# Fertilisation, Pregnancy & Embryonic Development

## 1 Mark Questions

**1.How is the entry of only one sperm ensured into an ovum during fertilisation in humans?[All India 2012]**

**Ans**.During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes (depolarisation) in the membrane that blocks the entry of additional sperms. This ensures that only one sperm can fertilise an ovum

**2.Mention the function of trophoblast in human embryo.[Delhi 2011]**

**Ans**.Trophoblast is the outer layer of blastocyst which helps in attachment of blastocyst to the endometrium of the uterus.

**3.Name the embryonic stage that gets implanted in the uterine wall of a human female. [All India 2011]**

**Ans.**Blastocyst gets implanted in the uterine wall.

**4.What stimulates pituitary to release the hormone responsible for parturition? Name the hormone.[All India 2011]**

**Ans**.Foetal ejection reflex stimulates pituitary to release the oxytocin hormone, which is responsible for parturition.

**5.How does colostrum provide initial protection against diseases to newborn infants? Give one reason. [Delhi 2009]**

**Ans**.Colostrum contains necessary antibodies (IgA) that provide protection against diseases to newborn infants.

## 2 Marks Questions

**6.Where does fertilisation occur in humans? Explain the events that occur during this process. [All India 2014]**

**Ans.**In humans, the fertilisation of ovum takes place in ampullary-isthmic junction of Fallopian tube.

The events that occur during the process of fertilisation are:

(i) The sperm reaches the junction of ampulla and isthmus and comes in contact with zona pellucida layer of ovum.

(ii) Acrosome of sperm head release sperm lysin enzymes that dissolves corona radiata and digests zona pellucida layer and enters cytoplasm.

(iii) Entry of sperm stimulates secondary oocyte to complete its suspended second meiotic division, thus producing haploid egg or ovum and second polar body.

(iv)Nucleus of sperm and of ovum fuses to form a diploid zygote.

**7.Explain the events that occur during fertilisation of an ovum in humans. How is it that only one sperm enters the OVUm? [All India 2014 C]**

**Ans.(i)**In humans, the fertilisation of ovum takes place in ampullary-isthmic junction of Fallopian tube.

The events that occur during the process of fertilisation are:

(a) The sperm reaches the junction of ampulla and isthmus and comes in contact with zona pellucida layer of ovum.

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(c) Entry of sperm stimulates secondary oocyte to complete its suspended second meiotic division, thus producing haploid egg or ovum and second polar body.

(d)Nucleus of sperm and of ovum fuses to form a diploid zygote.

**(ii)**During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and

induces changes (depolarisation) in the membrane that blocks the entry of additional sperms. This ensures that only one sperm can fertilise an ovum

**8.(i) Where do the signals for parturition originate in humans?**
**(ii) Why is it important to feed the newborn babies on colostrum? [All India 2012]**
**Ans**.(i)The signals for parturition originate from the fully developed foetus and the placenta, which induce mild uterine contraction called foetal ejection reflex
(ii)Colostrum contains necessary antibodies (IgA) that provide protection against diseases to newborn infants.

**9.Name the hormones produced only during pregnancy in human female. Mention their source organ.[Foreign 2011]**
**Ans.**The hormones produced only during pregnancy in human female are human Chorionic Gonadotropin (hCG), human Placental Lactogen (hPL) and relaxin. The source of hCG and hPL — Placenta, and Relaxin — Ovary.

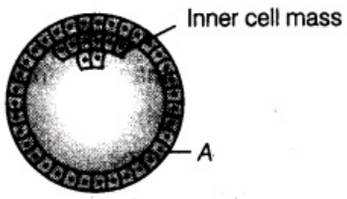
**10.Placenta acts as an endocrine tissue. Justify. [All India 2010]**
**Ans**.Placenta acts as an endocrine tissue as it secretes hormones like
(i) hCG (human Chorionic Gonadotropin)
(ii) hPL (human Placental Lactogen)
(iii) Oestrogens
(iv) Progesterone

**11.What is colostrum? Why is it important to be given to the newborn infants?**
**[Foreign 2009; AH India 2009 C]**
**Ans.**The milk produced by mammary glands of human female in initial few days of lactation is called colostrum. Colostrum contains necessary antibodies (IgA) that provide protection against diseases to newborn infants.

## 3 Marks Questions

**12.(i) How is placenta formed in human female?**
**(ii) Name any two hormones which are secreted by it and are also present in a non-pregnant woman. [Foreign 2014]**
**Ans**.(i)After implantation of blastocyst, the finger-like projections called chorionic villi, appear on the trophoblast and is surrounded by uterine tissue and maternal blood which become interdigitated with each other to form placenta.
(ii) The two hormones secreted by placenta that are also present in a non-pregnant women are oestrogen and progesterone.

