
Fertilization and Fetal development (NORMAL PREGNANCY)

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3rd stage/ Ist semister

Maternal & neonate nursing



The sex chromosome of mature ovum is always of X type. The mature spermatozoon may have an either X chromosome or a Y chromosome.

Thus the gender is determined at the time of fertilization by the spermatozoon and not by the ovum.




If pregnancy occur the corpus luteum continue functioning for 12 weeks until the placenta is developed sufficiently to produce the hormones necessary to maintain pregnancy.



Following ovulation, the ovum which is passes into the fallopian tube and is moved along towards the uterus by the cilia and the peristalsis of the tube.



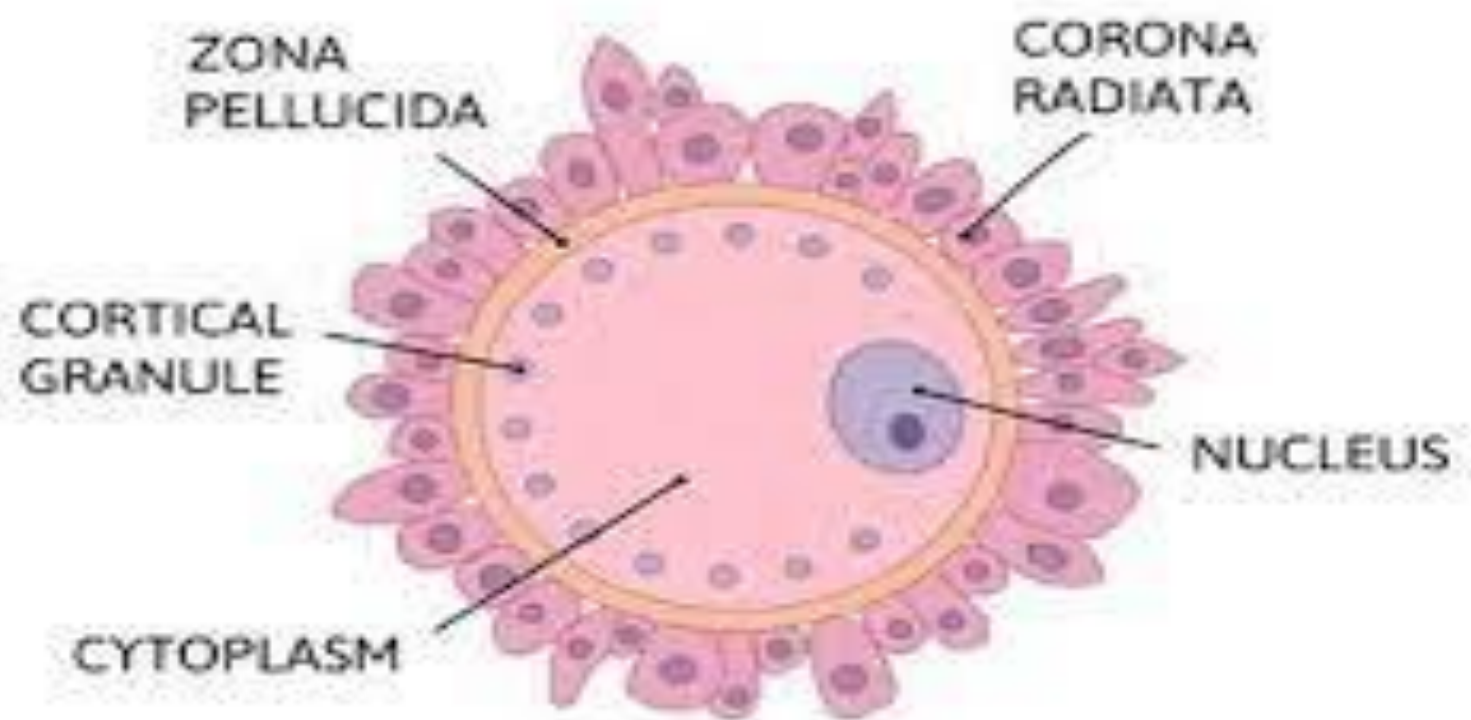
sperms are deposited into the posterior fornix of vagina. Those that reach the alkaline cervical mucus propel themselves towards the fallopian tubes. Some sperms reach the fallopian tube where the ovum in the ampulla.



