EMBRYOLOGICAL TERMS I

* **oocyte**: female germ/sex cell
* **sperm**: male germ/sex cell
* **zygote**: cell resulting from the union of oocyte/sperm during fertilization
* **gestational age**: calculated age of embryo/fetus from presumed first day of last normal menstrual period (approx 2 wks longer than fertilization age)
* **cleavage**: series of mitotic cell divisions of the zygote that result in blastomeres
* **morula**: “mulberry”; solid mass of 16 blastomeres that is formed by cleavage of zygote
* **compaction**: when blastomeres change shape and align themselves against each other to form compact ball of cells
  + probably mediated by cell surface adhesion glycoproteins
  + permits greater cell-to-cell interaction
  + prereq for segregation of internal cells to form inner cell mass
* **blastocyst**: “germ bladder”; morula à blastocyst; when blastocytic cavity develops w/n   
  inner cell mass/embryoblast: centrally located cells w/n blastocyst; embryonic part of embryo; differentiates into bilaminar embryonic disc (epi/hypoblast)
* **implantation**: process during which the blastocyst attaches to the endometrium (approx. 6 days b/n fertilization and implantation
* **gastrula**: three-layered trilaminar embryonic disc (ecto/meso/endo- derm) à differentiates into tissues/organs of embryo
* **gastrulation**: transformation of blastocyst into gastrula (3rd week)
* **neurula**: next stage after gastrula (3rd/4th wks); first appearance of nerv sys;
  + early embryo when neural tube is developing from neural plate
* **embryo**: developing human from 2-8 weeks
* **conceptus**: embryo and its adnexa (placental and extraembryonic membranes) and assoc membranes; includes embryonic and extraembryonic structures (i.e., amnion, chorionic sac, umbilical vesicle/yolk sac)
* **primordium**: beginning/first discernable indication of organ/structure
* **fetus**: after embryonic period (8-9 weeks) until birth
* **abortion**:
  + *threatened*: bleeding with possibility of abortion
  + *spontaneous*: occurs naturally; most common during 3rd wk after fertilization
  + *habitual*: spontaneous expulsion of dead/nonviable embryo/fetus in 3 or more consec preg
  + *Induced*: medically induced before 20 weeks; by drugs/mechanical means
  + *complete*: all products of conception expelled from uterus
  + *missed*: retention of conceptus in uterus after death of embryo/fetus
* **miscarriage**: spontaneous abortion of fetus/membranes before middle of 2nd trimester
* **trimester**: period of 3 calendar moths during pregnancy
* postnatal period: after birth
* **infancy**: roughly first year after birth
* **childhood**: period from approx 13 mos until puberty
* **puberty:** usually 12-15 for girls; 13-16 for boys
  + secondary sexual characs develop (i.e., pubic hair, breasts, growth of external genitalia; reproductively capable
* **adolescence**: approx 11-19 years of age
* **adulthood**: full growth/maturity; b/n ages 18 and 21
* **embryology**: study of embryos; prenatal development of embryo/fetuses
* **developmental anatomy**: field of embryology concerned with changes that cells/tiss/orgs/body undergo from germ cell of each parent to resulting adult
* **teratology**: division of embryology/pathology that deals w/ abnormal development (birth defects); concerned w/ various genetic/environ factors that disturb norm dev and prod birth defects
* **applied embryology**: topics of special interest to obstetricians/pediatricians
* **anterior**: front
* **posterior**: back
* **superior**: above
* **inferior**: below
* **cranial**: head
* **caudal**: tail
* **ventral**: front
* **dorsal**: back
* **sagittal plane**: ANY vertical plane passing through body that is parallel to median plane
* **section**: imaginary vertical plane of section that passes longitudinally thru body
* **lateral**: farther from median plane of body
* **medial**: nearer to median plane of body
* **transverse (axial) section**: any plane at right angles to both median/coronal planes
  + divides the boy into superior/inferior parts
* **frontal (coronal) section**: any vertical plane that intersects median plane at right angle
  + divides body into anterior/ventral and posterior/dorsal parts
* **zygote**: single cell formed from unity of oocyte/sperm
* **totipotent**: ability to differentiate into any cell
* **meiosis**: special type of cell division that occurs during gametogenesis
* **spermatogenesis**: gamete maturation in males; spermatogonia transformed to mature sperm; includes spermiogenesis
* **oogenesis**: gamete maturation in females
* **gametogenesis:** gamete formation; process of form/dev of specialized generative cells (gametes)
* **gametes**: sex cells (oocyte/sperm)
* **chromosome**: defn by presence of centromere; contains DNA; after DNA replication à double chromatid chromosomes
* **cetromere**: constricted part of chromosome