**13. Study the given figure below and answer the question that follow**




**(i)Name the stage of human embryo the figure represents.**
**(ii)Identify Ain the figure and mention its function.**
**(iii)Mention the fate of the inner cell mass after implantation in the uterus.**
**(iv)Where are the stem cells located in this embryo? [Delhi 2009]**
**Ans**.(i)The stage is blastocyst.
(ii) A—Trophoblast. It helps in attachment to endometrium during implantation and provides

nourishment to developing embryo.
(iii) Inner cell mass acts as precursor to embryo and gets differentiated into ectoderm and endoderm.
(iv) Stem cells are located in inner cell mass of embryo.

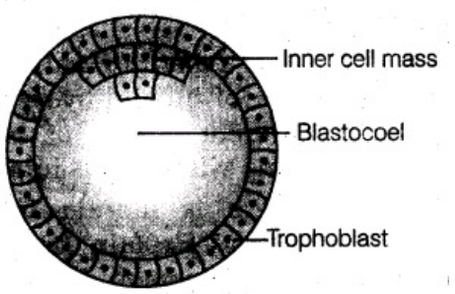
## 5 Marks Questions

**14.(i)Explain the events taking place at the time of fertilisation of an ovum in a human female.**
**(ii)Trace the development of the zygote up to its implantation in the uterus.**

**(iii)Name and draw a labelled sectional view of the embryonic stage that gets implanted. [Delhi 2010]**
**Ans.(i)**In humans, the fertilisation of ovum takes place in ampullary-isthmic junction of Fallopian tube.
The events that occur during the process of fertilisation are:
(a) The sperm reaches the junction of ampulla and isthmus and comes in contact with zona pellucida layer of ovum.
(b) Acrosome of sperm head release sperm lysin enzymes that dissolves corona radiata and digests zona pellucida layer and enters cytoplasm.
(c) Entry of sperm stimulates secondary oocyte to complete its suspended second meiotic division, thus producing haploid egg or ovum and second polar body.
(d)Nucleus of sperm and of ovum fuses to form a diploid zygote.
**(ii)**Development of zygote up to implantation takes place in following sequence

- Cleavage division (mitotic) starts in zygote as it moves through the isthmus of Fallopian tube towards the uterus.
- This division results into 2, 4, 8 and 16 daughter cells called blastomeres.
- The embryo with 8-16 blastomeres is called morula.
- Morula continues to divide and transforms into blastocyst as it moves further into uterus.
- Blastomeres in the blastocyst are arranged into an outer layer called trophoblast and inner group of cells attached to trophoblast called inner cell mass.
- Trophoblast layer then gets attached to the endometrium and the inner cell mass gets differentiated as the embryo.
- After attachment, the uterine cells divide rapidly and cover the blastocyst.

It leads to blastocyst's embedding in the endometrium of the uterus. This is called implantation.
(iii) Blastocyst stage implants in the uterus.




**15.Describe the post-zygotic events leading to implantation and placenta formation in humans. Mention any two functions of placenta. [All India 2010]**
**or**
**Explain the process of fertilisation in human female and trace the post-fertilisation events in**

**a sequential order up to implantation of the embryo. [Foreign 2010]**

**Ans**.Post-zygotic events leading to implantation and placenta formation. After implantation of blastocyst, the finger-like projections called chorionic villi, appear on the trophoblast and is surrounded by uterine tissue and maternal blood which become interdigitated with each other to form placenta. Events leading to formation of placenta. The chorionic villi and uterine tissue, after implantation become interdigitated with each other and form placenta, a structural and functional unit between embryo and maternal body.

**Functions of Placenta**

(i) It facilitates the supply of oxygen and nutrients to the foetus and removal of $C0_2$ and excretion products.

(ii) It acts as an endocrine gland and secretes hormones like hPL, hCG, oestrogen and progesterone.

**16.(i) Mention the event that induces the completion of the meiotic division of the secondary oocyte.**

**(ii) Trace the journey of the ovum from the ovary, its fertilisation and further development until the implantation of the embryo. [Ml India 2010 c]**

**Ans.**(i)Secondary oocyte completes meiosis-ll

only when a sperm enters its cytoplasm. It forms a larger cell, the ootid and a small cell, the second polar body.

(ii)

- The secondary oocyte is released by the rupture of the Graafian follicle in the process called ovulation.
- It is moved into the Fallopian tube with the help of fimbriae.
- It reaches the ampullary isthmic junction of the Fallopian tube, where fertilisation takes place.

