CHAPTER 3

Human Reproduction

3.1 The Male Reproductive System

1. Select the correct sequence for transport of sperm cells in male reproductive system.
(a) Testis → Epididymis → Vasa efferentia → Vas deferens → Ejaculatory duct → Inguinal canal → Urethra → Urethral meatus
(b) Testis → Epididymis → Vasa efferentia → Rete testis → Inguinal canal → Urethra
(c) Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra → Urethral meatus
(d) Seminiferous tubules → Vasa efferentia → Epididymis → Inguinal canal → Urethra
(NEET 2019)

2. Which of the following depicts the correct pathway of transport of sperms?
(a) Rete testis → Efferent ductules → Epididymis → Vas deferens
(b) Rete testis → Epididymis → Efferent ductules → Vas deferens
(c) Rete testis → Vas deferens → Efferent ductules → Epididymis
(d) Efferent ductules → Rete testis → Vas deferens → Epididymis *(NEET-II 2016)*

3. The shared terminal duct of the reproductive and urinary system in the human male is
(a) urethra (b) ureter
(c) vas deferens (d) vasa efferentia. *(2014)*

4. The Leydig's cells as found in the human body are the secretory source of
(a) progesterone (b) intestinal mucus
(c) glucagon (d) androgens. *(2012)*

5. If for some reason, the vasa efferentia in the human reproductive system get blocked, the gametes will not be transported from
(a) testes to epididymis
(b) epididymis to vas deferens
(c) ovary to uterus
(d) vagina to uterus. *(2011)*

6. The testes in humans are situated outside the abdominal cavity inside a pouch called scrotum. The purpose served is for
(a) maintaining the scrotal temperature lower than the internal body temperature
(b) escaping any possible compression by the visceral organs
(c) providing more space for the growth of epididymis
(d) providing a secondary sexual feature for exhibiting the male sex. *(2011)*

7. Sertoli cells are found in
(a) ovaries and secrete progesterone
(b) adrenal cortex and secrete adrenaline
(c) seminiferous tubules and provide nutrition to germ cells
(d) pancreas and secrete cholecystokinin. *(2010)*

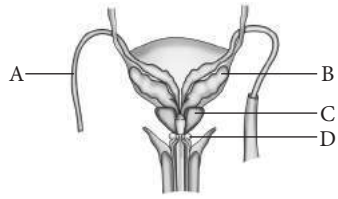
8. Vasa efferentia are the ductules leading from
(a) testicular lobules to rete testis
(b) rete testis to vas deferens
(c) vas deferens to epididymis
(d) epididymis to urethra. *(2010)*

9. Seminal plasma in human males is rich in
(a) fructose and calcium
(b) glucose and calcium
(c) DNA and testosterone
(d) ribose and potassium. *(2010)*

10. Secretions from which one of the following are rich in fructose, calcium and some enzymes?
(a) Male accessory glands
(b) Liver
(c) Pancreas
(d) Salivary glands *(Mains 2010)*

11. Seminal plasma in humans is rich in
(a) fructose and calcium but has no enzymes
(b) glucose and certain enzymes but has no calcium
(c) fructose and certain enzymes but poor in calcium
(d) fructose, calcium and certain enzymes. *(2009)*

12. Given below is a diagrammatic sketch of a portion of human male reproductive system. Select the correct set of the names of the parts labelled A, B, C, D.



(a) A-Vas deferens, B-Seminal vesicle, C-Prostate, D-Bulbourethral gland
(b) A-Vas deferens, B-Seminal vesicle, C-Bulbourethral gland, D-Prostate
(c) A-Ureter, B-Seminal vesicle, C-Prostate, D-Bulbourethral gland
(d) A-Ureter, B-Prostate, C-Seminal vesicle, D-Bulbourethral gland *(2009)*

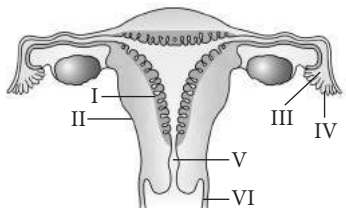
13. Male hormone is produced in the testis by cells of
(a) Sertoli (b) epithelial
(c) spermatocytes (d) Leydig. *(1993)*

14. Location and secretion of Leydig's cells are
(a) liver-cholesterol (b) ovary-estrogen
(c) testis-testosterone (d) pancreas-glucagon. *(1991)*

3.2 The Female Reproductive System

15. Hysterectomy is surgical removal of
(a) vas deferens (b) mammary glands
(c) uterus (d) prostate gland. *(2015 Cancelled)*

16. The figure given below depicts a diagrammatic sectional view of the human female reproductive system. Which set of three parts out of I-VI have been correctly identified?



(a) (II) Endometrium, (III) Infundibulum, (IV) Fimbriae
(b) (III) Infundibulum, (IV) Fimbriae, (V) Cervix
(c) (IV) Oviducal funnel, (V) Uterus, (VI) Cervix
(d) (I) Perimetrium, (II) Myometrium, (III) Fallopian tube *(2011)*

17. The part of Fallopian tube closest to the ovary is
(a) isthmus (b) infundibulum
(c) cervix (d) ampulla. *(2010)*

18. Bartholin's glands are situated
(a) on the sides of the head of some amphibians
(b) at the reduced tail end of birds
(c) on either side of vagina in humans
(d) on either side of vas deferens in humans. *(2003)*

3.3 Gametogenesis

19. Meiotic division of the secondary oocyte is completed
(a) prior to ovulation
(b) at the time of copulation
(c) after zygote formation
(d) at the time of fusion of a sperm with an ovum. *(NEET 2020)*

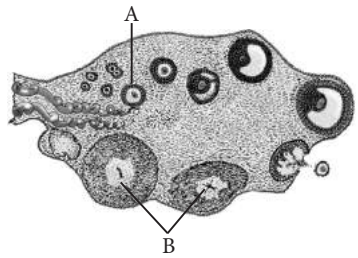
20. The difference between spermiogenesis and spermiation is
(a) in spermiogenesis spermatids are formed, while in spermiation spermatozoa are formed
(b) in spermiogenesis spermatozoa are formed, while in spermiation spermatids are formed
(c) in spermiogenesis spermatozoa from Sertoli cells are released into the cavity of seminiferous tubules, while in spermiation spermatozoa are formed
(d) in spermiogenesis spermatozoa are formed, while in spermiation spermatozoa are released from Sertoli cells into the cavity of seminiferous tubules. *(NEET 2018)*

21. Which of the following layers in an antral follicle is acellular?
(a) Stroma (b) Zona pellucida
(c) Granulosa (d) Theca interna *(2015)*

22. Which of the following cells during gametogenesis is normally diploid ?
(a) Spermatogonia
(b) Secondary polar body
(c) Primary polar body
(d) Spermatid *(2015 Cancelled)*

23. What is the correct sequence of sperm formation?
(a) Spermatogonia, spermatozoa, spermatocytes, spermatids
(b) Spermatogonia, spermatocytes, spermatids, spermatozoa
(c) Spermatids, spermatocytes, spermatogonia, spermatozoa
(d) Spermatogonia, spermatocytes, spermatozoa, spermatids *(NEET 2013)*

24. The figure shows a section of human ovary. Select the option which gives the correct identification of either A or B with function/characteristic.