* **chromatid**: parallel DNA strands
* **spermatogonia**: immature sperm; seminiferous tubules à mitotic divisions à primary spermatocytes
* **acrosome**: caplike saccular organelle derived from the Golgi region of spermatid
  + contains enzymes that are released at beginning of fertilization to assist sperm in penetrating corona radiate/zona pellucida surrounding 2ndary oocyte
* **primary spermatocytes:** largest germ cells in seminiferous tubules; undergoes reduction division (1st meiotic division) à forms 2 haploid secondary spermatocytes
* **secondary spermatocytes**: haploid cells; undergo 2nd meiotic division à form 4 haploid spermatids
* **spermiogenesis**: spermatids gradually transformed into 4 mature sperm
* **Sertoli cells**: line seminiferous tubules; support/nuture germ cells; involved in reg of spermatogenesis
* **primary oocyte**: enlarged oogonia; formed before birth
* **primordial follicle**: primary oocyte enclosed by layer of flattened, follicular epithelial cells
* **primary follicle**: primary oocyte enlarges (purberty) follicular epithelial cells become cuboidal, then columnar
* **zona pellucida:** amorphous acellular glycoprotein material
* **nondisjunction**: failure of paired chromatids to dissociate; occurs during early cleavage division of zygote; embryo produced w/ 2 or more cell lines w/ different chromosome complements
* **mosaics**: individuals in whom numerical mosaicism is present
* **first polar body**: small nonfx cell that degenerates; 1st meiotic div of primary oocyte forms secondary oocyte and 1st polar body (unequal division of cytoplasm)
* **second polar body:** small nonfx cell; product of 2nd meiotic division; if 2ndary oocyte fertilized à degenerates à maturation of oocyte complete
* **uterus**: “womb”; thick-walled, pear-shaped muscular organ; consists of 2 major parts: body and cervix
* **fundus**: rounded, superior part of body of uterus
* **cervix**: tapered vaginal end of uterus; nearly cylindrical
* **cervical canal**: lumen of cervix; constricted opening at each end
* **internal os**: opens to cavity of uterine body
* **external os**: opens to vagina
* **3 layers of uterine wall**:
  + *perimetrium*: thin external layer; peritoneal layer that is firmly attached to the myometrium
  + *myometrium*: thick smooth muscle layer
  + *endometrium*: thin internal layer
* **compact layer**: thin, consists of densely packed conn tiss around necks of uterine glands
* **spongy layer**: thick, consists of edematous conn tiss containing dilated/tortuous bodies of uterine glands
* **basal layer**: thin, contains blind ends of uterine glands
* **functional layer**: compact/spongy layers; disintegrate/shed during menstruation/after parturition
* **uterine tubes**: “fallopian tubes”; proximal end: uterine horn; distal end: peritoneal cavity;
  + 4 parts
    1. infundibulum
    2. Ampulla
    3. Isthmus
    4. uterine part
       - carry oocytes/cleaving zygote from ovaries and incoming sperm horns of the uterus: part from which the uterine tubes extend laterally
* **ampulla**: fertilization site within uterine horn
* **ovaries**: almond-shaped reprod glands loc close to lateral pelvic walls on each side of uterus; produce oocytes, estrogen/progesterone
* **hypothalamus**: contains neurosecretory cells that synthesize gonadotropin-releasing hormone
* **pituitary gland**: gonadotropin-releasing hormone carried by hypophysial portal system to anterior lobe of pituitary gland
* **gonadotropin**-releasing hormone: stimulates the release of follicle-stimulating hormone (FSH) and luteinizing hormone (LH)
* **vagina**:
* **mammary glands**:
* **hypophysial portal system**: carries GRH to anterior lobe of pituitary gland
* **follicle**-stimulating hormone (FSH): stim development of ovarian follicles and production of estrogen by follicular cells
* **estrogen**: produced by follicular cells; stim development of ovarian follicles
* **luteinizing hormone (LH):** serves as trigger for ovulation (release of 2ndary oocyte) and stim follicular cells and corpus luteum to produce progesterone
* **progesterone**: produced by follicular cells and corpus luteum; trigger for ovulation
* **theca folliculi**: capsule that adjacent conn tiss organizes into as primary follicle increases in size; differentiates into 2 layers
  + 1. *theca interna*: internal vascular and glandular layer
       - produces an angiogenesis factor that promotes growth of blood vessels à provide nutritive support for follicular cells
    2. *theca externa*: capsule-like layer
* **antrum**: formed by small fluid-filled spaces coalescing into single, large cavity containing follicular fluid
* **follicular fluid**: contained in the antrum
* **secondary (vesicular) follicle**: ovarian follicle after antrum forms
* **cumulus oophorus:** mound of follicular cells that surround primary oocyte; projects into antrum
