:** stone-like fetus [Gk. *lithos* = stone + *paidion* = child]
- Lóchia (pl.):** uterine discharges after birth [Gk. *lochía*]
- Mácrophage:** phagocytotic and paracrine cell type [Gk. *macro* = large + *phagein* = to eat]
- Mágma reticuláre:** jelly-like fluid in original embryonic sac [Gk. *magma* = suspension of finely divided material in small amount of water + L. *reticulum* = little net (network)]
- Mármoset:** family of small South American primates that always produce fraternal twins [Old Fr. *marmouset* = grotesque figure]
- Mecónium:** fetal intestinal content [Gk. *mekonion* = poppy juice]
- Mésenchyme:** undifferentiated connective tissue [Gk. *mesos* = in the middle of + *chein* = to pour (something poured in between)]
- Mésoderm:** the middle germ layer [Gk. *derma* = skin]
- Mésothelium:** connective tissue-derived epithelial layer [Gk. *thela* = mamilla]
- Microvillus:** finger-like extension of the cell surface
- Mitochóndrion:** rod-shaped cell organelle [Gk. *mitos* = thread + *chondros* = grain]
- Mole (hydatídiform, Breus’, etc.):** vesicular mass of placenta [L. *mola* = false conception]
- Monozygótic:** single-egg-derived twins (“identical twins”) [Gk. *monos* = single + *zygotos* = yoked]
- Nódus spúrius vasculósus (gelatínus):** false knot in umbilical cord of vascular genesis [L. *nodus* = knot + *spurius* = not genuine + *gelatina* = gelatin]
- Núchal (cord):** umbilical cord entwined around neck [L. *nucha* = nape of the neck]
- Óctoploid:** having eight sets of chromosomes [Gk. *okto* = eight + *ploos* = fold + *eidós* = form]
- Oligohydrámnios:** too little, or no amniotic fluid [Gk. *oligos* = little + *hydor* = water (*hydros* = sweat) + *amnion* = lamb caul]
- Ómphalo-(mesentéric):** umbilicus [Gk. *omphalos* = Navel]
- Páraplacénta:** those parts of the chorionic sac, not belonging to the placenta, e.g., membranes [Gk. *para* = beside]
- Pérvillous:** around the placental villi [Gk. *peri* = around]
- Placénta:** [L. flat cake] According to Hyrtl (1880) this term, with an originally Greek root, was introduced in 1559 by Realdus Columbus; others referred to it as “secundines”
- accréta:** unusually adherent placenta that fails to detach [L. *accrescere* = to grow together, adhere]

incréta: placenta that has grown into the myometrium [L. *increscere* = to grow into]

membranácea: very thin placental membrane, the entire outside of which is covered with villi [L. *membrana* = from parchment, membrane]

percréta: placenta that has grown through the uterine wall [L. *percrebescere* = to crowd everywhere]

prévia: placenta that is located in the lower uterus and is in the way before the fetus can be delivered [L. *praeuius* = in front of, before, leading the way]

Plasmódium: multinucleate mass of protoplasm [Gk. *plasma* = a thing formed (juice) + *eidōs* = to form]

Pólyploid: having many sets of chromosomes [Gk. *polys* = much, many + *plōos* = fold + *eidōs* = form]

Pólypoid: protrusion of tissue, polyp [Gk. *polys* = many + *pous* = foot + *oid* = like]

Pycnósís (pyknosis): degenerative condensation of cells or nuclei [Gk. *pyknos* = dense]

Schístocytes: broken red cells in disseminated intravascular coagulation [Gk. *schistos* = split]

Secúndines: synonymous with afterbirth [L. *secundus* = following]

Sínusoid: enlarged capillary [L. *sinus* = bight + Gk. *eides* = looking like]

Siréniform (fétus): malformed infant with fused legs [Gk. *seiren* = mermaid]

Sirenomélia: malformed infant with fused legs [Gk. *seiren* = mermaid + *melos* = limb]

Stróma: connective tissue core of an organ [L. *stroma* = cushion]

Subchórial: under the chorionic plate [L. *sub* = below + Gk. *chorion* = leather, embryonic membrane]

Succentúriate (lobe): accessory lobe of placenta [L. *succenturiare* = to substitute]

Superfecundátiön: fertilization of two or more ova at different times during the same menstrual period [L. *super* = beyond, excessively + *fecundus* = fertile]

Superfetátiön: pregnancy on top of already existing pregnancy [L. *superfetare* = to bring forth while already pregnant; L. *fetus* = fruit, offspring]

Sympus: fetus with fused legs [Gk. *syn* = together + *pous* = foot (same as siren)]

Syncytiotrophoblast: syncytial type of trophoblast

Syncytium: multinuclear mass, derived from cell fusion [Gk. *syn* = together + *kytos* = cell]

Synéchia (pl. synéchiaie): adhesion of parts, here in the uterus [Gk. *synecheia* = continuity]

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Tessellátiön: irregular surface of placenta [L. *tessella* = little square stone (From Gk. *tessares* = four)]

Tétraploid: having four sets of chromosomes [Gk. *tettares* = four + *plōos* = fold]

Thalassémias: hemoglobin disorders [from Gk. *thalassa* = the sea; generally referring to the Mediterranean]

Thixotrópic (Thyxo-) gel: gel that liquefies when shaken, generally the extraembryonic fluid [Gk. *thixis* = touching + *trope* = turn]

Thoracopágus: twins, conjoined at chest [Gk. *thorax* = chest + *pagos* = fix]

Trabécula: small septum [L. small beam]

Tróphoblast: the epithelium that covers the placenta [Gk. *trophe* = nourishment + *blastos* = germ]

Trophótropism: the “wandering” of the placenta to the site of best nourishment [Gk. *trophe* = nourishment + *trope* = turn]

Urachus: connection of bladder to allantoic sac [Gk. *ourachos* (“that which has a tail”) = cord that extends from bladder to navel]

Vas préviüm (pl. Vása prévia): blood vessels within membranes that present before fetal parts during delivery [L. *vas* = vessel(s) that is (are) ahead (“previous”) of fetal part]

Vas vasórum (Vása vasórum): blood vessels that nourish the vessels [L. *vas* = vessel]

Velaméntous (cord insertion): membranous insertion of umbilical cord [L. *velamen* = veil + *velamentum* = cover]

Vérnix caseósa: sebum, hair and other skin secretions from fetus [L. *vernix* = varnish + *caseus* = cheese]

Víllus (pl. vílli): ramifications of placenta with fetal vessels that are the “business end” of the placenta, covered with trophoblast [L. *villus* = tuft of hair]

Vitélline: belonging to the yolk sac [L. *vitellus* = yolk of an egg]

References

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Normative Values and Tables

Some quantitative structural and biochemical data concerning pregnancy, placental development, and composition of the term placenta are given in Tables 28.1 to 28.10.

When examining the tables on placental morphometry and comparing the results from different authors, it is important to note that quantitative structural data are heavily influenced by the mode of sampling and by the preparation of the material. Because of the high degree of maternal and fetal vascularization, the placenta reacts immediately to changes in intravascular pressure. Thus, the mode of birth, the time elapsing from cessation of maternal and fetal blood flows to tissue fixation (see Tables 28.6 to 28.10), and the nature of cord clamping (see Table 28.8) directly influence the volumetric relations of villi and intervillous space. In particular, parameters such as the width of fetal vessels, degree of fetal vascularization, maternal-fetal diffusion distance, and trophoblastic thickness are easily affected. Moreover, the composition of the fixative and its osmolarity (see Table 28.10), as well as the mode of fixation (immersion versus perfusion fixation) are of importance. Normally, immersion fixation of the entire placenta or of small pieces is used. The more advanced methods, such as perfusion fixation (Burton et al., 1987) or puncture biopsy of the still maternally perfused placenta during cesarean section (Schweikhart & Kaufmann, 1977; Voigt et al., 1978; Sen et al., 1979), are very time-consuming. When studying immersion fixed material, however, one should keep in mind that this material differs quantitatively and qualitatively from the *in vivo* conditions (see Tables 28.6 and 28.9). It is

impossible to include the results of numerous other valuable contributions to placental morphometry in these tables. For further information on special issues, we refer to the following publications: placental growth development in relation to birth weight (Bouw et al., 1978; Molteni et al., 1978); relationship of placental weight to body size at 7 years of age, and to abnormalities in children (Naeye, 1987); fetal and placental weights in relation to maternal weight (Auinger & Bauer, 1974); ultrasonographic measurements of volumetric growth of the placenta (Bleker et al., 1977); weight development of placenta and membranes in early pregnancy (Abramovich, 1969); ratio of gestational sac volume to crown-rump length in early pregnancy (Goldstein et al., 1986); villous surface area and villous volume densities in various placental regions and along different levels of the chorial basal axis (Teasdale, 1978; Boyd et al., 1980; Cabezon et al., 1985; Bacon et al., 1986); local variations of villous surface, fetal vascularization, and amount of vasculosyncytial membranes in the placentone (maternal-fetal circulatory unit) (Schuhmann et al., 1986); total villous surface in relation to fetal weight, in normal and various pathologic cases (Clavero-Nunez & Botella-Llusia, 1961, 1963); morphometric data affecting placental oxygen diffusion (Mayhew et al., 1984, 1986); computer measurement of the mass of syncytiotrophoblast (Boyd et al., 1983); ultrastructural morphometric analysis of the villous syncytiotrophoblast (Sala et al., 1983); microvillous surface enlargement of the villous surface (Teasdale & Jean-Jacques, 1985); comparison of villous structure following immersion and perfusion fixation (Burton et al., 1987).

TABLE 28.1. Length and weight data for placenta and fetus; pregnancies and deliveries at sea level. (1) Data extrapolated from Boyd & Hamilton (1970) and O’Rahilly (1973); (2) data from Johannigmann et al. (1972); (3) data from Winckel (1893), Branca (1922), Naeye & Tafari (1983), and Fujinaga et al. (1990); (4) data from Weissman et al. (1994). Placental weight data published by Molteni et al. (1978) are 5% to 10% lower because fetal blood was drained from chorionic vessels before weighing. Compare with data on influence of cord clamping given in Table 28.8. Umbilical cord length as measured by ultrasound throughout the first trimester (Hill et al., 1994) amounts to only about 50% of the length measured after abortion.

| Pregnancy week (postconception) | Pregnancy week (postmenstruation) | Pregnancy month (postmenstruation) | Crown-rump length (mm) ¹ | Embryonic/fetal weight (g) ¹ | Diameter of the chorionic sac (mm) ¹ | Placental diameter (mm) ¹ | Placental weight (g) ¹ | Placental thickness postpartum (mm) ¹ | Placental thickness including uterine wall measured by ultrasound in vivo (mm) ² | Length of the umbilical cord (mm) ³ | Diameter of the umbilical cord measured by ultrasound (mm) ⁴ | Diameter of the umbilical artery measured by ultrasound (mm) ⁴ | Diameter of the umbilical vein measured by ultrasound (mm) ⁴ |
|---------------------------------|-----------------------------------|------------------------------------|-------------------------------------|---|---|--------------------------------------|-----------------------------------|--|---|--|---|---|---|
| 1 | 1 | | | | | | | | | | | | |
| 2 | 2 | | | | | | | | | | | | |
| 3 | 3 | 1 | | | | | | | | | | | |
| 4 | 4 | | | | | | | | | 2 | | | |
| 5 | 5 | | 2.5 | | 5-11 | | | | | 4 | | | |
| 6 | 6 | 2 | 5 | | 12-19 | | | | | 7 | | | |
| 7 | 7 | | 9 | | 20-25 | | | | | 12 | | | |
| 8 | 8 | | 14 | 1.1 | 26-33 | | 6 | | | 20 | 2.5 | | |
| 9 | 9 | | 20 | 2 | 34-41 | | 8 | | | 33 | | | |
| 10 | 10 | 3 | 26 | 5 | 42-48 | | 13 | | | 55 | 3.3 | | |
| 11 | 11 | | 33 | 11 | 49-56 | | 19 | | | 92 | | | |
| 12 | 12 | | 40 | 17 | 57-65 | | 26 | | | 126 | 4.4 | | |
| 13 | 13 | | 48 | 23 | 66-73 | 50 | 32 | | | 158 | | | |
| 14 | 14 | 4 | 56 | 30 | 74-81 | 56 | 41 | 10 | | 188 | 6.1 | 1.2 | 2.0 |
| 15 | 15 | | 65 | 40 | 82-89 | 62 | 50 | 11 | | 215 | | | |
| 16 | 16 | | 75 | 60 | 90-99 | 69 | 60 | 12 | | 240 | 7.0 | 1.1 | 2.4 |
| 17 | 17 | | 88 | 90 | | 75 | 70 | 12 | | 264 | | | |
| 18 | 18 | 5 | 99 | 130 | | 81 | 80 | 13 | | 287 | 10.1 | 1.9 | 3.6 |
| 19 | 19 | | 112 | 180 | | 87 | 101 | 14 | | 309 | | | |
| 20 | 20 | | 125 | 250 | | 94 | 112 | 15 | 28 | 330 | 11.1 | 2.0 | 4.1 |
| 21 | 21 | | 137 | 320 | | 100 | 126 | 15 | 29 | 350 | | | |
| 22 | 22 | 6 | 150 | 400 | | 106 | 144 | 16 | 30 | 369 | 12.8 | 2.4 | 4.7 |
| 23 | 23 | | 163 | 480 | | 112 | 162 | 17 | 32 | 387 | | | |
| 24 | 24 | | 176 | 560 | | 119 | 180 | 18 | 34 | 404 | 13.9 | 2.6 | 5.4 |
| 25 | 25 | | 188 | 650 | | 125 | 198 | 18 | 35 | 420 | | | |
| 26 | 26 | 7 | 200 | 750 | | 131 | 216 | 19 | 36 | 435 | 15.2 | 2.8 | 6.0 |
| 27 | 27 | | 213 | 870 | | 137 | 234 | 19 | 37 | 450 | | | |
| 28 | 28 | | 226 | 1,000 | | 144 | 252 | 20 | 38 | 464 | 15.9 | 3.1 | 6.6 |
| 29 | 29 | | 236 | 1,130 | | 150 | 270 | 20 | 39 | 477 | | | |
| 30 | 30 | 8 | 250 | 1,260 | | 156 | 288 | 21 | 40 | 490 | 16.3 | 3.4 | 7.3 |
| 31 | 31 | | 263 | 1,400 | | 162 | 306 | 21 | 41 | 502 | | | |
| 32 | 32 | | 276 | 1,550 | | 169 | 324 | 22 | 42 | 520 | 17.6 | 3.6 | 7.7 |
| 33 | 33 | | 289 | 1,700 | | 175 | 342 | 22 | 42 | 530 | | | |
| 34 | 34 | 9 | 302 | 1,900 | | 181 | 360 | 23 | 43 | 540 | 17.4 | 3.3 | 7.4 |
| 35 | 35 | | 315 | 2,100 | | 187 | 378 | 23 | 43 | 549 | | | |
| 36 | 36 | | 328 | 2,300 | | 194 | 396 | 24 | 44 | 557 | 17.4 | 3.7 | 7.6 |
| 37 | 37 | | 341 | 2,500 | | 200 | 414 | 24 | 44 | 565 | | | |
| 38 | 38 | 10 | 354 | 2,750 | | 206 | 432 | 24 | 45 | 572 | 18.0 | 4.2 | 8.2 |
| 39 | 39 | | 367 | 3,000 | | 213 | 451 | 25 | 45 | 579 | | | |
| 40 | 40 | | 380 | 3,400 | | 220 | 470 | 25 | 45 | 585 | 17.0 | 3.9 | 7.8 |

TABLE 28.4. Fetal and placental weights as related to the number of pregnancies.

| Pregnancy no. | Male neonates | | | | Female neonates | | | |
|-------------------------|------------------|------------------|--------------|---------------|------------------|------------------|--------------|---------------|
| | Mat. age (years) | Neo. length (cm) | Neo. wt. (g) | Plac. wt. (g) | Mat. age (years) | Neo. length (cm) | Neo. wt. (g) | Plac. wt. (g) |
| First (<i>n</i> = 101) | 22.37 | 51.04 | 3,141.3 | 548.7 | 22.42 | 50.96 | 2,974.0 | 560.7 |
| Second (<i>n</i> = 71) | 25.24 | 51.95 | 3,442.8 | 607.9 | 25.15 | 51.29 | 3,133.6 | 565.5 |
| Third (<i>n</i> = 27) | 30.21 | 50.29 | 3,495.0 | 603.2 | 26.69 | 50.29 | 3,228.1 | 553.9 |
| Fourth (<i>n</i> = 18) | 30.00 | 53.83 | 3,677.5 | 599.6 | 29.00 | 50.83 | 3,095.0 | 568.3 |

Mat. = maternal; Neo. = neonatal; Plac. = placental.
 All results are given as the mean value.
 From Lips (1891).

TABLE 28.5. Qualitative data for the human placenta at term. The data were taken or calculated from (1) Knopp (1960); (2) Aherne & Dunnill (1966); (3) Baur (1970); (4) Wördehoff (1971); (5) Laga et al. (1973); (6) Ehrhardt & Gerl (1970); (7) Bacon et al. (1986); (8) Mayhew et al. (1986); (9) Bouw et al. (1976); (10) Feneley & Burton (1991); (11) Voigt et al. (1978); (12) Burton & Feneley (1992).

| | | | | |
|---|-----------------|----------------|----------------|----------------|
| Mean placental volume (cm ³) (without cord and membranes) | 448 (2) | 448 (5) | 540 (9) | 408 (10) |
| Percentage of villous volume per placenta (%) | 57.5 (1) | 57.9 ± 5.7 (2) | 45.6 (5) | 62.9 ± 2.1 (7) |
| Mean villous volume per placenta (g) | 273 (1) | 214 (5) | 224 (2) | 239 (9) |
| Percentage of intervillous space per placenta (postpartum) (%) | 35.8 ± 3.2 (2) | 23.29 (5) | 29.3 ± 2.0 (7) | 37.9 (8) |
| Volume of intervillous space (cm ³) | 144 (2) | 110 (5) | 210 (9) | 173 (8) |
| Percentage of intervillous fibrinoid per placenta (%) | 4.3 ± 2.1 (2) | 2.58 (5) | | |
| Villous surface covered with fibrinoid (%) | 0.364 (6) | | | |
| Percentage of villous tissues per placenta (chorionic plate, basal plate, septa, cell islands, infarctions) (%) | 27.6 (5) | | | |
| Villous surface per placenta (m ²) | 13.3 ± 0.47 (4) | 12.0 (3) | 11.8 (6) | 11.0 ± 1.3 (2) |
| Villous surface per 1cm ³ of villous volume (cm ²) | 330 (1) | 248 (3) | 301.2 (4) | |
| Inner fetal capillary surface per placenta (m ²) | 12.2 ± 1.5 (2) | 12.0 (5) | | |
| Total length of all villi per placenta (km) | 90 (1) | | | |
| Arithmetic mean thickness of villous membrane (mean maternofetal diffusion distance) (µm) | 3.5 (2) | 4.5 (10) | 5.0 (11) | |
| Harmonic mean thickness of villous membrane (µm) | 10.0 (5) | 4.9 (8) | | |

TABLE 28.6. Quantitative composition of peripheral villous types of diameter of less than 80µm following resin embedding.

| Parameter | All villous types after spon. del. | After in situ puncture of placenta | | | | | | |
|---|--|------------------------------------|------|------|------|----------|-------------|------|
| | | All villous types | SV | IIV | MIV | TV, neck | TV, no neck | |
| Villous surface showing cytotrophoblast below the syncytium (%) | 27.5 | 22.8 | 21.4 | 23.4 | 24.6 | 20.0 | 23.5 | |
| Cytotrophoblastic volume as a percentage of total villous trophoblast (%) | 13.3 | 14.0 | 11.7 | 14.3 | 13.8 | 11.6 | 15.7 | |
| Percent of total villous volume | Trophoblast | 41.7 | 37.7 | 30.0 | 33.8 | 38.0 | 46.2 | 29.6 |
| | Villous stroma | 58.3 | 62.3 | 70.0 | 66.2 | 62.0 | 53.8 | 70.4 |
| | Fetal vessel lumens | 20.0 | 28.4 | 26.0 | 15.7 | 21.0 | 20.2 | 45.2 |
| | Connective tissue including vessel walls | 38.4 | 33.9 | 44.0 | 50.5 | 41.0 | 33.6 | 25.2 |
| Mean trophoblastic thickness | 4.7 | 4.1 | 4.7 | 5.2 | 4.4 | 4.0 | 3.3 | |
| Distribution of maternofetal diffusion distances in % of villous surface | -0-2µm | 10.4 | 21.0 | 9.2 | 10.9 | 13.1 | 21.8 | 37.1 |
| | 2.1-5µm | 29.9 | 40.2 | 27.3 | 27.3 | 37.5 | 41.4 | 36.5 |
| | 5.1-10µm | 40.3 | 32.4 | 50.5 | 37.7 | 37.8 | 32.6 | 25.1 |
| | 10.1-∞µm | 19.5 | 6.4 | 13.0 | 24.1 | 11.6 | 4.4 | 1.3 |
| Mean maternofetal diffusion distance (µm) | 7.1 | 5.0 | 6.8 | 7.5 | 6.0 | 4.8 | 3.7 | |
| Macrophages (no.)/mm ² of histologic section | | | 24 | 730 | 241 | 83 | 192 | |
| Mast cells (no.)/mm ² of histologic section | | | 18 | 10 | 5 | <1 | <1 | |

Spon. del. = spontaneous delivery; SV = stem villi; IIV = immature intermediate villi; MIV = mature intermediate villi; TV, neck = neck regions of terminal villi; TV, no neck = terminal villi, excluding neck regions.