(a) B- Corpus luteum - Secretes progesterone
(b) A- Tertiary follicle - Forms Graafian follicle
(c) B- Corpus luteum - Secretes estrogen
(d) A- Primary oocyte - It is in the prophase I of the meiotic division
(Karnataka NEET 2013)

25. Which one of the following statements is false in respect of viability of mammalian sperm?
(a) Sperm is viable for only up to 24 hours.
(b) Survival of sperm depends on the pH of the medium and is more active in alkaline medium.
(c) Viability of sperm is determined by its motility.
(d) Sperms must be concentrated in a thick suspension. *(2012)*

26. Which one of the following statements about human sperm is correct?
(a) Acrosome has a conical pointed structure used for piercing and penetrating the egg, resulting in fertilisation.
(b) The sperm lysins in the acrosome dissolve the egg envelope facilitating fertilisation.
(c) Acrosome serves as a sensory structure leading the sperm towards the ovum.
(d) Acrosome serves no particular function. *(2010)*

27. The correct sequence of spermatogenetic stages leading to the formation of sperms in a mature human testis is
(a) spermatogonia - spermatocyte - spermatid - sperms
(b) spermatid - spermatocyte - spermatogonia - sperms
(c) spermatogonia - spermatid - spermatocyte - sperms
(d) spermatocyte - spermatogonia - spermatid - sperms. *(2009)*

28. In humans, at the end of the first meiotic division, the male germ cells differentiate into the
(a) spermatids
(b) spermatogonia
(c) primary spermatocytes
(d) secondary spermatocytes. *(2008)*

29. Sertoli cells are regulated by the pituitary hormone known as
(a) LH (b) FSH
(c) GH (d) prolactin. *(2006)*

30. The middle piece of the sperm contains
(a) proteins (b) mitochondria
(c) centriole (d) nucleus. *(1999)*

31. How many sperms are formed from a secondary spermatocyte?
(a) 4 (b) 8 (c) 2 (d) 1 *(1990)*

32. Egg is liberated from ovary in
(a) secondary oocyte stage
(b) primary oocyte stage
(c) oogonial stage
(d) mature ovum stage. *(1989)*

3.4 Menstrual Cycle

33. Which of the following hormone levels will cause release of ovum (ovulation) from the Graffian follicle?
(a) High concentration of Estrogen
(b) High concentration of Progesterone
(c) Low concentration of LH
(d) Low concentration of FSH *(NEET 2020)*

34. No new follicles develop in the luteal phase of the menstrual cycle because
(a) follicles do not remain in the ovary after ovulation
(b) FSH levels are high in the luteal phase
(c) LH levels are high in the luteal phase
(d) both FSH and LH levels are low in the luteal phase. *(Odisha NEET 2019)*

35. Match the items given in column I with those in column II and select the correct option given below.

	Column I		**Column II**
A.	Proliferative phase	(i)	Breakdown of endometrial lining
B.	Secretory phase	(ii)	Follicular phase
C.	Menstruation	(iii)	Luteal phase

	A	**B**	**C**
(a)	(iii)	(ii)	(i)
(b)	(i)	(iii)	(ii)
(c)	(ii)	(iii)	(i)
(d)	(iii)	(i)	(ii)

(NEET 2018)

36. Changes in GnRH pulse frequency in females is controlled by circulating levels of
(a) progesterone only
(b) progesterone and inhibin
(c) estrogen and progesterone
(d) estrogen and inhibin. *(NEET-I 2016)*

37. Select the incorrect statement.
(a) LH and FSH decrease gradually during the follicular phase.
(b) LH triggers secretion of androgens from the Leydig cells.
(c) FSH stimulates the Sertoli cells which help in spermiogenesis.
(d) LH triggers ovulation in ovary. *(NEET-I 2016)*

38. Identify the correct statement on 'inhibin'.
(a) Is produced by granulosa cells in ovary and inhibits the secretion of LH
(b) Is produced by nurse cells in testes and inhibits the secretion of LH
(c) Inhibits the secretion of LH, FSH and prolactin
(d) Is produced by granulosa cells in ovary and inhibits the secretion of FSH *(NEET-I 2016)*

39. Which of the following events is not associated with ovulation in human female?
(a) Release of secondary oocyte
(b) LH surge
(c) Decrease in estradiol
(d) Full development of Graafian follicle *(2015)*

40. The main function of mammalian corpus luteum is to produce
(a) estrogen only
(b) progesterone
(c) human chorionic gonadotropin
(d) relaxin only. *(2014)*

41. Menstrual flow occurs due to lack of
(a) oxytocin (b) vasopressin
(c) progesterone (d) FSH. *(NEET 2013)*

42. The secretory phase in the human menstrual cycle is also called
(a) luteal phase and lasts for about 6 days
(b) follicular phase and lasts for about 6 days
(c) luteal phase and lasts for about 13 days
(d) follicular phase and lasts for about 13 days.
(Mains 2012)

43. About which day in a normal human menstrual cycle does rapid secretion of LH (popularly called LH surge) normally occurs?
(a) 14^{th} day (b) 20^{th} day
(c) 5^{th} day (d) 11^{th} day
(Mains 2011)

44. Which one of the following is the correct matching of the events occurring during menstrual cycle?
(a) Proliferative phase : Rapid regeneration of myometrium and maturation of Graafian follicle
(b) Secretory phase : Development of corpus luteum and increased secretion of progesterone
(c) Menstruation : Breakdown of myometrium and ovum not fertilised
(d) Ovulation : LH and FSH attain peak level and sharp fall in the secretion of progesterone
(2009)

45. Which one of the following is the most likely root cause why menstruation is not taking place in regularly cycling human female?
(a) Maintenance of the hypertrophical endometrial lining
(b) Maintenance of high concentration of sex-hormones in the blood stream
(c) Retention of well-developed corpus luteum
(d) Fertilisation of the ovum *(2009)*

46. Which one of the following statements is incorrect about menstruation?
(a) At menopause in the female, there is especially abrupt increase in gonadotropic hormones.
(b) The beginning of the cycle of menstruation is called menarche.
(c) During normal menstruation about 40 mL blood is lost.
(d) The menstrual fluid can easily clot. *(2008)*

47. Which part of ovary in mammals acts as an endocrine gland after ovulation?
(a) Stroma
(b) Germinal epithelium
(c) Vitelline membrane
(d) Graafian follicle *(2007)*

48. In the human female, menstruation can be deferred by the administration of
(a) combination of FSH and LH
(b) combination of estrogen and progesterone
(c) FSH only (d) LH only. *(2007)*

49. Withdrawal of which of the following hormones is the immediate cause of menstruation?
(a) Progesterone (b) Estrogen
(c) FSH (d) FSH-RH *(2006)*

50. If mammalian ovum fails to get fertilised, which one of the following is unlikely?
(a) Corpus luteum will disintegrate.
(b) Progesterone secretion rapidly declines.
(c) Estrogen secretion further increases.
(d) Primary follicle starts developing. *(2005)*

51. Ovulation in the human female normally takes place during the menstrual cycle
(a) at the mid secretory phase
(b) just before the end of the secretory phase
(c) at the beginning of the proliferative phase
(d) at the end of the proliferative phase. *(2004)*

