

learning experience



NEW SYLLABUS

English Medium







B.Sc. (Hons), M.Sc.





Unit Reproduction Human Develop Human Development

ADVANCED LEVEL **Biology**

Unit - 05 Animal Reproduction

O Human Development

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ADVANCED LEVEL





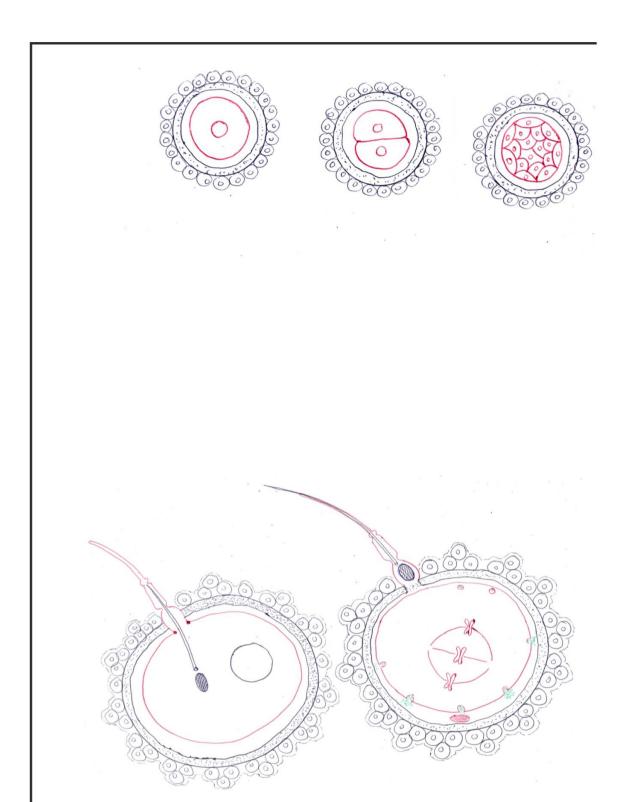


Smart Note

SAMPATH LANKADHEERA

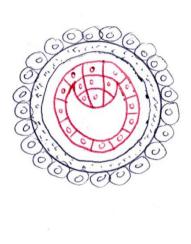
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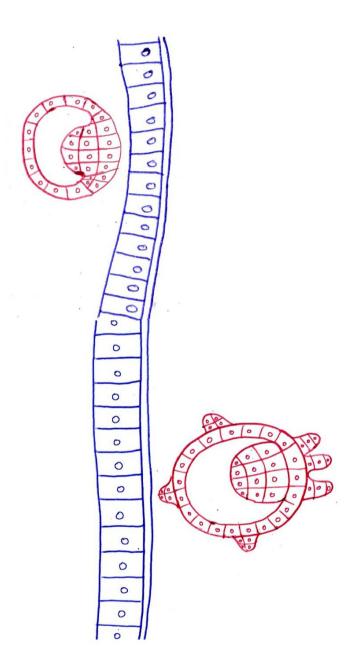
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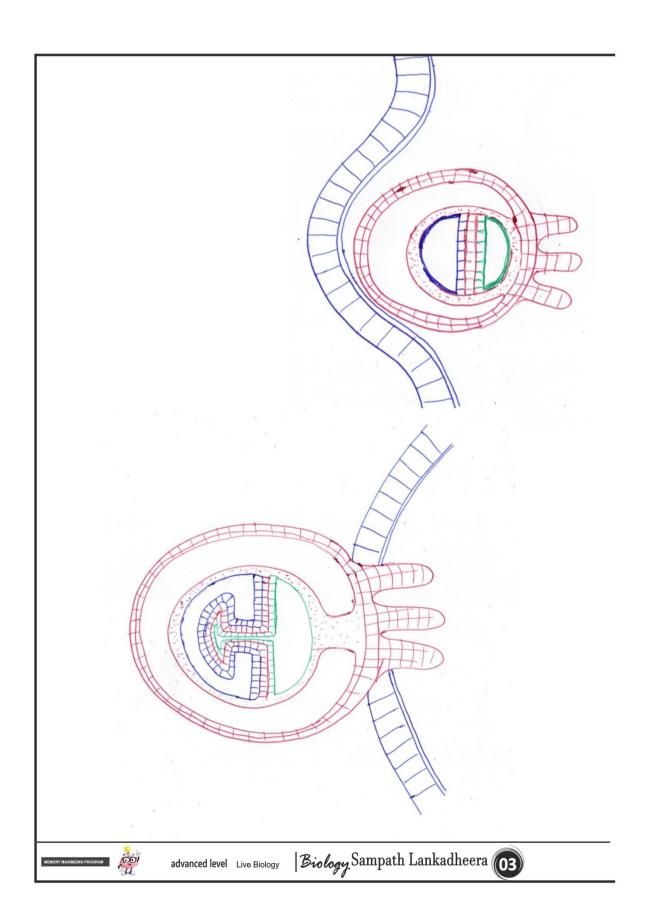