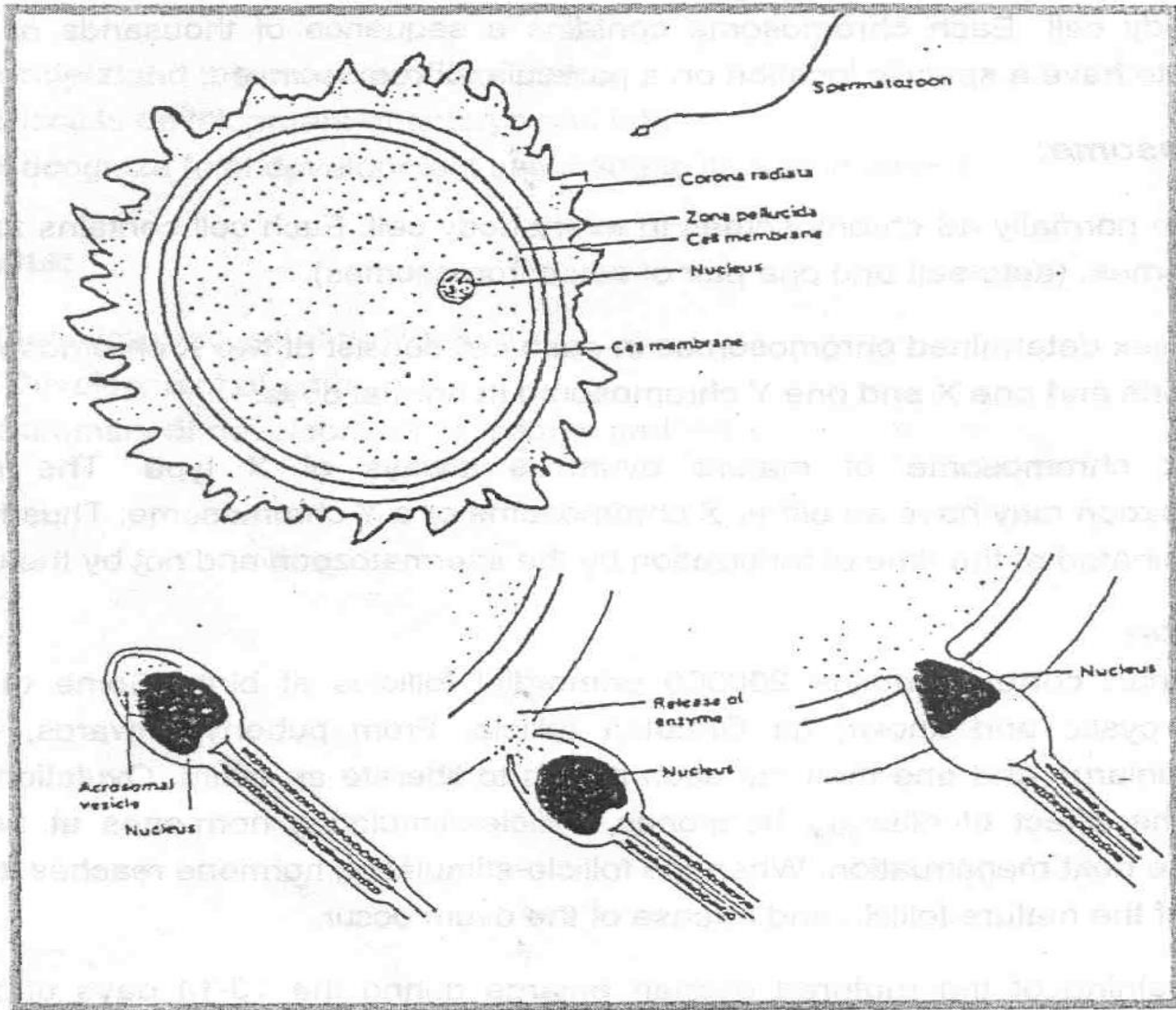
The remainder are destroyed by the **acid medium of the vagina** or died during the journey. The mature sperm is able to release enzymes, which allow them to penetrate ovum.

Only one enters the ovum and the nuclei of the two gametes fuse to form the zygote. Each gamete contributes half of the chromosomes to make a total of 46.