52. Which set is similar?
(a) Corpus luteum - Graafian follicles
(b) Sebum - Sweat
(c) Bundle of His - Pacemaker
(d) Vitamin B_7 - Niacin *(2001)*

53. After ovulation Graafian follicle regresses into
(a) corpus artesia (b) corpus callosum
(c) corpus luteum (d) corpus albicans.
(1999)

54. In the fertile human female, approximately on which day of the menstrual cycle does ovulation take place?
(a) Day 14 (b) Day 18
(c) Day 1 (d) Day 8 *(1997)*

55. The mammalian corpus luteum produces
(a) luteotrophic hormone
(b) luteinising hormone
(c) estrogen
(d) progesterone. *(1995)*

56. In the 28 day human ovarian cycle, the ovulation takes place typically on
(a) day 14 of the cycle
(b) day 28 of the cycle
(c) day 1 of the cycle
(d) day 5 of the cycle. *(1994)*

3.5 Fertilisation and Implantation

57. Extrusion of second polar body from egg occurs
(a) simultaneously with first cleavage
(b) after entry of sperm but before fertilisation
(c) after fertilisation
(d) before entry of sperm into ovum.
(NEET 2019, 1993)

58. Capacitation occurs in
(a) epididymis
(b) vas deferens
(c) female reproductive tract
(d) rete testis. *(NEET 2017)*

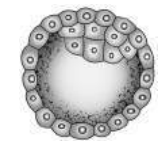
59. Fertilisation in humans is practically feasible only if
(a) the ovum and sperms are transported simultaneously to ampullary-isthmic junction of the cervix
(b) the sperms are transported into cervix within 48 hrs of release of ovum in uterus
(c) the sperms are transported into vagina just after the release of ovum in fallopian tube
(d) the ovum and sperms are transported simultaneously to ampullary-isthmic junction of the fallopian tube. *(NEET-I 2016)*

60. In human females, meiosis-II is not completed until
(a) uterine implantation
(b) birth
(c) puberty
(d) fertilisation. *(2015)*

61. Capacitation refers to changes in the
(a) ovum after fertilisation
(b) sperm after fertilisation
(c) sperm before fertilisation
(d) ovum before fertilisation. *(2015 Cancelled)*

62. In our society women are blamed for producing female children. Choose the correct answer for the sex-determination in humans.
(a) Due to some defect like aspermia in man.
(b) Due to the genetic make up of the particular sperm which fertilises the egg.
(c) Due to the genetic make up of the egg.
(d) Due to some defect in the women.
(Karnataka NEET 2013)

63. Identify the human developmental stage shown as well as the related right place of its occurrence in a normal pregnant woman and select the right option for the two, together.



Developmental stage		**Site of occurrence**
(a) Late morula	–	Middle part of Fallopian tube
(b) Blastula	–	End part of Fallopian tube
(c) Blastocyst	–	Uterine wall
(d) 8-celled morula	–	Starting point of Fallopian tube

(Mains 2012)

64. What happens during fertilisation in humans after many sperms reach close to the ovum?
(a) Secretions of acrosome helps one sperm enter cytoplasm of ovum through zona pellucida.
(b) All sperms except the one nearest to the ovum lose their tails.
(c) Cells of corona radiata trap all the sperms except one.
(d) Only two sperms nearest the ovum penetrate zona pellucida. *(Mains 2011)*

65. The second maturation division of the mammalian ovum occurs
(a) shortly after ovulation before the ovum makes entry into the fallopian tube
(b) until after the ovum has been penetrated by a sperm
(c) until the nucleus of the sperm has fused with that of the ovum
(d) in the Graafian follicle following the first maturation division. *(2010)*

66. Which one of the following statements about morula in humans is correct?
(a) It has almost equal quantity of cytoplasm as an uncleaved zygote but much more DNA.

(b) It has far less cytoplasm as well as less DNA than in an uncleaved zygote.
(c) It has more or less equal quantity of cytoplasm and DNA as in uncleaved zygote.
(d) It has more cytoplasm and more DNA than an uncleaved zygote. *(2010)*

67. In human female, the blastocyst
(a) forms placenta even before implantation
(b) gets implanted into uterus 3 days after ovulation
(c) gets nutrition from uterine endometrial secretion only after implantation
(d) gets implanted in endometrium by the trophoblast cells. *(Mains 2010)*

68. A change in the amount of yolk and its distribution in the egg will affect
(a) pattern of cleavage
(b) number of blastomeres produced
(c) fertilisation
(d) formation of zygote. *(2009)*

69. Grey crescent is the area
(a) at the point of entry of sperm into ovum
(b) just opposite to the site of entry of sperm into ovum
(c) at the animal pole
(d) at the vegetal pole. *(2005)*

70. What is true for cleavage?
(a) Size of embryo increases
(b) Size of cells decreases
(c) Size of cells increases
(d) Size of embryo decreases *(2002)*

71. Blastopore is the pore of
(a) archenteron (b) blastocoel
(c) coelom (d) alimentary canal. *(2000)*

72. Fertilizin is a chemical substance produced from
(a) polar bodies
(b) middle piece of sperm
(c) mature eggs
(d) acrosome. *(1997, 1991)*

73. In human beings, the eggs are
(a) mesolecithal (b) alecithal
(c) microlecithal (d) macrolecithal. *(1997)*

74. In an egg, the type of cleavage is determined by
(a) the amount and distribution of yolk
(b) the number of egg membranes
(c) the shape and size of the sperm
(d) the size and location of the nucleus. *(1995)*

75. What is true about cleavage in the fertilised egg in humans?
(a) It starts while the egg is in fallopian tube.
(b) It starts when the egg reaches uterus.
(c) It is meroblastic.
(d) It is identical to the normal mitosis. *(1994)*

76. Termination of gastrulation is indicated by
(a) obliteration of blastocoel
(b) obliteration of archenteron
(c) closure of blastopore
(d) closure of neural tube. *(1993)*

77. In telolecithal egg the yolk is found
(a) all over the egg (b) on one side
(c) both the sides (d) centre. *(1993)*

78. Acrosome reaction in sperm is triggered by
(a) capacitation (b) release of lysin
(c) influx of Na^+ (d) release of fertilizin. *(1993)*

79. Meroblastic cleavage is a division which is
(a) horizontal (b) partial/parietal
(c) total (d) spiral. *(1992)*

80. Blastopore is
(a) opening of neural tube
(b) opening of gastrocoel
(c) future anterior end of embryo
(d) found in blastula. *(1992)*

81. During cleavage, what is true about cells?
(a) Nucleocytoplasmic ratio remains unchanged.
(b) Size does not increase.
(c) There is less consumption of oxygen.
(d) The division is like meiosis. *(1991)*

82. Freshly released human egg has
(a) one Y-chromosome
(b) one X-chromosome
(c) two X-chromosome
(d) one X-chromosome and one Y-chromosome. *(1991)*

83. Sperm and egg nuclei fuse due to
(a) base pairing of their DNA and RNA
(b) formation of hydrogen bonds
(c) mutual attraction due to differences in electrical charges
(d) attraction of their protoplasts. *(1990)*

84. Cells become variable in morphology and function in different regions of the embryo. The process is
(a) differentiation (b) metamorphosis
(c) organisation (d) rearrangement. *(1989)*