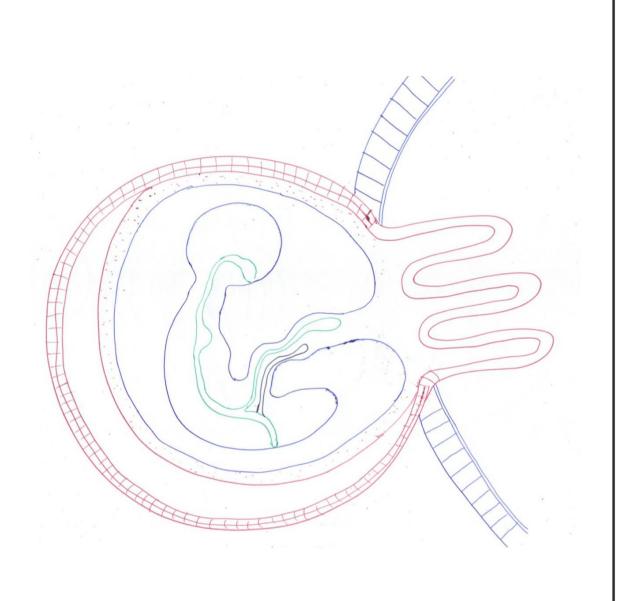












5.8.4: Inquires into the processes involved in fertilization up to birth

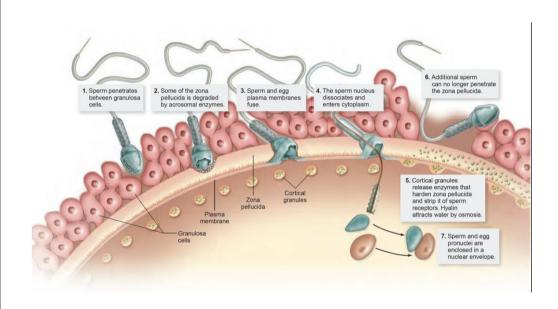
Learning Outcomes:

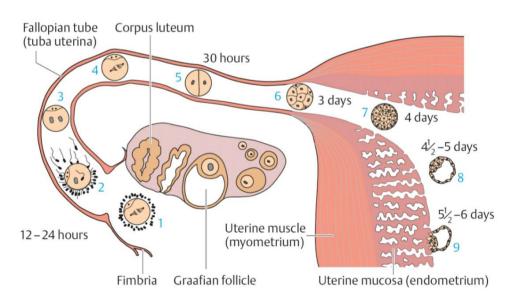
- States fertilization
- Briefly states the developmental stages of a zygote
- States what implantation is
- States the types of foetal membranes and functions of each
- Briefly describes the structures of placenta and umbilical cord
- States what pregnancy is and its duration
- Lists down the major foetal changes during pregnancy in each trimester
- Relates the mother's immune tolerance to the embryo
- Briefly describes the process and the role of positive feedback mechanism of parturition
- States what lactation is
- Briefly describes the hormonal and nervous regulation of lactation
- States the composition of human milk
- States the significance of breast feeding
- Appreciates the importance and complexity of fertilization and pregnancy
- Appreciates the importance of breast feeding

нитап речегортент
Fautilization / consocition and fauration of Human 7, mate
Fertilization/conception and formation of Human Zygote
During fertilization a sperm enters the secondary oocyte penetrating the epithelial cells surrounding the possite, the glycoprotein layer present between the cocyte, 's plasma membrane and the surrounding cells."

- oocyte, the glycoprotein layer present between the oocyte 's plasma membrane and the surrounding cells.
- Once the sperm enters the secondary oocyte, meiosis II of the oocyte is completed producing the mature
- Subsequently, the two haploid pronuclei of the mature ovum and the sperm fuse to produce a diploid, single cell referred to as the zygote.
- The fusion of the haploid nuclei of the sperm and the ovum is called fertilization.
- Fertilization takes place in the upper reaches of the oviduct within 12 to 24 hours after ovulation.









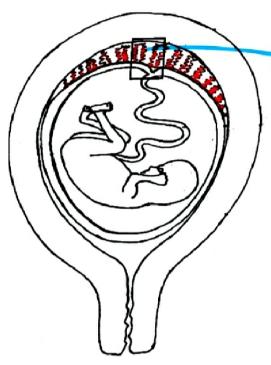
the zygote, blasto	-		

- Morula floats within the uterine cavity and gets nutrition by endometrial secretions.
- About five days after fertilization, a large fluid filled cavity is formed surrounding the ball of cells.
- With the formation of the cavity, this developing stage is referred to as the blastocyst.
- Further rearrangements of the cells in the blastocyst results in two distinct structures: the inner cell mass and the trophoblast.
- Inner cell mass is located internally and eventually develops into the embryo and the membranes enclosing the embryo are called the amniotic sac.
- The trophoblast which is the outer layer of cells will ultimately develops into the fetal portion of the placen-
- Around 7 days after fertilization, the blastocyst attaches to the endometrium of the mother 's uterus.
- This is called implantation.
- As the blastocyst implants, the inner cell mass orients towards the endometrium.
- The trophoblast grows outward and invades the endometrium.
- This is initiated by the enzyme secreted by the trophoblast to breakdown the uterine lining.
- Then the trophoblast extends finger like projections into the endometrium.
- Trophoblast begins to secrete human chorionic gonadotropin (hCG) hormone which has the action similar to LH.
- The hormone hCG rescues the corpus luteum from degeneration and sustains its secretion of progesterone and estrogen which maintain the uterine lining preventing menstruation.
- After implantation, three germ layers are formed in the developing embryo at the end of the gastrulation
- Extra-embryonic membranes begin to appear which surround the embryo.
- The placenta is formed by the cells of trophoblast and the adjacent endometrial tissues.