The data obtained from spontaneous deliveries (fixation about 10 minutes after cord clamping, ischemic period far above 10 minutes), are compared with such obtained by puncture aspiration out of the still maternally perfused in situ placenta (ischemic period: 0 minutes) (Voigt et al., 1978). In addition, data have been separately measured and calculated for different villous types (Sen et al., 1979).

TABLE 28.7. Number of villous cross sections (%), percentages of villous surface, and percentages of villous volume in different groups of villi.

| Parameter | Villous cross sections (% of total no.) | Surface of villi (% of total) | Volume of villi (% of total) | Type of villus | Mean caliber (μm) | Mean length of cross sections (μm) |
|---|---|-------------------------------|------------------------------|--|--------------------------------|---|
| Diameter of villi (μm) | | | | | | |
| ->1,500 | 0.003 | 0.1 | 1.2 | Trunci chorii | | |
| 1,201-1,500 | 0.002 | 0.1 | 0.8 | | | |
| 901-1,200 | 0.007 | 0.1 | 1.4 | Rami chorii | | |
| 601-900 | 0.02 | 0.5 | 2.4 | | | |
| 301-600 | 0.2 | 1.9 | 9.0 | Ramuli chorii, mature and immature intermediate villi, terminal villi ^a | | |
| 226-300 | 0.3 | 1.7 | 6.4 | | | |
| 151-225 | 0.6 | 3.2 | 7.7 | | | |
| 76-150 | 7.1 | 15.1 | 20.8 | | | |
| 0-75 | 91.8 | 77.2 | 50.4 | | | |
| Type of villus | | | | | | |
| Ramuli | 5.1 | 12.4 | 22.7 | | 120.5 | 340.1 |
| Immature intermediate | 5.1 | 8.4 | 10.1 | | 76.6 | 233.5 |
| Mature intermediate | 29.1 | 31.0 | 27.8 | | 60.6 | 153.5 |
| Terminal | 55.1 | 46.3 | 38.7 | | 50.8 | 118.4 |
| Neck regions | 5.5 | 2.0 | 0.8 | | 34.3 | 46.4 |

^aThe villi are classified according to diameter (using data from I. Hansen & V. König, personal communication, 1978) and compared according to structure.

Modified from Sen et al. (1979).

TABLE 28.8. Influence of cord clamping on placental structure.

| Parameter | Early clamped (n = 9) | Late clamped (n = 7) |
|--|-----------------------|----------------------|
| Placental weight (g) | 567.4 \pm 114.5 | 407.1 \pm 74.0 |
| Birth weight (g) | 3,593.5 \pm 380.0 | 3,404.3 \pm 313.5 |
| Placental weight index | 0.156 \pm 0.021 | 0.116 \pm 0.088 |
| Villous volume (cm^3) | 239.1 \pm 51.9 | 185.3 \pm 39.5 |
| Villous vessel volume (cm^3) | 74.9 \pm 28.2 | 33.4 \pm 18.3 |
| Villous vessel volume (%) | 30.4 \pm 5.8 | 17.4 \pm 6.9 |
| Villous vessel surface (mm^2) per mm^3 of villous volume | 66.9 \pm 10.0 | 46.3 \pm 10.5 |
| Total villous surface (m^2) | 13.3 \pm 2.6 | 9.3 \pm 2.1 |
| Volume of intervillous space (cm^3) | 210.3 \pm 50.0 | 116.0 \pm 21.7 |

Results are given as the mean \pm SD. A group of spontaneously delivered placentas of which the cord was clamped as early as possible as compared with a group of which the cord was clamped after cessation of the arterial pulsation.

Data from Bouw et al. (1976).

TABLE 28.9. Influence of total ischemia of varying length on the structure of terminal villi.

| Parameter | Ischemic period | | | | |
|---|-----------------|-------|-------|--------|--------|
| | 0 min | 2 min | 5 min | 10 min | 20 min |
| Fetal capillary volume (%) | 45 | 32 | 19 | 13 | 17 |
| Connective tissue volume (%) | 25 | 42 | 49 | 54 | 47 |
| Trophoblastic volume (%) | 23 | 26 | 32 | 33 | 36 |
| Mean maternofetal diffusion distance (μm) | 3.2 | 3.7 | 5.2 | 7.1 | 7.4 |
| Epithelial plates (percentage of villous surface) (%) | 40.4 | — | — | — | 14.7 |
| Mean mitochondrial diameter (syncytiotrophoblast) (μm) | 0.30 | 0.34 | 0.51 | 0.63 | 0.61 |

Data from Kaufmann (1985).

TABLE 28.10. Influence of total osmolarity of the fixative (2.2% phosphate-buffered glutaraldehyde) on the volumes of syncytiotrophoblast and fetal capillary lumina in the guinea pig placenta.

| Parameter | Osmolarity of the fixative | | | | |
|---|----------------------------|------|------|------|------|
| | 235 | 290 | 340 | 390 | 600 |
| Trophoblastic volume (%) | 39.5 | 39.3 | 33.3 | 32.7 | 24.6 |
| Fetal capillary volume (%) | 12.1 | 14.7 | 25.5 | 16.9 | 19.3 |
| Extracellular space (%) | <1.0 | <1.0 | <1.0 | 2.3 | 11.7 |
| Mean mitochondrial diameter (syncytiotrophoblast) (μm) | 0.68 | 0.56 | 0.30 | 0.26 | 0.25 |

Data from Kaufmann (1980) can be transferred to the human.

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Index

A

- Abdominal trauma, as transplacental hemorrhage cause, 552–557
- Ablatio placentae, 615
- ABO antigens
in choriocarcinoma, 851–852
in preeclampsia, 624
- ABO incompatibility, 519, 529
- Abortion
criminal, 762, 772, 774
definition of, 762
embryonic *versus* fetal, 762
frequency of, 763
habitual, 762
incomplete, 763
methods of
dilatation and curettage (D&C), 774, 776
effect on abortion specimens, 774, 776–777
missed, 762
as premature rupture of the membranes cause, 675
as selective fetal elimination of acardiac fetuses, 945–946
as fetus papyraceus cause, 924
in multiple pregnancies, 966
in trisomy, 957
septic, 669, 776–777, 779
spontaneous, 762–764
anatomic findings in, 764–768
bacterial vaginosis-related, 690
brucellosis-related, 682
causes of, 763–764, 784
Chlamydia infections-related, 690
chorionic villous sampling-related, 778–779
Coxsackie virus-related, 712
factor V Leiden-related, 594
herpes simplex virus-related, 708
listeriosis-related, 684
parvovirus B19-related, 536, 762–763
recurrent or habitual, 784–787
smallpox-related, 710, 711
smoking-related, 588
toxoplasmosis-related, 719–720
of twins, 919
Ureaplasma urealyticum-related, 688
villitis-related, 725
therapeutic (induced), 762, 772, 774
as fetomaternal hemorrhage cause, 554
in partial hydatidiform mole, 812–813
RhoGAM prophylaxis during, 526
threatened, 762
in twins, 967, 968
- Abortion specimens
anatomic examination of, 764–768
chromosome studies of, 767–777
- Abruptio placentae, 6, 480
alcohol abuse-related, 587
automobile accidents-related, 555
with bicornuate uterus, 616
chorioamnionitis-related, 657, 659
cocaine-related, 587
decidual spiral arterioles in, 480
definition of, 615
fetal effects of, 620
fetal survival in, 616
frequency of, 616
gender factors in, 619
hydatidiform mole and, 806
leiomyoma-related, 600
major histopathologic findings in, 480
neonate survival in, 619
“painless,” 615
preeclampsia-related, 55, 605, 616, 617–618, 620
recurrence of, 619
retroplacental hematoma associated with, 480, 615, 616
retroplacental tumors associated with, 462
smoking-related, 588, 589
snake bite-related, 586
systemic lupus erythematosus-related, 628
Tenney-Parker changes in, 622
as transplacental hemorrhage cause, 557
trauma-related, 552–553, 616–617
treatment of, 619
in twins, 619
unrecognized, 1010
- Abscess
subchorionic, 665
villous, 666
intervillous, 665
listeriosis-related, 684, 685
syphilis-related, 693
- Acardia, 340–341, 941–950, 951
anastomoses in, 940, 941, 943, 946, 949, 950
in animals, 947, 948
definition of, 941
edema in, 950
 α -fetoprotein in, 944
as fetus compressus, 924, 925
as fetus papyraceus, 925
hydrops fetalis in, 532
limb anomalies in, 942
malnutrition in, 946
omphalocele in, 941, 944
pathogenesis and etiology of, 946–950
single umbilical arteries in, 944
treatment of, 945–946
in triplets, 961
in twins, 340–341, 941–950, 951
anastomoses in, 941, 943, 946, 949, 950
calcification in, 943

- Acardia (*Continued*)
 congenital anomalies in, 946
 definition of, 941
 diamniotic, 355
 edema in, 942, 950
 α -fetoprotein in, 944
 as fetus compressus, 924, 925
 as fetus papyraceus, 925
 gender factors in, 942
 hydramnios in, 946
 hydrops fetalis in, 532
 hypoxia in, 946
 incidence of, 945
 karyotyping of, 948–950
 limb anomalies in, 942
 malnutrition in, 946
 omphalocele in, 941, 944
 pathogenesis and etiology of, 946–950
 selective fetal elimination in, 945, 946
 sex determination of, 946
 treatment of, 945–946
 umbilical cord entanglement in, 942, 943
 umbilical cord length in, 941
 unreported, 945
- Acetylcholinesterase, amniotic fluid content of, 923, 944
- Achordia, 396
- Acidosis
 maternal diabetes mellitus-related, 598
 metabolic, 669
- Acquired immunodeficiency syndrome (AIDS), 700, 715. *See also* Human immunodeficiency virus (HIV) infection
- Actin, 329
- Actinomyces*, 687
- Actinomycin D, 815, 817, 855
- Acute fatty liver of pregnancy, 586
- Acyclovir, 708
- ADAM complex, 363
- ADAM fusogenic proteins, 76–77
- Adenocarcinoma
 endometrial, 600
 sacrococcygeal teratoma-related, 954
- Adenoma, hepatocellular, 870
- Adenomatoid malformations,
 pulmonary, 533
- Adenovirus infections, 677–678
- Adrenal insufficiency, 940–941
- Adrenal tumors, heterotopic, 870–871
- Adrenocorticotrophic hormone (ACTH), 596
- Age
 gestational
 determination of, 497, 762
 of twins, 893
- maternal
 as choriocarcinoma risk factor, 852
 as hydatidiform mole risk factor, 801
 in quadruplet pregnancies, 960
 in quintuplet pregnancies, 960
 relationship to dizygotic twinning, 887
 relationship to spontaneous abortion, 764
 relationship to twinning rate, 892, 893
- Airbag deployment, as fetal injury and death cause, 552, 553
- Air embolism, 428
- Alastrim, 711
- Alcohol abuse, placental effects of, 586–587
- Alkylating agents, 589–590
- Allantoic blood vessels, 46
- Allantoic duct, umbilical cord remnants of, 386–391
- Allantois, 30
- Alloimmunization. *See also* Rh isoimmunization
 as neonatal thrombocytopenia cause, 593–594
- Altitude. *See* High altitude
- Amastogotes, 720–721
- Amatoxins, 586
- Amelia, in acardiac fetuses, 944
- American College of Obstetricians and Gynecologists, placental examination guidelines of, 1
- Amino acids, amniotic fluid content of, 330
- Aminopterin, 589
- Amniocentesis
 as abruptio placentae cause, 616
 aspiration of pus during, 662
 as chorioamniotic separation cause, 339
 as fetal hemorrhage cause, 409–410
 fetal puncture during, 410
 as placental injury cause, 523–524
 as Rh isoimmunization cause, 922
 as transplacental hemorrhage cause, 553
 as twin-twin transfusion syndrome treatment, 931, 937, 939
 as umbilical cord blood vessel injury cause, 421
- Amnion, 31, 40
 anatomy of, 321, 322, 326
 antibacterial properties of, 334
 chromosomal analysis of, 10
 clinical applications of, 334
 detached, 3, 5
 development of, 383
- of diamniotic/monochorionic twins, 881, 915, 916
 fluid of. *See* Amniotic fluid
 in hydatidiform mole, 807
 leukocyte permeation of, 661–663
 lipid content of, 328
 metaplasia of, 5, 331–333, 356
 placental, 325
 reflected, 325, 335
 research applications of, 335
 during the third trimester, 20, 22
 umbilical, 325
- Amniotic bands, 358–363
 as fetal amputation cause, 358, 359–360, 361, 363
- Amniotic cavity, development of, 325
- Amniotic epithelium, 327–331, 380–381
 anatomy of, 327
 apoptotic cell death in, 339
 cellular metaplasia of, 331–333
 chromosomal analysis of, 331
 cytologic and functional aspects of, 327–331
 development of, 325
 in gastroschisis, 354, 355
 meconium-related degeneration of, 347, 349, 350
 during the third trimester, 20, 22
- Amniotic fluid. *See also* Hydramnios; Oligohydramnios
 acetylcholinesterase in, 923
 antimicrobial peptides in, 661
 aspirated, 707
 bacteriostatic properties of, 673–674
 cells of, 331
 composition of, 330–331
 development of, 330
 effect on lung development, 913
 embolism of, 342–345
 glucose content of, 661
 herpes simplex virus in, 707
 human immunodeficiency virus in, 715
 meconium staining of. *See* Meconium
 oxygen tension in, 905
 pH of, 330
 production of, 325
 protein content of, 329
 pus in, 662, 663, 664
 secretion of, 329
 sources of, 329, 330
Toxoplasma in, 717
 volume of, 326
- Amniotic sac, 383
 in diamniotic/monochorionic twins, 916, 917
- Amniotic sac infection syndrome, 350, 660, 661, 668, 671, 1008. *See also* Chorioamnionitis
- Amniotic sheets, 358, 362

- Amnionitis, 663
 Amnion nodosum, 5, 342, 355–358, 364, 429
 with monosomy X, 771, 773
 in twins, 955
 in diamniotic/monochorionic twins, 915, 916
 Amniorrhea, 364
 Amniopatching, 669
 Amniotropism, 661
 Amorphous globosus, 948
 Amputations, fetal, 426, 430
 amnionic bands-related, 358, 359–360, 361, 363
 Anastomoses
 Hyrtl's, 5, 386–387, 404–405, 407
 in triplets, 960, 962
 in twins, 7–8, 883, 893–899, 901–902, 909–910, 912
 in acardiac twins, 940, 941, 943, 946, 949, 950
 in conjoined twins, 908
 in dizygotic twins, 958
 documentation of, 1005
 as exsanguination cause, 934
 in monoamniotic/monochorionic twins, 906–907, 912–913
 in twin-to-twin transfusion syndrome, 8, 928, 929, 935, 936, 939, 940, 958
 vitello-umbilical, 415
 Androgenesis, in hydatidiform mole, 802–803, 804
 Anemia
 aplastic, 529–530
 Diamond-Blackfan, 529
 fetal, 519, 524, 526, 529, 533
 hemolytic, 434
 hemorrhage-related, 561–563
 nucleated red blood cells in, 484
 transplacental hemorrhage-related, 563–565
 in twin-twin transfusion syndrome, 933–934, 935, 937, 939
 as hypoxia cause, 869
 maternal, 145, 508–509, 510, 595
 as chorangiosis cause, 478
 Langhans' cell in, 482
 neonatal, 458, 1009
 parvovirus B19-related, 535–540
 sickle cell, 527, 535, 592–593, 615, 699
 Anencephaly
 fetal tumors associated with, 435
 in twins, 946, 952, 955
 in conjoined twins, 952
 Aneuploidy, 780, 784
 in aborted fetuses, 767–768
 in hydatidiform mole, 802, 803, 805
 in twins, 946
 Aneurysms
 cirroid, 821, 825
 of the umbilical arteries, 422
 of the umbilical cord, 423–424
 Angelman's syndrome, 956
 Angiogenesis, fetoplacental, 146–154, 863
 abnormal, 502
 branching, 140, 148, 149, 153, 496–497, 499, 501, 509
 Tenney-Parker changes in, 479
 definition of, 147
 degree and type of, 499–500
 general aspects of, 147
 nonbranching, 140, 148, 149, 154, 157, 485, 496–497, 499, 501
 oxygen-controlled, 157–159
 of partial hydatidiform mole, 818–819
 as villous hypermaturity cause, 507
 Angiogenic growth factor, 157
 Angioma
 as hydrops fetalis cause, 531–532
 of the umbilical cord, 434–435
 Angiomyxoma, cystic, 434
 Angiopoietin-1, 153
 Angiotensin II, 386
 Anovulation, hypothyroidism-related, 596
 Antibacterial properties, of the amnion, 334
 Antibiotics, as candidiasis risk factor, 696
 Anticardiolipin antibodies, 630, 631, 633, 786
 Anti-CD14, 26
 Anti-CD68, 26
 Anticytokeratin, 24, 27, 29
 Anti-factor VIII-related antigen, 24, 26
 Antifibrin antibodies, 26, 27
 Anti-H-Y antibodies, 619
 Antinuclear antibodies, 626
 Anti-oncofetal fibronectin antibodies, 26, 27
 Antiphospholipid antibodies, 606, 630, 631
 Antiphospholipid syndrome, 594, 626
 Anti-proliferating-cell nuclear antigen (PCNA) antibodies, 29
 Anti- α -smooth muscle actin antibodies, 26, 28, 136
 Anti- γ -smooth muscle actin antibodies, 26, 28, 136
 Antithrombin III, 620
 Antivimentin antibodies, 24, 27
 Apgar score, 478, 614, 1001
 Aplasia cutis, 923, 927, 928
 Aponecrotic shedding, 620
 Apoptosis
 of the amniotic epithelium, 339
 cytotrophoblastic, 69, 70
 in intrauterine growth retardation, 620, 767
 in syncytial knots, 60, 61, 62, 64, 493
 trophoblastic, 73–76, 81, 767
 Apt test, 561
 Arachidonic acid, 345, 673
 Armadillos, monozygotic twinning in, 887–888, 889
 Arrhythmias, fetal, hydrops fetalis-related, 534–535
 ART. *See* Assisted reproductive technology
 Arteries. *See also* Pulmonary arteries; Umbilical arteries
 of the placental surface, 407–410
 villous, 483–484
 Arteriopathy, decidual
 in preeclampsia, 605–607, 609, 610–612
 in systemic lupus erythematosus, 626, 628, 629
 Arteriovenous crossings, 408
 Arteriovenous fistulas, 1005
 chorioangioma-related, 867
 teratoma as, 954
 Arteriovenous malformations, of the umbilical cord, 434–435
 Arteritis
 Takayasu's, 586
 umbilical, 680
 Asphyxia
 perinatal, 1001–1002
 prenatal, 1010–1011
 Asphyxial infiltrates, 477
 Aspiration, of meconium, 347, 349, 1007, 1008
 Aspiration pneumonia, 658
 Assisted reproductive technology (ART), 885
 blastocyst transfer, 892, 893
 diamniotic/monochorionic placentation in, 915
 monozygotic twinning in, 915
 in vitro fertilization, 892
 monozygotic twinning rate in, 888
 as preeclampsia risk factor, 610
 intracytoplasmic sperm injection (ICSI), 892
 monozygotic twin occurrence in, 879
 as multiple birth cause, 879, 892–893, 960
 techniques in, 892
 Atherosclerosis
 abruptio placentae-related, 480
 decidual, 605–607, 609, 611–612
 Atresia
 duodenal, 355, 356
 ileal, 927
 intestinal, 956
 Atrial natriuretic peptide, 96, 385–386
 Autoimmune disease, maternal, 585