3.6 Pregnancy and Embryonic Development

85. Match the following columns and select the correct option.

	Column-I		Column-II
(A)	Placenta	(i)	Androgens
(B)	Zona pellucida	(ii)	Human Chorionic Gonadotropin (HCG)
(C)	Bulbourethral glands	(iii)	Layer of the ovum
(D)	Leydig cells	(iv)	Lubrication of the penis

	(A)	(B)	(C)	(D)
(a)	(iv)	(iii)	(i)	(ii)
(b)	(i)	(iv)	(ii)	(iii)
(c)	(iii)	(ii)	(iv)	(i)
(d)	(ii)	(iii)	(iv)	(i)

(NEET 2020)

86. Hormones secreted by the placenta to maintain pregnancy are
(a) hCG, hPL, progestogens, prolactin
(b) hCG, hPL, estrogens, relaxin, oxytocin
(c) hCG, hPL, progestogens, estrogens
(d) hCG, progestogens, estrogens, glucocorticoids.
(NEET 2018)

87. The amnion of mammalian embryo is derived from
(a) ectoderm and mesoderm
(b) endoderm and mesoderm
(c) mesoderm and trophoblast
(d) ectoderm and endoderm. *(NEET 2018)*

88. Match column I with column II and select the correct option using the given codes.

	Column I		Column II
A.	Mons pubis	(i)	Embryo formation
B.	Antrum	(ii)	Sperm
C.	Trophectoderm	(iii)	Female external genitalia
D.	Nebenkern	(iv)	Graafian follicle

(a) A-(iii), B-(iv), C-(ii), D-(i)
(b) A-(iii), B-(iv), C-(i), D-(ii)
(c) A-(iii), B-(i), C-(iv), D-(ii)
(d) A-(i), B-(iv), C-(iii), D-(ii) *(NEET-II 2016)*

89. Several hormones like hCG, hPL, estrogen, progesterone are produced by
(a) ovary (b) placenta
(c) fallopian tube (d) pituitary.
(NEET-II 2016)

90. Ectopic pregnancies are referred to as
(a) implantation of defective embryo in the uterus
(b) pregnancies terminated due to hormonal imbalance
(c) pregnancies with genetic abnormality
(d) implantation of embryo at site other than uterus.
(2015)

91. Select the correct option describing gonadotropin activity in a normal pregnant female.
(a) High level of FSH and LH stimulates the thickening of endometrium.
(b) High level of FSH and LH facilitates implantation of the embryo.
(c) High level of hCG stimulates the synthesis of estrogen and progesterone.
(d) High level of hCG stimulates the thickening of endometrium. *(2014, 2012)*

92. Which one of the following is not the function of placenta?
(a) Facilitates removal of carbon dioxide and waste material from embryo
(b) Secretes oxytocin during parturition
(c) Facilitates supply of oxygen and nutrients to embryo
(d) Secretes estrogen *(NEET 2013)*

93. The first movements of the fetus and appearance of hair on its head are usually observed during which month of pregnancy?
(a) Fourth month (b) Fifth month
(c) Sixth month (d) Third month *(2010)*

94. Which extraembryonic membrane in humans prevents desiccation of the embryo inside the uterus?
(a) Yolk sac (b) Amnion
(c) Chorion (d) Allantosis *(2008)*

95. Which of the following hormones is not a secretion product of human placenta?
(a) Human chorionic gonadotropin
(b) Prolactin
(c) Estrogen
(d) Progesterone *(2004)*

96. During embryonic development, the establishment of polarity along anterior/posterior, dorsal/ventral or medial/lateral axis is called
(a) organiser phenomena
(b) axis formation
(c) anamorphosis
(d) pattern formation. *(2003)*

97. The extra embryonic membranes of the mammalian embryo are derived from
(a) trophoblast (b) inner cell mass
(c) formative cells (d) follicle cells. *(1994)*

98. Eye lens is formed from
(a) ectoderm
(b) mesoderm
(c) endoderm
(d) ectoderm and mesoderm. *(1992)*

99. Gonads develop from embryonic
(a) ectoderm
(b) endoderm
(c) mesoderm
(d) both mesoderm and endoderm. *(1990)*

3.7 Parturition and Lactation

100. Which of these is not an important component of initiation of parturition in humans?
(a) Release of oxytocin
(b) Release of prolactin
(c) Increase in estrogen and progesterone ratio
(d) Synthesis of prostaglandins *(2015 Cancelled)*

101. The fetal ejection reflex in humans triggers the release of
(a) oxytocin from fetal pituitary
(b) human chorionic gonadotropin (hCG) from placenta
(c) human placental lactogen (hPL) from placenta
(d) oxytocin from maternal pituitary.
(Karnataka NEET 2013)

102. Signals for parturition originate from
(a) both placenta as well as fully developed fetus
(b) oxytocin released from maternal pituitary
(c) placenta only
(d) fully developed fetus only. *(2012)*

103. Signals from fully developed fetus and placenta ultimately lead to parturition which requires the release of
(a) estrogen from placenta
(b) oxytocin from maternal pituitary
(c) oxytocin from fetal pituitary
(d) relaxin from placenta. *(Mains 2010)*

104. Fetal ejection reflex in human female is induced by
(a) release of oxytocin from pituitary
(b) fully developed fetus and placenta
(c) differentiation of mammary glands
(d) pressure exerted by amniotic fluid. *(2009)*

105. In human adult females oxytocin
(a) stimulates pituitary to secrete vasopressin
(b) causes strong uterine contractions during parturition
(c) is secreted by anterior pituitary
(d) stimulates growth of mammary glands.
(2008)

ANSWER KEY

1.	(c)	**2.**	(a)	**3.**	(a)	**4.**	(d)	**5.**	(a)	**6.**	(a)	**7.**	(c)	**8.**	(b)	**9.**	(a)	**10.**	(a)
11.	(d)	**12.**	(a)	**13.**	(d)	**14.**	(c)	**15.**	(c)	**16.**	(b)	**17.**	(b)	**18.**	(c)	**19.**	(d)	**20.**	(d)
21.	(b)	**22.**	(a)	**23.**	(b)	**24.**	(a)	**25.**	(a)	**26.**	(b)	**27.**	(a)	**28.**	(d)	**29.**	(b)	**30.**	(b)
31.	(c)	**32.**	(a)	**33.**	(a)	**34.**	(d)	**35.**	(c)	**36.**	(c)	**37.**	(a)	**38.**	(d)	**39.**	(c)	**40.**	(b)
41.	(c)	**42.**	(c)	**43.**	(a)	**44.**	(b)	**45.**	(b)	**46.**	(d)	**47.**	(d)	**48.**	(b)	**49.**	(a)	**50.**	(c)
51.	(d)	**52.**	(a)	**53.**	(c)	**54.**	(a)	**55.**	(d)	**56.**	(a)	**57.**	(b)	**58.**	(c)	**59.**	(d)	**60.**	(d)
61.	(c)	**62.**	(b)	**63.**	(c)	**64.**	(a)	**65.**	(b)	**66.**	(a)	**67.**	(d)	**68.**	(a)	**69.**	(b)	**70.**	(b)
71.	(a)	**72.**	(c)	**73.**	(b)	**74.**	(a)	**75.**	(a)	**76.**	(a)	**77.**	(b)	**78.**	(c)	**79.**	(b)	**80.**	(b)
81.	(b)	**82.**	(b)	**83.**	(d)	**84.**	(a)	**85.**	(d)	**86.**	(c)	**87.**	(a)	**88.**	(b)	**89.**	(b)	**90.**	(d)
91.	(c)	**92.**	(b)	**93.**	(b)	**94.**	(b)	**95.**	(b)	**96.**	(a)	**97.**	(a)	**98.**	(a)	**99.**	(c)	**100.**	(b)
101.	(d)	**102.**	(a)	**103.**	(b)	**104.**	(b)	**105.**	(b)										

Hints & Explanations

1. (c) **2. (a)**

3. (a) : Urethra is the urinary duct which originates from the neck of urinary bladder and opens to the exterior at the tip of penis in males. It is a common pathway for passage of urine and semen.