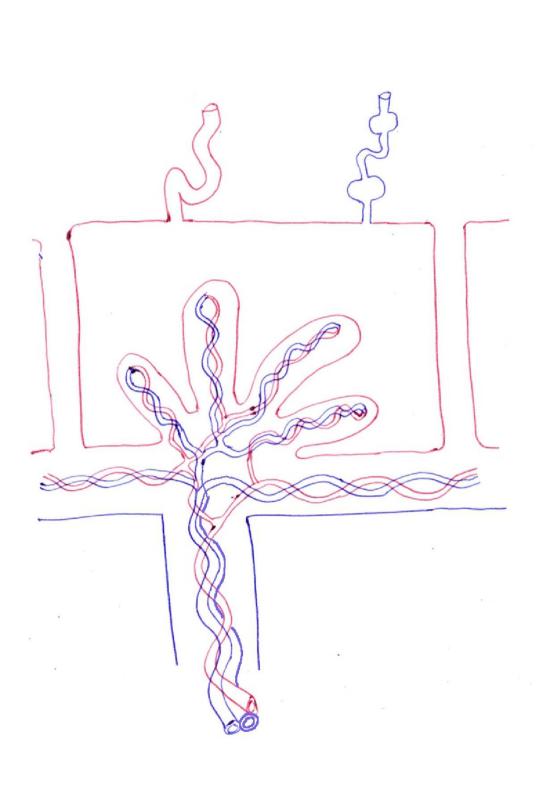


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It also protects the embryo/fetus from immune responses of the mother.	
Chorion produces hCG, an important hormone of pregnancy.	
Amnion is a protective membrane surrounding the embryo/fetus creating a fluid filled cavity which serve	es
as a shock absorber and helps prevent desiccation.	
 Yolk sac contributes to the cells that will become blood cells until the fetal liver takes over. It also is the source of primordial germ cells that migrate to the developing gonads. 	
 Allantois is a small outer -pouching of the yolk sac that serves as an early site for blood formation and is 	26
sociated with the development of the urinary bladder.	as-
Placenta and umbilical cord	
The placenta is a disc shaped organ formed by two parts:	
1. Embryonic/fetal portion formed by chorionic villi of the chorion	
 Embryonic/fetal portion formed by chorionic villi of the chorion Maternal portion formed by the endometrium 	
 Embryonic/fetal portion formed by chorionic villi of the chorion Maternal portion formed by the endometrium The placenta contains both embryonic/fetal and maternal blood vessels. 	
 Embryonic/fetal portion formed by chorionic villi of the chorion Maternal portion formed by the endometrium The placenta contains both embryonic/fetal and maternal blood vessels. However maternal and fetal blood vessels do not join and the blood they carry do not normally mix. 	
 Embryonic/fetal portion formed by chorionic villi of the chorion Maternal portion formed by the endometrium The placenta contains both embryonic/fetal and maternal blood vessels. However maternal and fetal blood vessels do not join and the blood they carry do not normally mix. The placenta mediates the exchange of material (nutrients, respiratory gases, metabolic wastes) between 	n
 Embryonic/fetal portion formed by chorionic villi of the chorion Maternal portion formed by the endometrium The placenta contains both embryonic/fetal and maternal blood vessels. However maternal and fetal blood vessels do not join and the blood they carry do not normally mix. 	n
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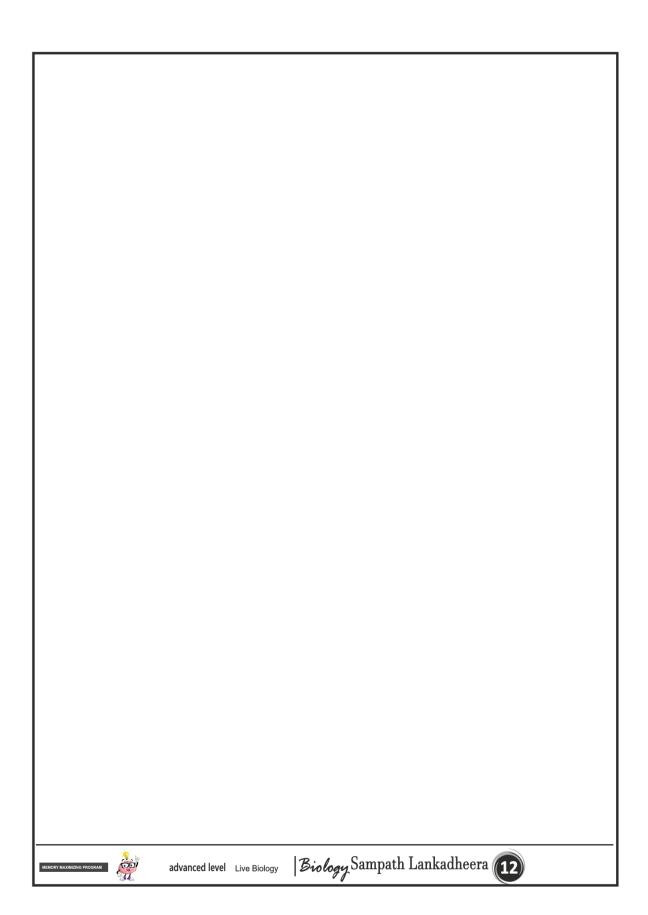
- The placenta supplies oxygen and nutrients to the fetus from the maternal blood stream and excrete waste products from the fetus to the maternal blood stream.
- The placenta also helps to provide immune protection to the developing embryo/fetus. The placenta produces hormones (Eg. hCG, progesterone etc.) needed to sustain the pregnancy.
- Umbilical cord is a flexible cord -like structure containing blood vessels and attaches embryo/fetus to the placenta during gestation.
- Oxygen poor blood from the embryo/fetus travels to the placenta through the two arteries of the umbilical cord and passes through fingerlike projections (chorionic villi) of the placenta where oxygen and nutrients are acquired.
- Fetal blood (oxygen rich blood) leaves the placenta through the umbilical vein leading back to the embryo/ fetus.







regnancy and its duration		



- The nine months of pregnancy are divided into three trimesters of about three months each.
- During the first trimester, the implanted embryo secretes hormones to regulate the mother's reproductive system and to indicate its presence.
- The hCG hormone secreted by the embryo, maintains the corpus luteum in the ovary to secrete progesterone and estrogen.
- Some amount of this hCG passes from the maternal blood to the urine.
- The presence of hCG in pregnant mother 's blood and urine can be easily detected and therefore is used as an early pregnancy detection test.
- High levels of progesterone brings about rapid changes in the mother.
- Both ovulation and menstrual cycles stop, the maternal side of the placenta grows, and the breasts and the uterus get larger.
- Mucus in the cervix of the mother forms a plug which prevents the fetus from infections.
- Most mothers experience nausea (morning sickness) during the first trimester.
- By the second trimester, the level of hCG declines and as a result the corpus luteum deteriorates. But the placenta takes over the production of progesterone and estrogens which helps to maintain the pregnancy.
- Mother can feel fetal movements.
- As the fetus grows, mother 's abdominal organs become compressed and displaced.
- In the third trimester of pregnancy this may lead to digestive blockage and frequent urination.