- Cleavage causes formation of 2, 4, 8 and 16 daughter cells called blastomeres. The embryo with 8-16 blastomeres is a solid spherical structure called morula.
- Cleavage start in the zygote.
- Morula continues to divide and blastomeres rearrange themselves as it moves further into the uterus.
- As a result, blastocyst is formed, which contains trophoblast (outer layer) and inner cell mass.
- The trophoblast attacheds to endometrium (implantation) and blastocyst gets embedded in it.

**17.(i) When and how does placenta develop in human female?**

**(ii)How is the placenta connected to the embryo?**

**(iii)Placenta acts as an endocrine gland. Explain. [Ml India 2009]**

Ans.(i)Development of placenta in human female After implantation of blastocyst, the finger-like projections called chorionic villi, appear on the trophoblast and is surrounded by uterine tissue and maternal blood which become interdigitated with each other to form placenta.

(ii) Placenta is connected to the embryo through an umbilical cord.

(iii) Placenta acts as an endocrine tissue as it secretes hormones like

(a) hCG (human Chorionic Gonadotropin)

(b) hPL (human Placental Lactogen)

(c) Oestrogens

(d) Progesteronem

## Miscellaneous Questions

## 3 Marks Questions

**1.Explain the steps in the formation of an ovum from an oogonium in humans.**
**or**
**Suggest and explain any three Assisted Reproductive Technologies (ART) to an infertile couple.**
**[All India 2013]**
**Ans.**Three reproductive techniques for sterile couple are:
(i) In vitro fertilisation The fertilisation outside the body in almost similar conditions as that in the body followed by embryo transfer to the mother. This method is popularly known as test-tube baby.
(ii) GameteintraFallopian transfer Transfer of an ovum collected from a donor into the Fallopian tube of another female who cannot produce ovum, but can provide suitable . environment for fertilisation and further development.
(iii) Intracytoplasmic sperm injection It is another specialised procedure to form an embryo in the laboratory in which a sperm is directly injected into the ovum.

**2.Write the function of each one of the following**
**(i)Fimbriae (oviducal)**
**(ii)Coleoptile**
**(iii) Oxytocin [Delhi20i2]**
**Ans**.(i)Fimbriae are the . feathery finger-like projections present at the end of Fallopian tubes and it collects the ovum after its release from the ovary into the Fallopian tube.
(ii) Coleoptile is a conical sheath present in the monocot seeds, its function is to protect the developing plumule
(iii)Oxytocin is a hormone secreted by the posterior pituitary and it stimulates the contraction of uterine muscles during child birth (parturition).

**3.Write the function of each of the following**
**(i)Middle piece in human sperm**
**(ii)Tapetum in anthers**
**(iii)Luteinising hormone in human males [Delhi 2012]**
Ans.(i)Middle piece in human sperm contains several mitochondria which produces energy for the motility of the sperm.
(ii) Tapetum in anthers It is the innermost layer of the anther. The main function of tapetum is to provide nourishment to the developing pollen grains.
(iii) Leuteinising hormones in human male stimulates the Leydig cells to produce testosterone, necessary to complete the process of spermatogenesis.

**4.Write the function of each of the following**
**(i)Seminal vesicle**
**(ii)Scutellum**
**(iii)Acrosome of human sperm [Delhi 2012]**
**Ans**.(i)Seminal vesicle spermatogenesis It secretes an alkaline fluid that helps in neutralising the acidity of the vaginal tract and thereby increase the lifespan of sperms. Secretion of seminal vesicle is also a source of nutrition for the sperms.
(ii) Scutellum It is a tissue present in seed to absorb food from the adjacent endosperm and develop into growing embryo.
(iii) Acrosome It is the cap-like covering or structure that is present at the tip of the sperm (male gamete). The acrosome contains enzymes, which help the sperm enter into the cytoplasm of the ovum and thus helps in fertilisation.

**5.Give reasons for the following**
**(i)The human testes are located outside the abdominal cavity.**
**(ii)Some organisms like honeybees are called parthenogenetic animals.[All India 2012]**
**Ans.**Testes are located outside the abdominal cavity within a pouch called scrotum. Scrotum maintains low temperature of the testes (2-2.5°C lower than normal body temperature) required for spermatogenesis.
(ii) In honeybees, workerbees are all females. Sometimes, they may develop functional ovaries and lay unfertilised eggs, which normally result into drone bees. Hence, worker bees are capable of producing diploid eggs parthenogenetically and replaces the queen bee if she dies. Since, they develop from unfertilised diploid eggs (and do not undergo fertilisation) they are called parthenogenetic animals.