- Automobile accidents, as transplacental hemorrhage cause, 555–556, 557, 562
- Autopsies, perinatal, 1002–1003
- Azidothymidine, 715
- B**
- Babesiosis, 722
- Bacteria, identification of, 10
- Bacterial infections. *See also specific types of bacterial infections*
as chorioamnionitis cause, 676–682
- Bacteroides* infections, 657, 663, 680, 690
- Ballantyne syndrome, 532–533
- Barr bodies, 334
in hydatidiform mole, 802
- Basal lamina. *See* Basement membrane
- Basal plate, 13–14, 15, 16, 17, 18, 19, 40
mature, 25
during third trimester, 20, 23, 24
- Basement membrane
amniotic, 328–329, 333, 334
calcium precipitates in, 483
capillary, 48
trophoblastic, 82, 482
staining of, 482
thickening of, 482
- “Battledore” placenta, 401
- Beckwith-Wiedemann syndrome, 541, 821, 956
chorangiosis associated with, 868, 869
mesenchymal dysplasia associated with, 873
- Bed rest, maternal, effect on twins’ survival, 969–970
- Bilirubin, 713
amniotic fluid content of, 330
in Hofbauer cells, 713
maternal, 586
in meconium-laden macrophages, 1007
- Birth weight, relationship to umbilical cord marginal insertion, 475
- Blastocyst, in twin-twin transfusion syndrome, 928–929
- Blastocyst implantation, 42–46
apposition stage and, 42
endometrium and, 42–44
implantation pole in, 42, 323–324
invasive, 43–44
noninvasive, 43
- Blastocyst transfer, 892, 893
diamniotic/monochorionic
placentation in, 915
monozygotic twinning in, 915
- Blastomeres, spontaneous separation of, 887–888
- Blastomycosis, 700
- Blebs, syncytial, 64–65
- Blister cells, 592
- Blood. *See also* Blood circulation:
Hemorrhage
fetal differentiated from maternal, 405
transplacental transfer of, 552
- Blood chimerism, 883, 898, 901
- Blood circulation
fetal, maternal cancer cells in, 600
fetomaternal, 163, 164
development of, 46–48
interrelations in, 37, 39
placental barrier in, 30, 35, 46–47
fetoplacental
blood flow impedance in, 145, 511
sinusoids in, 145
maternal, 160–163
development of, 45
fetal cells in, 781
through intervillous space, 16
placentone theory of, 160, 161, 162–163
in twins, 908
- Blood flow impedance, 145, 511
- Blood sampling, fetal, 911
- Blood transfusions, fetal, 410, 522–524
- Blood-type chimerism, 883, 898, 901, 957–959
- Blood vessels
abnormalities of, medicolegal aspects of, 1008–1009
allantoic blood, 46
basic structure of, 93–96
capillaries, 94, 95
development of, 46
high altitude-related increase in, 595–596
lumen of, 134
in maternal diabetes mellitus, 599–600
villous, 129, 132, 475, 484–485, 485
chorionic, 13
thrombosis of, 666, 668, 719, 868
vasculitis of, 668, 703, 704, 706
embryoblast-derived, 42
examination of, 6
during first trimester, 17
location within stromal channels, 127
of the placental (chorionic) surface, 407–410
arteriovenous crossings in, 408
disperse pattern of, 407, 408
magistral pattern of, 407–408
thrombosis of, 417–418
of the placental vascular tree, thrombosis of, 428–433
thrombosis in, 6
in twins, 7
umbilical arteries
absent or reverse end-diastolic blood flow in, 509–513
anastomosis between, 5
aneurysm of, 422
blood flow in, Doppler studies of, 622
calcification of, 428
in conjoined twins, 952–953
diameter of, 1020
Doppler studies of, 409, 622
extracellular matrix of, 384
Hyrtl’s anastomosis of, 386–387
necrosis of, 411–412, 425
single, 5, 7, 383, 403, 413–415, 426, 588, 589, 597–598, 781–782, 912, 915, 917, 919, 944, 945, 946, 966, 1005, 1008
thrombosis in, 404, 426–427, 522, 523, 668, 869, 1008–1009
of the umbilical cord
calcification of, 426, 427, 430
thrombosis of, 426–428
in trisomy 18, 781, 783
of the umbilical veins, 383
calcification of, 429
in chorioamnionitis, 660
compression of, 129
in conjoined twins, 953
diameter of, 1020
in funisitis, 666, 667
prostaglandin production in, 385
smoking-related injury to, 423
thickness of, 409
thrombosis of, 404, 405, 668
uteroplacental
arteries, 19, 20
trophoblast invasion of, 763–764
veins, 19, 20
“Blueberry muffin spots,” 938
- Blunt trauma, during pregnancy, 552, 556
- Borreliosis, 696
- Bosselations, 6, 13, 482
- Bouin’s solution, 484
- Brain
cerebral necrosis in, 910, 911
chorioamnionitis-related injury to, 669
cytomegalovirus infection of, 705
deportation of, 557
umbilical cord entanglement-related atrophy of, 905
- Breast cancer, 600
metastatic, 601, 602
- Breast milk, *Listeria monocytogenes* transmission in, 683
- Breech delivery, 970
- Breus’ mole, 341, 342, 567
with monosomy X, 771
in spontaneously-aborted fetuses, 765, 766
with triploidy, 771
Turner’s syndrome-related, 533

- Brucellosis, 682, 726
 Buds, syncytial, 61
 differentiated from syncytial sprouts, 622
 eclampsia-related, 620–621
 preeclampsia-related, 621–622
Burkholderia pseudomallei infections, 687
- C**
- Cachetin-tumor necrosis factor, 661
 Cadherin-11, 76
 Calcification
 in acardiac twins, 943
 along trophoblast basement membranes, 767
 of chorioangioma, 864
 fibrinoid, 565
 funisitis-related, 666
 maternal diabetes mellitus-related, 597
 on maternal surface of the placenta, 6
 of the placental blood vessels, 428, 430
 of postmature placenta, 475–476
 thrombotic
 in cytomegalovirus infections, 477
 Morquio syndrome-related, 580
 of the umbilical arteries, 428
 of the umbilical cord, 426, 534
 necrotizing funisitis-related, 694, 695
 of the umbilical cord blood vessels, 426, 427, 430
 of the umbilical veins, 429
 villous, 483
 I-cell disease-related, 580
 of villous trophoblastic basal lamina, 82
 Calcium, placental concentration of, 25
 Calcium precipitate, in basement membranes, 483
Campylobacter infections, 665, 680–681
 Cancer. *See also specific types of cancer*
 maternal, 600–604
 Cancer cells, transplacental passage of, 568, 600, 603–604
Candida. *See* Candidiasis
 Candidiasis, 666, 670, 696–699
 CA-1, 329
 CA-125, 321, 326, 608
 CAOS (chronic abruptio-oligohydramnios syndrome), 617
 Capillaries, 94, 95
 development of, 46
 high altitude-related increase in, 595–596
 lumen of, 134
 in maternal diabetes mellitus, 599–600
 villous, 484–485
 complete atrophy of, 484
 congestion of, 475, 485
 post-delivery collapse of, 484
 of terminal villi, 129, 132
 Capillary bed, fetal, examination of, 477–478
 Capillary net, paravascular, 141, 142, 143
Capnocytophaga infections, 663
 Cardiac arrest, maternal, 966
 Cardiomegaly
 chorioangioma-related, 867–868
 twin-twin transfusion syndrome-related, 935, 937–938
 Cardiothoracic index, in α -thalassemia, 529
 Cartilage, subamniotic, 340
 Caspase-8, 76
 Cats, as toxoplasmosis reservoirs, 717
 CA-2, 329
 Caudal regression syndrome, 878
 CD4 antigen, 92
 CD57⁺ cells, 662
 Cell columns, 17, 19, 24, 46
 Cell islands, 17, 19, 20, 23, 24, 46
 Cells, transplacental transfer of, 552, 568–569
 Central nervous system. *See also* Brain
 chorioamnionitis-related injury to, 669
 infarction of, 619
 in twins, 928
 hemorrhage from, 911
 in twin embolization syndrome, 907–908
 twin-twin transfusion syndrome-related defects of, 925–926, 940
 Cephalopagi, 912
 Cephalothoracopagi, 912, 953
 Ceramide lactoside, 661
c-erbB-2, 54–55
 Cerclage, 675
 in multiple pregnancies, 966
 Cerebral palsy, 397, 426, 427–428, 429
 chorioamnionitis-related, 1005
 cytomegalovirus infection-related, 701, 1006
 etiology of, 1003–1004
 as fetal demise cause, 925
 hypoxia-related, 1001, 1004
 meconium and, 1008
 medicolegal aspects of, 1001–1002, 1003–1004
 multiple births-related, 1004
 occluded umbilical arteries associated with, 1008–1009
 prenatal hemorrhage-related, 562
 in twins, medicolegal aspects of, 911
 umbilical cord hematoma associated with, 1009
 as vanishing twin cause, 925
 Cervical cancer, 322, 600, 840
 Cervix
 choriocarcinoma metastatic to, 840
 incompetent, 675, 960, 966
 Cesarean section
 as transplacental hemorrhage cause, 554
 in twin births, 1005
 in twin-twin transfusion syndrome, 939
 Chagas' disease, 538, 720–722
 Chang and Eng ("Siamese twins"), 908
 Chatetzky-Neumann cells, 87
 Chemotherapy
 for hydatidiform mole, 804
 during pregnancy, 589–590
 Chickenpox (varicella), 709–710
 Chimerism
 blood-type, 883, 898, 901, 957–959
 dispermic, 957
 micro, 585
 whole-body, 950, 957, 959–960
 Chirality, in umbilical cord. *See* Umbilical cord, spiraling (chiraling) in
Chlamydia infections, 666, 674, 687, 689–690, 691
 Cholestasis, 586
 pruritus gravidarum-related, 590
 Cholesterol ester storage disease, 581
 Chorangioma
 macroscopic appearance of, 865–879
 relationship to hydramnios, 865–866
 as transplacental hemorrhage cause, 557, 567
 Chorangiomas, 869–870
 definition of, 871
 Chorioadenoma destruens, 837, 842–843
 Chorioamnionitis, 657–687
 alcohol abuse-related, 587
 candidal, 697, 699
 causes of, 657, 660, 661
 bacterial infections, 657, 660, 663, 665, 666, 669–670, 676–682, 684, 686
 gonorrhoea, 676
 Mycoplasma infections, 687–689
 spirochetal diseases, 696
 syphilis, 693
 cerebral palsy associated with, 1005
 diagnosis of, 660, 671–672
 herpes simplex virus infection-related, 708
 macroscopic placental appearance in, 657–660
 meconium and, 350–351
 microscopic placental appearance in, 660–674
 necrotizing funisitis associated with, 694, 695

- Chorioamnionitis (*Continued*)
 in postmature placentas, 476
 preeclampsia-related, 605
 as premature rupture of the membranes cause, 661, 668, 669, 670–671, 674–675
 as preterm labor and delivery cause, 668–669, 969
 prevalence of, 668–669
 prostaglandins in, 328
 subacute, 669
 in twins, 658, 660, 663, 911, 1005
- Chorioangiocarcinoma, 846, 870
- Chorioangioma, 7, 863–870
 alcohol abuse-related, 587
 cardiomegaly associated with, 867–868
 giant, 869
 hydrops fetalis associated with, 867
 maternal disease-related, 532
 multiple, 896–870
 placenta previa associated with, 867, 869
 recurrent, 896–870
 relationship to choriocarcinoma, 870
 sickle cell anemia-related, 592
- Chorioangiosis, 129, 473, 474, 871–873
 definition of, 871
 high altitude-related, 478, 1010
 maternal anemia-related, 478
 maternal diabetes mellitus-related, 597, 598, 599
 medicolegal aspects of, 1010
 smoking-related, 588
 Tenney-Parker changes in, 479
 villitis of unknown etiology associated with, 1010
- Choriocarcinoma, 837–846
 in animals, 855–856
 antigenic studies of, 851–852
 in cell lines, 855–856
 coincident with pregnancy, 843–846
 definition of, 837
 differentiated from hydatidiform mole, 804, 805, 813–814
 ectopic, 853–854
 endocrine aspects of, 852–853
 epidemiology of, 852
 genetics of, 855–856
 hydatidiform mole and, 798, 800, 803, 804, 807, 808, 810, 811, 812, 813–814, 815, 817, 837, 838, 839, 840, 842, 843
 immune response in, 852
 in situ, 480, 843–845
 in males, 854
 metastatic, 837, 838, 840–842, 845
 relationship to chorioangioma, 870
 simultaneous, in mother and fetus, 845–846
 as transplacental hemorrhage cause, 557
 treatment of, 854–855
- Chorion
 connective tissue of, 335, 336
 irregular fusion in twins, 918–919
 lipid content of, 328
 placental, 335
 reflected, 335
 in syphilis, 693
 vascularization of, 31
- Chorionepitheliosis, 844, 845, 849, 850, 853
- Chorion frondosum, 324
- Chorionic artery, chorioangioma-related thrombosis of, 868
- Chorionic blood vessels, 13
 thrombosis of, 666, 668
 chorioangioma-related, 868
 cytomegalovirus infection-related, 719
 toxoplasmosis-related, 719
 vasculitis of, 668, 703, 704, 706
- Chorionic plate, 13, 20, 22, 40, 333
 development of, 43, 44, 47
 histology of, 16–17
 primary, 45
 during third trimester, 16, 18, 20–21, 22
 in twins, 899
- Chorionic sac, hydatidiform mole and, 808
- Chorionic veins, thickness of, 409
- Chorionic villous sampling (CVS), 778–781
 as amniotic band syndrome cause, 363
 as fetomaternal hemorrhage cause, 554, 557
 mosaicism detection with, 331
 as Rh isoimmunization risk factor, 526
 as septic abortion cause, 779
 as spontaneous abortion cause, 778–779
 for storage disease diagnosis, 577, 578
- Chorion laeve, 38, 40
 anatomy of, 321, 335, 336
 development of, 324
 rupture of, 364–366
- Chorion nodosum, 357
- Chromosomal analysis, 10
 of aborted fetuses, 767–777
 of conjoined twins, 951
 of hydatidiform mole, 798, 800, 802–806
 of vanished twins, 919
- Chromosomal anomalies
 as abortion cause, 763, 764, 765, 767–768, 776
 as habitual abortion cause, 785–786
 human chorionic gonadotropin as marker for, 782, 784
- Chronic abruption-oligohydramnios syndrome (CAOS), 617
- Circulating lupus anticoagulant syndrome (CLAS), 630–634
- CLAS (circulating lupus anticoagulant syndrome), 630–634
- Cleft palate, in conjoined twins, 952, 953
- Clitoris, 946
- Clomiphene, 800
- Clostridium* infections, 657, 679, 680
- Coagulopathies, 431
 preeclampsia-related, 620
 as thrombosis cause, 1008
- Cocaine abuse, 587–588
 as abruptio placentae cause, 616
- Coccidioidomycosis, 699–700
- Collagen, amniotic, 339
- Collagenases, 339
- Collagen defects, as amniotic band syndrome cause, 363
- Collagen I, 333, 334, 335, 336, 339
- Collagen II, 339
- Collagen III, 333, 334, 335, 339
- Collagen IV, 87, 334, 335
- Collagen V, 333, 335, 339, 662
- Collagen VI, 339
- Collagen VII, 339
- College of American Pathologists, placental examination guidelines of, 1
- Congenital anomalies. *See also specific anomalies*
 maternal diabetes mellitus-related, 596
 in multiple pregnancies, 878–879
 single umbilical arteries-associated, 414–415, 1008
 in twins, 913, 955–956
 acardia-related, 946, 950
 in conjoined twins, 952, 953
 in co-twins of fetus papyraceus, 927
- Congenital heart disease
 in conjoined twins, 952
 hydrops fetalis associated with, 534
- Congenital varicella syndrome, 710
- Congestive heart failure, 937
 acardia-related, 945
- Connective tissue
 chorionic, 335, 336
 villous trees and, 82–87
- Connexin 43, 76
- Copper, placental deposition of, 590
- Cordocentesis, adverse effects of, 522–524, 564
 fetal hemorrhage, 422, 564
 umbilical cord injury, 410
- Cor pulmonale, 842
- Corticotropin-releasing hormone (CRH), 57, 71, 328
- Cortisone, 910