Major fetal changes in each trimester

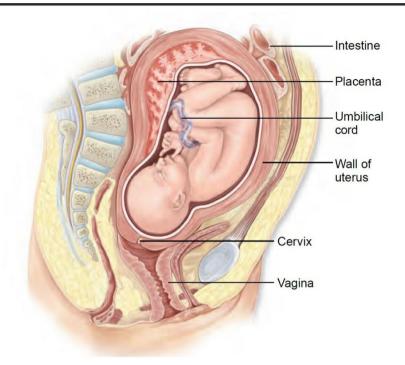
First trimester

- The first trimester is the most critical stage of development during which the rudiments of all major organ systems appear.
- This is the main period of organogenesis (the development of the body organs).
- The heart begins to beat by the 4th week (can be detected at 8 -10 weeks).
- By the 8th week, embryo is said to be the fetus as all the parts of an adult are present in rudimentary form.
- At the end of the 1st trimester, the fetus is well differentiated and about 5 -7 cm long.





Second trimester
Second triniester
Chorion Amnion Yolk sac Umbilical cord Chorionic frondosum (fetal) Decidua basalis (maternal) Umbilical artery Umbilical artery Umbilical vein Uterine wall



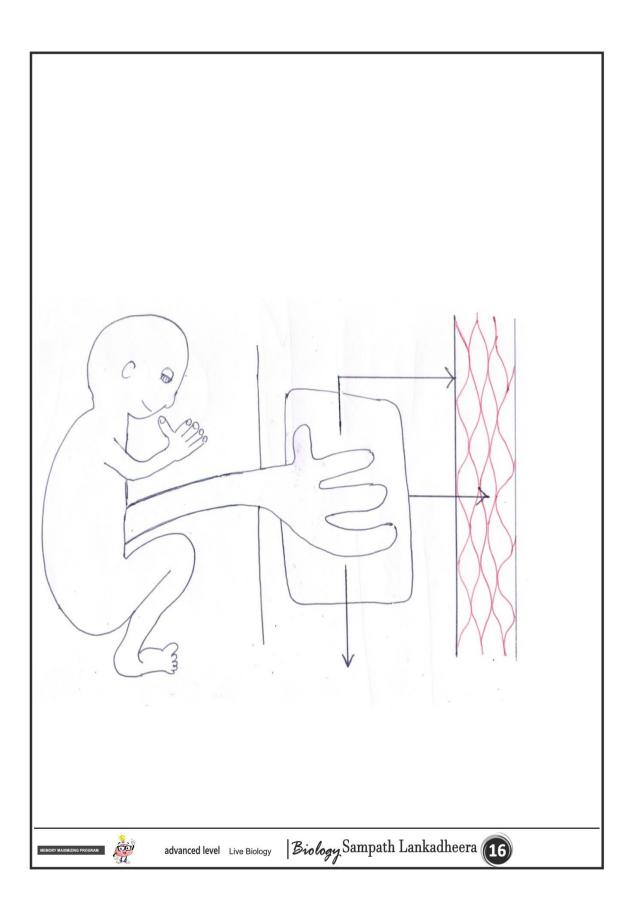
Maternal immune tolerances of the embryo and fetus

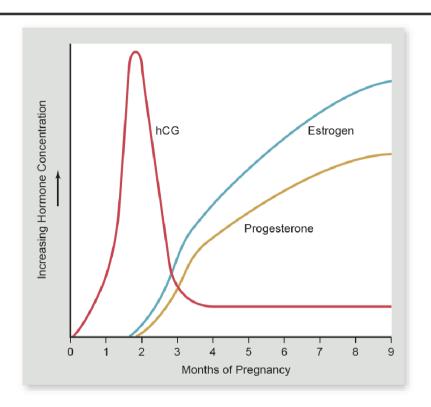
- During pregnancy the overall regulation of the mother 's immune system changes.
- These changes allow the mother to keep the embryo in her uterus without rejecting as a foreign body even though half the embryo's genes are inherited from the father and many chemical markers on the surface of the embryo are foreign to the mother.

Process of parturition

- Child birth begins with the labor. The labor is a series of strong, rhythmic uterine contractions that push the fetus and placenta out of the body.
- When labor begins, local regulators (prostaglandins) and hormones (mainly estradiol and oxytocin) induce and regulate further contractions of the uterus.
- This is a positive feedback mechanism as uterine contractions stimulate secretion of oxytocin which stimulates further contractions of the uterus.
- The labor can be divided into three stages. The first stage is the thinning and opening up (dilation) of the cervix.
- The second stage is the delivery of the baby. In this stage, continuous and strong contractions force the fetus out of the uterus and expel through the vagina.
- Delivery of the placenta is the final stage of labor.









preterm newborn infants



term newborn infants (0 to 28 days)



infants and toddlers (> 28 days to 23 months)



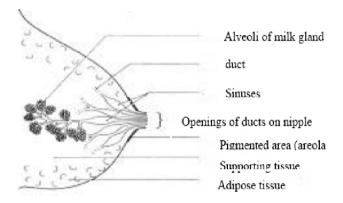
children (2 to 11 years)



adolescents (12 to 18 years)

Lactation

- The lactation which is unique to mammals begins as post natal care.
- Lactation is the secretion and ejection of mother 's milk from the mammary glands.
- Lactation is subjected to nervous and hormonal regulation.
- The main hormone in promoting milk synthesis and secretion is prolactin.
- In response to suckling by the new born baby (which initiates nerve impulses from touch receptors in the nipples) and decrease in estradiol and progesterone levels in the mother 's blood after birth, the hypothalamus send impulses to the anterior pituitary to secrete prolactin hormone which stimulates the mammary glands to produce milk.
- Suckling also stimulates the secretion of oxytocin hormone from the posterior pituitary gland and triggers the release (ejection) of milk from the mammary glands.
- This is a positive feedback mechanism as milk availability encourages continuous suckling, so touch sensation on the nipple and oxytocin release continue further ejecting milk from the mammary glands.