* **ovulation**: growth spurt of ovarian follicle and subsequent expulsionl; triggered by LH
* **stigma**: small, avascular spot that appears on cystic swelling produced by ovarian follicle on surface of ovary around midcycle (under influence of FSH/LH)
* **LH surge**: surge of LH production elicited by high estrogen in bld; ovulation usually follows 12-24 hrs later; stigma balloons out, forms vesicle, then ruptures, expelling 2ndary oocyte/follicular fluid
* **corona radiata**: zona pellucida and one or more layers of follicular cells arranged radially around secondary oocyte
* **glycoprotein**s: zona pellucida composed of 3 glycoproteins: ZPA, ZPB, ZPC; these usually form a network of filaments with multiple pores
* **corpus luteum**: endocrine glandular structure that develops under LH influence; secretes progesterone, some estrogen causing the endometrial glands to secrete/prepare for blastocyst implantation
* **mittelschmerz**: “mid pain”; abdominal pain accompanying ovulation
* **phases of menstrual cycle**:
  + *menstrual phase*: functional layer of uterine wall is sloughed off
  + *proliferative phase*: (follicular/estrogenic phase); surface epithelium reforms and covers endometrium; glands increase in number/length; spinal arteries elongate; endometrium thickens; increased water content; coincides w/ growth of ovarian follicles/ctrlld by estrogen
  + *luteal phase*: (secretory/progesterone phase); coincides w/ formation/fx/growth of corpus luteum; glands become wide, tortuous, saccular; endometrial thickening; large lacunae develop

IF NO FERTILIZATION à corpus luteum degenerates; estr/progest levels fall; menstruation occurs

* + *ischemic phase*: oocyte NOT fertilized; decreasing hormones, spiral arteries constrict à menses; eventually entire compact layer/most of spongy later discarded in menses

IF FERTILIZATION OCCURS à cleavage of zygote/blastogenesis; endometrial implantation; human chorionic gonadotropin keeps corpus luteum secreting estro/progest; luteal phase continues

* + *pregnancy phase*: menstrual cycles cease; endometrium passes into pregnancy phase
* **triploid conceptions**: accounts for approximately 20% of chromosomally abnormal spontaneous abortions; two sperms fertilize oocyte (dispermy) à result is zygote w/ extra set of chromosome   
  triploid embryos: 69 chromosomes; severe intrauterine growth retardation, disportionately small trunks, anomalies in CNS; nearly always abort or die shortly after birth
* **phases of fertilization**:
  + passage of sperm through the corona radiata: hyaluronidase rel from acrosome; mvmt of sperm tail; tubal mucosal enzymes asst in passage
  + penetration of zona pellucida: acrosome releases esterases, acrosin, neuraminidase à cause lysis of zona pellucida; penetration causes zona rxn à impenetrable to oth sperm   
    fusion of plasma membranes of oocyte/sperm: membranes of both fuse/breakdown; head/tail of sperm enter oocyte cytoplasm   
    completion of 2nd meiotic division of oocyte/formation of female pronucleus:
  + penetration of oocyte triggers 2nd meiosis à mature oocyte and 2nd polar body formed;
  + decondensation of maternal chromosomes à nucleus of mature oocyte becomes female pronucleus
  + formation of male pronucleus: nucleus of sperm enlarges to form male pronucleus   
    pronuclei fuse into single diploid aggregation of chromosomes à ootid becomes a zygote   
    attractants: chemical signals secreted by oocyte and surrounding follicular cells   
    sperm chemotaxis: capacitated sperm guided by chemical signals to oocyte
* **gamete**-specific proteins
* **sperm**-egg recognition
* **acrosin**: proteolytic enzyme released from acrosome; cause lysis of zona pellucida   
  early pregnancy factor: an immunosuppressant protein secreted by trophoblastic cells; forms basis of pregnancy test; appears in maternal serum w/n 24-48 hours
* **in vitro fertilization (IVF):** oocytes; ovarian follicles stimulated to grow/mature by clomiphene citrate/ gonadotropin; mature oocytes aspirated laparoscopically; oocytes placed in Petri dish of a medium and capacitated sperms; resulting embryos transferred into uterus; pt remains supine for several hrs
* **embryo transfer**: cleaving zygotes; same process as IVF
* cryopreservation: embryos resulting from IVF can be preserved for long periods with cryoprotectant
* **intracytoplasmic sperm injection**: sperm injected directly into cytoplasm of mature oocyte; used when failed IVF or too few sperm avail
* **assisted in vivo fertilization**: gamete intrafallopian transfer; enables fertilization to occur in ampulla of uterine tube; superovulation à oocyte retrieval à sperm collection à laparoscopic placement of several oocytes/sperms into uterine tubes
* **cleavage**: repeated mitotic divisions of zygote, results in rapid increase in # of cells; approx 30 hrs after fertilization
