# **UNIT B**

### REPRODUCTIVE SYSTEM AND HORMONES

**EMPHASIS 10 -15%** 

### DIFFERENTIATION AND DEVELOPMENT

EMPHASIS 5-10%



### ADVANTAGES OF SEXUAL VS ASEXUAL REPRODUCTION

### **Meiosis**

→crossing over, independent assortment, haploid gametes producing a diploid zygote (2n)

produces variety of diverse offspring

can increase chance of survival (Natural Selection)

# SEX CHARACTERISTICS

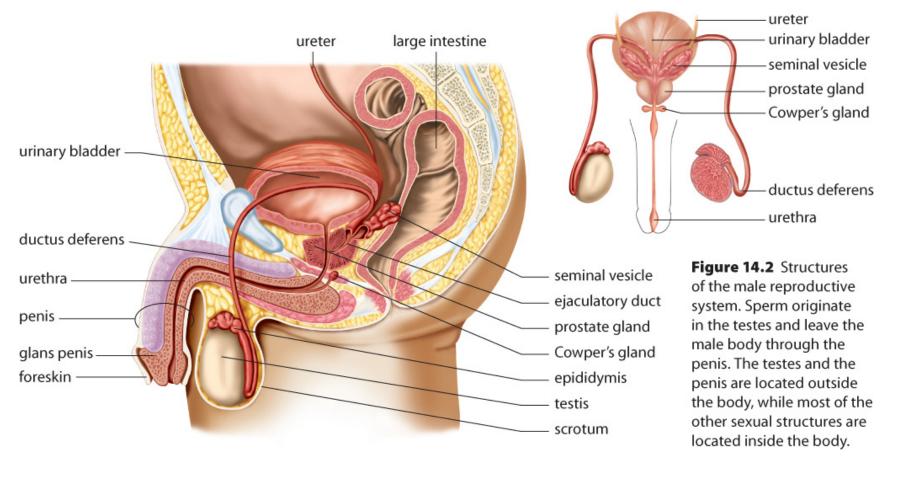
# **Primary**

= genitals present at birth (penis/vagina)

# **Secondary**

= appear at puberty as a result of hormones

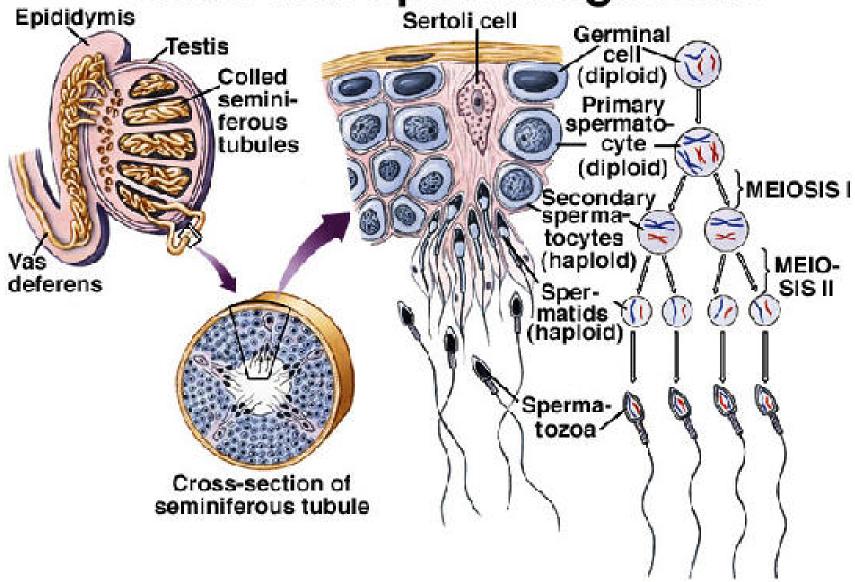
# MALE REPRODUCTIVE SYSTEM



# Seminiferous tubules

- o250 meters of microscopic tubes
- osite of *sperm production*
- ospermatogenesis
  - \*mitosis by diploid (2n) stem cells
  - \*meiosis → 1n gametes

# **Testis and Spermatogenesis**



HORMONAL STIMULATION OF SPERMATOGENESIS IN SEMINIFEROUS TUBULES

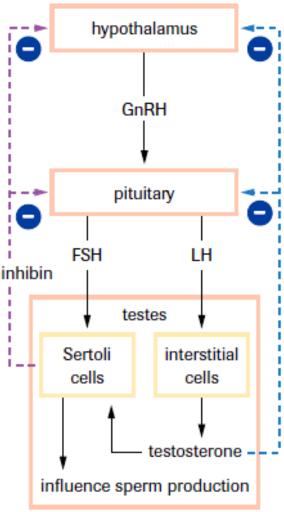
**FSH** – follicle stimulating hormone

oReleased from *anterior* pituitary gland

### Other cells in the testes

Sertoli cells

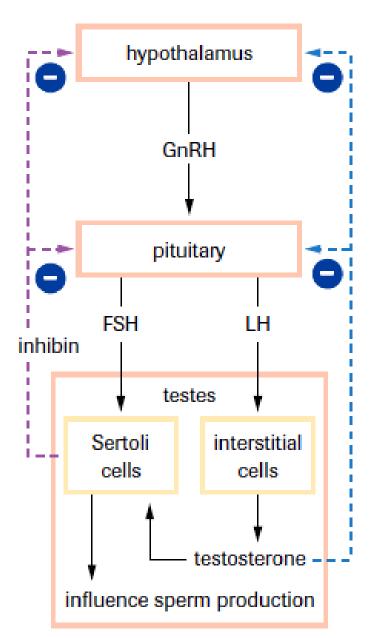
- + nourish/protect the sperm
- + make a hormone inhibin
  - prevents sperm production during childhood



### **OTHER CELLS IN THE TESTES**

# Leydig/Intersticial cells

- make testosterone
  - primary and secondary sex characteristics
  - also stimulates sperm production
- regulated by hormone from the ant. pituitary gland
  - **LH l**eutenizing **h**ormone



# **EFFECTS OF TESTOSTERONE**

#### Table 2 Secondary Sexual Characteristics of Males

- chest and abdominal hair
- more facial hair than women
- hair growth in armpits and pubis (crotch)
- deepervoice due to enlargement of the larynx
- larger, stronger muscles

- fat deposits around the abdomen and waist
- coarser skin texture
- hands and feet usually larger than females
- angle from thigh to ankle forms a straight line

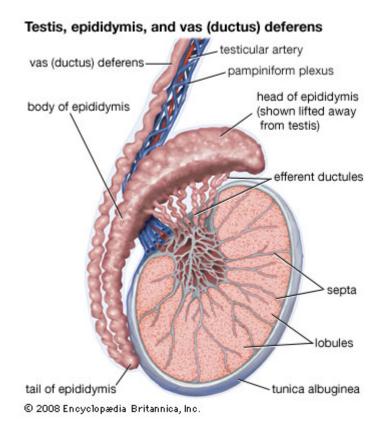
# MALE STRUCTURES CONTINUED

# **Epididymis**

- o sperm mature for 2-3 months
- o sperm are not produced here (storage)

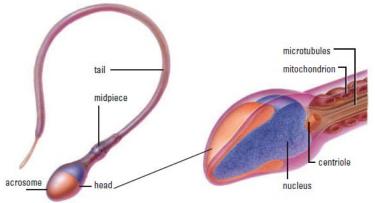
#### Scrotum

- o thin muscular surrounding layer around testicles
  - ★ normal sperm development needs 2°C less than body temperature
  - sterility issues
- o testes drop from the abdominal cavity before birth



# SPERM CELL (SPERMATOCYTE) = GAMETE

- flagellum (tail)
  - o motility = travel 3mm/hr
- midpiece
  - o mitochondria (ATP) for sperm flagellum
- head
  - o haploid nucleus (1n = 23 DNA)
  - o carries either an X or Y sex chromosome
  - **OACROSOME** = enzymes to digest outer layer of egg