4. (d) : Interstitial cells or Leydig's cells are the cells interspersed between the seminiferous tubules of the testis. They secrete androgens (*e.g.*, testosterone) in response to stimulation by luteinising hormone from the anterior pituitary gland.

5. (a) : The male sex accessory ducts include rete testis, vasa efferentia, epididymis and vas deferens. The seminiferous tubules of the testis open into the vasa efferentia through rete testis. The vasa efferentia leave the testis and open into epididymis located along the posterior surface of each testis. So, if vasa efferentia gets blocked, the gametes will not be transported from testes to epididymis.

6. (a) : The testes are situated outside the abdominal cavity within a pouch called scrotum. The scrotum helps in maintaining the low temperature of the testes (2–2.5°C lower than the normal internal body temperature) necessary for spermatogenesis.

7. (c) : Sertoli cells (named after Italian histologist Enrico Sertoli) are found in the walls of the seminiferous tubules of the testis. Compared with the germ cells they appear large and pale. They anchor and probably nourish the developing germ cells, especially the spermatids, which become partly embedded within them.

8. (b) : The seminiferous tubules are closed at one end but on the other side they join to a network the rete testis from where fine ciliated ductules, the vasa efferentia arise. Cilia help in conducting sperms. The rete testis is a network of tubules conducting sperms from the seminiferous tubules of the testis to the vasa efferentia.

9. (a) : Semen or seminal fluid or seminal plasma is the fluid ejaculated from the penis at sexual climax. Each ejaculate may contain 300 – 500 million spermatozoa suspended in a fluid secreted by the prostate gland and seminal vesicles with a small contribution from Cowper's glands. It is rich in fructose, calcium and certain enzymes. It provides a fluid medium for transport of sperms, nourishes and activates sperms, lubricates the reproductive tract of female and neutralizes the acidity of the vagina of female to protect the sperms.

10. (a) : The male accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes. The secretions of bulbourethral glands also help in the lubrication of the penis.

11. (d) : *Refer to answer 9.*

12. (a) **13. (d)**

14. (c) : *Refer to answer 4.*

15. (c) : Hysterectomy is the surgical removal of uterus. It may also involve removal of the cervix, ovaries, fallopian tubes and other surrounding structures.

16. (b) : The oviducts (fallopian tubes), uterus and vagina constitute the female accessory ducts. Each Fallopian tube is about 10-12 cm long and extends from the periphery of each ovary to the uterus, the part closer to the ovary is the funnel-shaped infundibulum. The edges of the infundibulum possess finger-like projections called fimbriae, which help in collection of the ovum after ovulation. The uterus is single and it is also called womb, open into vagina through a narrow cervix. So, III is infundibulum, IV is fimbriae and V is cervix.

17. (b) : Each fallopian tube is about 10-12 cm long and extends from the periphery of each ovary to the uterus, the part closer to the ovary is the funnel-shaped infundibulum. The edges of the infundibulum possess finger-like projections called fimbriae, which help in collection of the ovum after ovulation. The infundibulum leads to a wider part of the oviduct called ampulla. The last part of the oviduct, isthmus has a narrow lumen and it joins the uterus.

18. (c) : Bartholin's glands are situated on either side of vagina in human females. These glands secrete a fluid that lubricates the vulva during copulation.

19. (d) : In humans, the secondary oocyte is produced when the primary oocyte grows in size and completes its first meiotic division. The secondary oocyte will be halted at this stage of metaphase of meiosis II until fertilisation takes place. Thus, when a sperm cell fertilises the female sex cell, the secondary oocyte rapidly completes the remaining stages of meiosis II, giving rise to ovum, with which the sperm cell unites.

20. (d) : Formation of spermatozoa from spermatids is called spermiogenesis. After spermiogenesis, sperm heads become embedded in the Sertoli cells and are finally released from the seminiferous tubules by the process called spermiation.

21. (b)

22. (a) : Spermatogonia are diploid cells which mature into primary spermatocytes ($2n$) by growth. They then produce two haploid secondary spermatocytes by meiosis I. Each secondary spermatocyte (n) completes the meiosis II and produces two spermatids (n). Each spermatid (n) develops into a spermatozoan or sperm (n).

23. (b) : Spermatogenesis is the process of formation of haploid spermatozoa (sperms) from diploid spermatogonia inside the testes of the male. At sexual maturity, the undifferentiated primordial germ cells divide several times by mitosis to produce a large number of spermatogonia or sperm mother cells. Each spermatogonium actively grows to a larger primary spermatocyte by obtaining nourishment from the nursing cells. The phenomenon of formation of primary spermatocytes from spermatogonia, is called

spermatocytogenesis. Each primary spermatocyte undergoes two successive divisions, called maturation divisions. The first maturation division is reductional or meiotic. Hence, the primary spermatocyte divides into two haploid daughter cells called secondary spermatocytes. Both secondary spermatocytes now undergo second maturation division which is an ordinary mitotic division to form four haploid spermatids, by each primary spermatocyte. The transformation of spermatids into spermatozoa is called spermiogenesis or spermateleosis or differentiation phase.

24. (a) : The zona granulosa and theca cells of Graafian follicle remaining in the ovary after ovulation and some surrounding capillaries and connective tissue evolve into the corpus luteum (a temporary endocrine gland). The corpus luteum produces progesterone and in the event of fertilisation, provides the required progesterone until the placenta is formed. In the absence of fertilisation, the life span of the corpus luteum is 14 days. It then degenerates into a corpus albicans, which is mainly a scar tissue.

25. (a) : Sperms remain viable for 48 hours to 72 hours.

26. (b) : Acrosome is the cap-like structure on the front end of a spermatozoan. It breaks down just before fertilisation (the acrosome reaction), releasing a number of hydrolytic enzymes, also called sperm lysins that assist penetration between the follicle cells that still surround the ovum, thus facilitating fertilisation. Failure of the acrosome reaction is a cause of male infertility.

27. (a) : *Refer to answer 23.*

28. (d) : During embryonic development the primordial germ cells migrate to the testis where they become spermatogonia. At puberty the spermatogonia proliferate rapidly by mitosis. Some undergo growth phase to become primary spermatocytes that further undergo through meiotic division I to become secondary spermatocytes. After completion of meiotic division II the secondary spermatocytes produce spermatids which differentiate to form spermatozoa.

