

Functional anatomy
(for pathobiology graduate students)

Female Genital System



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The organs:

- Ovaries
- Fallopian tubes
- Uterus (corpus + cervix)
- Lower genital tract (vagina and vulva)
- Placenta

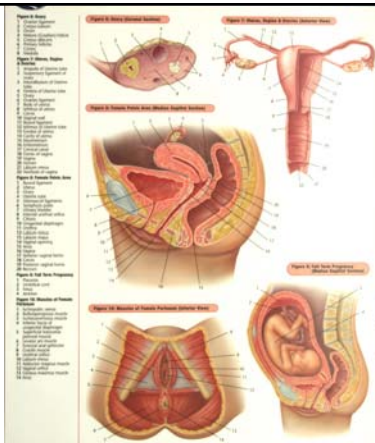
The functions:

- Conception
- Delivery of the baby
- Synthesis of estrogen and progesterone (hormonal organ)

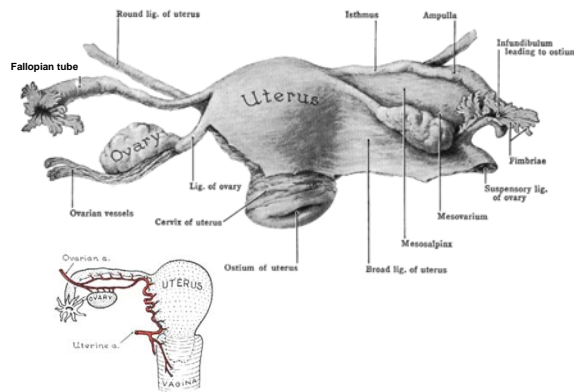
How to:

Ovaries provide the oocyte(s) and ovulate
Fertilization in the **fallopian tubes** and transportation to uterine cavity
Implantation and placental formation in the **uterus**
Ovaries and **placenta** function as hormonal organs to maintain the pregnancy
Induction of labor and delivery through **vagina**

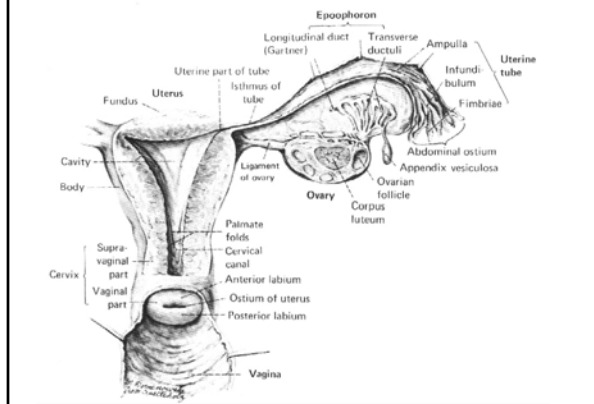
Review of anatomy



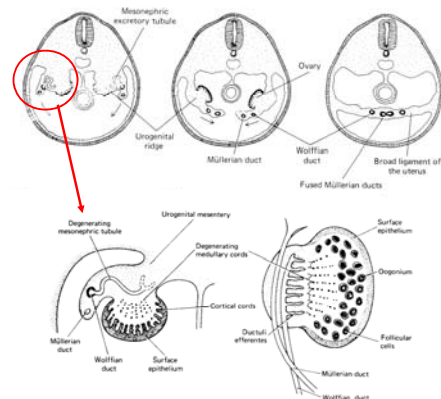
Gross anatomy of female genital organs-1