### **HOW SPERM MEET EGG**

# **Erection:**

- Parasympathetic nerves
- > vasodilation of arterioles in penis
- > spongy/erectile tissue fills with blood

### **Emission:**

- Sympathetic nerves
- → contraction of testes, glands

# **EMISSION**

# 1. Bulbourethral gland (Cowper's)

- Two glands
  - = neutralizes any urine residue in urethra

# 2. Epididymis

- 400 million sperm exit
- o 5% of semen

# 3. Vas deferens (2) (ductus deferens)

- sperm travel up into abdominal cavity near bladder
- vasectomy surgical procedure to prevent sperm from reaching urethra

#### **EMISSION CONT'D**

### 4. Seminal vesicles = 2 sacks behind bladder

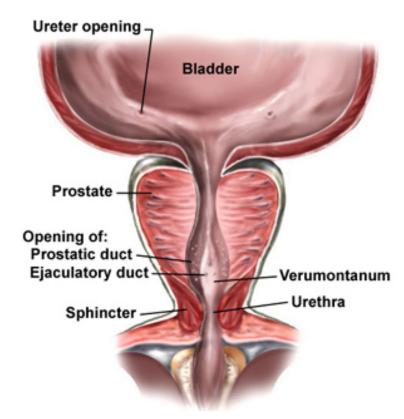
- Yellow fluid (60 % of semen)
  - fructose = fuel for sperm
  - mucous = enhance mobility
  - prostaglandins = uterine contractions

# 5. Prostate gland

- White secretion (30% of the semen)
  - basic/alkaline = buffers against pH of vagina
- Can become enlarged
  - difficult/painful urination & ejaculation issues

#### **Urethra**

- ejaculation sperm exit body
- part of both excretory and reproductive systems



#### SEMINAL FLUID COMPOSITION & FUNCTIONS

Cowper's – cleanse urethra

Prostate – alkaline to protect sperm from neutralize acidic vagina

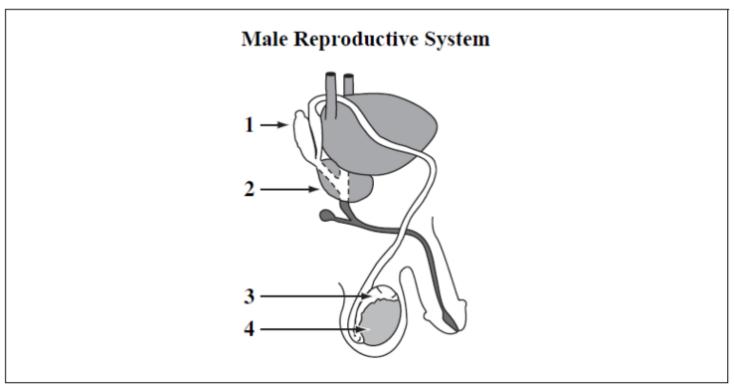
**Seminal Gland – fructose sugar** 

# **PROBLEMS**

|                    | Infertility                                                                                  | Sterility                                                          | Impotence                                                                                                       |
|--------------------|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Definition         | Little viable sperm                                                                          | permanent infertility                                              | Inability to maintain an erection                                                                               |
| Possible<br>Causes | <ul><li>Lifestyle/diet/cloth ing</li><li>Alcoholism/drugs</li><li>Injury to testes</li></ul> | <ul><li>Vasectomy</li><li>Chemotherapy</li><li>Radiation</li></ul> | <ul> <li>Age</li> <li>Smoking     (cardiovascular)</li> <li>Psychological     issues</li> <li>Stress</li> </ul> |



Use the following diagram to answer the next question.



Which numbers on the diagram above indicate the site of sperm production and the site of prostate fluid production?

- A. 3 and 1 respectively
- **B.** 3 and 2 respectively
- C. 4 and 1 respectively
- D. 4 and 2 respectively



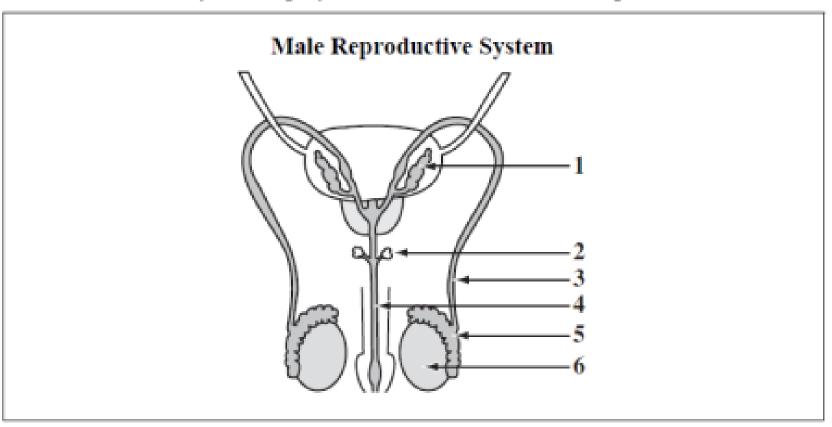
Which of the following rows identifies a substance that is present in semen and the structure that produces the substance?

| Row | Substance present<br>in semen | Structure that produces substance |
|-----|-------------------------------|-----------------------------------|
| A.  | Sperm                         | Vas deferens                      |
| В.  | Mucus                         | Prostate gland                    |
| C.  | Fructose                      | Seminal vesicle                   |
| D.  | Testosterone                  | Interstitial cells                |



#### NUMERICAL RESPONSE #1

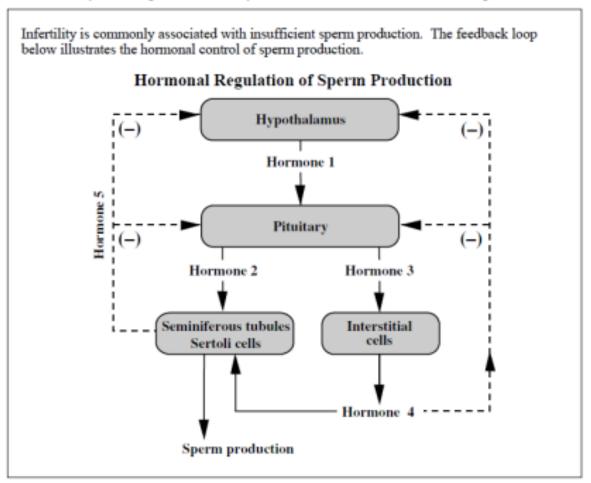
Use the following information to answer the next question.



In a normal male, the sequence of the structures numbered above through which sperm cells travel from the time when spermatogenesis occurs to the time when ejaculation occurs is \_\_\_\_\_, \_\_\_\_, and \_\_\_\_\_.



Use the following additional information to answer the next two questions.



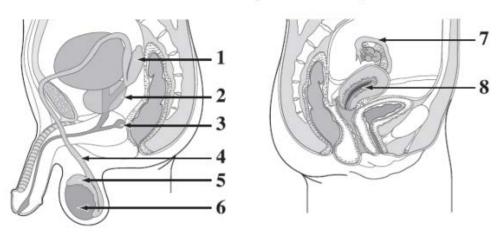
In the diagram above, the hormones FSH, LH, and testosterone are labelled, respectively,

- A. 2, 3, 4
- B. 2, 3, 5
- C. 3, 2, 4
- D. 3, 2, 5

Use the following information to answer the next two questions.

One cause of male infertility is congenital absence of the vas deferens (CAVD). In CAVD, a portion or all of the epididymis, vas deferens, and seminal vesicle is missing. This disorder results in the obstruction of the passage of sperm from the testes. Microsurgical epididymal sperm aspiration (MESA) has been used to enable some men affected with CAVD to father children. This procedure is used to obtain sperm that can be used for *in vitro* fertilization.