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Note

- ▶ Fetal growth and development are typically divided into three periods:
 - ▶ preembryonic (first 2 weeks, beginning with fertilization), embryonic
 - ▶ (weeks 3 through 8), and fetal (from week 8 through birth).
 - ▶ Fertilization: the beginning of pregnancy
 - ▶ Fertilization (also referred to as conception and impregnation).
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- ▶

Development of embryo:

Decidua: Is the structure of thickened endometrium that develops after conception and it is divided into three portions:



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1. ***Decidua basalis***: The part lying directly under the imbedded ovum.
 2. ***Decidua capsularis***: The portion that overlies the Fertilized ovum.
 3. ***Decidua vera*** : the remaining portion that is not in immediate contact with the ovum.
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THREE AREAS OF UTERINE DECIDUA

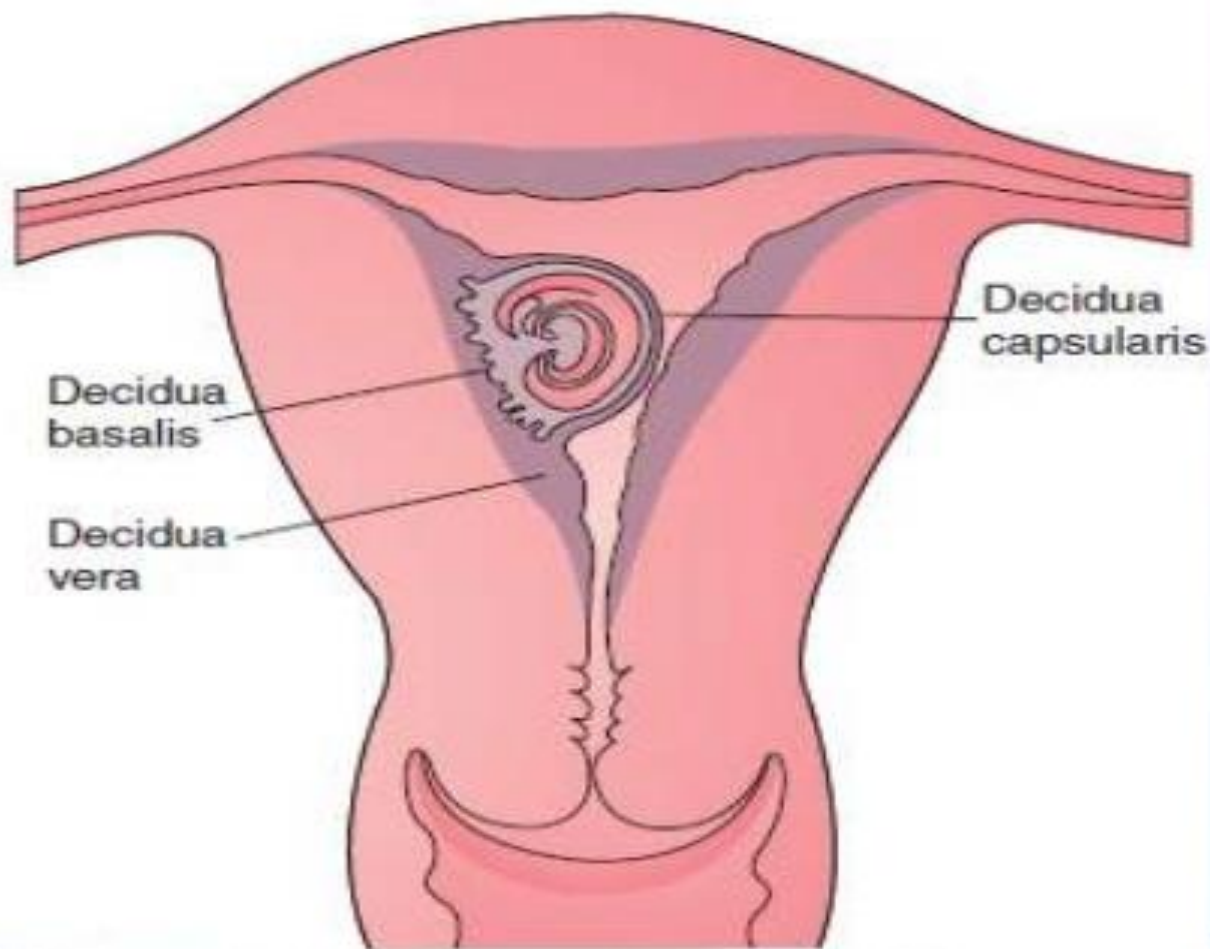


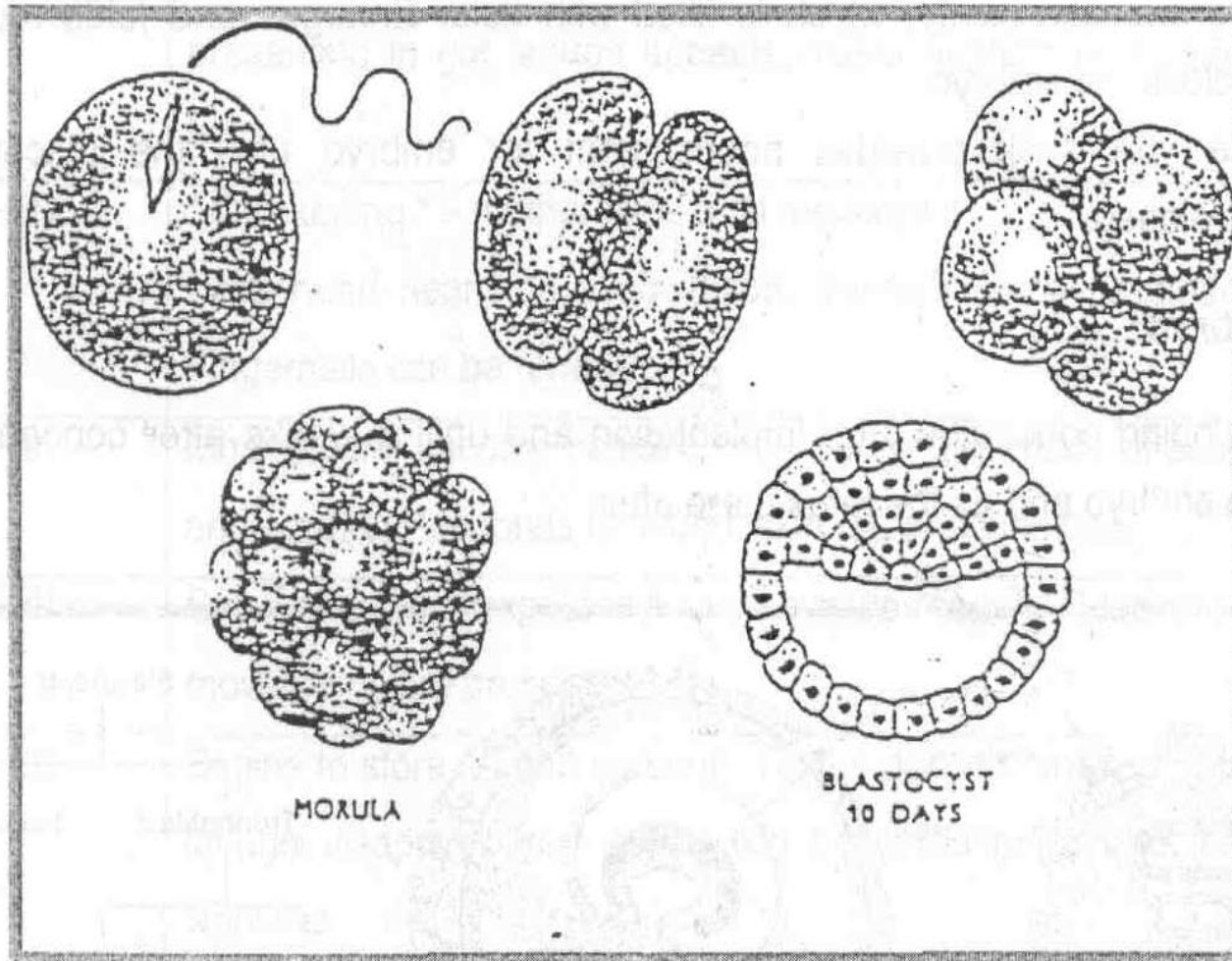
FIGURE 9.2 The three areas of uterine decidua.

The zygote:

It continues its passage through the fallopian tube for 3-4 days and divides into 2,4,8,16 cells and so on until a cluster of cells is formed known as the **morula**.(16-50)cells.