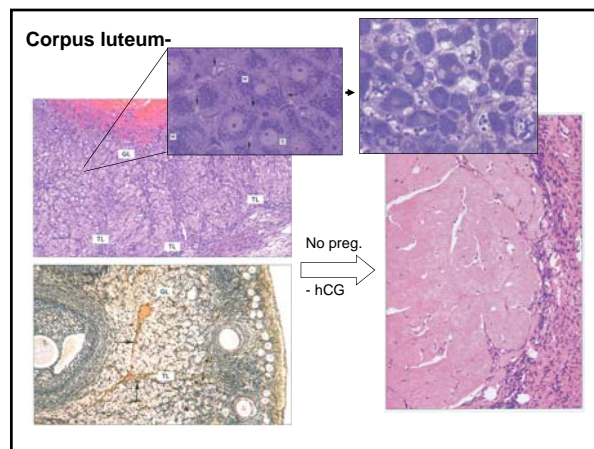
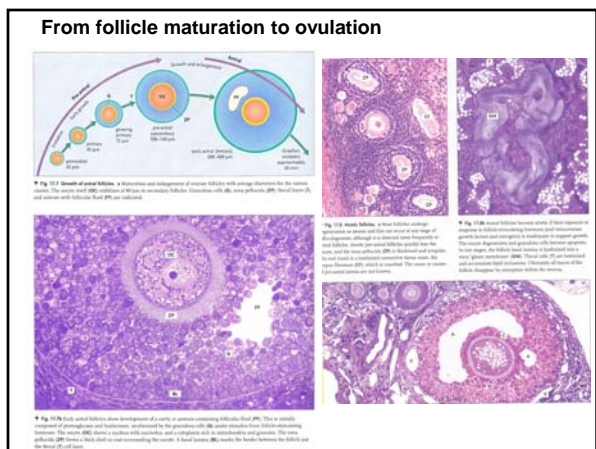
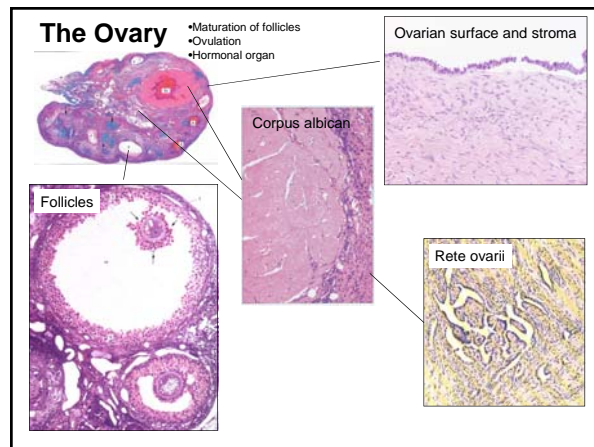
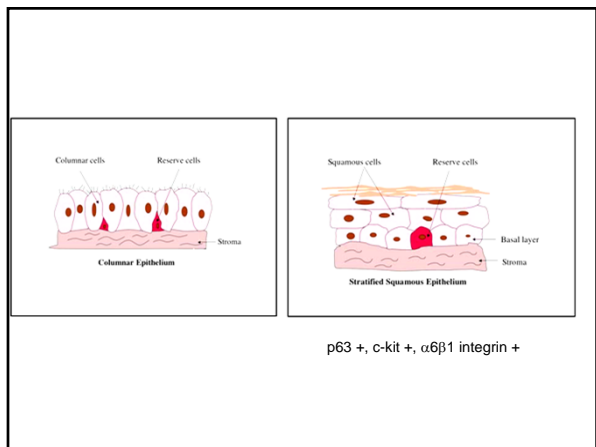
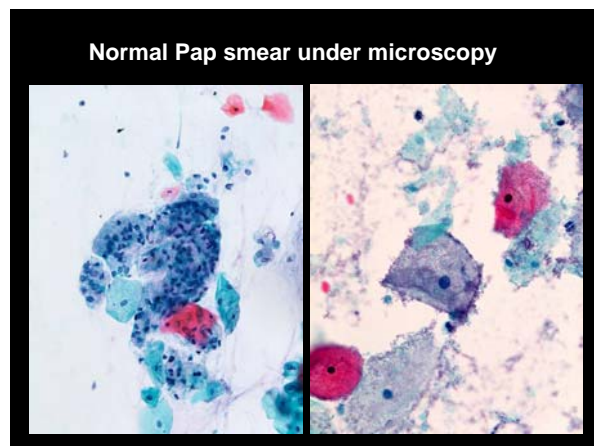
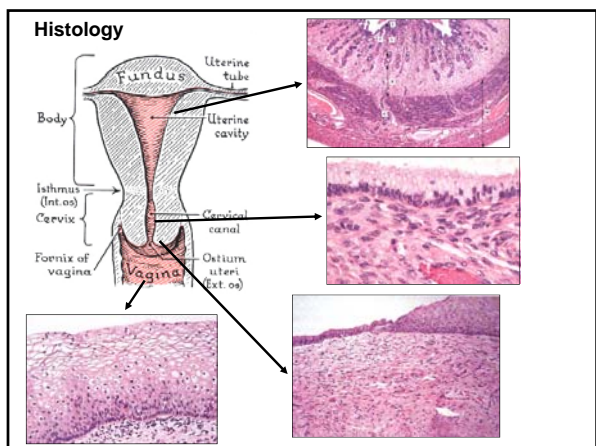