#### Male and Female Reproductive Systems



In the diagram above, the reproductive structures that are associated with CAVD are numbered

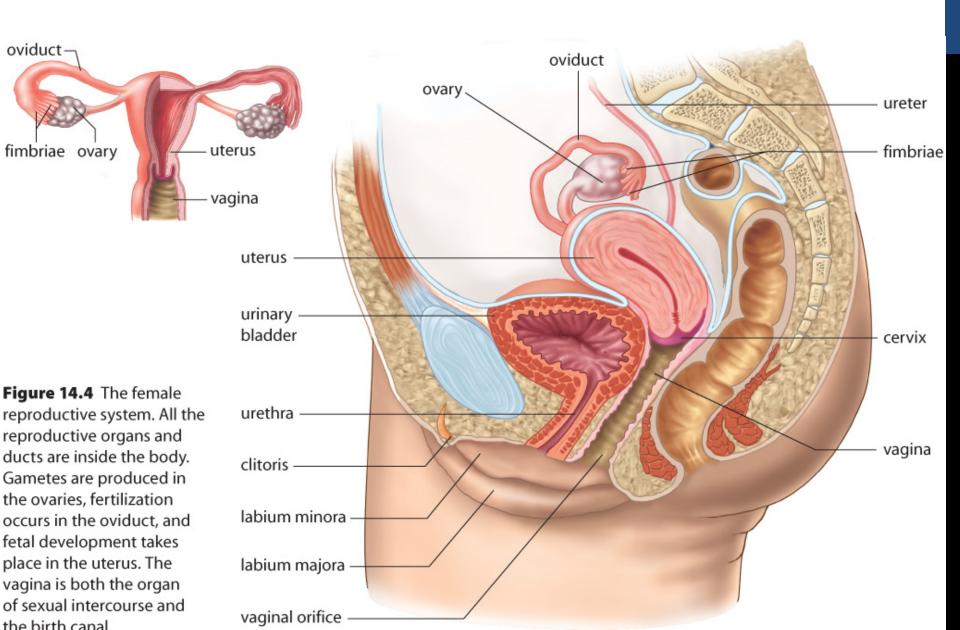
- A. 1, 2, and 5
- **B.** 1, 4, and 5
- C. 3, 4, and 6
- D. 4, 5, and 6



The structure from which sperm are aspirated using the MESA procedure and the structure into which an embryo is inserted following *in vitro* fertilization are numbered, respectively,

- **A.** 5 and 7
- **B.** 5 and 8
- **C.** 6 and 7
- **D.** 6 and 8

### FEMALE REPRODUCTIVE SYSTEM



### **ANATOMY**

# **Vagina**

- elastic, muscular tube
  - entry for sperm
  - birth canal

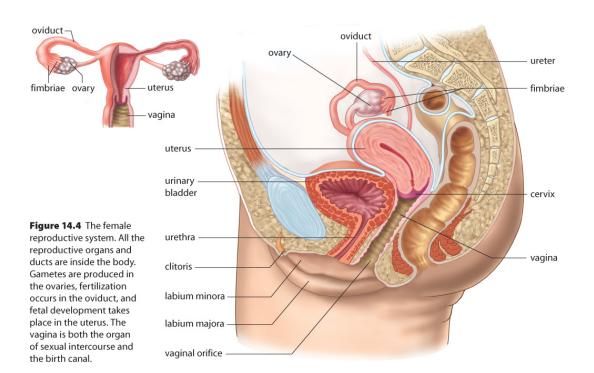
## **Cervix**

entrance to uterus/womb ring of muscle

o dilates for birth (10 cm)

**PAP** smear

o cervical cells (cancer?)



# **Uterus/womb**

muscular organ (size of fist)

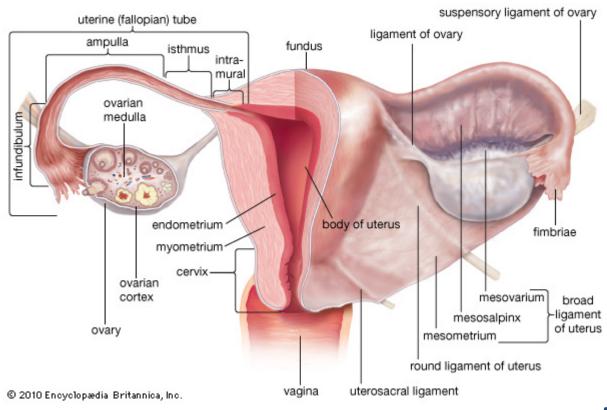
site for fetal growth/development Inner layer = endometrium

oshed once/month

operiod or menses

### Fallopian tubes (2)

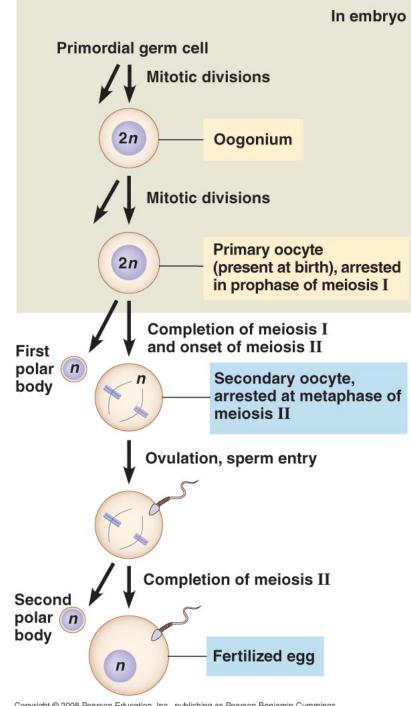
a.k.a oviducts
fimbria = sweep egg
into tube
site of
fertilization\*\*\*
scarring →STI
(Chlamydia)
ectopic pregnancy
tubal ligation (tubes
tied) = sterility



# Ovaries (2)

- oogenesis & ovulation
- hormone production
  - estrogen
  - progesterone

# OOGENESIS (MEIOSIS)



Copyright @ 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

#### **FEMALE HORMONES**

#### Table 2 Secondary Sexual Characteristics in Females

- enlarged breasts
- less facial hair than men
- hair growth in armpits and pubis (crotch)
- wider at the hips than at the shoulders
- fat deposits around buttocks and hips

- more body fat than men
- hands and feet usually smaller and narrower than males
- angle from thigh to ankle is slightly bent

# **OVARIAN/MENSTRUAL CYCLE**

#### 4 stages:

- Flow Phase
- Follicular Phase
- Ovulatory Phase
- Luteal Stage

# **OVARIAN CYCLE - FOLLICULAR STAGE**

- FSH (follicle stimulating hormone)
  - released by anterior pituitary gland
  - target = ovary (follicular cells around oocyte)
  - causes follicle
    - o become larger (filled with fluid)
    - o produce estrogen
- estrogen causes endometrial layer of uterus to thicken
  - o negative feedback loop for FSH
  - o *positive* feedback loop for LH ( at around day 12)

### **OVARIAN CYCLE – OVULATORY PHASE**

- High levels of LH is released by anterior pituitary gland (due to high estrogen)
- target (ovary)
  - o causes **ovulation** oocyte released from ovary

#### **OVARIAN CYCLE - LUTEAL STAGE**

- LH (leutenizing hormone)
  - o causes remnant follicle cells to transform into the corpus luteum
  - Corpus leteum produce progesterone (and estrogen second peak in bloodstream)
- causes = further thickening of endometrium/prevents uterine contractions