Development of the Fertilized Ovum



Blastocele:

Is a fluid filled cavity which appears in the morula, the outer layer is formed from a single layer of **cells known as** **trophoblast.**

The remaining, cells are **clumped** together at one end forming the **inner cell mass.**



This structure is called (**blastocyst**).

The **trophoblast** will form the placenta
and chorion while the **inner cell mass**
will become the fetus, amnion and
umbilical cord



The blastocyst lies free in the uterus for 3-4 days. The trophoblast secretes substances, which digest the endometrial cells, allowing the blastocysts to be embedded in the uterus. Embedding is completed by 11th day after ovulation



The zygote is nourished by glycogen from the goblet cells of the fallopian tubes and then by the secretory glands of the **uterus.**



The Inner cell mass:

The fetus is formed from the inner cell mass which differentiate into **three layers.**



Origin of Body Tissue

▶ **I.Ectoderm**

- ▶ Central nervous system (brain and spinal cord)
- ▶ Peripheral nervous system
- ▶ Skin, hair, and nails
- ▶ Sebaceous glands
- ▶ Sense organs
- ▶ Mucous membranes of the (anus, mouth, and nose)
- ▶ Tooth enamel
- ▶ Mammary glands



2. Mesoderm

Supporting structures of the body (connective tissue, bones, cartilage, muscle, ligaments, and tendons) Dentin of teeth Upper portion of the urinary system (kidneys and ureters) Reproductive system, Heart, Circulatory system, Blood cells, Lymph vessels

3. Endoderm Lining of pericardial, pleura, and peritoneal cavities, Lining of the gastrointestinal tract, respiratory tract, tonsils, parathyroid, thyroid, thymus glands Lower urinary system (bladder and urethra)