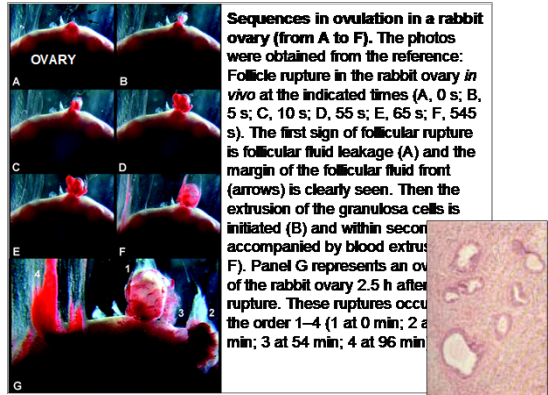
Gross anatomy of female genital organs-2



Development of female genital organs and tract





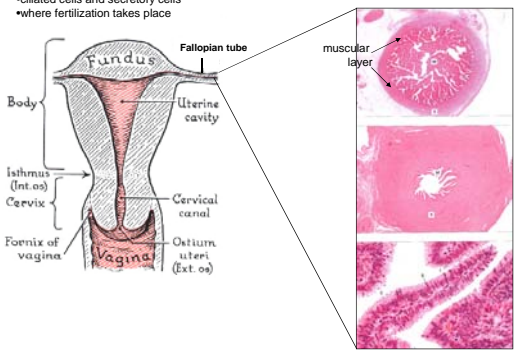
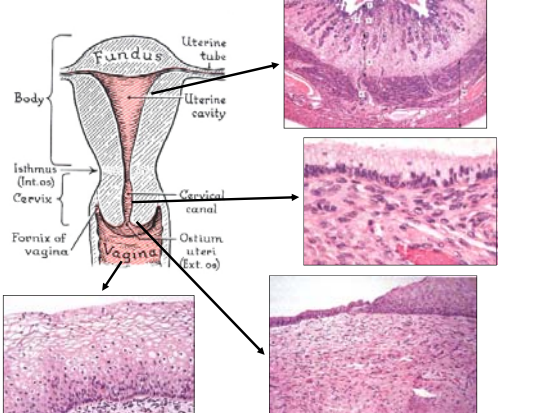


Sequences in ovulation in a rabbit ovary (from A to F). The photos were obtained from the reference: Follicle rupture in the rabbit ovary *in vivo* at the indicated times (A, 0 s; B, 5 s; C, 10 s; D, 55 s; E, 65 s; F, 545 s). The first sign of follicular rupture is follicular fluid leakage (A) and the margin of the follicular fluid front (arrows) is clearly seen. Then the extrusion of the granulosa cells is initiated (B) and within second accompanied by blood extrusion (C-F). Panel G represents an ovulated follicle of the rabbit ovary 2.5 h after rupture. These ruptures occur in the order 1-4 (1 at 0 min; 2 at 15 min; 3 at 54 min; 4 at 96 min).

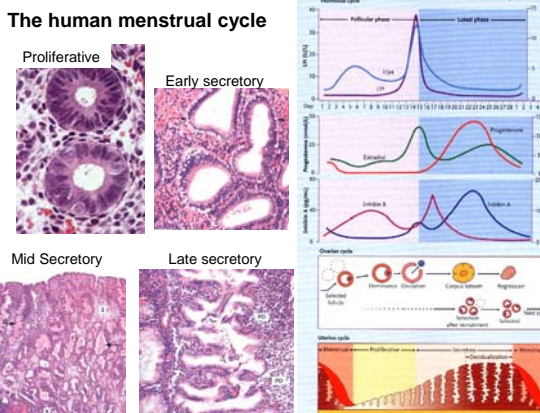
Ref: Human Reproduction, 21:624-31, 2006.

Fallopian tube

- muscular tube that connect uterus and ovaries
- ciliated cells and secretory cells
- where fertilization takes place

The human menstrual cycle



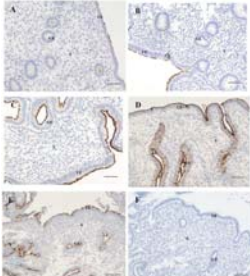
Fertility and Sterility

Volume 83, Issue 4, Supplement 1, Pages 1297-1302

Differential expression of L-selectin ligand in the endometrium during the menstrual cycle.