29. (b) : Sertoli cells are present in the germinal epithelium of the seminiferous tubules. These cells nourish the developing sperms. These cells differentiate spermatogonia into sperms. They are under the influence of FSH released by anterior pituitary gland.

30. (b) : The sperm consists of head, neck, middle piece and tail. The middle piece of human sperm contains the mitochondria coiled around the axial filament called mitochondrial spiral. They provide energy for the movement of the sperm.

31. (c) : Spermatogonia are diploid cells which mature into primary spermatocytes ($2n$) by growth. They then produce two haploid secondary spermatocytes by meiosis I. Each secondary spermatocyte (n) completes the meiosis II and produces two spermatids (n). Each spermatid (n) develops into a spermatozoan or sperm (n). Similarly, in females, oogonia are the diploid cells from which through meiosis, polar bodies (n) and single ovum (n) are produced.

32. (a) : In humans, ovum is released from the ovary in the secondary oocyte stage. The wall of the ovary gets ruptured to release the oocyte. In humans ovulation occurs about 14 days before the onset of the next menstruation. Ovulation is induced by LH.

33. (a) : FSH, LH and estrogen are at peak during ovulation (release of ovum).

34. (d) **35. (c)**

36. (c) : GnRH is secreted by the hypothalamus which stimulates the anterior lobe of pituitary gland to secrete luteinising hormone (LH) and follicle stimulating hormone (FSH). FSH stimulates the growth of the ovarian follicles and stimulates the formation of estrogens. LH stimulates the corpus luteum to secrete progesterone. Rising levels of progesterone and estrogen inhibits the release of GnRH, which in turn, inhibits the production of FSH and LH.

37. (a) : During follicular phase, FSH secretion increases. Follicular phase (proliferative phase) usually includes cycle days 6-13 or 14 in a 28 days cycle. The follicle stimulating hormone (FSH) secreted by the anterior lobe of the pituitary gland stimulates the ovarian follicle to secrete estrogen.

38. (d)

39. (c) : In human females, ovulation is the release of secondary oocyte from the ovary at about 14^{th} day of the menstrual cycle. Both LH and FSH attain a peak level during this period. Rapid secretion of LH induces rupturing of fully developed Graafian follicle and thereby release of ovum. LH surge is actually responsible for ovulation.

40. (b) : Corpus luteum secretes steroid hormones progesterone and estrogen, to make uterus suitable for implantation (in case fertilisation occurs) and its maintenance (mainly endometrium).

41. (c) : The corpus luteum secretes large amount of progesterone which is essential for maintenance of the endometrium necessary for implantation of the fertilized ovum and other events of pregnancy. In the absence of fertilization, the corpus luteum degenerates. This causes disintegration of the endometrium leading to menstruation. The menstrual flow results due to breakdown of endometrial lining of the uterus and its blood vessels which forms liquid that comes out through vagina.

42. (c) : After ovulation which occurs in the middle of menstrual cycle, empty Graafian follicle continues growth under the influence of LH. The follicular cells are converted into lutein cells by deposition of yellowish lipid inclusions. The phenomenon is called luteinization. The ruptured Graafian follicle is now called corpus luteum. It secretes hormones, mainly progesterone and small quantity of estrogen. Both LH and progesterone help in further growth and thickening of endometrium. The major change is that the endometrial glands become secretory. The uterine wall becomes ready for nourishing and anchoring blastocyst if fertilization takes place. Hence, this phase of menstrual cycle is called luteal or secretory phase. The phase lasts for about 13 days, *i.e.*, 15-28 days of 28 days menstrual cycle.

43. (a) : *Refer to answer 39.*

44. (b) : Secretory phase is also called as luteal phase. The luteinising hormone or LH is secreted by the anterior lobe of pituitary gland. LH causes ovulation. LH stimulates cells of ovarian follicles to develop corpus luteum. Corpus luteum secretes large amount of progesterone.

45. (b) : High concentration of sex steroids (estrogen) exerts negative feedback on anterior pituitary, decreasing LH secretion and release thus, lowering LH level in blood. Due to insufficient LH level, no ovulation occurs which causes irregular menstruation.

46. (d) : Menstruation is a process which involves discharge of blood (45 – 100 mL), serous fluid, cell debris and mucosal fragments from cast off endometrial lining due to reduced titre of both estrogen and progesterone hormone. Blood clotting does not occur due to presence of fibrinolysin.

47. (d) : The Graafian follicle is fluid-filled capsule that surrounds and protects the developing egg cell inside the ovary during the menstrual cycle. Graafian follicle represents the final stage of follicular development before ovulation. Shortly before ovulation the follicle swells and develops a stigma. At ovulation, the stigma ruptures, releasing the secondary oocyte and corona radiata into the peritoneal cavity to be taken up by the oviduct. The zona granulosa and theca cells remaining in the ovary after ovulation and some surrounding capillaries and connective tissue evolve into the corpus luteum (a temporary endocrine gland) *i.e.,* after the egg cell has been released, the follicle remains and is known as a corpus luteum. The corpus luteum produces progesterone and in the event of fertilisation, provides the required progesterone until the placenta is formed. The corpus luteum also produces some estrogen.

48. (b)

49. (a) : The menstrual cycle consists of three phases; proliferative phase, secretory phase and menstrual phase. During menstrual phase the production of LH is considerably reduced. The withdrawal of this hormone causes degeneration of the corpus luteum and, therefore, progesterone production is reduced. The endometrium degenerates and breaks down. Thus, menstruation begins.

50. (c) : If the mammalian ovum fails to fertilise choices, (a) and (b) are obvious. Since corpus luteum declines so progesterone also decreases rapidly (progesterone is essential for maintenance of pregnancy). Also estrogen continues to cause growth of the endometrium which ultimately becomes thick enough to breakdown and cause menstruation. Hence choice (c) is incorrect as estrogen secretion does not decrease further. Primary follicles continue developing irrespective of ovulatory condition.

51. (d) : Ovulation (the release of secondary oocyte from the Graafian follicle) takes place at the end of proliferative phase of menstrual cycle. During this phase, the follicle stimulating hormone (FSH) secreted by the anterior lobe of the pituitary gland stimulates the ovarian follicle to secrete estrogen.

Estrogen stimulates the proliferation of the endometrium of the uterine wall. The endometrium becomes thicker by rapid cell multiplication and this is accompanied by an increase of uterine glands and blood vessels. This phase ends when the ovarian follicle ruptures and ovulation occurs and at the same time the production of estrogen stops.

52. (a) : A mature ovarian follicle is called Graafian follicle. It contains follicular cells, an antrum and an oocyte. After ovulation, the empty Graafian follicle shows deposition of leutin and forms corpus luteum that ultimately degenerates.

53. (c) : *Refer to answer 52.*

54. (a) : Ovulation is the release of egg by ruptured Graafian follicle. The wall of Graafian follicle is ruptured by sudden increase in the level of luteinising hormone. The length of menstruation cycle is 28 days (average) from the start of one menstruation period to the start of the next. At about 14^{th} day of the cycle, the distended follicle ruptures and the ovum is extruded into the fallopian tube and ovulation takes place.