- Corynebacterium kutscheri* infections, 679–680
- Cotyledons
 entrance of fetal vessels into, 6
 examination of, 6–7
 fetal, 14, 15
 “holes” in, 7
 hypoxia-induced vasoconstriction in, 622
 maternal, 14
 placentones, 408
 in twins, 897
 in twin-to-twin twin transfusion syndrome, 928, 929–930, 936
- Coxiella burnetii*, 724
- Coxsackie virus, 657, 712, 728, 1006
- C-reactive protein, 671
- Creatinine, amniotic fluid content of, 330
- Crown-rump length, 762, 1020
- Cryptococcosis, 700
- C-type particles, 716
- Curettage, blunt, 480
- Cushing’s disease, 596
- “Cushions,” vascular, 477, 1008, 1012
- CVS. *See* Chorionic villous sampling (CVS)
- Cyclophosphamide, 589
- Cyclosporine, 586
- Cystic angiomyxoma, 434
- Cystic fibrosis, 346, 590
- Cystic hygroma, 533
- Cystinosis, fetal, 591
- Cystinuria, 591
- Cysts
 amniotic, 340
 amniotic epithelial inclusion, 411
 cell islands and, 24
 epidermoid, 340, 341
 ovarian lutein, 520, 528–529, 530, 806
 of the placental membrane, 340–341
 subchorionic, 321, 337
Toxoplasma, 717, 718, 719, 720
 of the umbilical cord, 383, 388
 of vitelline origin, 389–390
 within Wharton’s jelly, 411
 X-cell, 337
- Cystylaminopeptidase, 971
- Cytogenetic studies
 of amniotic epithelium, 331
 chorionic villous sampling-based, 779–781
 of fetus papyraceus, 925
 of recurrent abortions, 785–786
- Cytokines, 1006
- Cytomegalovirus infections, 430, 486, 700–706, 719, 1006
 avascular villi in, 478
 “blueberry muffin spots” of, 938
 as stem blood vessel thrombosis cause, 483
 as thrombi calcification cause, 477
 in twins, 701
 of the umbilical cord, 1008
 as villitis cause, 701, 702–705, 706
 as villous calcification cause, 483
 as villous edema cause, 487
- Cytotrophoblast
 definition of, 44
 development of, 43, 44
 extravillous. *See* Trophoblast, extravillous
 villous, 17, 65. *See also* Langhans’ cells
- D**
- “Dead-fetus syndrome,” 910
- Decapitation, fetal, 359
- Decidua, 337–338
 arteriopathy of
 in preeclampsia, 605–607, 609, 610–612
 in systemic lupus erythematosus, 626, 628, 629
- Decidua basalis, 338
 in abortion specimens, 777
 development of, 324
 relationship to decidua capsularis, 322, 323
 in syphilis, 693
- Decidua capsularis
 anatomy of, 321, 322, 323
 in chorioamnionitis, 657
 degeneration of, 337, 340
 development of, 324
 examination of, medicolegal aspects of, 1003
 intrauterine devices and, 3, 4
 in preeclampsia, 607, 610
 relationship to decidua basalis, 323
 relationship to decidua parietalis (vera), 322, 323
- Decidual cells, 45
 definition of, 20
 shape of, 19, 20
- Decidua parietalis (vera), 322, 337, 338
 atherosclerosis of, 611
- Deciduitis, 458
 candidal, 699
 chorioamnionitis-related, 657, 659, 669, 670
 herpes simplex virus-related, 707–708
 as preterm labor risk factor, 673
 toxoplasmosis-related, 718
- Deciduoma, 837
- Decorin, 86–87
- Delivery
 in maternal diabetes mellitus, 597
 premature
 chorangioma-related, 863
 chorioamnionitis-related, 668–669
 fundal height as predictor of, 969
 incompetent cervix-related, 675
 prediction of, 674
 twin-twin transfusion syndrome-related, 939, 1005
 villi maturation in, 506–507
 Rh isoimmunization prophylaxis during, 525
 transplacental hemorrhage during, 554
- Dengue virus, 716
- Dermatitis, papular, 590–591
- Dermatomyositis, 585
- Dermoids, of the umbilical cord, 435
- Desmin, 136
- Desmopressin, 596
- Desmosomes, 337, 839
- Diabetes insipidus, 596
- Diabetes mellitus, maternal, 128, 596–600. *See also* Eclampsia; Preeclampsia
 edematous villi associated with, 128, 597
 gestational, 596
 hyperthyroidism-associated, 596
 as indication for placental examination, 2
 intravillous fibrinoid associated with, 483
 Langhans’ cells in, 482
 as placental surface vessel thrombosis cause, 1008
 uterine blood flow in, 622
 villi in, 515–516
- Diandry, 771
- DIC. *See* Disseminated intravascular coagulation (DIC)
- Digoxin, 939
- Digyny, 771
- Dilatation and curettage (D&C), 774, 776
- Dionne quintuplets, 963 965
- Diphenylhydantoin, 590
- Diplococcus pneumoniae*
 (*Streptococcus pneumoniae*)
 infections, 679
- Diploidy
 differentiated from triploidy, 765
 in hydatidiform mole, 803, 804, 805
 in partial hydatidiform mole, 819, 820
- Disomy, uniparental, 780
- Disseminated intravascular coagulation, 345, 426, 429, 434, 620, 665, 690, 774, 776, 812, 879
 as brain defect cause, 911
 maternal
 abruptio placentae-related, 619
 “dead-fetus syndrome” and, 910
 in twins, 907, 911–912
- Diverticulum, Meckel’s, 389

- Doppler studies
of fetal blood flow, 432–433
of monochorionic/monoamniotic twins, 881
of twin placental blood flow, 912
of twin-twin transfusion syndrome, 929
of umbilical arterial blood flow, 409, 622
of umbilical cord entanglement, 1009
- Down's syndrome. *See* Trisomy 21
- Drugs. *See also names of specific drugs*
placental effects of, 589–590
- Duodenum, atresia of, 355, 356
- Dysplasia, mesenchymal, 821
Beckwith-Wiedemann syndrome-related, 873
- Dystocia
acardia-related, 945
fetus papyraceus-related, 927
in twins, 968
- DZ. *See* Twins, dizygotic
- E**
- Ear, pus in, 663
- Ebstein's anomaly, 534
- E-cadherin, 76
- Echinococcus granulosa*, 724
- ECHO (enterocytopathologic human orphan) virus, 712, 728
- Eclampsia, 604, 620
as abruptio placentae cause, 617
granulomatous reactions in, 610
hydatidiform mole associated with, 812
- Ectopia cordis, 415
- Ectopic hydatidiform mole, 817
- Edema
in acardiac twins, 942, 950
endothelial, 484
hydrops fetalis-related, 526
maternal diabetes mellitus-related, 597
preeclampsia-related, 623
pregnancy-induced hypertension-related, 604
pulmonary maternal, 811
of the umbilical cord, 411–412
in chorioangioma, 867, 868
maternal diabetes mellitus-related, 598
- villous, 486–487
in chorioangioma, 867
hypoxia and, 1013
maternal diabetes mellitus-related, 128, 597
medicolegal aspects of, 1013
molar, 818, 819
- sacrococcygeal teratoma-related, 954
- EGF. *See* Epidermal growth factor (EGF)
- Ehlers-Danlos syndrome, 363, 585
- Ehrlichiosis, 722
- Eikenella corrodens* infections, 669–670
- Embolicism
air, 428
of amniotic fluid, 342–345
pulmonary, 621, 774, 776
in twins, 910
- Embryo, in hydatidiform mole, 807–808
- Embryoblast, 42
- Embryo reduction. *See also* Fetal reduction
in multiple pregnancies, 967
- Encephalocele, 924
in acardiac twins, 946
in triplets, 956
- Encephalomalacia, periventricular, 932
- “Endangitis obliterans,” 714
- Enderteritis obliterans, 431–432, 483–484
maternal diabetes mellitus-related, 599
- Endocervix, mucus in, 671–672
- Endocrine disorders, maternal, 596–600
- Endometrial glands, 19, 20
cytomegalovirus in, 701
- Endometritis, syncytial, 811–812, 837, 849
- Endometrium
implantation and, 42–44
stroma of, 45
- Endothelial tubes, 148–152
- Endothelin, 409
- Endothelin-1, 96, 329
- Endotheliosis, glomerular capillary, 605
- Endothelium, insulin-binding receptors on, 598
- Endotoxins, 671, 680
- Endovasculitis, hemorrhagic, 432, 433, 477, 483–484, 579, 728
preeclampsia-related, 607
in twins, 1006
- Enterobius vermicularis*, 724
- Enterocytopathologic human orphan (ECHO) virus, 712, 728
- Enteroviruses, 712
- Enzymes. *See also names of specific enzymes*
amniotic fluid content of, 331
- Eosinophils, in chorioamnionitis, 661
- Epidermal growth factor (EGF), 54–55, 81, 158, 159, 329
- Epidermoid cysts, 340, 341
- Epidermolysis bullosa, 354–355, 356, 487
- Epignathus, 954
- Epstein-Barr virus, 710
- ERV-3 protein, 77
- Erythema infectiosum, 536–537
- Erythema migrans, 696
- Erythroblastosis, 345, 480
persisting villous immaturity in, 504
- Erythroblastosis fetalis, 519–529
intravillous fibrinoid associated with, 483
placental pathology in, 520–529
- Erythrocytes, fetal
life span of, 560
malaria-related sequestration of, 722
nucleated. *See* Nucleated red blood cells
- Erythropoiesis, twin-twin transfusion syndrome-related, 938
- Erythropoietin, 57, 484, 519, 588, 1011
in twins, 911
- Escherichia coli* infections, 3, 663, 665–666, 670, 675, 676–677, 679
- Esterase, 671
- Estradiol, 971
- Estrogens, 625
- Ethnic groups
hydatidiform mole incidence in, 800–801
 α -thalassemia in, 527
twinning in, 885–886, 887
dizygotic twinning, 891, 892, 893
zygosity of multiple births among, 960
- Evans syndrome, 593
- Examination, of the placenta, 1–12
indications for, 1
instruments for, 3
macroscopic, 1–12
medicolegal implications of, 100–1015
in multiple births, 7–8
photography use in, 2
protocol for, 2–7
special procedures in, 10
tissue fixation techniques in, 2, 8–10
- Exencephaly, 361
- Expert testimony, 1002
- Exsanguination
in acardiac twins, 942
chorioangioma-related, 869
fetal, 553–554, 555, 556, 561, 563–564
in twins, 934
- Extracellular matrix molecules, 87
- F**
- Fabry's disease, 578, 580
- Factor VII deficiency, 594
- Factor V Leiden, 426, 427, 594–595
- Fallopian tubes
choriocarcinoma in, 853–854
hydatidiform mole in, 817
- Fathers, of twins, 893
- Fetal alcohol syndrome, 586–587

- Fetal demise
 abruptio placentae-related, 616, 619
 cerebral palsy-related, 925
 chorioangioma-related, 869
 in co-twins of fetus papyraceus, 927
 maternal hypothyroidism-related, 596
 medicolegal aspects of, 1002–1003
 in multiple pregnancies, 966
 smallpox-related, 710
 transplacental hemorrhage-related, 561–562, 563, 564
 in twins, 927–928
 cerebral consequences of, 908–909
 in monozygotic twins, 911
 twin-twin transfusion syndrome-related, 930, 932, 939
 as vanishing twin phenomenon, 919–923
 umbilical cord knotting-related, 416
 umbilical cord spiraling-related, 1009
- Fetal heart rate monitoring, 399
- Fetal reduction
 of acardiac fetuses, 945–946
 as fetus papyraceus cause, 924
 in multiple pregnancies, 966
 in trisomy, 957
- α -Fetoprotein, 342
 in acardiac twins, 944
 in choriocarcinoma, 845
 in chorionic villous sampling, 526
 in molar vesicles, 806
 in partial hydatidiform mole, 820
 in renal anomalies, 820
 in twin pregnancies, 971
 in umbilical angioma, 434
 in vanishing twin phenomenon, 923
- Fetoscopic laser occlusion of chorioangiopagous vessels (FLOC), 940
- Fetus
 amputations in, 358, 359–360, 361, 363, 426, 430
 blood transfusions in, 410, 522–524
 in molar vesicles, 806
 mummified, 927
 overweight, 598, 599
 Rh isoimmunization management in, 522–524
 sex determination of, 764
 traumatic injury to, 552
- Fetus compressus, 923, 924, 927
 acardiac twins as, 924, 925
- Fetus papyraceus, 908
 acardiac, 925
 co-twins of, 927
 cytogenetic analysis of, 925
 differentiated from vernix caseosa, 343
 in septuplet pregnancies, 966
 in triplets, 956
 in twins, 898, 908, 914, 919, 923–928
 in twin-twin transfusion syndrome, 930, 932, 940
- Fever, maternal, 669, 671
- FGF. *See* Fibroblast growth factor (FGF)
- Fibrin
 in abruptio placentae, 619
 in chorioangioma, 7
Gitterinfarcts, 7, 479, 482–483, 585
 perivillous, 479
 subchorionic, 341, 565, 567
 in maternal cardiac disease, 567
- Fibrinoid, 20, 22, 23, 479
 calcification of, 565
 of cell islands, 21, 23
 definition of, 21, 96
 fibrin-type, 21, 24, 27, 97
 intravillous, 96–97, 98–99, 483
 on Langhans' plate, 21, 22
 in maternal floor infarction, 479, 1009–1010
 matrix-type, 21, 24, 27, 97
 Nitabuch's, 21, 23, 43
 perivillous, 96–98, 482–483
 in preeclampsia, 609
 Rohr's, 21, 23, 24, 43
 in scleroderma, 584
 septal, 21, 23
 smoking-related, 588
 subchorionic, 482
 as trophoblastic cover or replacement, 21, 23
 villous, 96–99, 479
- Fibrinopeptide, 620
- Fibroangiomyxoma, 863
- Fibroblast growth factor (FGF), 148, 157
- Fibroblasts, villous, 83–84
- Fibroelastosis, endocardial, 911
 as hydrops fetalis cause, 488
- Fibroma, 863
- Fibromuscular sclerosis, 484
- Fibronectin, 82, 336
 in preeclampsia, 623
 smoking-related inhibition of, 339
- Fibrosis
 endocardial, 944
 stromal, 87, 485–486
 villous, 140
 stromal, 153, 158
- Fifth disease, 536–537
- Fistulas, arteriovenous, 1005
 chorioangioma-related, 867
 teratoma as, 954
 of the umbilical cord, 434–435
- Fixation, of the placenta, 8–10. *See also* Tissue fixation
 for villous tissue evaluation, 473
- Fixatives, osmolarity of, 1024
- Flippases, 76
- FLOC (fetoscopic laser occlusion of chorioangiopagous vessels), 940
- Floppases, 76
- Flow cytometry
 for diploidy/triploidy differentiation, 765
 of hydatidiform mole, 804–805, 806, 823
- Fluorescent in situ hybridization (FISH), 568–569
- Foam cells, 578, 579
- Folate/folic acid deficiency, 595, 618
- Follicle-stimulating hormone (FSH), 885–886, 887
- Food, *Listeria monocytogenes* transmission in, 683–684
- Fractures, fetal, 554–555, 557
- Francisella tularensis* infections, 682
- Freemartins, 947, 958
- Fructokinase deficiency, 534
- Fructose intolerance, 600
- Fundal height, as premature delivery predictor, 969
- Fungal infections, 696–700
 candidiasis, 666, 670, 696–699
- Funiculopagus, 946
- Funisitis, 660–661, 661, 662, 663, 669
 bacterial infection-related, 679–680
 candidal, 697
 cerebral palsy associated with, 1005
 exudate in, 666, 667
 herpes simplex virus-related, 707
 maternal diabetes mellitus-related, 598
 necrotizing, 666, 669, 694–695
 subacute, 694
 preterm rupture of the membranes and, 657, 660
- Fusobacterium* infections, 663, 680, 681
- Fusogenic proteins, 76–77
- G**
- Galactosialidosis, 578
- α -Galactosidase deficiency, 580
- β -Galactosidase deficiency, 580
- Gangliosidoses, 578, 580, 581
- Gangrene, clostridial infections-related, 679
- Gardnerella vaginalis* infections, 681–682, 690
- Gastroschisis, 354, 355, 401, 956
 amnionic epithelium in, 354, 355
- Gaucher's disease, 540, 577, 578, 591, 781
- Gender factors
 in abruptio placentae, 619
 in acardiac twinning, 942
 in sacrococcygeal teratoma, 953–954
 in twin-twin transfusion syndrome, 936, 940

- German measles (rubella), 713–714
 “blueberry muffin spots” of, 938
- Gestational sac, small, 763
- Gestational trophoblastic disease (GTD), 797
 classification of, 801–802
 World Health Organization classification of, 837, 838
- Gestational trophoblastic neoplasia (GTN), 797
- Giant cells
 cytotrophoblastic, in villi, 771, 773
 multinuclear, 45
- Gitterinfarcts*, 7, 479, 482–483, 585
- Glossary, 1016–1018
- Glucose
 in amniotic fluid, 330, 661
 placental passage of, 598
- Glucose-phosphate-isomerase deficiency, 540
- β -Glucuronidase deficiency, 578
- Glycogen
 amniotic epithelial content of, 333
 placental deposition of, 598–599
- Glycogenesis IV, 540
- Glycogen storage disease type V, 581
- Glycohemoglobin, 599
- Glycosphingolipidosis, 578
- Gonadotropin-releasing hormone, 71
- Gonadotropins, 885, 886, 887, 963
- Gonorrhea, 662, 676
- Gordon’s syndrome, 590
- Graft-*versus*-host disease, 585, 958–598
- Granulomas
 candidal, 697
 placental, 591
 syphilitic, 693
 tuberculous, 683
- Granulomatosis, 684
- Granulomatous reactions, in eclampsia, 610
- Graves’ disease, 541, 596
- Griseofulvin, 952
- Growth rate, fetal, 38
- Gummas, 693
- Gunshot injuries, as fetal injury and death cause, 554–555
- H**
- Haemozoin, 722
- Hamartosis, 868
- Handedness, 940–941
- Hand-foot-mouth disease, 712
- hCG. *See* Human chorionic gonadotropin (hCG)
- Heart block, hydrops fetalis-related, 535
- Heart disease
 congenital
 in conjoined twins, 952
 hydrops fetalis associated with, 534
 maternal, 590
- Heart failure, fetal, 527
 congestive, 937
 acardia-related, 945
 twin-to-twin transfusion syndrome-related, 939
- Heart malformation. *See also* Acardia; Cardiomegaly
 hemiacardia, 941, 944
 pseudoacardia, 941
- Heart rate, fetal
 in cerebral palsy, 1004
 monitoring of, 399
- Hellin’s rule, 960
- HELLP syndrome, 513–515
- Hemangioendothelioblastoma, 865
- Hemangioendotheliomas, 868
- Hemangioma
 neonatal
 chorioangioma associated with, 868
 of the umbilical cord, 435
 of the uterus, 603
- Hematocrit, fetal
 in hemorrhage, 1009
 in twins, 879
 in twin-to-twin transfusion syndrome, 932
- Hematologic disorders, maternal, 592–596
- Hematoma
 preplacental, 341, 342
 retroplacental, 480, 555, 657, 659, 1010
 subchorionic, 341–342, 594
 of the umbilical cord, 410, 420, 421–423
 cerebral palsy-related, 1009
- Hematoma mole, 766
- Hematopoietic stem cells, 46, 152
- Hemiacardia, 941, 944
- Hemiacardius, 941
- Hemoglobin, fetal
 cord blood analysis of, 527
 in erythroblastosis fetalis, 519–520
 glycosylated, 599
 in placental infarcts, 479–480
 in twins, 1005
 in twin-to-twin transfusion syndrome, 932
- Hemoglobin-Bart’s disease, 527
- Hemoglobinopathies, 527
- Hemolytic disease of the newborn. *See* Erythroblastosis fetalis
- Hemorrhage, 554–555
 from the central nervous system, 911
 of the chorionic surface vessels, 409–410
- fetal hematocrit in, 1009
- hydrops fetalis-related, 529–530
- idiopathic thrombocytopenia-related, 593
- intracranial, 932
- Kline’s, 565
- marginal, in chorioamnionitis, 657, 658
- nucleated red blood cells in, 558, 559–561
- retromembranous, 922
- retroplacental, 567, 615, 633
- subamniotic, 341
- transplacental, 552
 diagnosis of, 562
 evaluation of, 558–561
 fetal consequences of, 563–567
 as fetal demise cause, 561–562, 563, 564
 fetal movement-related, 565
 non-traumatic, 557
 nucleated red blood cells in, 484
 significant, 561–562
 spontaneous, 556–557, 565
 trauma-related, 552–557
 twin-to-twin transfusion syndrome-related, 908–909
 of the umbilical cord, 420, 421–423
 postpartum, 415–416
 umbilical cord clamping-related, 1009
 umbilical cord insertional anomaly-related, 404, 405
 vaginal, 919
- Hemosiderin, 1007
 in chorioangioma, 864
 differentiated from meconium, 346, 348, 351, 352, 353, 354
 in erythroblastosis fetalis, 520–521
 as placental discoloration cause, 3, 5
- Hemozoin, 722
- Heparan sulfate, 329
- Heparin, 590
- Hepatitis, 712–713, 1006
- Hepatocellular adenoma, 870
- Hepatosplenomegaly, 520
- Hermaphroditism, 959–960
- Heroin abuse, 588
- Herpes simplex virus infections, 706–709, 1006
- Heterochromia, 959
- Heterokaryotypy, in monozygotic twins, 956–957
- Heteropagus, 951
- High altitude
 chorangiosis at, 1010
 as chorangiosis cause, 478
 as chorioangioma cause, 863
 effect on intervillous space, 158
 placental effects of, 509, 595–596
 as syncytial knotting cause, 480, 482
 terminal villous capillarization in, 482