- Li J
- Zhang J
- Wang H
- Xu C
- Wang F
- Zhang Y

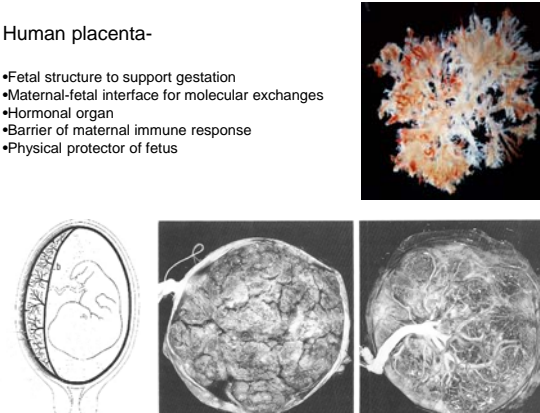
Department of Gynecology and Obstetrics, Johns Hopkins University School of Medicine, Baltimore, MD 21287, USA.

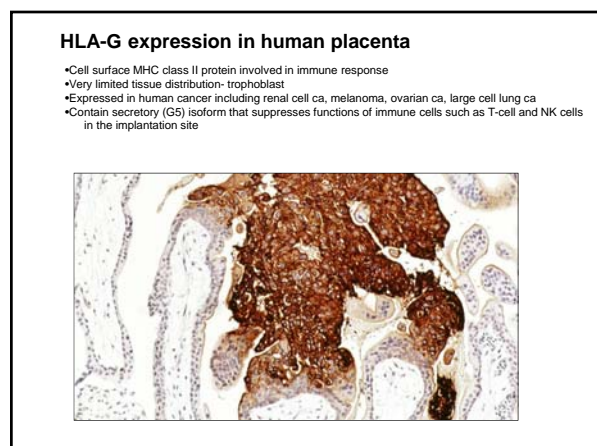
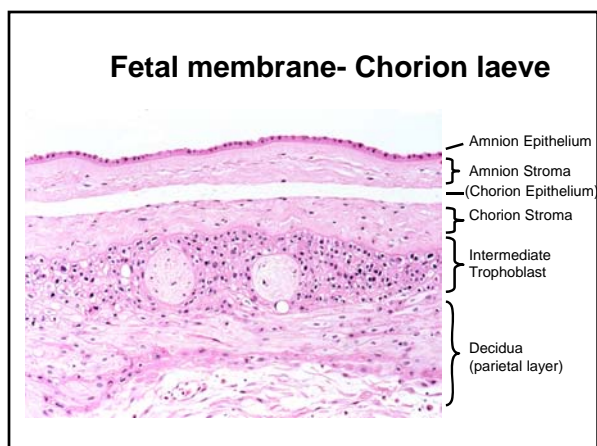
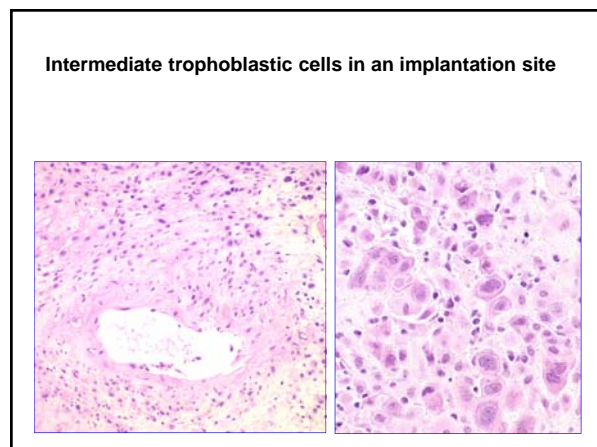
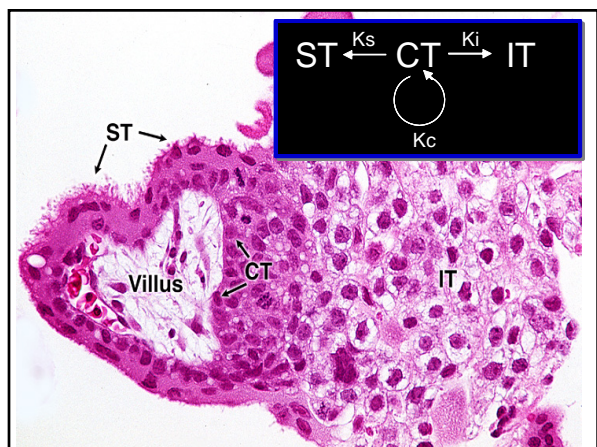
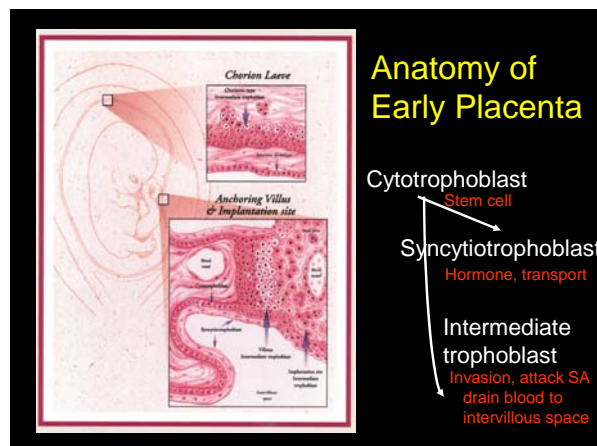
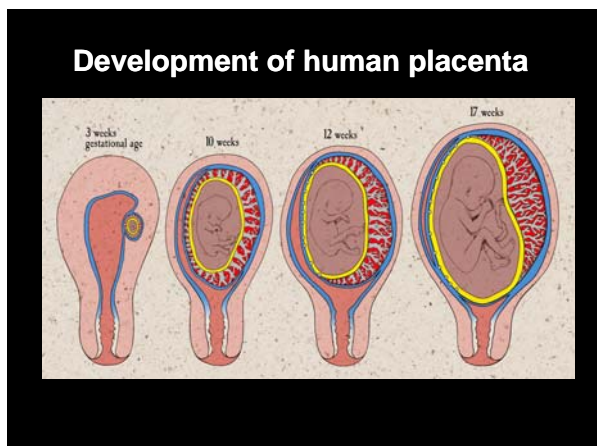