* **blastomeres**: embryonic cells that become smaller w/ each division   
  Blastomeres à further cleavage à 9-stage cell à compaction à 12-32 blastomeres (morula) à development of blastocystic cavity à separation into trophoblast and inner cell mass
* **trophoblast**: “nutrition”; thin, outer cell layer; gives rise to embryonic part of placenta   
  inner cell mass: group of centrally located blastomeres; gives rise to embryo; also called the embryoblast
* **embryoblast**: inner cell mass; primordium of embryo
* **blastogenesis:** development of blastocyst
* **blastocyst:** conceptus during blastogenesis   
  embryonic pole: adjacent area where the blastocyst normally attaches to the endometrial epithelium
* **trophoblast differentiates into**:
  + *cytotrophoblast*: inner layer of cells that is mitotically active; forms new cells that migrate into increasing mass of syncytioblast where they fuse and lose cell membranes
  + *syncytiotrophoblast*: outer layer that consists of multinucleated protoplasmic mass in which no cell boundaries can be observed; invades/burrows into endometrial epithelium and erodes endometrial blood vessels allowing maternal blood to seep in/out à establishes uteroplacental circulation; rapidly expanding, multinucleated mass
* **hypoblas***t*: primary endoderm; layer of cells on surface of embryoblast facing the blastocystic cavity
* **apoptosis**: programmed cell death; endometrial cells undergo as syncytiotrophoblastic cells displace them
* **decidual cells**: connective tissue cells around implantation site that accumulate glycogen and lipids and assume a polyhedral appearance; they degenerate adjacent to synctiotrophoblast and are engulfed by them to provide rich source of embryonic nutrition
* **human chorionic gonadotrophin (hCG**): maintains hormonal activity of corpus luteum in the ovary during pregnancy; used in pregnancy tests
* **lacunae**: hollow cavities filled with maternal blood; makes oxygen and nutritive substances available to the embryo; in syncytiotrophoblast
* **amniotic cavity**: small space in the embryoblast
* **amnion**: encloses the amniotic cavity
* embryonic disc: bilaminar embryonic disc composed of epiblast and hypoblast; gives rise to germ layers that form all tissues and organs of embryo
* **epiblast**: thicker layer, consisting of high columnar cells related to amniotic cavity; forms floor of amniotic cavity; continuous peripherally with amnion
* **hypoblast**: consisting of small cuboidal cells adjacent to exocoelomic cavity; forms roof of exocoelomic cavity; continuous with thin exocoelomic membrane; adjacent to blastocyst cavity   
  primordial uteroplacental circulation
* **decidual reaction**: as conceptus implants, the endometrial connective tissue cells undergo a transformation; provide nutrition for early embryo and immunologically privileged site for conceptus implantation
* **decidual cells**: endometrial connective tissue cells swell b/c of accumulation of glycogen and lipid in cytoplasm
* **lacunar networks**: fused syncytiotrophoblastic lacunae; giving sponge-like appearance   
  primary chorionic villi: proliferation of cytotrophoblastic cells produce cellular extensions that grow into syncytiotrophoblast; first stage in development of chorionic villi of placenta
* **extraembryonic somatic mesoderm**: possibly induce growth of primary chorionic villi; lines trophoblast and covers amnion
* **extraembryonic splanchic mesoderm**: surrounds umbilical vesicle
* **chorion**: forms wall of chorionic sac (w/n which embryo and amniotic sac and umbilical vesicle are suspended by connecting stalk); formed by extraembryonic somatic mesoderm and two layers of trophoblast (syncytiotrophoblast and cytotrophoblast)
* **prechordal plate**: future site of mouth and important organizer of head region; hypoblastic cells in localized area are now columnar and form thickened circular area; located in roof of secondary umbilical vesicle
* ectopic pregnancy: blastocyst implantation outside the uterus (i.e., ampulla, isthmus)
* **tubal pregnancy**: signs/symptoms of pregnancy, may have abdominal pain, can be confused w/ appendicitis; slower rate of beta-human chorionic gonadotropin so pregnancy test may read false-negative; can be related to delay/prevention of transport of cleaving zygote to uterus (i.e., pelvic inflammatory disease); can rupture, hemorrhage, death of embryo/mother; affected tube/conceptus usually surgically removed
* **abdominal pregnancy**: blastocyst implant in ampulla/fimbriae of uterine tube and may be expelled into peritoneal cavity; commonly implant in rectouterine pouch; usually placenta attaches to abdominal organs causing intraperitoneal bleeding
* **lithopedion**: “stone fetus”; abdominal conceptus dies, not detected and becomes calcified