Composition of human milk and significance of breast feeding

- Several types of white blood cells are also present in the breast milk which help the baby to resist microbial infections.
- Compared to the true milk, colostrum contains less nutrients (less lactose and no fat) but they are adequate for the early nutritional needs.
- Breast feeding supports optimal infant growth, enhances intellectual development and fosters mother infant relations by establishing early and prolonged contact between them.
- Compared to cow's milk, the fat, iron and the proteins in the breast milk are more readily metabolized.
- Lower sodium content of breast milk is more suited to the baby 's needs. The baby is less likely to have allergic reactions to mother's milk than the milk from another source.

Birth control methods

- The deliberate prevention of pregnancy is called contraception.
- This can be achieved in several ways.
- Some contraceptive methods prevent gamete development or releasing gametes.
- Some contraceptive methods prevent fertilization of gametes. Some methods are available to prevent implantation of an embryo. Unwanted pregnancies are avoided by birth control methods.

Common temporary birth control methods:

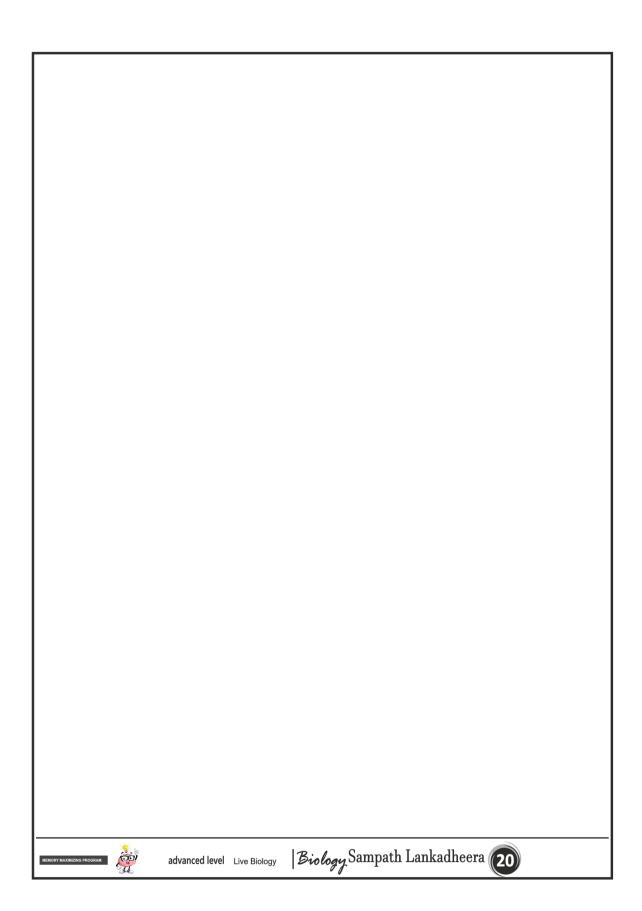
Oral contraceptives for females:

- Most oral contraceptives contain high concentration of synthetic estrogen and progesterone.
- High levels of these hormone inhibit GnRH release from hypothalamus and FSH and LH secretions from anterior pituitary through negative feedback.
- Prevention of LH release blocks ovulation.
- Inhibition of FSH secretion prevents follicle maturation.
- Some oral contraceptives contain only high levels of synthetic progesterone (progestin) which thickens cervical mucus so that it blocks entering sperms to the uterus.
- If fertilization occurs it can interfere with implantation as well.









Condoms for males:

Barrier devices which prevent sperm entry





IUD (loop) for females:

A device placed in the uterus which interferes with fertilization and prevents implantation of a fertilized ovum



Depo-Provera injection for females:

- Periodic injection of a synthetic progesterone which thicken cervical mucus and prevents sperm entry.
- If fertilization occurs it prevents implantation by making the endometrium thin.



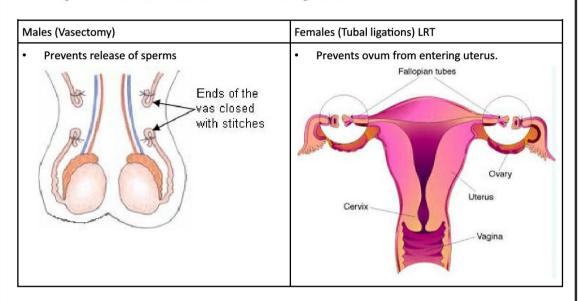






Surgical Sterilization (preventive methods of gamete release)

- Vasectomy for males Prevents release of sperms
- Tubal ligation for females Prevents ovum from entering uterus



Abortion

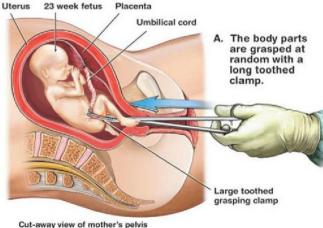
Abortion is the premature termination of a pregnancy in progress.

Miscarriage:

Spontaneous abortion which occurs naturally.

Induced abortion

- Induced abortion is intentionally performed (surgical or non-surgical).
- Certain drugs can induce abortion non -surgically within the first 7 weeks after conception.
- They block progesterone receptors in the uterus thereby preventing progesterone from maintaining the pregnancy.