#### **CHANGES IN THE OVARY**

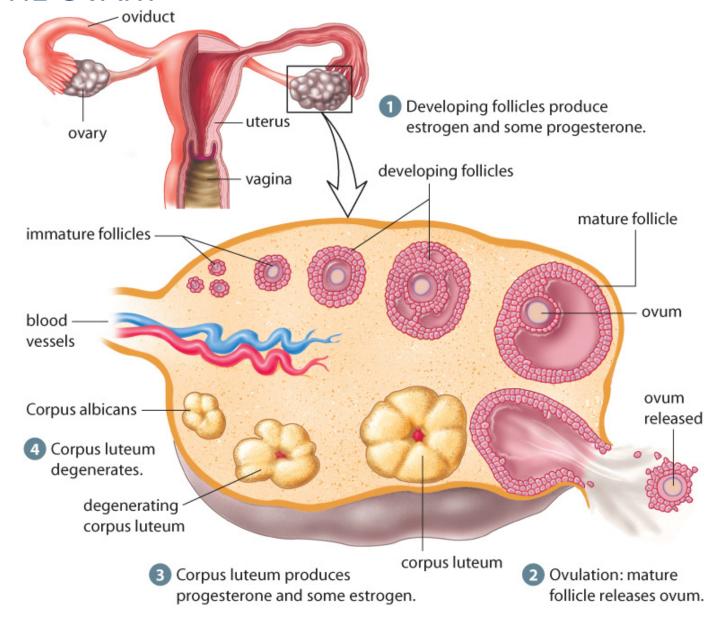
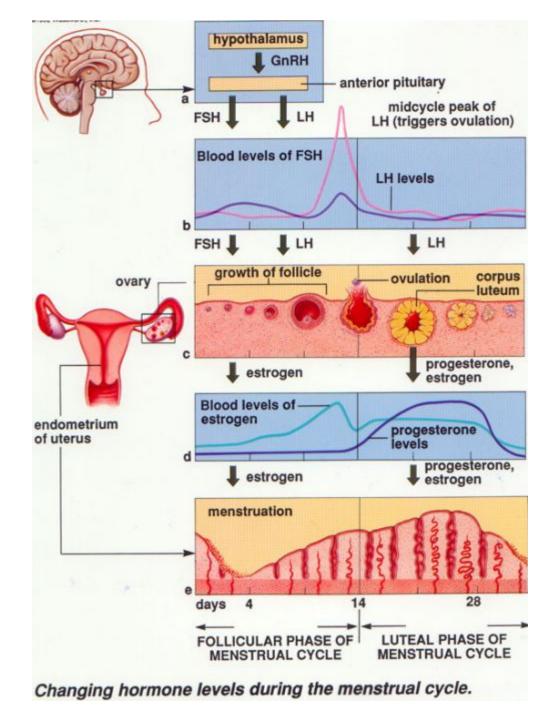


Figure 14.14 A follicle matures by growing layers of follicular cells and a central fluid-filled vesicle. The vesicle contains the maturing ovum. At ovulation, the follicle ruptures and the ovum is released into the oviduct. The follicle develops into a corpus luteum. If pregnancy does not occur, the corpus luteum starts to degenerate after about 10 days. Note that the follicle does not migrate around the ovary, as shown here for clarity, but goes through all the stages in one place.



### OVARIAN CYCLE – FLOW PHASE (MENSTRUAL STAGE)

negative feedback loop

o causes ↓ LH and ↑ of FSH new follicles start to mature corpus luteum shrinks (corpus albicans)

oprogesterone levels fall uterine contractions

oshedding of endometrial layer = *menstruation* 

# FEEDBACK LOOPS

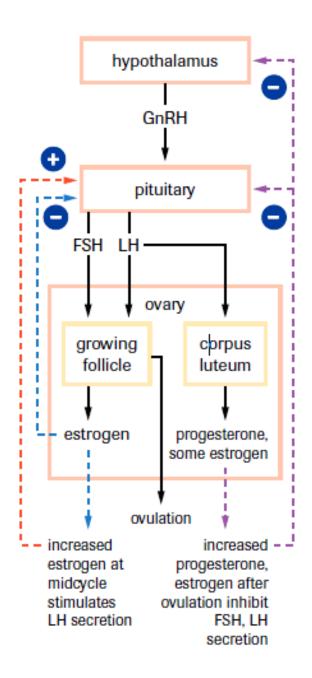
# Negative (-) feedback loop

o estrogen & FSH

o progesterone & LH

Positive (+) feedback loop (~day 12)

o estrogen & LH



#### THE BIRTH CONTROL PILL

- contraception
- estrogen and/or progesterone
- no maturation of follicles or ovulation

### **MENOPAUSE**

- ovaries ↓ production of estrogen and progesterone
- ovulation & menstruation stop



Use the following information to answer the next two questions.

A pharmaceutical company has filed patents for new kinds of panty liners that change colour in response to the variation in a woman's hormonal levels. About four hours before the start of menstrual flow, red and blue markers in one type of panty liner turn purple. Just before ovulation, a purple spot appears on the gold background of a different type of panty liner.

—based on New Scientist, 2001

Fox, Barry. 2001. Smarty pants. New Scientist 169 (February 17): 23

The colour change in the panty liner prior to menstrual flow is **most likely** associated with

- A. increased hCG
- **B.** decreased FSH
- **C.** increased estrogen
- D. decreased progesterone

A purple spot would appear on the panty liner's gold background when a woman's ovary contained a

- **A.** mature follicle
- **B.** developing follicle
- C. mature corpus luteum
- **D.** degenerating corpus luteum

Use the following information to answer the next question.

Research on the effect of cocaine on blood flow in the brain revealed that males and females react differently to the drug. Men who use cocaine have a 20% decrease in blood flow in the brain. Women who use cocaine have no change in blood flow in the brain at the beginning of their menstrual cycle.

—Kaufman, Marc J., Jonathan M. Levin, Luis C. Maas, Thellea J. Kukes, Rosemond A. Villafuerte, Kerstin Dostal, Scott E. Lukas, Jack H. Mendelson, Bruce M. Cohen, and Perry F. Renshaw. 2001. Cocaine-induced cerebral vasoconstriction differs as a function of sex and menstrual cycle phase. *Biological Psychiatry* 49: 774–781.

Which of the following hormones **most likely** play a role in reducing the effects of cocaine on blood flow in a woman's brain at the beginning of the woman's menstrual cycle?

- A. FSH and progesterone
- **B.** LH and progesterone
- C. FSH and estrogen
- **D.** LH and estrogen

Use the following information to answer the next two questions.

Researchers found that the timing of breast cancer surgery in a woman's menstrual cycle affects the outcome of the surgery. Surgery to remove a cancerous tumour is most successful during a woman's luteal phase, partly because the hormone that has the highest concentration in the luteal phase seems to cause the tissue surrounding the tumour to compress the tumour.

According to the findings, on which day or days of a woman's menstrual cycle would it be **best** to perform surgery to remove a cancerous breast tumour?

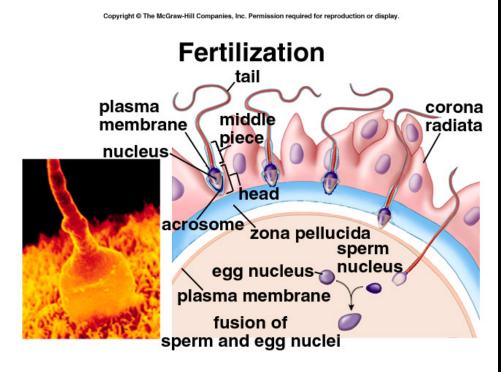
- **A.** Days 1 to 5
- **B.** Days 6 to 13
- **C.** Day 14
- **D.** Days 15 to 28

The hormone that has a high concentration **only** during the luteal phase and, therefore, that probably contributes to the success of breast cancer tumour removal at this stage is

- A. LH
- **B.** FSH
- C. estrogen
- **D.** progesterone

# DIFFERENTIATION AND DEVELOPMENT

- Fertilization
  - secondary oocyte meets sperm in fallopian tube
  - sperm release enzymes from acrosome
    - o one sperm in  $\rightarrow$  zona hardens
    - o meiosis II → ovum
    - o 2 nuclei fuse = zygote (2n)



# FIRST TRIMESTER: (3 MONTHS)

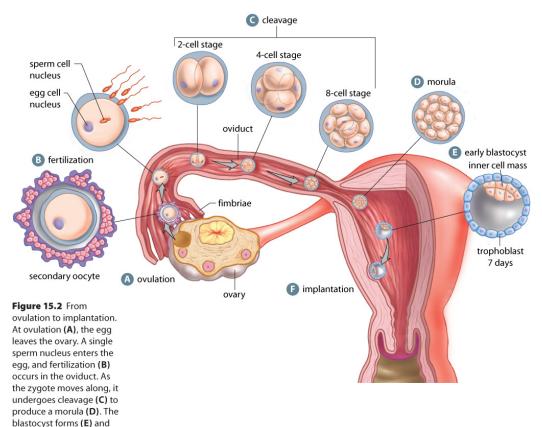
#### Stage 1:

- 30 hrs after fertilization
  - o zygote splits in half (cleavage)
  - o mitosis  $\rightarrow$  ball of 16 tiny cells
  - o zygote now called a *Morula*

#### day 4 - enters the uterus

- morula fills with fluid to form a hollow ball
  - o called a *Blastocyst or blastula*

implants in the lining of the uterus (F).