- Hoboken valves (nodes), 387
- Hodgkin's disease (lymphoma), 589–590, 602–603
- Hofbauer cells, 17, 87–93, 486
 bilirubin in, 713
 in Chagas' disease, 721
 in erythroblastosis fetalis, 520, 522
 granulated, 88
 in hepatitis, 713
 in human immunodeficiency virus infection, 715
 in immature intermediate villi, 127
 immunologic aspects of, 91–93
 in monosomy X, 771, 773
 morphology of, 87–90
 in mucopolipidoses, 577
 occurrence and distribution of, 90
 origin of, 90–91
 in Rh isoimmunization, 478
 in sacrococcygeal teratoma, 954
 in spontaneous abortion specimens, 784
 vacuolated, 88
- Holoacardia amorphi, 945
- Hookworm, 724
- Hormones. *See also specific hormones*
 amniotic fluid content of, 330
 effect on twinning rate, 885–886
 effect on villous development, 159–160
 syncytiotrophoblastic synthesis of, 56–57
- Human chorionic gonadotropin (hCG), 57, 72, 328, 329, 520, 763
 in chorioangioma, 869
 in choriocarcinoma, 852–853, 855
 as chromosomal abnormality marker, 782, 784
 in Hofbauer cells, 90
 in hydatidiform mole, 477, 806, 810, 811, 818
 in hyperplacentosis, 591
 in maternal diabetes mellitus, 599
 in partial hydatidiform mole, 820
 in placental site trophoblastic tumors, 849
 source of, 70–71
 in twin pregnancies, 971
- Human immunodeficiency virus (HIV), 1006
- Human immunodeficiency virus (HIV) infection, 92, 484, 715–716, 722
- Human leukocyte antigens (HLA)
 choriocarcinoma-related, 851–852
 in hydatidiform mole, 810
 in neonatal thrombocytopenia, 593
 in preeclampsia, 624
 in twins, 893
- Human placental lactogen (hPL)
 in placental site trophoblastic tumors, 849
 in twin pregnancies, 971
- Human umbilical vein-derived endothelial cells (HUVEDCs), 384
- Hurler's syndrome (mucopolysaccharidosis I), 578, 580, 781
- Hyaline membrane disease, 671, 678, 1003
- Hyaluronan, 87
- Hydatid disease, 724
- Hydatidiform mole, 797–836
 androgenesis-related, 802–803, 804
 aneuploidy in, 802, 803, 805
 antigen markers for, 810
 Barr bodies in, 802
 benign metastasizing, 812, 813
 chemotherapy for, 804
 choriocarcinoma associated with, 798, 800, 803, 804, 807, 808, 810, 811, 812, 813–814, 815, 817, 837, 839, 840, 842, 843
 chromosomal studies of, 798, 800, 802–806
 classification of, 801
 with coexisting fetus, 821–823
 complete, 797
 differentiated from partial hydatidiform mole, 804, 805, 807–808
 definition of, 797, 806
 degeneration of, 765, 766
 deportation of, 812–813
 diagnosis of, 805
 differential diagnosis of, 807–808
 differentiated from choriocarcinoma, 804, 805, 813–814
 diploidy-related, 803, 804, 805
 ectopic, 817
 ethnic distribution of, 800–801
 flow cytometry of, 804–805, 806, 823
 genetics of, 798, 800, 802–806
 human chorionic gonadotropin in, 477, 806, 810, 811, 818
 implantation in, 811, 812
 incidence of, 800–801
 in situ, 806
 intervillous thrombi associated with, 797
 invasive, 808–809, 813–817
 differentiated from choriocarcinoma, 813–814
 treatment of, 814, 815, 817
 karyotype analysis of, 802, 803, 804, 805, 806, 808
 as maternal Rh isoimmunization cause, 526
 morphology of, 806–812
 partial, 765, 817–825
 choriocarcinoma associated with, 797, 842, 845
 diagnosis of, 805
 differential diagnosis of, 807–808, 820–821
 differentiated from complete hydatidiform mole, 804, 805, 807–808
 ectopic, 817
 edematous villi in, 487
 genetics of, 818–820
 human chorionic gonadotropin in, 477
 mesenchymal dysplasia of, 821
 morphology of, 813, 818
 natural history of, 820
 prenatal diagnosis of, 810
 triploidy-related, 770, 771, 797
 trisomy 3-related, 805–806
 with twin gestation, 832–825
 placental site trophoblastic tumors (PSTT) associated with, 846
 polymerase chain reaction analysis of, 804, 805
 pregnancy-induced hypertension associated with, 604
 prenatal diagnosis of, 810–811
 recurrent, 798, 800
 tetraploidy-related, 803, 804, 805, 806
 transitional, 809
 in triplets, 799
 triploidy-related, 487, 804, 808, 818
 trophoblast in, 815, 816
 in twins, 798, 799, 877
 ultrastructural studies of, 810
- Hydramnios, 401, 408, 411
 chorioangioma-related, 863, 864
 diabetes-induced, 598
 hyperthyroidism-related, 596
 relationship to chorioangioma, 865–866, 868
 sacrococcygeal teratoma-related, 954
 in twins, 969
 in acardiac twins, 945, 946
 acardia-related, 945
 in conjoined twins, 952
 fetal demise and survival in, 930, 932, 939
 twin-to-twin transfusion syndrome-related, 930, 932, 936, 938, 939–940, 940, 1005
- Hydrocephaly, 719
 in acardiac fetuses, 944
- Hydronephrosis, 590
- Hydropic abortus, differential diagnosis of, 807–808
- Hydrops fetalis, 525–541
 definition of, 519
 endocardial fibroelastosis-related, 488
 as fetal hemorrhage cause, 529–530
 idiopathic, 527, 540
 laser therapy for, 864–865

- Hydrops fetalis (*Continued*)
 medicolegal aspects of, 1009
 nonimmune, 519, 521, 526–527, 533
 chorioangioma-related, 864–865, 867
 congenital anomalies associated with, 533–534
 cytomegalovirus-related, 701
 fetal tumors-related, 530–533
 fetomaternal hemorrhage-related, 561, 562
 Graves' disease-related, 596
 listeriosis-related, 684
 parvovirus B19-related, 535–540, 911
 sacrococcygeal teratoma-related, 954
 storage diseases-related, 577
 α -thalassemia-related, 529–530
 trauma-related, 527
 as Rh isoimmunization cause, 1009
 in twins, 926
 of unknown etiology, 540–541
 as villous edema cause, 487
 5-Hydroxytryptamine, 386
 Hygroma, with monosomy X, 771, 773
 Hyperbilirubinemia, twin-twin transfusion syndrome-related, 937, 939
 Hypercholesterolemia, 590
 Hyperemesis gravidarum, 586
 Hyperglycemia, maternal, 597
 Hyperhomocysteinemia, 591
 Hyperkeratosis, 333
 Hyperlipidemia, 590
 Hypertension
 maternal, 604–615. *See also* Eclampsia; Preeclampsia
 as abruptio placentae cause, 617, 618
 cocaine-related, 587
 erythropoietin levels in, 1011
 pulmonary, 417–418
 twin pregnancy-related, 893
 pregnancy-induced. *See* Hypertension, maternal
 Hyperthyroidism
 fetal, 596
 maternal, 596, 811
 Hypervolemia, fetal, 597
 Hypobetalipoproteinemia, 590
 Hypoglycemia, twin-twin transfusion syndrome-related, 937, 939
 Hypoplasia
 placental, 763
 pulmonary, 364
 Hypoproteinemia, 869
 Hypothyroidism, maternal, 596
 Hypoxia
 in acardiac twins, 946
 as cerebral palsy cause, 1001, 1004
 defective placental maturation-related, 621
 effect on angiogenesis, 156–159
 effect on intervillous space width, 479
 effect on trophoblast proliferation and fusion, 79–81
 effect on villi, 132, 155–156, 485–486, 497, 499, 500, 508–509, 510, 863, 1013
 as fetal capillary vasodilation cause, 621
 inflammation and, 1005–1006
 nucleated red blood cells and, 484
 postplacental, 479, 494, 499, 500, 511, 512
 HELLP syndrome and, 513–515
 Langhans' cell in, 482
 preplacental, 494, 499, 500, 508, 510
 thrombosis-related, 1008
 in twins, 911
 uteroplacental, 509–511
 villous edema and, 1013
 Hypoxia-inducible factor, 157
 Hyrtl's anastomoses, 5, 386–387, 404–405, 407
 Hysterectomy, as choriocarcinoma treatment, 854–855
 Hysterectomy specimens, 16
- I**
- I-cell disease, 578–580
 Ichthyosis congenita, 332
 Ileal atresia, 927
 Immune responses
 in choriocarcinoma, 852
 in Hofbauer cells, 91–93
 in hydatidiform mole, 811–812
 in preeclampsia, 608, 610
 in recurrent abortions, 786–787
 Immunoglobulin A, 626
 Immunoglobulin G, 626
 maternal, 596
 in twin-to-twin transfusion syndrome, 940
 Immunoglobulin M, 626
 Immunohistochemical markers, 24–25
 Immunohistochemical studies
 of cytomegalovirus infections, 703–704
 of the placenta, 9–10
 villous, 134, 136, 137
 Impetigo herpetiformis, 590–591
 Implantation. *See* Blastocyst implantation
 Implantation pole, 42, 323–324
 Inclusion body blenorrhoea, 689
 Inclusion cells, as owl-eye cells, 486, 702–704, 705
 Indomethacin, 675, 939
- Infarction
 of the central nervous system, 619
 differentiated from thromboses, 479
 maternal floor, 482–483, 584, 585, 785, 1009–1010
 fibrinoid deposits in, 479
 placental, 458, 479–480, 565, 567, 623
 abruptio placentae-related, 616, 618, 619
 of the placental edge, 1010
 preeclampsia-related, 612–615
 rubeola (measles)-related, 714
 within succenturiate placental lobes, 455
 systemic lupus erythematosus-related, 627, 628
 throughout the placenta, 1010
 varicella (chickenpox)-related, 709–710
 “white,” 612, 613, 614
 Infections. *See also specific types of infections*
 maternal, as hydrops fetalis cause, 535–540
 prenatal, 657. *See also specific infections*
 route of infection in, 671
 as recurrent abortion cause, 785
 Inflammation/inflammatory reactions, 486, 1005–1007
 in the umbilical cord, 426
 Influenza, 712
 Inhibin, 71–72, 886
 α -Inhibin, 849
 Insulin, 160, 520
 immunogenic, 598
 Insulin-binding receptors, 598
 Insulin-like growth factor, 80
 Insulin-like growth factor binding protein-1, 608
 Insulin receptors, 94
 Intelligence quotient (IQ), in monozygotic twins, 940
 Intercellular adhesion molecule-1, 722
 Interferons, 92–93
 Interleukins, 92, 93, 328, 350, 671–672, 674
 Intervillositis, 663, 665, 725–726
 Intervillous space, 40, 479
 definition of, 16
 development of, 46
 effect of hypoxia on, 159
 during first trimester, 16, 18
 infectious organisms in, 663, 665
 in malaria, 722, 723, 724
 maternal blood flow to, 38, 158–159
 relationship to villous trees, 160–164
 “subchorionic lakes” of, 20
 during third trimester, 20, 22
 toxins in, 663, 665
 width of, 16, 20, 161, 163, 479

- Intestinal atresia, in twins, 956
 Intracytoplasmic sperm injection (ICSI), 892
 Intrauterine devices (IUDs), 421, 675, 698–699, 784
 detection during placental examination, 3, 4
 Intrauterine growth retardation (IUGR), 411, 473
 abruptio placentae-related, 619
 apoptosis in, 620
 cocaine-related, 587
 end-diastolic umbilical blood flow in, 482, 485, 509–513
 etiology of, 509–510
 maternal floor infarction-related, 1009–1010
 maternal hyperhomocysteinemia-related, 591
 placental apoptosis in, 767
 placental pathology of, 510–513
 preeclampsia-related, 510, 512–513, 605
 single umbilical arteries in, 413, 414, 1008
 stromal fibrosis associated with, 485
 twin-to-twin transfusion syndrome-related, 937, 938, 939
 villi in, 145–146
 In vitro fertilization, 892
 monozygotic twinning rate in, 888
 as preeclampsia risk factor, 610
 Ipsilon zone, 881
 Ischemia
 effect on terminal villi, 1024
 placental, 491, 623
 Ischiopagi, 953
 Isoxuprine, 871
 IUGR. *See* Intrauterine growth retardation (IUGR)
- J**
- Junctional zone, 17
 Juxta-hemangiogenic cells, 151–152
- K**
- Kala-azar, 720
 Karyorrhexis, 479
 Karyotype analysis
 of acardiac fetuses, 948–950
 of hydatidiform mole, 802, 803, 804, 805, 806, 808
 with coexisting fetus, 822–823
 of partial hydatidiform mole, 818–820
 in twin pregnancies, 823
 of monozygotic twins, 956–957
 Keratinization, amnionic, 331–333
 Kernicterus, 1001
- Ki-67 antibody, 29, 137
 Kidneys, agenesis of, 428, 429
 in twins, 913, 955
 Kleihauer-Betke test, 552, 553, 556, 559–561, 562, 563, 564
 Kline hemorrhage, 565
 Klippel-Feil syndrome, 905
 Klippel-Trenaunay syndrome, 533
 Knots
 syncytial, 60, 61, 62, 64, 474, 479, 480, 482, 491–497
 apoptotic, 60, 61, 62, 64, 493
 in Beckwith-Wiedemann syndrome, 541
 definition of, 21
 deportation to the lung, 813
 diagnostic value of, 491
 in erythroblastosis fetalis, 521
 interpretation of, 491–494
 intrauterine growth retardation-related, 510–511
 medicolegal aspects of, 1012
 preeclampsia-related, 481, 612, 621
 as sectional artifacts, 491–492, 493, 494
 systemic lupus erythematosus-related, 628, 629
 trisomy-related, 781, 782
 of the umbilical cord, 401, 416–418, 784
 false, 418–419
 in twins, 903
- L**
- Labor
 premature
 chorioamnionitis-related, 671–673
 prediction of, 671–672
 transplacental hemorrhage during, 554
 Lactate, 623
 Lactate dehydrogenase, 326
 Lacunae, 44, 45
 Lacunar stage, of placenta development, 44–45
 Lacunar system, 44, 45
 Langhans' layer, in erythroblastosis fetalis, 520
 Langhans' cells, 17, 20, 46–47, 65–72
 endocrine activities of, 70–72
 in immature placentas, 482
 in mesenchymal villi, 133, 137
 necrotic, 70
 Langhans' plate, fibrinoid deposition on, 21, 22
 Laser therapy
 for hydrops fetalis, 864–865
 for twin-twin transfusion syndrome, 929, 930, 932–933, 940
 comparison with amniocentesis therapy, 939
- Legal considerations, 1001–1015
 Leiomyoma, 462, 600
 Leishmaniasis, 720
 Leprosy, 682
 Leptin, 57, 810
 Leptospirosis, 695–696
 Letterer-Siwe's disease, 591–592
 Leukemia
 acute myelogenous, 603
 fetal
 placental, 531, 532
 primary, 604
 maternal, 603
 transplacental transmission of, 603–604
 Leukoagglutinins, 594
 Leukocytes
 amnionic, 10
 transplacental passage of, 568, 569
 Leukotaxins, 661, 663
 Leukotrienes, 345
 Leu-M3, 92
 Limb anomalies, in acardiac twins, 942
 Limb-body wall complex, 358, 360–361
 Limb-reduction deficits, 779
 Lipids, amnionic, 327, 328
 Lipofuscinosis, 577, 578
 Listeriosis, 3, 486, 665, 683–687
 as chorioamnionitis cause, 657, 660
 recurrent, 686–687
 in twins, 684, 685, 935
 Lithopedion, 926–927
 Litigation, malpractice, 1001–1015
 Liver anomalies, in acardiac twins, 942
 Lobes, placental. *See* Cotyledons
 "Locked" twins, 968
 LSD (lysergic acid diethylamide), 588
 Lung
 choriocarcinoma metastatic to, 838, 840, 841, 843, 853
 cystic-adenomatoid malformations of, 533
 development of, 913
 invasive hydatidiform mole in, 814–816
 molar tissue deportation to, 812–813
 mycoplasmal infections of, 688
 pus in, 663, 664
 Lung cancer, maternal, 600
 metastatic, 601–602
 Lupus anticoagulant, 608, 611, 630–634, 786
 in circulating lupus anticoagulant syndrome (CLAS), 630–634
 as indication for placental examination, 2
 in placental infarction and, 612
 as thrombosis cause, 1008
 Luteinizing hormone (LH), 885–886
 Lyme disease, 696