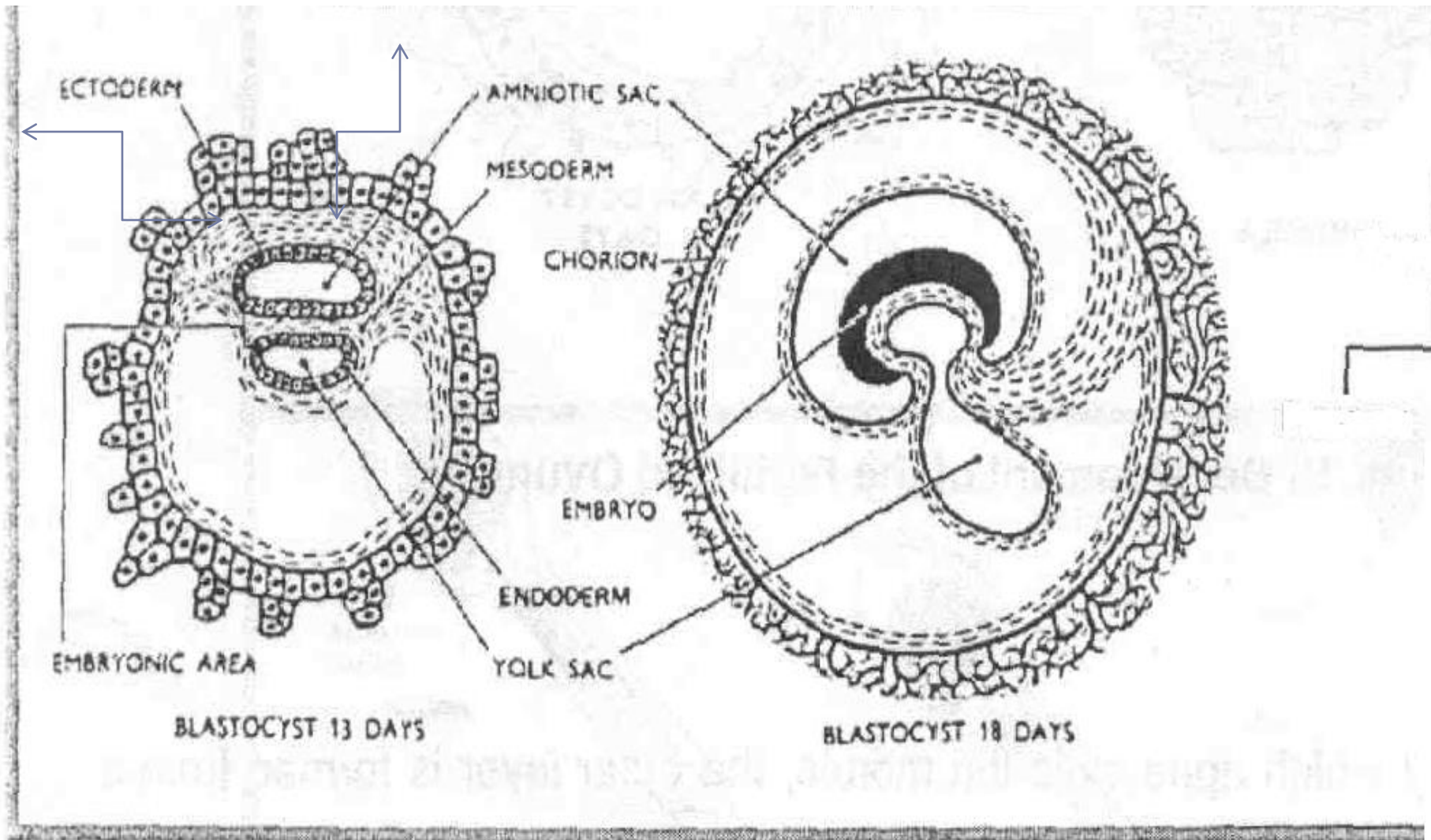


Two cavities appear in the inner cell mass:

1. The amniotic cavity, which is filled with fluid. Enlarges and folds round to enclose the embryo.
2. The yolk sack provides nourishment for embryo until the placenta is developed.



The development of Blastocyst



Summary Of Development Of Embryo**** And Fetus

End of 4th Gestational wks

The spinal cord is formed

The head folds forward

The rudimentary heart appears

Rudimentary eyes, ears, and nose are visible

Arms and legs are budlike structures.



End of 8th wks

- ▶ Organogenesis is complete.
 - ▶ • The heart, with a septum and valves, is beating rhythmically.
 - ▶ • Facial features are definitely discernible.
 - ▶ • External genitalia are forming, but sex is not yet distinguishable .
 - ▶ An ultrasound shows a gestational sac.
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End of 12th wks

- ▶ • Tooth buds are present.
- ▶ • Urine secretion • The heartbeat is audible through Doppler technology
- Spontaneous movements but not felt by the mother.



End of 16th wks

- ▶ Fetal heart sounds are audible by an ordinary stethoscope.
 - ▶ • Lanugo is well formed.
 - ▶ urine is present in amniotic fluid.
 - ▶ • Sex can be determined by ultrasound
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End of 20th wks

- ▶ Quickening•
- ▶ The hair forms on the head, extending to include eyebrows.
- ▶ • Meconium is present .
- ▶ • Vernix caseosa.
- ▶ • Passive antibody transfer from mother to fetus begins.
- ▶ • Definite sleeping .



End of 24th wks

- ▶ Eyebrows and eyelashes become well defined.
- ▶ • When fetuses reach 24 weeks at which fetuses could survive if born at that time
- ▶ • Hearing can be demonstrated by response to sudden sound.



End of 28th Gestational Week

- ▶ • Lung alveoli begin to mature•
- ▶ Testes begin to descend into the scrotal sac •



End of 32nd Week

- ▶ • Subcutaneous fat begins to be deposited (“little old man” appearance is lost).
- ▶ • Fetus responds by movement to sounds outside the mother’s body..
- ▶ • Iron stores, which provide iron for the time during which the neonate will ingest only milk after birth, are beginning to be developed.





End of 36th **wks**

- ▶ • Body stores of glycogen, iron, carbohydrate, and calcium are deposited.
- ▶ • Additional amounts of subcutaneous fat are deposited.
- ▶ • Most babies turn into a vertex (head down) presentation during this month.



End of 40th wks

- ▶ • Fetus kicks actively, hard enough to cause the mother considerable discomfort.
- ▶ • Vernix caseosa is fully formed.

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Development Of Placenta, Membranes Amniotic Fluid And Umbilical Cord

Placenta:

Three weeks after fertilization, projections from the trophoblastic layer proliferate and branch, forming the chorionic villi.



The villi become most profuse in the *basal decidua* where the blood supply is richest.