55. (d) : Progesterone is secreted by the corpus luteum of the ovary. It stimulates further development of the uterine epithelium and mammary glands. It is also required for the formation of the placenta and for the maintenance of pregnancy. Luteotrophic hormone and luteinising hormone are secreted by the anterior lobe of pituitary gland. Estrogen is secreted by the cells of the Graafian follicles.

56. (a) : *Refer to answer 54.*

57. (b) : Entry of sperm into the secondary oocyte induces the completion of the meiotic division of the secondary oocyte. The second meiotic division is unequal and results in the formation of a second polar body and a haploid ovum (ootid). Soon the haploid nucleus of the sperm and that of the ovum fuse together to form a diploid zygote.

58. (c) : The sperms in the female's genital tract are made capable of fertilising the egg by secretions of the female genital tract. These secretions remove coating substances deposited on the surface of the sperms particularly those on the acrosome. Thus, the receptor sites on the acrosome are exposed and sperm becomes active to penetrate the egg. This phenomenon of sperm activation in mammals is known as capacitation.

59. (d) : The fusion of a haploid male gamete (sperm) and a haploid female gamete (ovum) to form a diploid zygote is called fertilisation. In human beings, it takes place in the ampullary-isthmic junction of the oviduct (fallopian tube).

60. (d) : In human beings, ovum is released from the ovary in the secondary oocyte stage. The maturation of secondary oocyte is completed in the mother's oviduct (fallopian tube) usually after the sperm has entered the secondary oocyte for fertilisation. Entry of the sperm restarts the cell cycle breaking down MPF (M-phase promoting factor) and turning on APC (Anaphase promoting complex). Completion of meiosis II converts the secondary oocyte into a fertilised ovum (egg) or zygote (and also a second polar body).

61. (c) : *Refer to answer 58.*

62. (b) : Establishment of sex through differential development in an individual at an early stage of life is called sex determination. Fusion of male nuclei with that of female nucleus decides the sex of the baby. Chromosome pattern in the human female is XX and that in the male is XY. Therefore, all the haploid gametes produced by the female have the sex chromosome X whereas in the male gametes the sex chromosome could be either X or Y, hence, 50 per cent of sperms carry the X chromosome while the other 50 per cent carry the Y. After fusion of the male and female gametes the zygote would carry either XX or XY depending on whether the sperm carrying X or Y fertilised the ovum. The zygote carrying XX would develop into a female and XY would form a male.

63. (c) : After fertilisation, zygote undergoes rapid mitotic divisions, called cleavage, which is characterised by absence of growth of daughter cells. This leads to the conversion of single celled zygote into a multicellular structure called blastocyst or blastula. Implantation or embedding of zygote into endometrium of uterus occurs in blastocyst stage.

64. (a) : The process of fusion of a sperm with an ovum is called fertilisation. During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that block the entry of additional sperms. Thus, it ensures that only one sperm can fertilise an ovum. The secretions of the acrosome help the sperm enter into the cytoplasm of the ovum through the zona pellucida and the plasma membrane. In contact with the surface of egg covering, the acrosome releases its contained hydrolytic enzymes, also called sperm lysins. It is known as acrosomal reaction. Acrosome reaction results in dissolving of corona cells and degeneration of zona pellucida which helps in sperm penetration.

65. (b) : Oogenesis starts with division of oogonia (gamete mother cells) giving rise to primary oocyte which enters into prophase I of the meiotic division and get temporarily arrested at this stage. The primary oocyte gets surrounded by primary, secondary and tertiary follicles respectively. The tertiary follicle grow in size and completes its first meiotic division to give rise to haploid secondary oocyte. This secondary oocyte forms a new membrane called zona pellucida surrounding it. During fertilisation the sperm enter into the cytoplasm of the ovum through the zona pellucida and the plasma membrane. This induces the completion of the meiotic division (2^{nd} division) of the secondary oocyte. The second meiotic division is also unequal and results in the formation of a second polar body and a haploid ovum (ootid).

66. (a) : A morula is an embryo at an early stage of embryonic development, consisting of cells (called blastomeres) in a solid ball contained within the zona pellucida. The morula is produced by embryonic cleavage, the rapid division of the zygote. The increase in number of cells does not change the size of the original mass. The divisions are rapid because there is no net growth of the embryo-the cell cycle alternates between DNA replication and mitosis. In the absence of growth, the cell number in the embryo increases while the cell size decreases. Thus, it has almost equal quantity of cytoplasm as an uncleaved zygote but much more DNA.

67. (d) : Implantation in endometrial uterine wall takes place at blastocyst stage of embryonic development. Before implantation, the blastomeres of early blastocyst get arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called inner cell mass. It is the trophoblast layer through which blastocyst gets attached to the endometrium and the inner cell mass gets differentiated as the embryo.

68. (a) : Cleavage is a series of cell divisions by which a single fertilised egg cell is transformed into a multicellular body, the blastula. Characteristically no growth occurs during cleavage, the shape of the embryo is unchanged except for the formation of central cavity (the blastocoel)

and the ratio of nuclear material (DNA) to cytoplasm increases. The mode of cleavage is determined by the amount of yolk and its distribution. On this basis cleavage may be holoblastic or meroblastic.

69. (b) : Grey crescent is the area just opposite to the site of entry of sperm into ovum. It marks the future dorsal side of the embryo.

70. (b) : During cleavage, the zygote divides repeatedly to convert the large cytoplasmic mass into a large number of small blastomeres. It involves cell division without growth in size because cells continue to be retained within the zona pellucida. However, cell size decreases during cleavage.

71. (a) : Archenteron is known as the primitive gut that forms during gastrulation in the developing blastula. It develops into the digestive tract of an animal. The open end of the archenteron is called blastopore.

72. (c) : Mature egg (ovum) secretes a chemical named fertilizin (composed of glycoprotein = monosaccharides + amino acids). Sperm has on its surface a protein substance called antifertilizin (composed of acidic amino acids). The fertilizin of an egg interacts with the antifertilizin of a sperm of the same species. This interaction makes the sperms stick to the egg surface. The adhesion of sperm to the egg of the same species through chemical recognition is known as agglutination.

73. (b) : In human beings, the eggs are alecithal, *i.e.*, they do not contain yolk. Mesolecithal eggs contain moderate amount of yolk, *e.g.*, frog. Microlecithal eggs contain a little amount of yolk, *e.g., Amphioxus*. Macrolecithal eggs contain large amount of yolk, *e.g.*, birds.

74. (a) : The amount of yolk and how it is distributed determines the type of cleavage. On this basis cleavage is of two types:

(i) Holoblastic (total cleavage) - where the segmentation line passes through the entire egg. It occurs in alecithal (without yolk), microlecithal (with very little amount of yolk) and mesolecithal (little amount of yolk) egg.

(ii) Meroblastic (partial cleavage) - where segmentation line does not pass through the egg and remain confined to a part of the egg. It occurs in megalecithal (large amount of yolk) egg.

75. (a) : Cleavage is a series of rapid mitotic divisions of the zygote which convert the single celled zygote into a multicellular structure called blastula (blastocyst). About thirty hours after fertilisation, the newly formed zygote divides into two cells, the blastomeres, in the upper portion of the fallopian tube. This is the first cleavage. The next division occurs within forty hours after fertilisation. The third division occurs about three days after fertilisation. During these early cleavages, the young embryo is slowly moving down the fallopian tube towards the uterus. At the end of fourth day, the embryo reaches the uterus. It has thirty two cells.