Cut-away view of mother's pelvis



Sexually transmitted infections

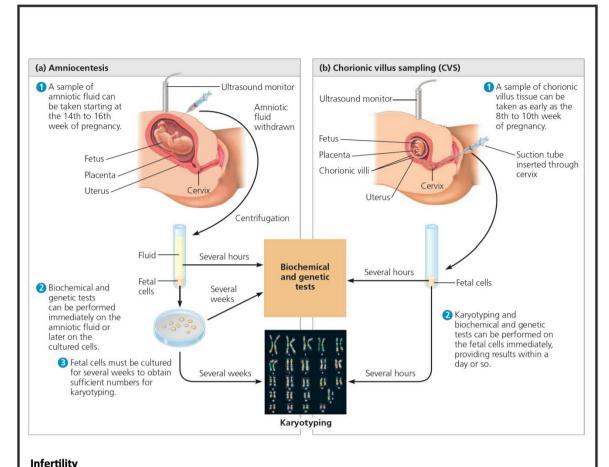
Infection	Pathogen	Main mode of transmission	Main symptoms
Gonorrhea	Neisseria gonorrhoeae (Bacterium)	Sexual contact, Mother to child at birth	 In males-burning feeling/ discomfort when passing urine, yellow discharge with pus from genito-urinary tract. Accompanied by fever, head- ache. Females—Fallopian tubes become filled with pus.
Syphilis	Treponema pallidum (Bacterium)	Sexual contact,Mother to child at birth	Sores or painless ulcers on any part of the body (vagina, lips, fingers, nipples), fever, skin rashes
AIDS (acquired immunodeficiency syndrome)	HIV (Human immunodeficiency virus)	Sexual contact Transfer of body fluids (blood, serum) Use of unsterilized needles Mother to fetus/Child: during pregnancy, at birth and during lactation	Loss of appetite and weight, fever, persistent dry cough, Lymphoma (cancer in lym- phatic system), pneumonia and other disease resulting from breakdown of the im- mune system
Genital herpes	Herpes simplex 2 (Virus)	Sexual contact	Itchy, painful sores around genital area, fever in some cases

Detecting disorders during pregnancy

- Many development problems and genetic disorders can be diagnosed during the gestation period.
- Ultrasound images can be used to analyze the size and condition of the fetus.
- 2. Amniocentesis and chorionic villi sampling A needle is used to obtain fetal cells from amniotic fluid or tissue surrounding the embryo.
- 3. Genetic analysis can be done with these samples.
- 4. Newest method is to use a pregnant mother 's blood to analyze the genome of the fetus as the mother 's blood contains fetal DNA.
- But all detectable disorders are untreatable when the embryo is in the uterus and many cannot be corrected even after birth.
- However, parents can take informed decisions with the help of these tests.







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Modern reproductive technology for resolving infertility problems

Some infertility problems are resolved by recent scientific and technogical advances. This includes hormone therapy, surgery and assisted reproductive technology.

Hormone therapy

Sometimes, hormone therapy can increase sperm production in the infertile male or egg production in the infertile female.

Surgery:

The ducts in the reproductive system that are formed improperly or have become blocked can be corrected surgically to resolve infertility.





Biology Sampath Lankadheera 25



Assisted reproductive technology
In vitro fertilization (IVF):
 The fertilized eggs are incubated until they reach at least 8 cells and then these embryos are transferred to the woman's uterus for implantation and to continue its development.
Conventional IVF needs between 50000 and 100 000 of sperm from the male per one oocyte in order to shi was the familiar to a specific per one of the specific per one
 achieve the fertilization. This is due to the fact that in IVF, acrosome reaction has to take place and thousands of sperm cells have to be involved.
Egg collection
Ovary
Embryo
Sperm Egg Embryo Transfer
Intra-cytoplasmic sperm injection (ICSI):
Unlike in conventional IVF, the sperm which will be inserted into a particular oocyte is already selected in

•	The fertilized egg can then be returned to the woman's uto	erus for implantation.
a	ICSI	b Conventional IVF
P	Polar body Injection pipette Cumulus cell Oocyte	Spermatozoa Oocyte Petri dish
	Questions	
1.	What is fertilization	
2.	What is cleavage.	
3.	How long it takes after fertilization to begin cleavage.	
4.	What is implantation	
5.	What is the structure to begin the production of (hCG) horn	none
6.	What is the role of hCG hormone.	
7.	States the types of foetal membranes and functions of each	
	· .	
MEMORY M	ANIMIZNO PROGRAM Biology Biology S	ampath Lankadheera 🔂

8.	What is the function of the placenta?
9.	Following diagram shows the structure of placenta. Label it.
	А—, — В
	}— c
	K —
	D
	L H E
	G F
	G T
10.	What are the materials exchanged through placenta.
11.	What are the maternal parts of the placenta and what are the foetal parts of the placenta.
12	M/hat are the harmone are duced by placents
12.	What are the hormones produced by placenta.
13.	State what pregnancy is and its duration
8	
MEMORY	advanced level Live Biology Biology Sampath Lankadheera 28

14.	What is the period of transition of embryo to foetus?
15.	What is the size and weight of a normal foetus at the end of pregnancy?
16.	What is the hormone involve in child delivery and milk release.
17.	States what lactation is
18.	What is colostrum? How long it is produces.
19.	What is milk let-down hormone?
20.	What is the composition of human milk
21.	States the significance of breast feeding
22.	What is contraception
23.	What are different methods to achieve contraception.
24.	State surgical sterilization methods for males and females.
MEMORY	advanced level Live Biology Biology Sampath Lankadheera 29

25.	What is an abortion
26	What is the difference between miscarriage and induced abortion.
20.	what is the difference between miscarriage and induced abortion.
27.	State symptoms of following STD
	Gonorrhea
	Syphilis
	,,
38	What are methods of transmission of HIV from one person to another.
50.	
29.	What are the methods available for detection disorders in pregnancy.
30.	What is infertility
31.	What are different Modern reproductive technology for resolving infertility problems
MEMOR	advanced level Live Biology Biology Sampath Lankadheera 30
	31