- Lymphocytes, transplacental passage of, 568
- Lymphoma, 602–603
Hodgkin's, 589–590
- Lymphoproliferative disorders, maternal, 600
- Lyonization, 957
- Lysergic acid diethylamide (LSD), 588
- Lysolecithin, 662
- M**
- Macrophages
 amniotic, 333–334
 decidual, 673
 hemosiderin-containing, 354, 520–521
 meconium-containing, 350, 351–352, 1007
 placental, 336
 villous. *See also* Hofbauer cells of terminal villi, 129, 132
- Macrosomia, 596, 598
- Magma reticulare, 326, 330, 339
- Magnetic resonance imaging, for twin-twin transfusion syndrome diagnosis, 930
- Major histocompatibility complex (MHC), 91–93
- Malaria, 722–724
- Malnutrition, fetal, 937, 938
 in acardiac twins, 946
- Malpractice litigation, 1001–1015
- Marginal sinus, 322, 323
 thrombosis of, 617
- Marijuana, 588
- Mast cells, 93
- Maternal conditions, 584–656
 cancer, 600–604
 diabetes mellitus, 596–600
 endocrine disorders, 596
 hematologic disorders, 592–596
 hypertensive disorders, 604–625
 lupus erythematosus and lupus anticoagulant, 625–634
 maternal diseases, 584–592
- Maternal death
 abortion-related, 774, 776
 amniotic fluid embolism-related, 344, 345
- Maternal floor infarction, 482–483, 584, 585, 1009–1010
 fibrinoid deposition in, 479, 1009–1010
- Maternofetal barrier, 35–37
- Maternofetal diffusion distance, 48
- Maternofetal interdigitation, placental, 30, 32–35
- Matrix metalloproteinases, 87, 340
- Matrix proteins, 86
- Maturitas praecox placentae, 476, 482, 506
- Measles (rubeola), 714–715
- Meckel's diverticulum, 389
- Meconium, 345–355, 1007–1008
 in alcohol abuse, 587
 as amniotic epithelium degeneration cause, 347, 349, 350
 artificially-caused, 1007
 aspiration of, 347, 349, 1007, 1008
 cholestasis of pregnancy-related, 586
 as chorioamnionitis cause, 661
 definition of, 345
 differentiated from hemosiderin, 346, 348, 351, 352, 353, 354
 medicolegal aspects of, 346, 1007
 as placental discoloration cause, 3
 in postmaturity, 475
 toxicity of, 349–351
 as umbilical artery necrosis cause, 411–412, 425
- Medicolegal considerations, 346, 1001–1015
- Medulloblastoma, 601–602
- Melanoma, maternal, 600–601
- Melanoma cells, transplacental passage of, 568
- Melioidosis, 687
- Membranes, placental, 30, 31, 32, 321–379
 anatomy and pathology of, 321–379
 as “bag of waters,” 321
 in chorioamnionitis, 657
 color of, 5
 definition of, 321
 development of, 323–325
 differentiated from chorion frondosum, 321
 examination of, 3, 5
 interhemal, 30, 35
 pathology of, 338–366
 premature rupture of, 321, 338–340
 candidiasis-related, 698
 chlamydial infection-related, 689–690
 chorioamnionitis-related, 657, 660, 661, 663, 668, 669, 670–671, 674–675
 cocaine-related, 587
 funisitis-related, 657, 660
 multifactorial mechanism of, 673
 Mycoplasma infections-related, 688–689
 prediction of, 672, 674
 prevention and treatment of, 669, 674–675
 proteoglycan-mediated sealing of, 333
 streptococcal infections-related, 677, 678
 in twins, 969
 as vaginal hemorrhage cause, 660
- surface measurement of, 321
 tensile properties of, 321, 338, 339
 thickness of, 325, 338
 in twin births, 7, 8
- Meningitis
 candidal, 697
 coccidioidal, 700
 neonatal, 679, 684
- Mesenchymal cells, villous, 82, 83. *See also* Villi, mesenchymal
- Mesenchymal dysplasia, Beckwith-Wiedemann syndrome-related, 873
- Mesenchyme
 amniotic, 333–334
 embryoblast-derived, 42
 extraembryonic, 45
- Mesoblast, extraembryonic, 325
- Mesoderm
 amniotic, 333
 development of, 325
 during the third trimester, 20, 22
 chorionic, 16, 18, 335–336
 development of, 325
 during the third trimester, 20, 22
- Mesothelium, chorionic, 16, 18
- Metabolism, inborn errors in. *See* Storage diseases
- Metalloproteinase-8, 661
- Metaplasia, amniotic, 5, 331–333, 356
- Metastases, of maternal cancer, 600–602
- Methotrexate, 461, 589, 814, 815, 817, 854, 855
- Methyl dopa, 409
- Metronidazole, 673
- MIB-1 antibody, 29, 137
- Microcephaly
 acardia-related, 950
 prenatal hemorrhage-related, 562
 twin-to-twin transfusion syndrome-related, 909
- Microchimerism, 585
- Microgyria, cerebral, 701
- Microvilli, 327
- Mirror imagery, in conjoined twins, 952
- Miscarriages, 762
- Mole, invasive. *See* Choriodenoma destruens
- Monitoring, fetal, 399, 1003–1004
- Monoamine oxidase, 604
- Monosomy X, 771, 772, 773
 as abortion cause, 764
- Morquio's disease (mucopolidosis IV), 578, 580–581
- Mortality
 fetal. *See* Fetal demise
 maternal
 abortion-related, 774, 776
 amniotic fluid embolism-related, 344, 345

- Mosaicism, 779
 in aborted fetuses, 769
 confined placental, 780, 804
 confined to cytotrophoblast, 780–781
 detection of, 331
 hydatidiform mole-related, 805
 in twins, 957–959
 XY/XXY, 334
- Motilin, 346–347
- Mucopolysaccharidoses
 type I, 578
 type II (I-cell disease), 578–580
 type III, 577–578
 type IV, 581
 type V (Morquio's disease), 578, 580–581
- Mucus, endocervical, 671–672
- Multiple myeloma, 602
- Mummified fetus, 927
- Mumps, 712
- Mushroom toxins, 586
- Mycoplasma* infections, 666, 674, 687–689, 690
- Myelin bodies, 580
- Myelomeningocele, 944
- Myofibroblasts, 84–86, 136
- Myosin, smooth muscle, 136
- Myositis ossificans, 586
- MZ. *See* Twins, monozygotic
- N**
- Nails, fetal, 410
- Natural killer cells, in preeclampsia, 624–625
- Necrosis
 amniotic, 668
 herpes simplex virus-related, 707, 708
 oligohydramnios-related, 915
 cerebral, in twins, 910, 911
 chorionic, herpes simplex virus-related, 707
 coccidioidomycosis-related, 699–700
 eclamptic hepatic, 620
 in Langhans' cells, 70
 syncytiotrophoblastic, malaria-related, 723
 of the umbilical arteries, 425
 villous
 fibrinoid, 482
 listeriosis-related, 684
 mumps-related, 712
 syphilis-related, 693
- Negligence, medical, 1001
- Neisseria gonorrhoeae*, 676
- Nematosomes, 70
- Nephropathy, diabetic, 598
- Nephrosclerosis, malignant, 586
- Nephrosialidosis, 581
- Nephrosis, "Finnish," 534, 536
- Nephrotic syndrome, 534, 536, 537
- Netzinfarcts, 7
- Neu-Laxova syndrome, 333
- Neuroblastoma, congenital, 530
- Neuronal ceroid lipofuscinosis, 578
- Neuropeptide Y, 71–72, 386
- Nevi
 fetal giant pigmented, 601, 602
 port-wine, 533
- Niemann-Pick disease, 541, 578, 581, 591
- Nitric oxide, 96, 385, 409, 622
- Nodus spuriosus gelatinosus, 418
- Nodus spuriosus vasculosus, 418
- Nonatuplets, 960
- Noonan's syndrome, 533
- Normative values and tables, 1019–1026
- Nucleated red blood cells (NRBCs), 410–411, 558, 563
 in asphyxia, 1010–1011
 chorangioma-related, 863
 in chorioangioma, 867
 in erythroblastosis fetalis, 519, 520, 521
 in fetal circulation, 477, 1010
 in fibromuscular sclerosis, 484
 during first trimester, 17, 18
 isolation from maternal blood, 781
 in maternal circulation, 568–569
 medicolegal aspects of, 1010–1011
 in neonatal circulation, 1010–1011
 normal, 484
 in rubella-infected fetus, 714
 in sacrococcygeal teratoma, 954
 in sickle cell anemia, 592
 technique for identification of, 559–561
 during third trimester, 484
 in twins, 879
- O**
- Oligohydramnios, 5, 1007
 diabetes insipidus-related, 596
 relationship with amnion nodosum, 355, 357, 358
 in twins, 930, 931
- Omphalocele, 391, 401, 435, 710
 in acardiac twins, 941, 944
- Omphalomesenteric (vitelline) duct, remnants of, 342, 343, 389–391
- Oocytes
 age of, 764
 tertiary, 891
- Ophthalmia neonatorum, 660, 689
- Oral contraceptives
 as candidiasis risk factor, 696
 relationship to twin pregnancies, 886
- Osmolarity, of fixatives, 1024
- Osteogenesis imperfecta, 363
- Otitis, correlation with chorioamnionitis, 663
- Ouchterlony immunodiffusion plates, 426, 666, 695
- Ovarian cancer, maternal metastatic, 601–602
- Ovary
 hydatidiform mole in, 817
 teratoma of, 954
- Ovulation, hormonal induction of, 885–886, 892
- Ovum, "blighted," 919
- Owl-eye cells, 486, 702–704, 705
- Oxidative stress, 620
- Oxygenation, placental. *See also* Asphyxia; Hypoxia
 effect on trophoblast proliferation and fusion, 79–81
 effect on villous and vascular development, 155–159
 normal, 500
- Oxygen tension, in amniotic fluid, 905
- Oxytocin, 57
 interaction with prostaglandins, 328
- P**
- Pancreas cancer, maternal metastatic, 601–602
- Parabiocirculation, 937
- Parasitic infections, 724
- Paravascular capillary net, 141, 142, 143
- Parvovirus B19 infections, 535–540, 657, 711–712
 as hydrops fetalis cause, 911
 as spontaneous abortion cause, 536
- Passive smoking, 589
- Pelvic inflammatory disease (PID), 675, 687
- Pena Shokeir sign, 393
- Peptostreptococcus* infections, 663
- Periarthritis nodosa, 585–586
- PGF. *See* Placental growth factor (PGF)
- Phenylketonuria, 590
- Pheochromocytoma, 591, 596
- Phocomelia, 432
 in acardiac fetuses, 944
- Phosphatidylserine, 76
- Phospholipase A₂, 662, 673
- Photography, use in placental examinations, 1003
- Placenta
 accreta, 457, 460–462
 lucency of, 479
 allantochorial, 30, 32
 annular, 457
 "Battledore," 401
 bed, 13, 15
 bidiscoidal, 32, 33
 bilobate, 13, 454

- Placenta (*Continued*)
- bipartite (duplex), 454–455, 456–457
 - “capped,” 457
 - chorioallantoic, 380
 - circummarginate, 464, 467–468
 - circumvallate, 455, 457, 464–468, 617
 - in extramembranous pregnancy, 364
 - in herpes simplex virus infections, 709
 - classification systems for, 30–41
 - blood flow interrelations-based, 37
 - maternofetal barrier-based, 30, 35–37
 - placental shape-based, 32–35, 39
 - color of, 1007
 - in conjoined twins, 952–953
 - cotyledonaria, 32, 33
 - development of
 - early, 42–49
 - stages of, 42–49
 - diameter of, 13, 1020
 - diffusa, 31, 32, 33
 - discoidal, 32
 - duplex, 13
 - as “errors in outline,” 454
 - extrachorialis, 464, 466
 - fenestrata, 455–456
 - “fetal,” 15
 - fetal movement-related injury to, 556–557
 - fetal surface of, 13, 14, 15
 - examination of, 6
 - folded, 34
 - formation of, 30, 31
 - functional activities of, 30
 - green, 1007–1008. *See also* Meconium
 - “holes” in, 565
 - increta, 461
 - labyrinthine, 34–35, 45
 - diabetes-related degeneration of, 599
 - lamellar, 34
 - macroscopic features of, 13–15
 - marginata, 467–468
 - margin of, 13
 - “maternal,” 15
 - maternal surface of, 13, 15
 - examination of, 6–7
 - maternofetal interdigitation on, 30, 32–35
 - measurement of, 5
 - membranacea, 13, 462–464
 - microscopic survey of, 16–29
 - first trimester, 16–20
 - third trimester, 20–29
 - percreta, 462
 - lucency of, 479
 - phylogenetic variations in, 37–38, 39
 - premature separation of, 615. *See also* Abruptio placentae
 - previa, 406–407, 418–419, 454–455, 456, 457–462, 620
 - accreta, 345, 461
 - central, 457–458
 - chorioangioma-related, 867, 869
 - definition of, 457
 - low-lying, 458–459
 - marginal, 457–458
 - partial, 457
 - as transplacental hemorrhage cause, 557
 - rupture of, trauma-related, 552–553
 - shape aberrations of, 452–472
 - shapes of, 3, 32–33
 - succenturiate, 13, 454–455, 456, 457
 - thickness of, 13, 1020
 - trabecular, 34
 - of twins
 - in acardiac twins, 941, 942
 - in vanishing twins, 919–923
 - vascular anatomy of, 893–902
 - types of, 30–41
 - villous, 34
 - volumetric growth of, 454
 - weight of, 6, 476, 1020
 - in maternal diabetes mellitus, 597, 599
 - in α -thalassemia, 528, 529
 - zonaria, 13, 32, 33
- Placental barrier, in fetomaternal blood circulation, 30, 35, 46–47
- Placental dysfunction, 475–476
- Placental growth factor (PGF), 140, 149, 152, 155, 157, 625
- Placental insufficiency, 475–477, 724–725, 1007, 1011
 - definition of, 476
 - prednisolone-related, 628, 630
- Placental site
 - localization of, 452–454
 - nodules of, 849–851
- Placental site trophoblastic tumors (PSTT), 846–849, 850, 851, 853
- Placentomegaly, sacrococcygeal
 - teratoma-related, 954–955
- Placentones, 15, 160, 161, 162–163, 408, 473
- Placentone theory, of blood flow, 160, 161, 162–163
- Plakopathia diabetica, 599
- Plasma cells, 93
 - in cytomegalovirus infections, 701, 704, 705
 - in herpes simplex virus infections, 708–709
- Plasminogen, 340
- Plasmodia, malarial, 722, 723, 724
- Plasmodiotrophoblast, 44
- Platelet endothelial cellular adhesion molecule, 604
- Plethora, in acardiac twins, 910–911, 912, 930, 932–933, 934–935, 937–938, 942
- Pneumonia
 - aspiration, 658
 - chorioamnionitis-related, 663
 - Mycoplasma* infections-related, 688
 - varicella, 710
- Polar bodies, fertilization of, 890–891, 955
- Polycythemia, twin-twin transfusion syndrome-related, 935, 938, 939
- Polyhydramnios, 533
 - ichthyosis-related, 332
- Polymerase chain reaction (PCR)
 - analysis
 - of hydatidiform mole, 804, 805
 - for parvovirus B19 infection diagnosis, 711
 - of twins, 879
- Polymorphonuclear leukocytes
 - in chorioamnionitis, 657, 661–663, 665
 - in funisitis, 666
 - in preterm labor, 673
- Polyovulation, 885, 886, 887
- Polyps
 - “hairy,” 955
 - placental, 777
- Polysaccharide, 336
- Pompe’s disease, 581
- Porencephaly, 911, 914
- Porphyria, 595
- Postcapillary venules, 142–143
- Postmaturity, 475–476
 - meconium discharge in, 346–347, 353
- Potassium chloride injections, 946, 966, 976
- Potter’s syndrome, 332, 364, 913, 966
 - in twins, 955
- Prednisolone, as placental insufficiency cause, 628, 630
- Preeclampsia, 604–612, 604–615
 - as abruptio placentae cause, 55, 605, 616, 617–618, 620
 - animal models of, 605
 - as chorioangioma cause, 869
 - classification of, 604
 - decidual arteriopathy associated with, 605–607, 609, 610–612
 - early-onset, 511–512, 513
 - etiology of, 604–605, 623–625
 - hydatidiform mole associated with, 812, 820
 - immature placenta in, 481
 - immunologic phenomenon in, 608, 610
 - incidence of, 623
 - as indication for placental examination, 2
 - as intrauterine growth retardation cause, 510, 512–513

- late-onset, 509–511
maternal thyroid disease-related, 596
as placental infarction cause, 1010
placental pathology in, 605–612,
605–615
in renal transplant recipients, 586
sickle cell anemia-related, 592
 α -thalassemia-related, 528
villi abnormalities in, 482
- Pregnancy
ectopic
as Rh isoimmunization risk factor,
526
as tubal pregnancy, 389–390, 815
of twins, 967–968
extramembranous, 364–366
molar, 797–836. *See also*
Hydatidiform mole
multiple, 877–1000. *See also*
Quadruplets; Quintuplets;
Sextuplets; Triplets; Twins
assisted reproductive technology-
related, 960
perinatal morbidity and mortality
in, 960–961
placental examination in, 7–8
selective fetal reduction in, 966,
970
prolonged, 507–508, 1007
Prelacunar stage, of placenta
development, 42–44
- Premature delivery
chorangioma-related, 863
chorioamnionitis-related, 668–669
incompetent cervix-related, 675
prediction of, 674
with fundal height, 969
twin-to-twin transfusion syndrome-
related, 939, 1005
villi maturation in, 506–507
- Premature fetus, white blood cell count
in, 662
- Premature labor
chorioamnionitis-related, 671–673
prediction of, 671–672
- Premature rupture of the membranes.
See Membranes, premature
rupture of
- Prematurity
infection-related, 1005
meconium in, 346–347, 350–351
perinatal autopsies in, 1003
placental examination techniques in, 2
in twins, 969
- Progesterone, 93, 971
- Programmed cell death. *See* Apoptosis
- Proliferating-cell nuclear antigen
(PCNA), 137
- Propranolol, 590
- Prostacyclin, 386, 625, 633
- Prostaglandins, 327–328, 385, 625,
672–673, 674
- Protein, amniotic fluid content of, 330
- Protein C deficiency, 426–427, 483, 594,
595, 632
- Protein C resistance, 426
activated, 594–595
- Protein S deficiency, 483
- Proteinuria
maternal hypertension-related, 604
preeclampsia-related, 604, 623
- Proteoglycans, 86–87, 333
- Proteus mirabilis* infections, 665
- Pruritus gravidarum, 590–591
- Pseudoacardius, 941
- Pseudometastases, 601
- Pseudo-partial mole with angiomatoid
proliferation, 821
- Pseudovasculitis, 660–661
- Psittacosis, 689
- Pulmonary arteries
choriocarcinoma metastatic to, 840
thrombosis of, 814
- Purpura, thrombotic thrombocytopenic,
593
- Pus
in amniotic fluid, 662, 663, 664
aspiration during amniocentesis, 662
- Q**
- Q fever, 724
- Quadruplets, 886, 963–964
maternal age and, 960
mortality rate in, 970
twin-to-twin transfusion syndrome in,
937
- Quintuplets, 944, 963, 964–965
acardiac, 941, 944
Dionne family, 963–965
maternal age and, 960
mortality rate in, 970
selective fetal elimination in, 966
- R**
- Rabies, 712
- Rachipagus, 951
- Radiation therapy, during pregnancy,
590
- Radiofrequency ablation, of acardiac
fetuses, 945–946
- Radiographic studies, of fetus
papyraceus, 924, 925
- Rectal cancer, maternal metastatic,
601–602
- Red blood cells. *See* Erythrocytes
- Relaxin, 340
- Renal agenesis, 428, 429
in twins, 913, 955
- Renal anomalies
twin embolization syndrome-related,
907–908
twin-to-twin-transfusion syndrome-
related, 938–939
- Renal failure
acute, 586
chronic, 586
- Renal transplantation, 586
- Respiratory distress syndrome, 411
- Retromembranous hemorrhage, 922
- Retroplacental hematoma, 480, 555, 657,
659, 1010
- Retroplacental hemorrhage, 567, 615,
633
- Retroviruses, envelope proteins of, 77–79
- Rhabdomyosarcoma, 601–602
- RhD typing, fetal, 781
- Rheumatoid arthritis, 585, 626
- Rh isoimmunization, 128
amniocentesis-based evaluation of, 553
fetal management of, 522–524
Hofbauer cells in, 478
hydrops fetalis-associated, 1009
maternal
after fetal demise, 524–525
fetomaternal hemorrhage-related,
561
hydatidiform mole-related, 526
surveillance of, 957
vanishing twin phenomenon-related,
921–922
villi in, 504
- RhoGAM, 410, 519, 525, 526, 554, 559,
563, 564
- Rickettsial disease, 722
- Rocky Mountain spotted fever, 722
- Rohr's fibrinoid, 21, 23, 24, 43
- Rubella (German measles), 713–714
“blueberry muffin spots” of, 938
- Rubeola (measles), 714–715
- S**
- Sacral agenesis, 598
- “Sad fetus syndrome,” 797, 821
- Saline infusions, as abortion method,
774, 776
- Salla's disease, 578
- Salmonella* infections, 679
- Salt intake, as preeclampsia cause, 625
- Sandhoff's disease, 578, 580
- Sarcoidosis, 591
- Schistocytes, 431
- Schistosoma japonicum*, 724
- Schistosoma mansoni*, 724
- Scleroderma, 584–585, 626
- Sclerosis, fibromuscular, 484
- Scramblases, 76
- Seasonality, of dizygotic twin births, 893