76. (a) : Gastrulation is the process through which the presumptive areas of organ specific rudiments present on the surface of blastula move to their specific positions where these occur in the adult. Gastrulation results in setting apart of the three primary germinal layers, *i.e.*, the ectoderm, mesoderm and endoderm from single layer of cells, the blastoderm and in the formation of primordial gut or archenteron. At the onset of gastrulation, the blastoderm at the vegetal pole becomes flat. It gradually bends inwards till the embryo assumes the appearance of a double-walled cup. The cavity formed by invagination is called archenteron or primitive gut. Its opening is called blastopore and the embryo at this stage is gastrula. As a result of invagination, the presumptive endoderm, mesoderm and notochord are shifted from the surface to the interior of the embryo. The blastocoel is gradually obliterated till the two layers come in contact. By the completion of gastrulation, the lateral horns of mesodermal crescent converge and come to lie on either side of the presumptive notochord.

77. (b) : Eggs with abundant yolk concentrated in one hemisphere of the egg are termed telolecithal. This occurs in many invertebrates and in all vertebrates lower than marsupial mammals.

78. (c) : The activated spermatozoan on reaching the egg plasma membrane, undergoes a number of changes in its acrosomal region. All these changes are collectively described under acrosome reaction. Acrosome reaction is calcium dependent involving massive uptake of calcium and sodium with an efflux of hydrogen generating high pH and osmotic pressure, producing negative surface charge and partial or total release of the acrosomal enzymes. Calcium influx may activate phospholipase resulting in accumulation of unsaturated fatty acids and fusiogenic lysophospholipids contributing to acrosome reaction.

79. (b) : *Refer to answer 74.*

80. (b) : Blastopore is the opening by which the cavity of the gastrula (gastrocoel), communicates with the exterior. It is formed as a result of invagination of endoderm during embryonic development. During maturation of some animals it evolves into the anus or the mouth; in others it is covered over and contributes to the canal joining the primitive gut with the cavity of the neural tube.

81. (b) : During cleavage, the zygote divides repeatedly to convert the large cytoplasmic mass into a large number of small blastomeres. It involves cell division without growth in size because cells continue to be retained within the zona pellucida. However, cell size decreases during cleavage.

82. (b) : The egg released is haploid (has only one X-chromosome and 22 autosomes) as it is formed due to meiotic division of diploid primary oocyte having XX chromosome and 44 autosomes.

83. (d) : The two gametes, *i.e.*, sperm and egg move in opposite direction by an unknown mechanism but most probably by streaming currents of cytoplasm, *i.e.*, due to attraction of their protoplasts. The nucleus of one male gamete fuses with the egg nucleus and the phenomenon is called fertilisation.

84. (a) : Differentiation are the changes from simple to more complex forms undergone by developing tissues and organs so that they become specialised for particular functions. Differentiation occurs during embryonic development and regeneration.

85. (d)

86. (c) : Placenta is temporary organ that helps in exchange of gases, nutrients and waste materials between mother and fetus. During pregnancy, placenta acts as an endocrine gland and secretes some hormones such as estrogen, progestogens, human chorionic gonadotropin (hCG), human placental lactogen (hPL), chorionic thyrotropin, chorionic corticotropin and relaxin.

87. (a) : Amnion, in reptiles, birds and mammals is a membrane forming a fluid-filled cavity (the amniotic sac) that encloses the embryo. During development, the amnion arises by a folding of a mass of extra-embryonic tissue called the somatopleure. Lined with ectoderm and covered with mesoderm, the amnion contains a thin transparent fluid in which the embryo is suspended, thus providing a cushion against mechanical injury.

88. (b)

89. (b) : *Refer to answer 86.*

90. (d) : Ectopic pregnancy is a complication of pregnancy in which implantation of embryo takes place at site other than uterus. Signs and symptoms include abdominal pain and vaginal bleeding. Most ectopic pregnancies (90%) occur in the fallopian tube, which are known as tubal pregnancies.

91. (c) : The trophoblastic cells secrete human chorionic gonadotropin hormone which has properties similar to those of luteinising hormone (LH) of the pituitary gland. It takes over the job of pituitary LH during pregnancy. The hCG maintains the corpus luteum and stimulates it to secrete progesterone. The latter maintains the endometrium of the uterus and causes it to grow throughout pregnancy. This also prevents menstruation. Progesterone also causes increased secretion of mucus in the cervix of the uterus that forms a protective plug during pregnancy.

92. (b)

93. (b) : In human beings, after one month of pregnancy, the embryo's heart is formed. By the end of the second month of pregnancy, the fetus develops limbs and digits. By the end of 12 weeks (first trimester), most of the major organ systems are formed. The first movements of the fetus and appearance of hair on the head are usually observed during the fifth month. By the end of 24 weeks (second trimester), the body is covered with fine hair, eyelids separate and eyelashes are formed. By the end of nine months of pregnancy, the fetus is fully developed and is ready for delivery.

94. (b) : Amnion is a type of extraembryonic membrane formed by the amniogenic cells inside and splanchnopleuric extraembryonic mesoderm outside. Amnion surrounds the embryo creating the amniotic cavity that is filled with amniotic fluid. The amniotic fluid serves as a shock absorber for the fetus, regulates fetal body temperature and prevents desiccation.

95. (b) : Prolactin is secreted by anterior pituitary gland which stimulates mammary gland development during pregnancy and lactation after child birth.

96. (a) : During embryonic development, the establishment of polarity along anterior/posterior, dorsal/ventral or medial/lateral axis is called organiser phenomenon. The organiser is the part of an embryo consisting of undifferentiated cells that follow a specific course of development by identifying the polarity of particular region.

97. (a) : Trophoblast is the layer of cells encircling the blastocoel and the inner cell mass. The latter gives rise to the embryo. The cells of the trophoblast form the placenta and fetal membrane.

98. (a) : Ectoderm, mesoderm and endoderm are the three germ layers that give rise to the specific tissues, organs and organ-systems. Ectoderm gives rise to conjunctiva, cornea, lens of eye, muscles of iris, vitreous humour, retina, lacrimal gland along with other parts of the body.

99. (c) : Gonads, muscles, dermis, kidneys, etc., develop from mesoderm. Ectoderm produces epidermis, glands, nervous system, etc. Pancreas, lining of urinary bladder, etc., develop from endoderm.

100. (b) : Process of parturition is induced by both nervous system and hormones secreted by the endocrine glands of the mother. The signals for child birth (parturition) originate from the fully developed fetus and placenta which induce mild uterine contractions called fetal ejection reflex. This causes quick release of oxytocin from the maternal posterior lobe of pituitary gland which induces labour pains. Prostaglandins, progesterone and estrogen also play a role. Prolactin is the hormone which induces lactation and has no role in parturition.

101. (d)

102. (a) : *Refer to answer 100.*

103. (b) : *Refer to answer 100.*

104. (b) : *Refer to answer 100.*

105. (b) : In human adult female, oxytocin is a hormone released by the pituitary gland (neurohypophysis) that causes contraction of the uterus during labour and stimulates milk flow from the breasts by causing contraction of muscle fibres in the milk ducts.

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