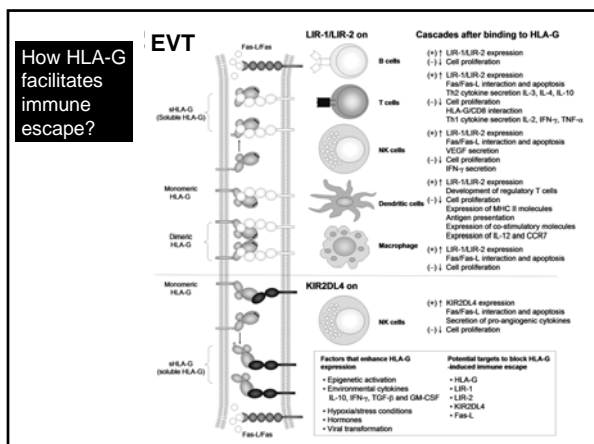
Increased expression of L-selectin ligand in the human endometrium during the early and midsecretory phases of the menstrual cycle may be related to the process of implantation.

Human placenta-

- Fetal structure to support gestation
- Maternal-fetal interface for molecular exchanges
- Hormonal organ
- Barrier of maternal immune response
- Physical protector of fetus







Uterine cervix

The check point of vaginal bacterial flora

Secrete mucin to control bacterial growth in vagina

Stopper for conceptus before term (prevent preterm labor)

Endocervical gland

Ectocervix **Endocervix**

Ectocervix

Endocervix

Principles of HPV E6 / E7 Oncogene Activity

E7 binds to RB-P which results in release of E2F transcription factors

RB **E2F** **E7**

RB **E7** **E2F**

Inactivation of RB and release of E2F

Inactivation of RB results in marked overexpression of p16ink4a

(Klaes et al., Int.J. Cancer 92, 276-284, 2001)
(Sano et al., Am.J.Pathol. 153, 1741-1748, 1998)

Pathology of female reproductive system

Ovaries- neoplastic diseases, cysts (torsion), endometriosis, hemorrhagic corpus luteum, hormonal imbalance

Fallopian tubes- infection, tubal pregnancy, neoplastic disease

Uterus corpus- neoplastic disease, hyperplasia, functional bleeding, infection

Lower genital tract (vagina and vulva)- neoplastic disease (HPV related)