22	2. State different assisted reproductive techniques						
32.	Stat	e different as:	sisted reproductive techniques				
33	Brie	fly describe th	ne difference between IVF and ICSI.				
00.	0110	ing describe a	and the contract of the contra				
			Classical IVF IVF-ICSI				
Structured Essay 2009 D. (i) What foetal membranes participate in the formation of human plancenta?							
		(ii) Name the	hormone secreted by the placenta at the initial stage of pregnancy and state its function.				
	(iii) Name two substance that pass from foetus to maternal blood trough the human placenta.						
	(iv) Name a substance secreted by human placenta which stimulates uterine contractions in the birth process.						
2011/New							
	A.	(i) White are	structures involve in formation of human placenta?				
		(ii) Name hor	mone produced by the placenta during the initial stage of pregnancy and state its functions.				
		Hormone	Function				
_		200					

	nones produced by the placenta during late stage of pregnancy.			
functions.	other important substance produced by the placenta in addition to hormones and sate its			
	T			
Substance	Function			
(h) Nama tha	harmona that induce the production of substance stated in (iv) (a) above and state its site			
sites of synthe	normone that induce the production of substance stated in (iv) (a) above and state its sit sis.			
Hormone	Site of synthesis			
Tiormone	Site of Synthesis			
(v) M/bat is the	harmone reconneible for inhibiting the contraction of myamatrium during programs			
(v) What is the	e hormone responsible for inhibiting the contraction of myometrium during pregnancy.			
(i) Nama tha h	ormones responsible for the development of milk glands their ducts.			
	ormones responsible for the development of milk grands their ducts.			
Hormone				
(ii) (a) Name th	he hormone responsible for the production of breast milk and state its site of production			
(ii) (a) Name th	he hormone responsible for the production of breast milk and state its site of production Site of production			
Hormone	Site of production			
Hormone				
Hormone	Site of production			
Hormone (b) Name the h	Site of production			
Hormone (b) Name the h	Site of production normone that prevents the secretion of breast milk during pregnancy. the major components of breast milk other than water			
(b) Name the h	Site of production normone that prevents the secretion of breast milk during pregnancy. the major components of breast milk other than water			
(b) Name the h	Site of production normone that prevents the secretion of breast milk during pregnancy. the major components of breast milk other than water			
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(b) Name the h	Site of production normone that prevents the secretion of breast milk during pregnancy. the major components of breast milk other than water			
(b) Name the h	Site of production normone that prevents the secretion of breast milk during pregnancy. the major components of breast milk other than water se should supplementary foods should be introduce to infants.			



- Which of the following statements regarding capacitation of human sperms is incorrect?
 - (1) During capacitation some glycoproteins of sperm membrane are altered.
 - (2) Highly motile sperms release trypsin. (3) Acrosome reaction occurs only in capacitated sperms.
 - (4) Capacitated sperms can bind to receptors in zona pellucida. (5) Capacitation starts in the epididymis.

2012/23

- 2. Which one of the following statements regarding human fertilization is correct?
 - (1) It usually occurs in the lower 1/3 of the fallopian tube. (2) It must occur within 24 hours of ovulation.
 - (3) During this process polyspermy is prevented by the egg membrane. (4) At fertilization entire sperm enters the egg.
 - (5) Under no circumstances it occurs outside the female reproductive system.

2014/26

(2001)

- 3. Which of the following statements is incorrect regarding human milk?
 - (1) It is the best food that can be given to an infant. (2) It's synthesis is stimulated by oxytocin
 - (3) It provides antibodies to the infant. (4) It has iron binding proteins. (5) It is virtually sterile.
- Select the correct statement regarding human lactation and milk.
 - (1) oxytocin stimulates milk production.
- (2) Prolactin controls release of milk.
- (3) Release of milk stars immediately after birth.
- (4) Sodium content of milk is low. (5) Milk is rich in glucose. 2009/27
- Which one of the following statements on implantation of human embryo is correct?
 - (1) It is the process of embedding of morula stage in the endometrium. (2) It usually starts on the third day of fertilization.
 - (3) It is completed by the 15th day after fertilization. (4) It takes about two weeks to complete.
 - (5) When it is completed, the embryo is known as the fetus.

2010/17

- Which of the following statements regarding parturition in women is incorrect?
 - (1) It usually occurs 36 weeks after fertilization.
 - (2) it results from a series of strong rhythmic contractions of the smooth muscles of myometrium
 - (3) The signal for parturition comes from the fetus.
 - (4) About a week before parturition progesterone triggers formation of oxytocin receptors in myometrium.
 - (5) Uterine stretch receptor play an important role in oxytocin release at parturition.

2012/24

- Which of the following statements regarding human lactation is incorrect?
 - (1) It is the production and release of milk from mammary glands. (2) Oxytocin is involved in the milk ejection reflex.
 - (3) Progesterone suppresses milk production. (4) Baby's suckling is essential for maintenance of milk production.
 - (5) Human placental lactogen enhances milk production.

2013/22

- 8. Which of the following statements regarding human reproduction is correct?
 - (1) Acrosome reaction of sperms is necessary for penetration of corona radiata.
 - (2) Cortical reaction of ovum prevents polyspermy. (3) During ovulation a primary oocyte is ejected from Graafian follicle.
 - (4) Fertilization should occur within 48 hours after ovulation. (5) Oogenesis starts after puberty.

2013/24

- Which one of the following statements is incorrect regarding contraception?
 - (1) Lactation can provide a contraceptive effect.
 - (2) Oral contraceptive pill obstructs the release of FSH and LH from the pituitary.
 - (3) Depo -Provera prevents uterine implantation.
 - (4) IUDs prevent ovulation.
 - (5) Vasectomy is a permanent method of male contraception.