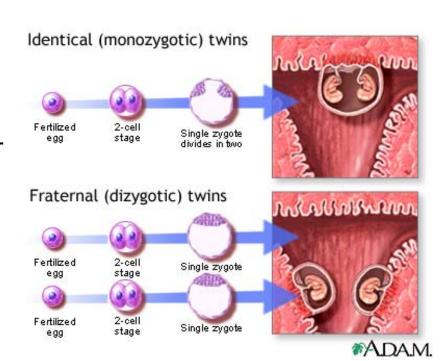
# TWINS?

# **Monozygotic (identical)**

- o blastocyst splits
- o 1 egg + 1 sperm
- o DNA identical must be same gender

# Dizygotic (fraternal)

- o 2 eggs + 2 sperm
- o DNA different
- o can be different genders



#### FIRST TRIMESTER CONT'D

# **Stage 2: Implantation**

### after 1 week, blastula releases enzymes

digest a hole into mother's endometrium

## Mother's hormone cycle – $\downarrow$ LH – corpus luteum will die

#### blastula must prevent menses

- o releases **HCG** (**h**uman **c**horionic **g**onadotropin)
  - very similar to LH
- o keeps corpus luteum in mother's ovary intact
  - keeps progesterone high = no menstruation
- o pregnancy tests <u>detect HCG in mother's urine</u>

# FIRST TRIMESTER CONT'D

**Stage 3: Embryogenesis** 

Day 12 - blastula undergoes transformation

- → gastrulation
  - o becomes a gastrula

inner cell mass develops into 3 germ layers

these stem cells give rise to the various human tissues and organs

ay ayacama anas acresap from the three primary

germ layers

#### Ectoderm (Outer Primary Germ Layer)

- outer skin (epidermis) and associated structures (hair, nails, sweat glands, mammary glands)
- nervous tissue and sense organs
- pituitary gland
- tooth enamel
- adrenal medulla.
- eve lens

#### Mesoderm (Middle Primary Germ Layer)

- dermis of skin.
- cellular lining of blood vessels, lymphatic vessels, body cavities
- muscle tissue
- · connective tissue (including bone, cartilage, blood)
- adrenal cortex
- kidneys and ureters

heart

- spleen
- internal reproductive organs

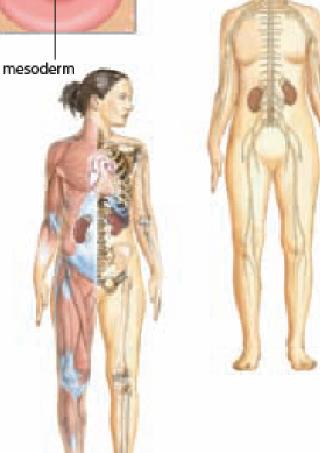
#### Endoderm (Inner Primary Germ Layer)

- · cellular lining of respiratory tract, digestive tract, urinary bladder, urethra
- liver (most)
- tonsils (partial)
- gallbladder
- · parathyroid glands
- pancreas
- · thyroid glands

thymus



ectoderm



endoderm

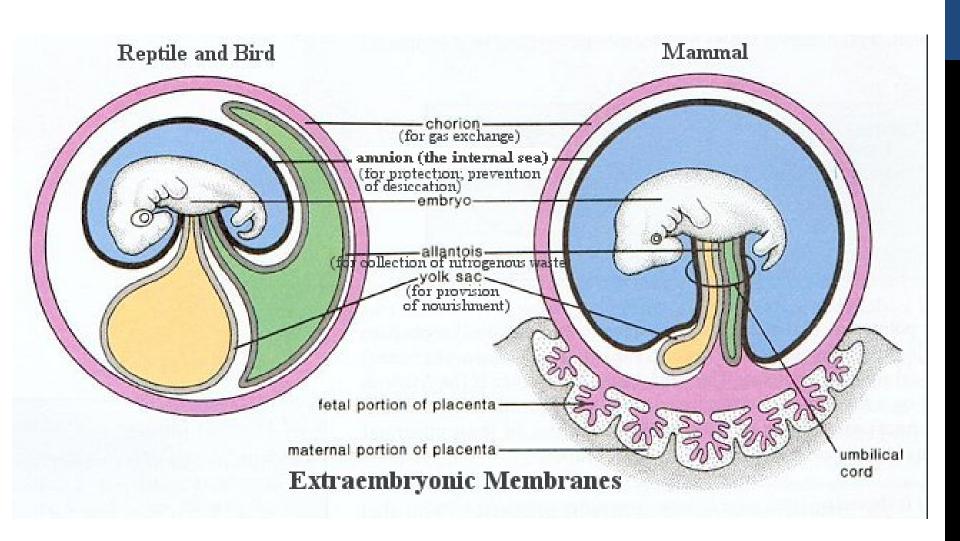
# 3 GERM LAYERS (EMBRYOGENESIS)

- Ectoderm  $\rightarrow$  nervous system, skin
- Mesoderm → muscles, skeleton, reproductive system
- Endoderm 

   ining of digestive/respiratory system, some endocrine glands

\*\*\* MEMORIZE!

## **EXTRA EMBRYONIC MEMBRANES**



## **EXTRA EMBRYONIC MEMBRANES**

# 1. Yolk sac

- no nutritive function in humans
- makes blood until liver forms
- fate- intestine/gonads/stem cells of the immune system

# 2. Amnion

- lines amniotic cavity and produces fluid
- amniocentesis contains DNA of embryo
- breaks before birth

### EXTRA EMBRYONIC MEMBRANES CONT'D

# 3. Allantois

umbilical arteries (2) and vein (1)

# 4. Chorion

- forms fetal portion of placenta
- CVS Chorionic villus biopsy

   test for genetic disorders

### FIRST TRIMESTER CONT'D

## **Stage 4: Placentation**

A. Interface – exchange site

embryo needs to access moms blood supply

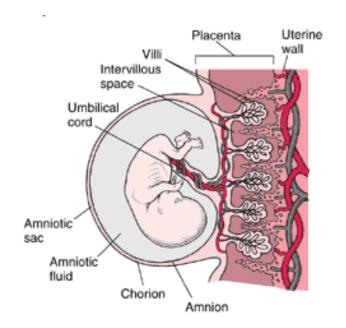
chorion → protrusions → chorionic villi

penetrate deeply into uterine tissue (endometrium)

placenta = genetically is ½ embryo ½ mom

#### 1 umbilical vein

Returns blood to fetus Mom → Fetus O<sub>2</sub> Glucose, fatty acids, amino acids Vitamins



#### 2 umbilical arteries

Carry blood to placenta (away from baby's heart)
Fetus → Mom
CO<sub>2</sub>
Urea (N waste)
Heat