- Seat belt injuries, 555, 556, 1011
- Sepsis
 abortion-related, 669, 776–777, 779
 fetal, 666
- Septa, placental, 14–15, 16, 17, 18, 19, 24, 40
 during third trimester, 20, 23
- Septal tips, 23, 24
- Septicemia, maternal, 665–666
- Septuplets, 960
- Sex determination, fetal, 764
 in acardiac twins, 946
- Sextuplets, 892, 960, 965–966
 mortality rate in, 970
- Sexual intercourse, as premature
 delivery risk factor, 675
- Shigella* infections, 679
- Shirodkar operation, 675
- “Short cord syndrome,” 396–397
- Shunts, arteriovenous, 895, 896
- Shwartzman reaction, 433, 619
- Sialic acid storage disease, 578, 581–582
- Sialidosis III, 540
- “Siamese twins,” 908
- Sickle cell anemia, 527, 535, 592–593, 615, 699
- Sinusoids, 81, 93–94, 143, 145
- Sipple’s syndrome, 591, 596
- Sirenomelia, 414, 415, 913
 in twins, 922, 955
- Situs inversus, 952
- Sjögren’s syndrome, 534–535
- Skin cancer. *See also* Melanoma
 maternal metastatic, 601–602
- Skull fractures, fetal, 552, 557
- “Slapped cheeks” syndrome, 537
- Smallpox, 710–711
- Smith-Lemli-Opitz syndrome, 590
- Smoking, 588–589
 as abruptio placentae cause, 619
 effect on umbilical veins, 423
 as hydatidiform mole cause, 801
 passive, 589
 placental effects of, 386
 as premature rupture of the
 membranes cause, 339
- Snake bites, renotoxicity of, 586
- Somatostatin, 71
- Somatotropin, 329
- Sphingomyelin storage disease, 578
- Spider bites, renotoxicity of, 586
- Spirochetal diseases, 695–696. *See also*
 Syphilis
- Spirochetes, 691–692, 693–694, 695, 696
- Spongy (intermediate) layer, 335
- Sprouts
 syncytial (trophoblastic), 17, 18, 60, 61, 62, 63, 64, 133, 134, 137, 491–492, 504, 505–506
 as artifacts, 492, 505–506
 development of, 46
 differentiated from syncytial buds, 622
 villous, 133, 134, 135, 137, 482
- Squames, fetal, 343, 344, 345
 in chorioamnionitis, 662
- Squamous cell carcinoma, maternal
 metastatic, 601–602
- Squamous metaplasia, amnionic,
 331–332
- Stab wounds, 562
- Staphylococcal infections, 665
- Staphylococcus aureus* infections, 665
- Stem cells, hematopoietic, 46
- Stereoradiography, 898–899
- Stillbirth
 cholestasis-related, 586
 chorangioma-related, 872
 Cushing’s disease-related, 596
 hemorrhagic endovasculitis-related,
 477
 maternal floor infarction-related,
 1009–1010
 meconium and, 1008
 parvovirus B19 infection-related, 711
 placental examination in, 1
 smoking-related, 589
 in twins, 968
- Storage, of the placenta, 1–2, 1003
- Storage diseases, 577–583, 591
- Streeter’s bands, 363
- Streptococcobacillus moniliformis*
 infections, 681
- Streptococcal infections, 695
- Streptococcus* group A β -hemolytic
 infections, 663, 678–679
- Streptococcus* group B infections, 663,
 666, 673, 675, 676, 677, 678
- Strictures, of the umbilical cord, 419–420
- Stroma
 endometrial, 45
 fibrosis of, 87, 485–486
 villous, 82–93, 133, 134
 effect of hypoxia on, 159
 herpes simplex virus in, 707
 reticular, 481
- Stromal channels, 21
 in immature intermediate villi,
 127–128
- Strongyloidosis, 724
- Subchorial closing ring, 13
- Sulfasalazine, 529–530
- Superfecundation, 893
- Superfetation, 893
- Syncytial blebs, 64–65
- Syncytial bridges, 61–62, 63, 491–492,
 493–494, 495, 504
 as artifacts, 492
 in hypoxic placenta, 509, 510
- Syncytial buds, 61
 differentiated from syncytial sprouts,
 622
- eclampsia-related, 620–621
 preeclampsia-related, 621–622
- Syncytial cells, 44
- Syncytial sprouts, 17, 18, 60, 61, 62, 63,
 133, 134, 137, 491–492, 504,
 505–506
 as artifacts, 492, 505–506
 development of, 46
 differentiated from syncytial buds,
 622
- Syncytins, 77–79
- Syncytioma, 837
- Syncytiotrophoblast, 16, 44, 50–65
 blebs in, 64–65
 cytoskeleton of, 55, 81
 cytotrophoblast (Langhans’ cells) of,
 65–72
 definition of, 50
 development of, 44
 focal degeneration of, 97
 freshly fused, 70
 fusion in, 67, 69, 72–76, 81
 molecular mechanisms of, 76–82
 human immunodeficiency virus in,
 715, 716
 major histopathologic observations
 of, 480
 malaria-related necrosis of, 723
 plasmalemmas and microvilli of,
 54–55
 with prevailing rough endoplasmic
 reticulum, 55–57, 58
 with prevailing smooth endoplasmic
 reticulum, 57–58
 of terminal villi, 132
 thickness of, 55
 trophoblastic channels in, 64
 vasculosyncytial membranes of, 59,
 482
 vertical cell membranes of, 50, 52
 villous, 17
 zones of, 55
- Syncytiotrophoblast cells, in maternal
 lung, 568
- Syncytium, deportation to the lung, 812,
 813
- Syphilis, congenital, 690, 692–694, 695
 as villous edema cause, 487
- Systemic lupus erythematosus,
 625–630
 absence of lupus anticoagulant in,
 608, 700
 decidual arteriopathy associated
 with, 626, 628, 629
 occult, 631
- Systemic sclerosis, 584–585
- T**
- Tachycardia, fetal, 596
- Takayasu’s arteritis, 586

- Tay-Sachs disease, 578, 580
 T-cell leukemia/lymphoma, 604
 T cells, 811–812
 in preeclampsia, 608, 610, 624
 Telangiectasia, hemorrhagic hereditary, 594
 Temporal bone, 663
 Tenascin, 82
 Tenney-Parker changes, 61, 63, 474, 475, 480, 493–494, 497, 592, 595. *See also* Knots, syncytial; Sprouts, syncytial; Syncytial bridges
 in branching angiogenesis, 479
 in chorangiosis, 479
 definition of, 621
 in preeclampsia, 605, 621
 Teratoma, 340–341, 922
 differentiated from acardiac fetuses, 944–945
 ovarian, 954
 sacrococcygeal, 430, 530–531, 953–955
 gender factors in, 953–954
 as twinning phenomenon, 953–955
 of the umbilical cord, 435
 Tessellations, 6
 Tetralogy of Fallot, 911
 Tetraploidy, 771
 in hydatidiform mole, 803, 804, 805, 806
 α -Thalassemia, 521, 527–529
 β -Thalassemia, 527, 593
 Thalidomide, 414
 Thiazide, as neonatal thrombocytopenia cause, 593–594
 “Thin cord syndrome,” 412, 420
 Thoracopagi, 897, 951, 952, 953
 Thrombocytopenia
 chorioangioma-related, 868
 erythroblastosis fetalis-related, 520
 fetal alloimmune, 593
 idiopathic, 593
 Thrombohematoma, 479
 subchorionic, 341–342
 Thrombophilia, 634, 786
 as pregnancy loss cause, 594
 Thrombophilic defects, 594
 Thrombosis
 calcification of
 cytomegalovirus infections-related, 477
 Morquio syndrome-related, 580
 chorangioma-related, 863
 chorioamnionitis-related, 1006
 choriocarcinoma-related, 840, 841
 of the chorionic artery, 868
 of the chorionic blood vessels, 666, 668, 868
 differentiated from infarcts, 479
 in fetal stem blood vessels, 483
 in fetal surface blood vessels, 1006
 as hypoxia cause, 1008
 intervillous, 7, 341, 559, 565–567
 in erythroblastosis fetalis, 521, 522
 fetal erythrocytes in, 561
 maternal heart disease-related, 590
 lupus anticoagulant-related, 1008
 marginal sinus, 617
 maternal diabetes mellitus-related, 598
 medicolegal aspects of, 1008–1009
 of the placental surface vasculature, 417–418
 of the placental vascular tree, 428–433
 preeclampsia-related, 606, 607, 608, 609
 of the pulmonary arteries, 814
 subchorionic, 6, 479
 in twins, 910
 of the umbilical arteries, 426–427
 cerebral palsy-related, 1008–1009
 umbilical cord insertional anomaly-related, 404
 of the umbilical cord, 400, 426–428, 1008
 automobile accidents-related, 556
 chorioangioma-related, 869
 pheochromocytoma-related, 591
 of the umbilical veins, 668
 umbilical cord insertional anomaly-related, 404, 405
 of villous vessels, 431, 432
 Thromboxane, 386
 Thrombus, 787
 Thyroid diseases, maternal, 596
 Thyroid hormones, 160
 Thyrotoxicosis, 541
 Thyroxine, 596
 Tissue fixation, placental
 medicolegal considerations in, 1002, 1003
 techniques in, 2, 8–10
 Tocolysis, 620, 674–675
 Toll-like receptors, 91–92, 657, 661
 Toxemia, of pregnancy. *See* Preeclampsia
 Toxins, in the intervillous space, 663, 665
 Toxoplasmosis, 705, 710, 716–720
 as placental surface vessel thrombosis cause, 1008
 as spontaneous abortion cause, 719–729
 as villous edema cause, 487
 Trabeculae, 44, 45
 Transfusion syndrome. *See* Twin-to-twin transfusion syndrome
 Transplacental cell transfer, in autoimmune disease, 585
 TRAP (twin reversal arterial perfusion), 942, 949–950
 Trauma
 as abortion cause, 763
 as abruptio placentae cause, 616–617
 as amniotic band syndrome cause, 362–363
 as chorionic vessel hemorrhage cause, 409–410
 as incompetent cervix cause, 675
 as transplacental hemorrhage cause, 552–557, 562
Treponema pallidum, as syphilis cause, 690
 Trichomoniasis, 722
 Triplets, 879, 888, 944, 960–963
 abnormal umbilical cord insertion in, 899
 acardiac, 941, 961
 conjoined, 951
 encephalocele in, 956
 as fetus papyraceus cause, 927, 956
 hydatidiform mole in, 799
 ipsilon zone in, 881
 monoamniotic placentation in, 913–914
 perinatal morbidity and mortality in, 960–961, 970
 placental vascular abnormalities in, 899
 placentation in, 960–963
 reduction to twins, 924
 twin-to-twin transfusion syndrome in, 937, 962
 laser therapy for, 940
 umbilical cord entanglement in, 961, 963
 vanished, 922
 Triploidy, 770–771
 as abortion cause, 764
 differentiated from diploidy, 765
 as hydatidiform mole cause, 804, 808, 817, 818
 in partial hydatidiform mole, 818, 819–820
 Trisomy, 781–784
 as abortion cause, 764
 selective feticide in, 957
 Trisomy 2, 769
 Trisomy 3, 805–806
 Trisomy 13, 401, 768, 769, 770, 780–781, 783
 Trisomy 16, 768, 780
 Trisomy 18, 430, 568–569, 780–781, 782
 Trisomy 21 (Down’s syndrome), 531, 568–569, 764, 769–770, 781, 782
 villous congestion in, 872
 Trisomy 22, 769
 Trophoblast, 336–337
 apoptosis of, 767
 as chorioangioma covering, 864
 deportation to the lung, 812–813
 development of, 42, 43
 in erythroblastosis fetalis, 520
 extravillous, 20–21, 22, 337
 in abortion specimens, 777–778
 homogeneous thickness of, 480

- Trophoblast (*Continued*)
 in hydatidiform mole, 809–810, 815, 816
 proliferation of, effect of hypoxia on, 79–81
 subdivisions of, 323–324
 in α -thalassemia, 527
 tumors of, 837–862. *See also* Choriocarcinoma
 turnover of, 72–76, 81, 620
 effect on syncytiotrophoblast specialization, 81–82
 villous, 128, 129, 133
 effect of hypoxia on, 159
- Trophoblast cells
 extravillous, 337
 definition of, 20
 histologic appearance of, 19, 20
 intraluminal plugs of, 16
- Trophoblastic flat sectioning, 497
- Trophoblastic pseudotumors, 846
- Trophoblastic shell, 43, 44
- Trophoblastic tumors
 epithelial, 849
 placental site (PSTT), 846–849, 850, 851, 853
 sex determination of, 802
 ultrastructure of, 851
- Trophoblast invasion, 45, 763–764
 effect of oxygen on, 159
- Truncus arteriosus, 879
- Trypanosoma cruzi*, 720
- Trypanosomiasis, American, 720
- Trypomastigotes, 720
- TTTS. *See* Twin-to-twin transfusion syndrome
- Tubal pregnancy
 hydatidiform mole associated with, 815
 of vitelline origin, 389–390
- Tuberculosis, congenital, 683
- Tuberous sclerosis, 534
- Tubuloreticular inclusions, 716
- Tularemia, 682
- Tumor growth factor- α , 158
- Tumor necrosis factor, 671
- Tumor necrosis factor- α , 93, 158, 672, 701, 785
- Tumor necrosis factor- β , 93, 158
- Tumors
 fetal, 530–533
 placental site trophoblastic tumors (PSTT), 846–849, 850, 851, 853
 solid, 60–1602
 trophoblastic, 837–862. *See also* Choriocarcinoma
 sex determination of, 802
 of the umbilical cord, 434–435
- Turner's syndrome, 533, 771, 945, 957
- Twin embolization syndrome, 907–908
- “Twinning impetus,” 889–890
- “Twin peak sign,” 880
- Twin reversal arterial perfusion (TRAP), 942, 949–950
- Twins, 877–1000
 abortion of, 919, 967, 968
 abruptio placentae in, 619
 acardiac, 340–341, 941–950, 951
 anastomoses in, 941, 943, 946, 949, 950
 calcification in, 943
 congenital anomalies in, 946
 definition of, 941
 diamniotic, 355
 edema in, 942, 950
 α -fetoprotein in, 944
 as fetus compressus, 924, 925
 as fetus papyraceus, 925
 gender factors in, 942
 hydramnios in, 946
 hydrops fetalis in, 532
 hypoxia in, 946
 incidence of, 945
 karyotyping of, 948–950
 limb anomalies in, 942
 malnutrition in, 946
 omphalocele in, 941, 944
 pathogenesis and etiology of, 946–950
 selective fetal elimination in, 945, 946
 sex determination of, 946
 treatment of, 945–946
 umbilical cord entanglement in, 942, 943
 umbilical cord length in, 941
 amnion nodosum in, 955
 anastomoses in, 883, 909–910
 anencephaly in, 946, 952
 aneuploidy in, 946
 causes of, 885–891
 central nervous system defects in, 928
 central nervous system hemorrhage in, 911
 cerebral necrosis in, 910, 911
 cerebral palsy in, medicolegal aspects of, 911
 chimerism in, 957, 959–960
 chorioamnionitis in, 658, 660, 663, 911, 1005
 cleft palate in, 952, 953
 congenital anomalies in, 913, 952, 953, 955–956
 congenital heart disease in, 952
 conjoined, 889, 908, 950–953
 in animals, 951, 952
 cephalopagous, 912
 chromosomal analysis of, 951
 etiology of, 952
 forked umbilical cords in, 912
 gender factors in, 951
 hydramnios in, 952
 mirror imagery in, 952
 placenta of, 952–953
 in plants, 951, 952
 single umbilical artery in, 953
 cytomegalovirus infections in, 701
 death of co-twins, 909–910
 diamniotic/dichorionic (DiDi), 7–8, 880, 882, 883, 884, 917–919
 chorioamnionitis in, 658, 663
 gastroschisis in, 355
 irregular chorionic fusion in, 918–919
 placentation in, 917–919
 diamniotic/monochorionic (DiMo), 880, 881, 882, 883, 884, 885, 915–917
 adenovirus infections in, 677–678
 amnion in, 329–330, 334
 amnion nodosum in, 915, 916
 amnion of, 881, 915, 916
 single umbilical artery in, 915
 umbilical cord insertion in, 915
 disseminated intravascular coagulation in, 907, 911–912
 dizygotic (“fraternal”), 877, 878
 anastomoses in, 958
 in ethnic groups, 891, 892, 898
 etiology of, 885–886
 hydatidiform mole in, 822
 seasonality of, 893
 twinning rate in, 891–892
 as ectopic pregnancy, 967–968
 embolism in, 910
 erythroblastosis fetalis in, 521, 524, 525
 erythropoietin in, 911
 in extramembranous pregnancies, 366
 fetal demise in, 927–928
 fetal elimination in, 911
 as fetus compressus, 919
 as fetus papyraceus, 898, 908, 914, 919, 923–928, 930, 932, 940
 genetic factors in, 886–887, 951
 hemoglobin levels in, 1005
 hemorrhagic endovasculitis in, 1006
 hydatidiform mole in, 798, 799, 823–825
 hydramnios in, 969
 fetal demise and survival in, 930, 932, 939
 hydrops fetalis in, 533–534, 926
 hypoxia in, 911
 incidence of, 891–893
 intestinal atresia in, 956
 listeriosis in, 684, 685, 935
 “locked,” 968
 medicolegal issues regarding, 1004–1005
 monoamnionic, congenital anomalies in, 913