Placenta- abnormality (molar pregnancy), infection, placental dysfunction, neoplastic disease (rare)

Gross anatomy of female genital organs

Leiomyoma
Leiomyosarcoma

Chorio-carcinoma

mole

“Ovarian” cancer:
Primary carcinoma
Metastatic carcinoma
Stromal tumor
Germ cell tumor

Endometrial hyperplasia
Endometrioid carcinoma

estrogen

Squamous intraepithelial lesion
Squamous carcinoma

HPV

Mesothelioma and Ovarian cancer

If ovarian cancer is derived from ovarian surface Epithelial cells, i.e., mesothelial cells, ovarian cancer should resemble mesothelioma morphologically and molecularly.

Other origin of ovarian cancer?

Affymetrix U133 Plus 2.0 microarrays

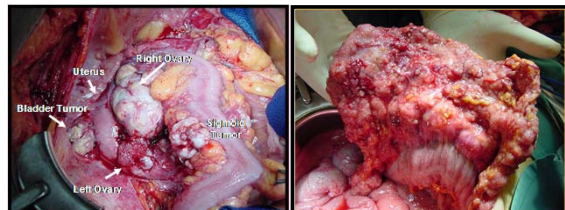
Ovary

Müllerian duct

Wolffia duct

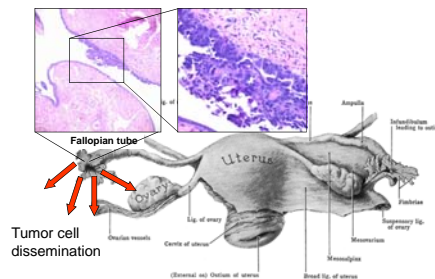
Fused

The fact



Bristow et al. J Am Coll Surg 2003; 197: 565.

New hypothesis- fallopian tube origin of "ovarian" cancer



Review question set

1. Which of the following cell type does NOT produce hormone(s):

- A. Theca cells.
- B. Corpus luteal cells.
- C. Syncytiotrophoblast.
- D. Ovarian surface epithelium.
- E. Ovarian stromal cells.

2. Which of the following statement is NOT correct regarding human endometrium?

- A. It is composed of glandular epithelium and underlying stromal tissues.
- B. It is the site for implantation occurs.
- C. Subnuclear vacuolization is a sign of the late menstrual cycle.
- D. Progesterone is the major hormone responsible for secretory changes in the endometrium.
- E. All of above is correct.

3. The pregnancy (except the first few weeks) is maintained and progressed by:

- A. Estrogen secreted by follicular cells in the ovary.
- B. Progesterone secreted by corpus luteum in the ovary.
- C. hCG secreted by human placenta.
- D. LH secreted by pituitary glands.
- E. FSH secreted by pituitary glands.

4. Which of following statements is correct?

- A. Fallopian tube connects uterus and ovary in a continuum.
- B. Ovary is the most common site for ectopic pregnancy.
- C. Endometrial gland is the primary source of mucin in vaginal wall.
- D. Corpus luteum is no longer present in postmenopausal ovaries.
- E. Vulva is not considered as skin because it does not contain skin appendages.

5. Which of the following structure is NOT derived from Mullerian duct?

- A. Rete ovarii.
- B. Fallopian tube.
- C. Endometrium.
- D. Endocervix.
- E. Upper third of vagina.

6. Which of following condition is most likely associated with a preterm labor?

- A. Fallopian tube atresia.
- B. Cervical incompetence.
- C. Removal of ovary in late pregnancy.
- D. Vaginal wall relaxation.
- E. HPV infection in vulva.

7. Which of the following statement is correct regarding HLA-G molecule?

- A. The secreted form is produced by the ovary.
- B. It is essential to stimulate the placental growth during pregnancy.
- C. It participates in immune suppression in the placenta.
- D. It belongs to MHC class I molecules.
- E. None of above.

8. Which of the following statement is NOT correct regarding the development of female genital organs?

- A. Ovaries developed from urogenital ridge.
- B. Rete ovarii is the embryonic remnant of mesonephric duct.
- C. Upper third and lower third of vagina are derived from different embryonic structures.
- D. Wolffian ducts fused to form the uterine body.
- E. Vulva developed from the skin not the Mullerian duct.