#### PLACENTA CONT'D

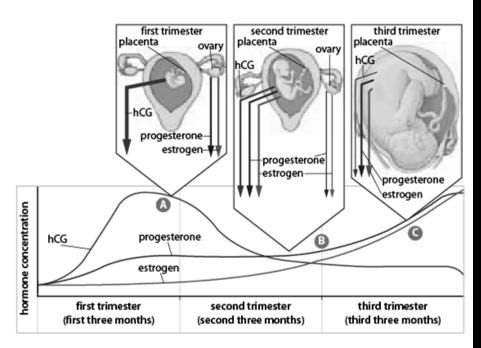
- choronic villi surrounded by pools of maternal blood
- fetal blood does NOT mix with mom's
- diffusion across membrane
  - o concentration gradients
  - o cells of chorion semipermeable
  - o RBC/WBC too big

# B. Hormone production

by 10th week, placenta fully develops

### progesterone

- o takes over role of corpus luteum
- o keeps FSH low = no ovulation
- HCG will drop



*estrogen* = breast growth and changes

# STAGE 4: PLACENTATION CONT'D

### C. Barrier?

#### **TERATOGENS**

Cause fetus to develop abnormally

Alcohol (F.A.S)

**Smoking** 

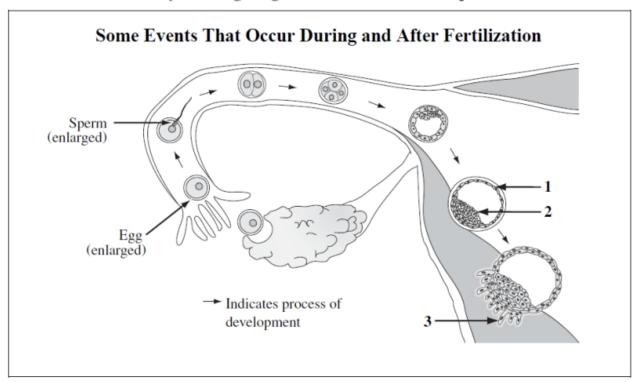
**Thalidomide** 

**Bacteria** 

#### Virus

- Chicken pox
- o German measles

Use the following diagram to answer the next question.



Which of the following rows identifies structure 3 and the structure it becomes part of?

| Row | Structure 3 | Structure It Becomes Part of |
|-----|-------------|------------------------------|
| A.  | Chorion     | Placenta                     |
| В.  | Amnion      | Chorion                      |
| C.  | Placenta    | Amnion                       |
| D.  | Placenta    | Chorion                      |

Use the following information to answer the next question.

Scientists in Japan have created an artificial womb. In it, they placed goat fetuses, which developed for up to three weeks. The device is composed of a clear plastic box that is filled with fluid at 37°C and connected to various machines that maintain vital functions. Inside the clear plastic box, the fetus is connected to a dialysis machine that removes wastes and provides nutrients to the fetus.

In the future, scientists hope to use this device to study the process of human development.

The structure in the human female that the clear plastic box functions as and a structure that normally surrounds the fetus are, respectively,

- **A.** a uterus and the allantois
- **B.** a placenta and the allantois
- **C.** a uterus and the amniotic sac
- **D.** a placenta and the amniotic sac

Use the following information to answer the next question.

The drug RU-486 can be used in combination with a particular prostaglandin to end a pregnancy. RU-486 blocks the effects of progesterone, and the prostaglandin stimulates uterine contractions.

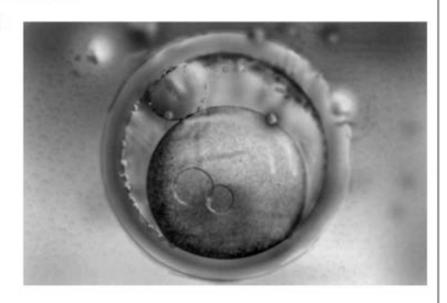
The effect of RU-486 on a woman would be the deterioration of the

- **A.** uterus
- **B.** endometrium
- C. corpus luteum
- **D.** developing follicles

Use the following information to answer the next question.

#### Fertilization

Fertilization occurs when a sperm fuses with an egg to form a zygote. In this photomicrograph of a zygote, the sperm and egg nuclei are just fusing. One polar body is also visible.



The event shown above normally occurs in the

- A. ovary
- B. uterus
- C. vagina
- D. Fallopian tube

Use the following information to answer the next question.

Abnormal genetic material can be identified in a mature ovum by analyzing a polar body that develops during formation of the ovum. The polar body normally contains the same number of chromosomes as the mature ovum.

The analysis of a polar body would be **most useful** prior to the procedure of

- **A.** amniocentesis
- **B.** ultrasound imaging
- C. in vitro fertilization
- D. chorionic villi sampling

Use the following information to answer the next question.

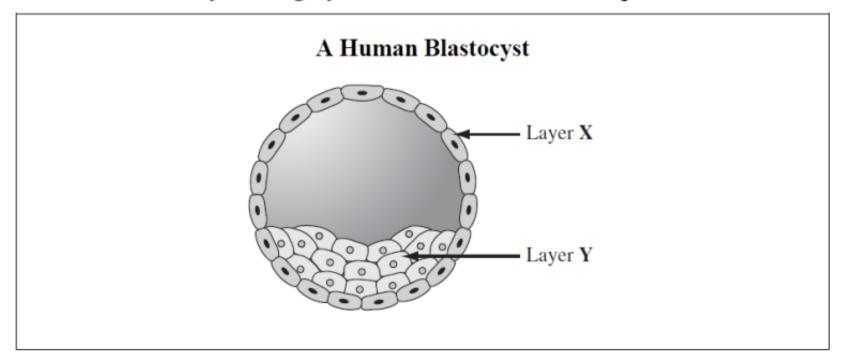
Abnormal genetic material can be identified in a mature ovum by analyzing a polar body that develops during formation of the ovum. The polar body normally contains the same number of chromosomes as the mature ovum.

The analysis of a polar body would be **most useful** prior to the procedure of

- A. amniocentesis
- B. ultrasound imaging
- C. in vitro fertilization
- **D.** chorionic villi sampling



Use the following information to answer the next question.



In the diagram above, the structure that develops from layer X and the structure that develops from layer Y are, respectively, the

- A. embryo and the amnion
- **B.** chorion and the amnion
- **C.** chorion and the embryo
- **D.** embryo and the chorion

# NUMERICAL RESPONSE #2

Use the following information to answer the next question.

#### Some Organs and Tissues That Develop in an Embryo

- Muscle and blood
- 2 Lining of digestive tract
- 3 Brain and outer layer of skin

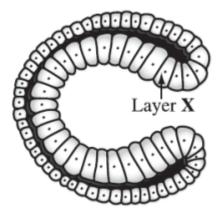
Match the organs and tissues listed above with the germ layer from which they develop, as indicated below.

| Organs and Tissues: |          |          |          |  |
|---------------------|----------|----------|----------|--|
| Germ Layer:         | Endoderm | Mesoderm | Ectoderm |  |



Use the following diagram to answer the next question.





Which of the following rows identifies layer X as shown in the diagram above and structures that develop from this layer?

| Row | Layer X  | Structures That Develop From Layer X  |  |
|-----|----------|---------------------------------------|--|
| A.  | Ectoderm | Skeletal, cardiac, and smooth muscles |  |
| В.  | Mesoderm | Lining of the respiratory tract       |  |
| C.  | Endoderm | Lining of the digestive tract         |  |
| D.  | Mesoderm | Ear and eye                           |  |

Use the following information to answer the next question.

Spina bifida is a serious birth defect in which the vertebrae do not form normally around the spinal cord. A woman can greatly reduce the risk of her baby having spina bifida by taking folic acid supplements.

Folic acid is critical to the normal formation of the vertebrae and spinal cord during the

- A. cleavage of the blastocyst
- **B.** formation of the blastocyst
- **C.** first trimester of development
- **D.** third trimester of development

Which of the following events occur during the first trimester in human development?

- **A.** Nervous system forms, heart pumps blood, tube-like gut forms
- **B.** Nervous system forms, sex differentiation occurs, fingernails develop
- C. Heart pumps blood, tube-like gut forms, lungs become fully functional
- **D.** Lungs become fully functional, heart pumps blood, sex differentiation occurs

#### MULTIPLE CHOICE #21

Use the following information to answer the next question.