2014/24



Biology Sampath Lankadheera 33



10.	 (1) Which of the following statements regarding human pregnancy is incorrect? (1) Its duration is usually about 40 weeks after fertilization. (2) During pregnancy placental progesterone suppresses myometrial contractions. (3) Foetus has a hairy wrinkled skin by the end of the first trimester of pregnancy. (4) Presence of hCG in urine confirms pregnancy. (5) Towards the end of pregnancy oestrogen triggers the development of oxytocin receptors in the myometrium. 					
11.	In which of the following structures develop the ability to fertilize an ovum? (1) Seminal vesicle (2) Vagina (3) Urethra (4) Vas deferens (5) Epididymis	015/25				
	Essay					
	Write short notes on Human placenta (AL 2001)					
2.	(a) States what lactation and briefly describes the hormonal and nervous regulation of lactation.(b) State composition of human milk and describe significance of breast feeding					
3.	Write short notes on (a) Importance of breast feeding. (AL 2007) (b) Implantation of Human embryo. (AL 2015)					
4.	(a) States what is infertility.(b) States the major two types of modern reproductive technologies;(c) Describes assisted reproductive technologies.					
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B. A. Sampath Lankadheera	_

Write short notes on Human placenta (AL 2001) 1.

Answer

- The embryonic trophoblast and the mother's endometrium intermingles and form the placenta.
- The placenta is a disc shaped organ formed by two parts:
- embryonic/fetal portion formed by chorionic villi of the chorion
- and maternal portion formed by the endometrium.
- The placenta contains both embryonic/fetal and maternal blood vessels.
- However maternal and fetal blood vessels do not join
- and the blood they carry do not normally mix.
- The placenta mediates the exchange of material (nutrients, respiratory gases, metabolic wastes)
- between the embryonic/fetal and the mother's circulatory systems.
- The placenta supplies oxygen
- and nutrients to the fetus from the maternal blood stream
- and excrete waste products from the fetus to the maternal blood stream.
- The placenta also helps to provide immune protection to the developing embryo/fetus.
- The placenta produces hormones (eg. hCG, progesterone etc.) needed to sustain the pregnancy.
- Umbilical cord is a flexible cord-like structure containing blood vessels
- and attaches embryo/fetus to the placenta during gestation.
- Oxygen poor blood from the embryo/fetus
- travels to the placenta through the two arteries of the umbilical cord and passes through
- fingerlike projections (chorionic villi) of the placenta where oxygen and nutrients are acquired.
- Fetal blood (oxygen rich blood) leaves the placenta through
- the umbilical vein leading back to the embryo/fetus.

2. (a) States what lactation and briefly describes the hormonal and nervous regulation of lactation.

- Lactation is the secretion and ejection of mother's milk from the mammary glands.
- Lactation is subjected to nervous and hormonal regulation.
- The main hormone in promoting milk synthesis and secretion is prolactin.
- In response to suckling by the new born baby (which initiates nerve impulses from touch receptors in the nipples)
- and decrease in estradiol
- and progesterone levels in the mother's blood after birth,
- the hypothalamus send impulses to the anterior pituitary
- to secrete prolactin hormone which stimulates the mammary glands to produce milk.
- Suckling also stimulates the secretion of oxytocin hormone
- from the posterior pituitary gland
- and triggers the release (ejection) of milk from the mammary glands.
- This is a positive feedback mechanism as milk availability encourages continuous suckling,
- so touch sensation on the nipple
- and oxytocin release continue further ejecting milk from the mammary glands.

(b) State composition of human milk and describe significance of breast feeding

- During the first few days after birth, the mammary glands secrete a fluid called 'colostrum' until appearance of true milk.
- lactose, fatty acids, amino acids, minerals, vitamins, and water
- ideal for baby's digestion, brain development and growth.
- Human milk includes proteins such as casein, lactalbumin and immunoglobulins.
- Colostrum and true milk provide nutrients for the baby and contain important antibodies that protect the infant.
- Several types of white blood cells are also present in the breast milk which help the baby to resist microbial infections.
- Compared to the true milk, colostrum contains less nutrients (less lactose and no fat) but they are adequate for the early nutritional needs.
- Breast feeding supports optimal infant growth, enhances intellectual development and fosters mother-infant relations by establishing early and prolonged contact between them.
- Compared to cow's milk, the fat, iron and the proteins in the breast milk are more readily metabolized. Lower sodium content of breast milk is more suited to the baby's needs.
- The baby is less likely to have allergic reactions to mothers milk than the milk from another source.



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Answer

- 4. (a) States what is infertility.
- Infertility is the inability to conceive off spring.

(b) States the major two types of modern reproductive technologies;

- Hormone therapy:
- can increase sperm production in the infertile male or egg production in the infertile female.
- Surgery
- The ducts in the reproductive system that are formed improperly or have become blocked can be corrected surgically to resolve infertility.

(c) Describes assisted reproductive technologies.

- In vitro fertilization (IVF):
- In vitro fertilization is a series of procedures used to treat infertility problems
- and assist with the conception of a child.
- The process involves removal of oocyte(s) from a female ovary
- · and obtaining sperm from a male
- and combining the oocyte and the sperm to achieve the fertilization
- · under laboratory conditions.
- The fertilized eggs are incubated
- until they reach at least 8 cells
- and then these embryos are transferred to the woman's uterus
- for implantation and to continue its development.
- Conventional IVF needs between 50 and 100 thousands of sperm
- from the male per one oocyte in order to achieve the fertilization.
- This is due to the fact that in IVF, acrosome reaction has to take place
- and thousands of sperm cells have to be involved.
- Intra-cytoplasmic sperm injection (ICSI):
- This is also a type of in vitro fertilization method
- · which is used to address male infertility.
- If mature sperm are defective or low in number,
- a whole sperm or
- a spermatid nucleus
- · is injected directly into the cytoplasm
- of an oocyte that has been removed from the women's ovary.
- For insemination, ICSI needs only one sperm per oocyte.
- Unlike in conventional IVF, the sperm which will be inserted into a particular oocyte is already selected in ICSI.
- The fertilized egg can then be returned to the woman's uterus for implantation.