- monoamniotic/monochorionic (MoMo), 7–8, 881, 884, 902–915
 fetal demise in, 902, 903
 transfusion syndrome in, 902
 umbilical cord entanglement in, 902, 903–904, 905, 906, 1005
 yolk sac of, 914, 915
- monochorionic, fetal demise of, 1004–1005
- monozygotic (“identical”), 877, 878
 in animals, 887–889
 blastocyst transfer-related, 915
 brain defects in, 911
 congenital anomalies in, 879, 955–956
 conjoining in, 950–951, 952
 etiology of, 886–890
 fetal demise in, 911
 heterokaryotypic, 956–957
 hydatidiform mole in, 798, 799
 identification of, 883–884
 intelligence quotient in, 940
 rate, 891–892
 streptococcal B infections in, 677
 “twinning impetus” in, 889
 yolk sac of, 951
- morbidity and mortality in, 968–971
- mosaicism in, 957–959
- oligohydramnios in, 930, 931
- parasitic, 951, 953
- paternal factors in, 887
- placentas of
 dividing membranes of, 880, 881, 882
 examination techniques for, 2, 7–8
 vascular anatomy of, 893–902
- plethoric, 910–911, 912, 930, 932–933, 934–935, 937–938, 942
- Potter’s syndrome in, 955
- prematurity in, 969
- racial factors in, 885–886, 887
- renal agenesis in, 913, 955
- rubeola (measles) in, 715
- “Siamese,” 908
- single umbilical artery in, 1005
- sirenomelia in, 922, 955
- “stuck,” 355, 928, 930, 942
 acardiac, 942
- superfecundation of, 893
- superfetation of, 893
- “third type,” 890–891
- thrombosis in, 910
- toxoplasmosis in, 717–718
- twin-twin transfusion syndrome in, 933
- umbilical cord clamping in, 899–900, 1005
- umbilical cord insertion in, 406, 407, 897
 velamentous-type, 894, 899, 900–901, 912–913
- undetected, 415, 899–900
- vanishing, 340, 919–923
- vasa previa in, 899, 900
- weight of, 879
- zygosity of
 identification of, 878, 879
 sex ratio in, 877–878
 Weinberg formula for, 877–878, 955
- Twin-to-twin transfusion syndrome, 8, 540, 901, 908–909, 928–941, 1005
- acute, 1005
- anastomoses in, 8, 894, 928, 929, 935, 939, 940, 958
- blood chimerism and, 883
- cesarean section in, 939
- clinical values in, 932
- donor twin in, 924–925, 928, 932
 sacrifice of, 940
- earliest evidence of, 935
- fetal anemia in, 933–934, 935, 937, 939
- fetal cardiovascular readjustment in, 911
- fetal demise in, 939
- fetal urination in, 930, 938, 939, 940
- frequency of, 936
- gender factors in, 936, 940
- hemorrhage associated with, 908–909
- hydramnios associated with, 930, 932, 936, 938, 939–940
- as intrauterine growth restriction cause, 937, 938, 939
- laser therapy for, 929, 930, 932–933
- neurodevelopmental sequelae of, 925–926
- parabiotic circulation in, 937
- polycythemia in, 935, 938, 939
- as premature delivery cause, 939
- prognosis for, 929
- recipient twin in, 928
- selective fetal elimination in, 940, 967
- survival rate in, 937
- treatment of
 with amniocentesis, 931, 937, 939
 with division of amniotic membranes, 993–940
 with laser therapy, 939, 940
- in triplets, 937, 962
 laser therapy for, 940
- umbilical cord spiraling in, 392
- velamentous umbilical cord insertion with, 403
- weight of twins in, 932, 933–934
- U**
- Ultrasound
 of conjoined twins, 951
 of hydatidiform mole, 810–811
- lucency in, 479
- of placental abnormalities, 10
- for twin-to-twin transfusion syndrome diagnosis, 939
- of vanishing twins, 919, 922, 923
- Umbilical arteries
 absent or reverse end-diastolic blood flow in, 509–513
- anastomosis between, 5
- aneurysm of, 422
- blood flow in, Doppler studies of, 622
- calcification of, 428
- in conjoined twins, 952–953
- diameter of, 1020
- Doppler flow waveform studies of, 409
- extracellular matrix of, 384
- Hyrtl’s anastomosis of, 386–387
- necrosis of, 411–412, 425
- single, 5, 383, 413–415, 426
 in acardiac fetuses, 414, 944, 945, 946
- congenital anomalies associated with, 414–415, 1008
- in diamniotic/dichorionic twins, 919
- in diamniotic/monochorionic twins, 915
- intrauterine growth restriction associated with, 413, 414, 1008
- maternal diabetes mellitus-related, 597–598
- in multiple pregnancies, 7, 414, 966
- in septuplet pregnancies, 966
- smoking-related, 588, 589
- trisomy-related, 781–782
- in twins, 912, 917, 1005
- velamentous umbilical cord insertion with, 403
- thrombosis in, 426–427
 arteritis-related, 668
- cerebral palsy-related, 1008–1009
- chorioangioma-related, 869
- cordocentesis-related, 522, 523
- umbilical cord insertional anomaly-related, 404
- Umbilical blood vessels
 contractility of, 385–386
- effect of smoking on, 588–589
- Hoboken valves (nodes) of, 387
- knots of
 false, 394
 true, 387, 394
- structure of, 383–385
- Umbilical coiling index, 392–393
- Umbilical cord, 380–451
 in acardiac fetuses, 944–945
- allantoic remnant in, 386–391
- anatomy of, 380–385
- aneurysm of, 423–424

- Umbilical cord (*Continued*)
- arteriovenous malformations of, 434–435
 - calcification of, 426, 534, 694
 - candidiasis of, 696–697
 - clamping of, 415–416
 - effect on placental structure, 1024
 - as hemorrhage cause, 1009
 - in twins, 899–900, 1005
 - color of, 1009
 - compression of, 129, 400–401
 - in conjoined triplets, 951
 - in conjoined twins, 953
 - cysts of, 388
 - cytomegalovirus infections of, 1008
 - dermoids of, 435
 - development of, 380–383
 - diameter of, 1020
 - edema of, 388, 411–412, 1009
 - in chorioangioma, 867, 868
 - maternal diabetes mellitus-related, 598
 - effect of smoking on, 589
 - entanglement of
 - in acardiac twins, 942, 943
 - Doppler studies of, 1009
 - in monoamniotic/monochorionic twins, 1005
 - in triplets, 961, 963
 - examination of, 5–6, 9
 - in twins, 879
 - forked
 - in acardiac twins, 945, 946
 - in conjoined twins, 912
 - “giant,” 388
 - hematoma of, 410
 - cerebral palsy-related, 1009
 - hemorrhage of, postpartum, 415–416
 - inflammation of. *See* Funisitis
 - inflammatory reactions in, 426. *See also* Funisitis
 - innervation of, 384–385
 - insertion of, 13, 14, 401, 402–407
 - in abruptio placentae, 618
 - eccentric, 42
 - effect of smoking on, 588
 - furcate, 402
 - marginal, 42, 475, 917
 - in multiple pregnancies, 879
 - in triplets, 963
 - in twin placentas, 7
 - in twins, 894, 897, 899, 900–901, 912–913, 917
 - in twin-twin transfusion syndrome, 933
 - usual, 42
 - velamentous, 5, 42, 403–407, 618, 894, 899, 900–901, 912–913, 917, 933, 963, 1005
 - knots of, 401, 416–418, 784
 - false, 418–419
 - in twins, 903
 - length of, 394–401, 402, 416, 1020
 - excessively long, 1008, 1009
 - nuchal, 395–401
 - ligation of, in acardia, 945, 946
 - meconium-related degeneration of, 347, 349–350
 - in multiple births, 7
 - prolapse of, 400
 - rupture of, 420–421
 - single, 388
 - in conjoined twins, 953
 - spiraling (chiraling) in, 392–394, 419, 420, 1009
 - as thrombosis cause, 1008
 - strictures of, 419–420
 - in syphilis, 692
 - tensile properties of, 381
 - thickness (diameter) of, 383, 412
 - “thin cord syndrome” of, 412, 420
 - thrombosis of, 400, 426–428, 1008
 - automobile accidents-related, 556
 - chorioangioma-related, 869
 - pheochromocytoma-related, 591
 - traction on, 410, 421
 - in triplets, 951
 - tumors of, 434–435
 - in twins, 879–885
 - entanglement of, 902, 903–904, 905, 906
 - varices of, 424–425, 426
 - vasculature of, 477
 - water content of, 412
- Umbilical cord blood vessels
- calcification of, 426, 427, 430
 - thrombosis of, 426–428
 - in trisomy 18, 781, 783
- Umbilical ligament, median, 388
- Umbilical veins, 383
- calcification of, 429
 - in chorioamnionitis, 660
 - compression of, 129
 - in conjoined twins, 953
 - diameter of, 1020
 - in funisitis, 666, 667
 - prostaglandin production in, 385
 - smoking-related injury to, 423
 - thickness of, 409
 - thrombosis of, 668
 - umbilical cord insertional anomaly-related, 404, 405
- Urachus, 388
- Urea, amniotic fluid content of, 330
- Urea urealyticum* infections, 663, 666, 682, 687, 688, 689, 690
- Urethane, 602
- Urinary tract infections, 592, 678, 687
- Urination, fetal, in twin-twin transfusion syndrome, 930, 938, 939, 940
- Uteroplacental blood vessels,
 - trophoblast invasion of, 763–764
- Uteroplacental (spiral) arteries,
 - anatomy of, 19, 20
- Uteroplacental veins, anatomy of, 19, 20
- Uterus
- bicornuate, 616
 - Couvelaire, 605, 619
 - hemangioma of, 603
- V**
- Vaccinations
- rubella, 714
 - smallpox, 711
- Vaccinia, 711
- VACTERL association, 955
- Vagina, choriocarcinoma metastatic to, 840
- Vaginosis, bacterial, 673, 690, 722
- Vanishing twin phenomenon, 919–923
- Varicella (chickenpox), 709–710
- Varices, of the umbilical cord, 424–425, 426
- Vasa previa, 403, 405–406, 410, 454
 - in twins, 899, 900
- Vasa vasorum, 388–389
- Vascular abnormalities, medicolegal aspects of, 1008–1009
- Vascular anastomoses. *See* Anastomoses
- Vascular cell adhesion molecule-1, 604
- Vascular epidermal growth factor (VEGF), 140, 148, 149, 151, 152, 153, 154, 155, 157, 509, 521
 - in chorioangioma, 863
- Vascular epidermal growth factor (VEGF) receptor-1, 605
- Vascular steal, 933
- Vasculature. *See* Blood vessels
- Vasculitis, of chorionic blood vessels, 668, 703, 704, 706
- Vasculogenesis, fetal, 147–154
 - of endothelial tubes, 148–152
 - of hemangiogenic progenitor cells, 148
- Vasculosyncytial membranes, 59, 482
- Vasoconstriction
 - hypoxia-related, 621
 - meconium-related, 1008
- Vasodilators, 385–386
- Vasomotor control, 96
- Vasorelaxation, carbon monoxide-mediated, 96
- V cells, 82–83, 85
- VDA cells, 83, 85
- VDAG cells, 84, 85
- VDAGM cells, 84, 85
- VD cells, 83–84, 85
- Velamentous blood vessels, laceration of, 410
- Venereal Disease Research Laboratory (VDRL) test, 631

- Venom, transplacental passage of, 586
- Vernix caseosa, 5, 327
 antimicrobial peptide content of, 661
 differentiated from fetus papyraceus, 343
 relationship to amnion nodosum, 355–356
 subamniotic accumulation of, 342–345
- Vernix granulomas, 355
- Villi
 in aborted fetuses, 767
 anchoring, 16, 17, 18, 20, 23, 43, 46, 725
 during third trimester, 23, 24
 angioarchitecture of, 140–145
 angiogenesis in, 146–154
 architecture of, 121–173, 478–479
 basic structure of, 50–120
 syncytiotrophoblast, 50–65
 calcification of, 483
 I-disease-related, 580
 capillaries of
 complete atrophy of, 484
 congestion of, 475, 485
 post-delivery collapse of, 484
 in chorioamnionitis, 666
 of chorion frondosum, 321
 classification of, 121–136, 134, 136
 congestion of, in trisomy 21, 872
 deficient fetal perfusion in, 481
 definition of, 38
 development of
 early, 46–48
 effect of hormones on, 160
 effect of oxygen on, 154–159
 fetoplacental angiogenesis and, 146–154
 differentiation of, 48, 133, 136, 137
 edematous, 128, 478–479, 486–487
 in chorioangioma, 867
 in erythroblastosis fetalis, 520
 in hydrops fetalis, 532
 maternal diabetes mellitus-related, 597
 medicolegal aspects of, 1013
 molar, 806–807, 808, 809, 818, 819
 sacrococcygeal teratoma-related, 954
 effect of hypoxia on, 132, 154–156, 485–486, 497, 499, 500, 508–509, 510, 863, 1013
 fibrotic, 140
 “ghost,” 40, 322
 histomorphometrical evaluation of, 1022
 histopathologic evaluation of, 473–490
 hydropic
 degeneration of, 765, 766, 767
 in spontaneous abortions, 765
 immature intermediate, 17, 18, 121, 126–128, 136, 140, 142, 478–479, 488, 497
 development of, 138
 diagnostic problems associated with, 127–128
 disseminated pattern of, 488
 function of, 127–128
 paravascular capillary net of, 141, 142, 143
 in preeclampsia, 481
 with reticular stroma, 481
 in term placenta, 504–505, 506
 during third trimester, 21, 22
 immaturity of
 in erythroblastosis fetalis, 520, 521–522
 in maternal diabetes mellitus, 597
 persisting, 502, 504
 synchronous, 502, 503
 α -thalassemia-related, 528
 immunohistochemistry of, 134, 136, 138
 length of, high altitude-related
 decrease in, 595–596
 maldevelopment of, 491–518
 classification of, 497–502
 definition of, 473
 in postmaturity, 475–476
 in prematurity, 476
 in maternal diabetes mellitus, 515–516
 maturation of, 137–140, 499–500
 accelerated, 476, 481, 498, 500, 502
 assessment of, 473–476
 delayed, 498, 502
 as dysmaturity, 1012
 estimation of, 479
 hypermaturity, 146, 475, 476, 506–507, 508
 normal, 498, 500, 502
 in premature placentas, 476
 preterm, 506–507
 in prolonged pregnancy, 507–508
 scoring of, 500–502
 typical signs of, 505
 mature intermediate, 21, 23, 128, 130, 131, 136, 497
 angiogenesis in, 153
 development of, 140
 differentiated from stem villi, 21
 function of, 129
 with persisting immaturity, 481
 vascularization of, 142–143, 149, 150
 mesenchymal, 17, 19, 82–83, 121, 132–134, 140, 142, 497
 development of, 137
 function of, 134
 vascularization of, 149, 150
 molar, 797, 798, 814
 in normal mature placenta, 504–506
 primary, 46
 regression of, 324
 sclerosis of, 688
 secondary, 46
 sprouts, 133, 134, 135
 stem, 21, 121, 136
 capillary regression in, 153
 as chorangioma source, 864
 development of, 138–140, 153
 diameter of, 21
 fibrinoid in, 482
 for gestational age determination, 497
 histologic characteristics of, 21, 22
 maturation of, 498
 myofibroblasts of, 84–86
 paravascular capillary net of, 141, 142, 143
 stromal differentiation in, 85
 in term placenta, 504–505
 vascularization of, 140–142, 143, 483–484
 stroma of, 17, 82–93
 connective tissue cells of, 82–87
 matrix components of, 86–87
 in syphilis, 692–693
 tangential sectioning in, 494–497, 504, 505, 510
 terminal, 21, 23, 121, 126, 129, 131–132, 140, 497
 capillarization in, 482
 deficiency of, 511, 512
 development of, 140
 effect of ischemia on, 1024
 function of, 129, 133
 hypermature, 507
 knots of, 21, 482
 in premature placenta, 476
 sinusoids of, 145
 structure of, 57
 in term placenta, 504
 vascularization of, 140–141, 143–145, 149, 150, 482
 tertiary, 46, 48
 during third trimester, 20, 22
 total weight of, 135
 in toxoplasmosis, 718, 719
 in trisomic placenta, 781–782, 783
 trophoblastic basement membrane of, 82
 trophoblastic surface of, 17
 use in structural and genetic studies, 781
 vasculogenesis in, 46, 147–162
- Villitis
 acute, 486
 alcohol abuse-related, 587
 Chagas’ disease-related, 721
 chlamydial, 690, 691
 Coxsackie virus infection-related, 712
 cytomegalovirus infection-related, 701, 702–705, 706, 1006

- Villitis (*Continued*)
 necrotizing, listeriosis-related, 684
 of unknown etiology (VUE), 486, 700, 707, 710, 711, 712, 724–732, 785, 1006–1007
 chorangiogenesis-related, 1010
 definition of, 724
- Villous blood vessels, thrombosis of, 431, 432
- Villous tissue
 color of, 7, 1009–1010
 examination of, legal aspects of, 1003
 premature aging of, 621
- Villous trees, 40. *See also* Cotyledons
 central stems of, 17
 connective tissue of, 82–87
 development of, 46
 expansion of, 46
 inhomogeneity of, 163–164
 in placental vessel thrombosis, 430–431
 relationship to intervillous space, 160–164
- Vimentin, 136, 326, 329
- Vinblastine, 589
- Vinci, da, Leonardo, 394
- Viral infections, 700–716. *See also specific viral infections*
 diagnosis of, 1006
- Vitamin A deficiency, 852
- Vitamin C, 339
- Vitelline (omphalomesenteric) duct, remnants of, 342, 343, 389–391
- W**
- Warfarin, 590
- Weinberg formula, for zygosity of twins, 877–878, 955, 960
- West Nile virus, 716
- Wharton's jelly, 381
 compression of, 418
 cysts within, 411
 decrease in, 412, 419–420, 422
 green discoloration of, 1009
 leukocyte infiltration of, 666, 667
 meconium-related dissolution of, 347, 349
- Wharton's jelly-like material, in chorangioma, 864
- White blood cell count, in premature fetuses, 662
- Whole-body chimerism, 950
- Willebrand's disease, 594
- Wilson's disease, 590
- Windei*, 764, 768
- Wolman's disease, 541
- X**
- X-cell cysts, 337
- X cells, 6. *See also* Trophoblast, extravillous
 in choriocarcinoma, 838
- in chorionepitheliosis, 850
 in I-cell disease, 579
 in mucopolysaccharidoses, 577
 in placental site trophoblastic tumors (PSTT), 846, 847, 848, 849
 in preeclampsia, 611–612
 in scleroderma, 584, 585
- XY chromosome, in male fetuses, 661
- Y**
- Yolk sac, 31, 380, 391
 of abortion specimens, 774, 775
 of diamniotic/monochorionic twins, 915
 in early gestation, 774, 775
 extraembryonic, 380
 of monoamniotic/monochorionic twins, 914, 915
 of monozygotic twins, 951
 remnants of, 342
 single, of twins, 901
 size of, 5
- Z**
- Zebra bodies, 580
- Zollinger-Ellison syndrome, 596
- Zona pellucida, monochorionic placentation and, 892–893