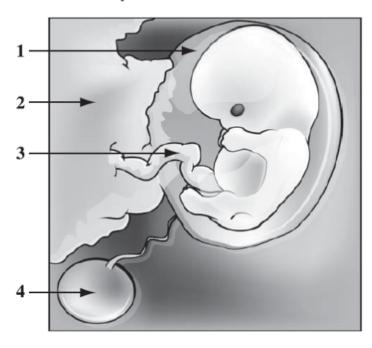
Premature infants born at 24-weeks gestation face a wide spectrum of physiological problems.

These problems arise because prior to the third trimester of pregnancy, fetuses

- **A.** have organs that are underdeveloped
- **B.** have not yet begun cell specialization
- C. depend upon amniotic fluid for oxygen
- **D.** depend upon amniotic fluid for nutrients



#### **Human Embryo Six Weeks After Fertilization**



#### Descriptions of Embryonic Structures' Functions

- A Provides protection
- B Transports embryonic blood
- C Is used for nourishment in vertebrates other than mammals
- D Is the site of exchange between embryonic and maternal blood

Match each embryonic structure, as numbered above, with the letter that represents its function, as listed above.

| <b>Structure:</b> |                         |                         |          |                         |
|-------------------|-------------------------|-------------------------|----------|-------------------------|
| <b>Function:</b>  | $\overline{\mathbf{A}}$ | $\overline{\mathbf{B}}$ | <u> </u> | $\overline{\mathbf{D}}$ |

Use the following information to answer the next question.

Research has shown that the interests and abilities of a female twin may be influenced by sharing the uterus with a male twin. In sets of non-identical twins with one female and one male, the females appear to have brain activity patterns that are more similar to males than to other females.

Which of the following hormones is **most likely** responsible for influencing the development of brain activity patterns in a female who has a male twin?

- A. FSH
- **B.** Estrogen
- C. Testosterone
- **D.** Progesterone

Use the following information to answer the next question.

In the late 1950s and early 1960s, the drug thalidomide was prescribed to pregnant women to combat morning sickness. Thalidomide was found to cause birth defects, such as stunted growth of the arms and legs.

Which of the following rows identifies the classification of thalidomide as a factor affecting fetal development and the trimester during which exposure to thalidomide would have the **greatest** effect on a fetus?

| Row | Classification | Trimester |
|-----|----------------|-----------|
| A.  | Genetic        | First     |
| В.  | Environmental  | First     |
| C.  | Genetic        | Second    |
| D.  | Environmental  | Second    |

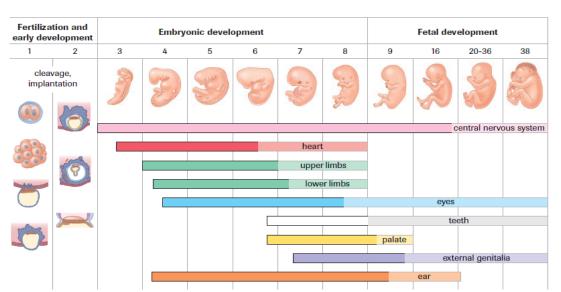
# **DEVELOPMENT**

## **Embryonic DEVELOPMENT**

- o embryonic stage (up to 8 weeks)
- o development (organogenesis)
- o specialization; differentiation

#### **Fetal GROWTH**

- o fetal stage (after 8th week to parturition)
- o growth and "maturation" of structures formed
- o increase in # cells



#### KNOW THE MAJOR CHANGES OF EACH TRIMESTER

- o1st = neurulation, organogenesis
- o2nd = organs begin to function, continue development (organs are not functional)
- o3rd = growth, ossification of bones, myelination of neurons

## **PARTURITION**

during the last few weeks

the placenta produces another hormone

## → RELAXIN

- o causes cervix to relax/dilate
- o ligaments between pubis bones in pelvis loosen

## baby turns upside down

o head applies pressure to cervix

# PARTURITION CONT'D

placenta ↓ progesterone output

#### posterior pituitary gland

- o releases hormone OXYTOCIN (made in hypothalamus)
- o causes contraction of uterine muscles

\*\*\*Positive feedback loop

**↑oxytocin ↑contractions** 

= ↑oxytocin ↑contractions

### STAGES OF PARTUITION

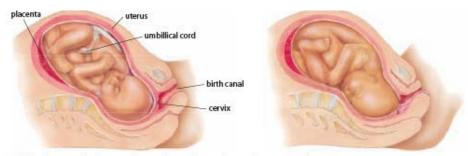
1st stage (8-24 hrs or minutes)

contractions become regular amniotic sac rupture – water breaks cervix dilates

2<sup>nd</sup> stage (min-hrs)

forceful/frequent contractions fetus enters birth canal

3rd stage (10-45min)



Dilation stage Uterine contractions and oxytocin cause the cervix to open, or dilate. During this stage, the amniotic sac breaks and the amniotic fluid is released through the vagina. The dilation stage usually lasts from 2 to 20 hours.



Explusion stage Forceful contractions push the baby through the cervix to the birth canal. As the baby moves through the canal, the head rotates, making it easier for the body to pass through the birth canal. This stage usually lasts from 0.5 to 2 hours.



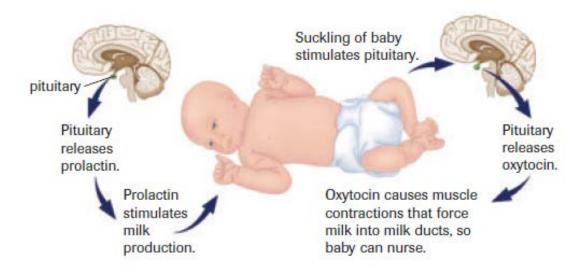
Placental stage About 10 to 15 minutes after the baby is born, the placenta and umbilical cord are expelled from the uterus. The expelled placenta is called the afterbirth.

contractions expel placenta - the "after birth"

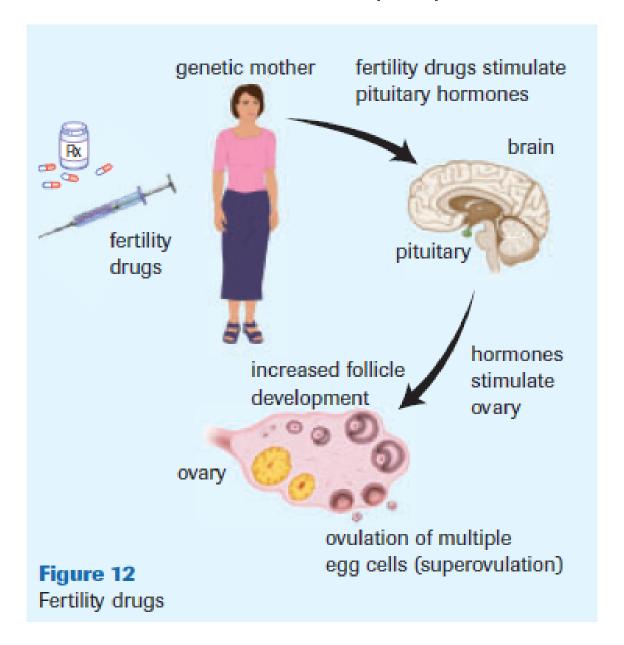
## POST NATAL PERIOD

## **Breast feeding**

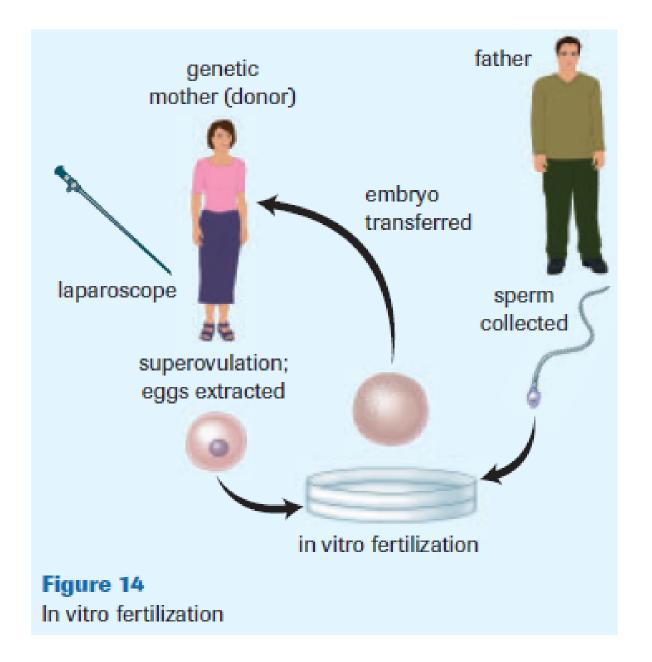
- 1st few days → colostrum
- PROLACTIN = causes breast to make milk
- baby "Latches on"
  - posterior pituitary releases OXYTOCIN
  - milk is *released* from breast