## 5 Marks Questions

**6.(i) When does oogenesis begin? (ii) Differentiate between the**
**location and function of Sertoli cells and Leydig cells.[All India 2010]**
**Ans**.Oogenesis begins during the embryonic development stage when a million gamete mother cells (oogonia) are formed within each foetal ovary.
(ii) (a) Sertoli cells are located on the inside lining of seminiferous tubule. These cells provide nutrition to the germ cells.
(b) Leydig cells or interstitial cells are located in the regions outside the seminiferous tubule called interstitial spaces. These cells synthesise and secrete testicular hormone called androgens.

**7.(i) Draw a labelled diagram of the human female reproductive system.**
**(ii) Enumerate the events in the ovary of a human female during**
**(b) Luteal phase of menstrual cycle**
**(a) Follicular phase [Delhi 2012]**
**Ans. (i)**Refer to page no. 43. (2)
(ii) (a) Follicular phase The primary follicle in the ovary grow to become fully mature Graafian follicle. Endometrium gets thickened. The follicular cells secrete oestrogen.
(b) Luteal phase The remaining parts of ruptured Graafian follicle transforms into corpus luteum, that secretes progesterone.

**8.(i) Write the specific location and the functions of the following cells in human males**

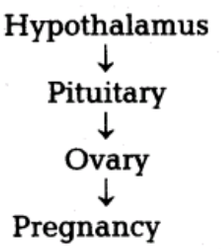
- **Leydig cells**
- **Sertoli cells**
- **Primary spermatocyte**

**(ii) Explain the role of any two accessory glands in human male reproductive system.[Delhi 2011]**
Ans.(I)Oogenesis begins during the embryonic development stage when a million gamete mother cells (oogonia) are formed within each foetal ovary.
(ii) (a) Sertoli cells are located on the inside lining of seminiferous tubule. These cells provide nutrition to the germ cells.
(b) Leydig cells or interstitial cells are located in the regions outside the seminiferous tubule called interstitial spaces. These cells synthesise and secrete testicular hormone called androgens.
Primary spermatocytes Located inside the seminiferous tubule and involved in the formation of spermatozoa.
(II) Accessory glands of human male reproductive system are:

(a) Prostate and seminal vesicles Their secretion provide a fluid medium for the sperms to swim towards the ovum. They provide nutrition to sperms.
(b) Bulbourethral glands Their secretion helps in the lubrication of penis.

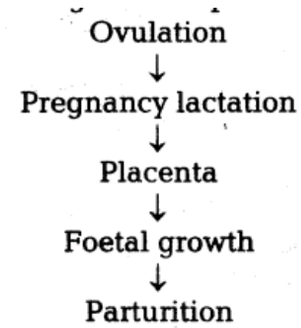
**9.(i) Draw a diagrammatic sectional view of human ovary showing different stages of oogenesis along with corpus luteum.**
**(ii) Where is morula formed in human? Explain the process of its development from zygote. [Delhi 2009]**
**Ans.**(i) Sectional view of human ovary.
(ii) Morula is formed in the
(a)Isthmus of the oviduct (Fallopiantube).
(b)The zygote undergoes mitotic divisions in quick succession called cleavage, forming 2, 4, 8 and 16 daughter cells called blastomeres.
(c)The embryo with 8-16 blastomeres is called a morula and the inner cell mass gets ready to form the embryo proper.

**10.Study the flow chart given below. Name the hormones involved at each stage and explain their function.[All India 2009]**




**Ans.Hypothalamus** Gonadotropin Releasing Hormones (GnRH) are released by the hypothalamus.
**Pituitary** GnRH stimulates pituitary to release FSH and LH.
**Ovary** FSH and LH act on ovary. LH stimulates ovulation, formation of corpus luteum from the ruptured follicle and secretion of progesterone by the corpus luteum.
**Pregnancy** Progesterone maintains pregnancy.

**11.Study the flow chart given below. Name the hormones involved at each stage and explain their role.**




**Ans.Ovulation** Induced by LH secreted from anterior pituitary. LH also stimulates the formation of corpus luteum and secretion of progesterone from it.
**Pregnancy** Progesterone is necessary for maintaining pregnancy and for the differentiation of alveoli in the mammary glands during pregnancy for producing milk during lactation.
**' Placenta and foetal growth** It secretes human chorionic gonadotropin that is necessary for foetal growth. It also secretes human placental lactogen for milk production.
**Parturition** Foetal ejection reflex stimulates the secretion of oxytocin which induces stronger contractions of uterine muscles leading to parturition.