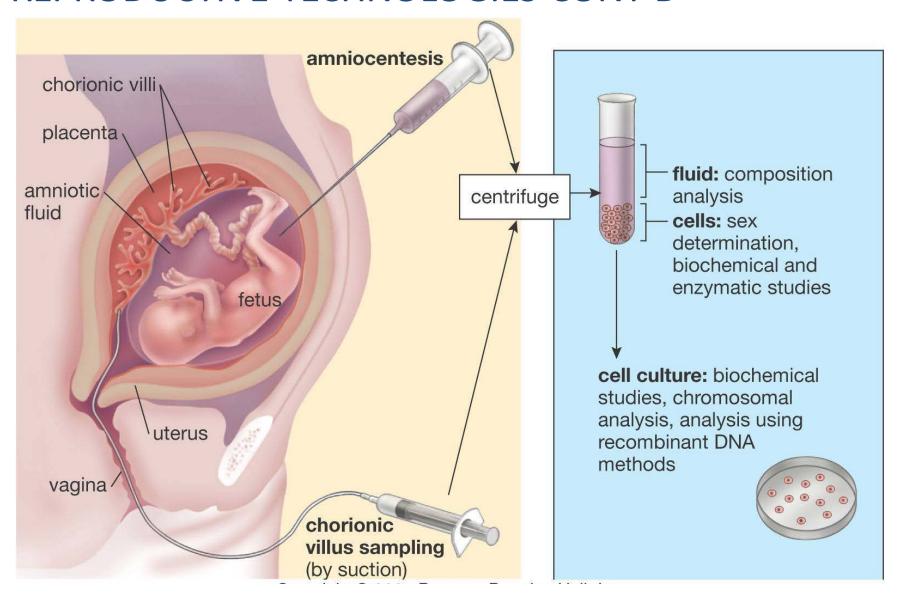
# REPRODUCTIVE TECHNOLOGIES (STS)



# REPRODUCTIVE TECHNOLOGIES CONT'D



# REPRODUCTIVE TECHNOLOGIES CONT'D



# REPRODUCTIVE TECHNOLOGIES CONT'D

| Selected Technologies for                                                                                                                                                                                                                                                                                                                                      | Selected Technologies for                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enhancing Conception                                                                                                                                                                                                                                                                                                                                           | Preventing Conception                                                                                                                                                                                                                                                                                                                                 |
| <ul> <li>artificial insemination (AI)</li> <li>assisted hatching (also called laser assisted hatching)</li> <li>gamete intrafallopian transfer (GIFT)</li> <li>in vitro fertilization (IVF)</li> <li>intracytoplasmic sperm injection (ICSI)</li> <li>surrogacy</li> <li>tubal embryo transfer (TET)</li> <li>zygote intrafallopian transfer (ZIFT)</li> </ul> | <ul> <li>condoms</li> <li>fertility awareness methods</li> <li>intrauterine device (IUD)</li> <li>lactational amenorrhea (LAM)</li> <li>oral contraceptives (pills containing both estrogen and progestin (synthetic progesterone))</li> <li>progestin-only contraceptives</li> <li>spermicides</li> <li>tubal ligation</li> <li>vasectomy</li> </ul> |

# MULTIPLE CHOICE #24

*Use the following information to answer the next three questions.* 

Some women who have difficulty conceiving a child are able to become pregnant with the assistance of in vitro fertilization and embryo transfer. Female Reproductive System

In the diagram above, the organ into which an embryo produced by in vitro fertilization is transferred is numbered

- B. 2C. 3

## MOLTIPLE CHOICE #25

To prepare her uterus for the implantation of an embryo, a woman can be given injections of

- A. FSH and LH
- **B.** estrogen and LH
- **C.** progesterone and FSH
- D. estrogen and progesterone

### MULTIPLE CHOICE #26

Which of the following hormones would be administered to a woman following the implantation of an embryo conceived through IVF in order to maintain the pregnancy?

- A. LH
- B. FSH
- C. Estrogen
- **D.** Progesterone

## MULTIPLE CHOICE #27

Use the following information to answer the next three questions.

A contraceptive ring for women is being tested in the Netherlands. The flexible plastic ring can be folded and inserted into the vagina. Once inserted, it springs back into shape and fits around the cervix, where it releases hormones at a constant rate for three weeks. These hormones are the same as the ones found in most oral contraceptives.

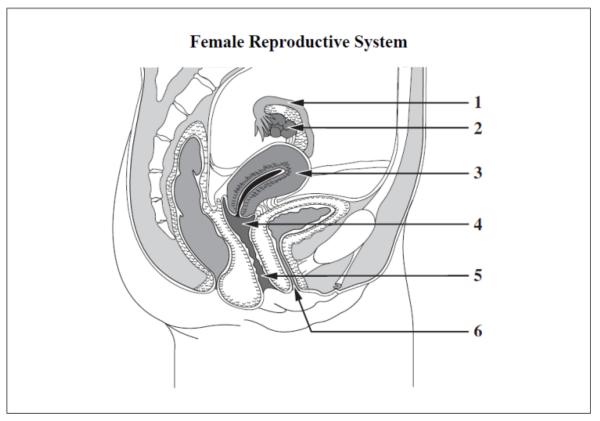
Like most oral contraceptives, the contraceptive ring prevents pregnancy by **directly** inhibiting

- **A.** ovulation
- **B.** fertilization
- C. implantation
- **D.** menstruation



## NUMERICAL RESPONSE #4

Use the following additional information to answer the next question.



In the diagram above, the site of insertion of the contraceptive ring, the site where the ring is placed and secretes hormones, and the normal site of fertilization are numbered, respectively, \_\_\_\_\_, and \_\_\_\_.

(Record all three digits of your answer in the numerical-response section on the answer sheet.)



## MULTIPLE CHOICE #28

Which of the following rows identifies the hormones released by the contraceptive ring and their effect on the secretion of reproductive hormones in a woman?

| Row | Hormones released by the contraceptive ring | Effect on the secretion of reproductive hormones in a woman |
|-----|---------------------------------------------|-------------------------------------------------------------|
| A.  | FSH and LH                                  | Stimulate estrogen and progesterone                         |
| В.  | FSH and LH                                  | Inhibit estrogen and progesterone                           |
| C.  | Estrogen and progesterone                   | Stimulate FSH and LH                                        |
| D.  | Estrogen and progesterone                   | Inhibit FSH and LH                                          |

# ANSWERS TO MULTIPLE CHOICE:

1. D

11. A

21. A

2. C

**12.** C

22. C

3. A

13. B

23. B

4. B

14. D

24. C

5. B

**15.** C

25. D

6. D

16. C

26. D

7. A

17. C

27. A

8. C

18. C

28. D

9. D

19. C

10. D

**20.** A

# ANSWERS TO NUMERICAL RESPONSE:

- 1.6534
- 2. 213
- 3. 1342
- 4. 541