This part is known as *chorion frondosum* and will develop into the placenta




*The placenta is completely formed and functioning from **10-12 weeks** after **fertilization**.*



Functions of the Mature Placenta

Respiration: The fetus obtains oxygen and excretes carbon dioxide through the placenta.

Oxygen from the mother's hemoglobin passes into the blood and carbon dioxide from fetal blood passes into the maternal blood by **simple diffusion.**



2. *Nutrition:*

Food for the fetus comes from the mother's diet, which has been broken down into simple form.



3- Storage:

The placenta metabolizes **glucose**, **stores** it in the form of **glycogen** and reconverts it to glucose as required.

It also stores **iron**, fat and **soluble vitamins**.



4- Excretion

Carbon dioxide is the main substance excreted from the fetus.



5- Protection:

The placenta provides a limited barrier to infection.

Few bacteria for example Treponema Pallidum of syphilis and the Tubercle bacilli can cross the placenta.

Rubella virus and some drugs cross to the fetus except heparin.

Small **antibodies** are transferred to the fetus and give immunity to the baby for the **first 3 months after birth**.



6. *Endocrine:*

Human chorionic gonadotrophin (HCG) forms the basis or **pregnancy tests** it is excreted in the mothers **urine**.

Its function is to stimulate the growth and activity of the **corpus luteum**.until

Oestrogens are produced by the placenta.

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- **Progesterone** is secreted by the placenta in large amounts until it falls before the onset of labour.
 - **Human placental lactogen** (HPL) has a role in glucose metabolism in pregnancy and milk production.



The Placenta at Term

The placenta is a round, flat mass, about 20 cm in diameter and 2.5 cm thick at its center.

It weighs ***one-sixth*** of the baby's weight at term and has **two surfaces**.



1. The Maternal Surface

The maternal surface: this surface is dark red in colour.

The chorionic villi are arranged in about **30 lobules** known as **cotyledons** each cotyledon contains a single villus with its branches.



2. The Fetal surface

- ▶ ***The amnion covering the fetal surface gives it a white, shiny appearance. Branches of the umbilical vein and arteries are visible, spreading out from the insertion of umbilical cord (normally the center).***



Membranes

Membranes form the fetal sac, which protects the fetus against ascending bacteria! infection.

It consists of a double membrane chorion and amnion.

- **Chorion**. Which lies under the capsular decidua and adheres to the uterine wall.
 - **Amnion**. The inner membrane, which contains the amniotic fluid. It is a smooth, tough, membrane derived from the inner cell mass.
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Amniotic Fluid

Origin

Amniotic fluid is secreted by the amnion, which covers the(**placenta** and **umbilical cord**) ..

Fetal urine also contributes to the volume from the 10th week of pregnancy.



Volume

Throughout pregnancy, the amniotic fluid increases and normal volume is 800-1200 ml.

When, amniotic fluid is more than 2000 ml is known as **polyhydramnios** and amniotic fluid is less than 300 ml is referred to as **oligohydramnios**.




The most important purpose of amniotic fluid

- ▶ protect the fetus against pressure
- ▶ protects the fetus from changes in temperature.
- ▶ it aids in muscular development,
- ▶ protects the umbilical cord from pressure.



The Umbilical Cord

is formed from the fetal membranes (amnion and chorion) that connects the embryo to the chorionic villi of the placenta. Its function is to transport oxygen and nutrients, waste products .53 cm in length at term . Wharton's jelly, prevents pressure on the vein and arteries that pass through it. The outer surface is covered with amniotic membrane. An umbilical **one vein**, but **two arteries** .



The Fetal Circulation

1. The fetus receives oxygen through the placenta because its lungs do not function as organs of respiration in the uterus.



2. The fetal circulation contains certain special vessels that shunt the blood around the lungs, with only a small amount circulating through them for nutrition.



3. The oxygenated blood flows up the cord through the umbilical vein and passes in to the inferior vena cava, part of the oxygenated blood goes through the liver, but most of it passes through a special fetal structure.



4. The ductus venosus, which connects the umbilical vein and inferior vena cava.



5. The blood flows in the umbilical circulation has been estimated at approximately 125 ml/kg of body weight.



6. From the inferior vena cava, the current flows into the right auricle (atrium) and goes directly on to the left auricle through a special fetal structure, the foramen ovale.




7. It flows into the left ventricle and out through the aorta.



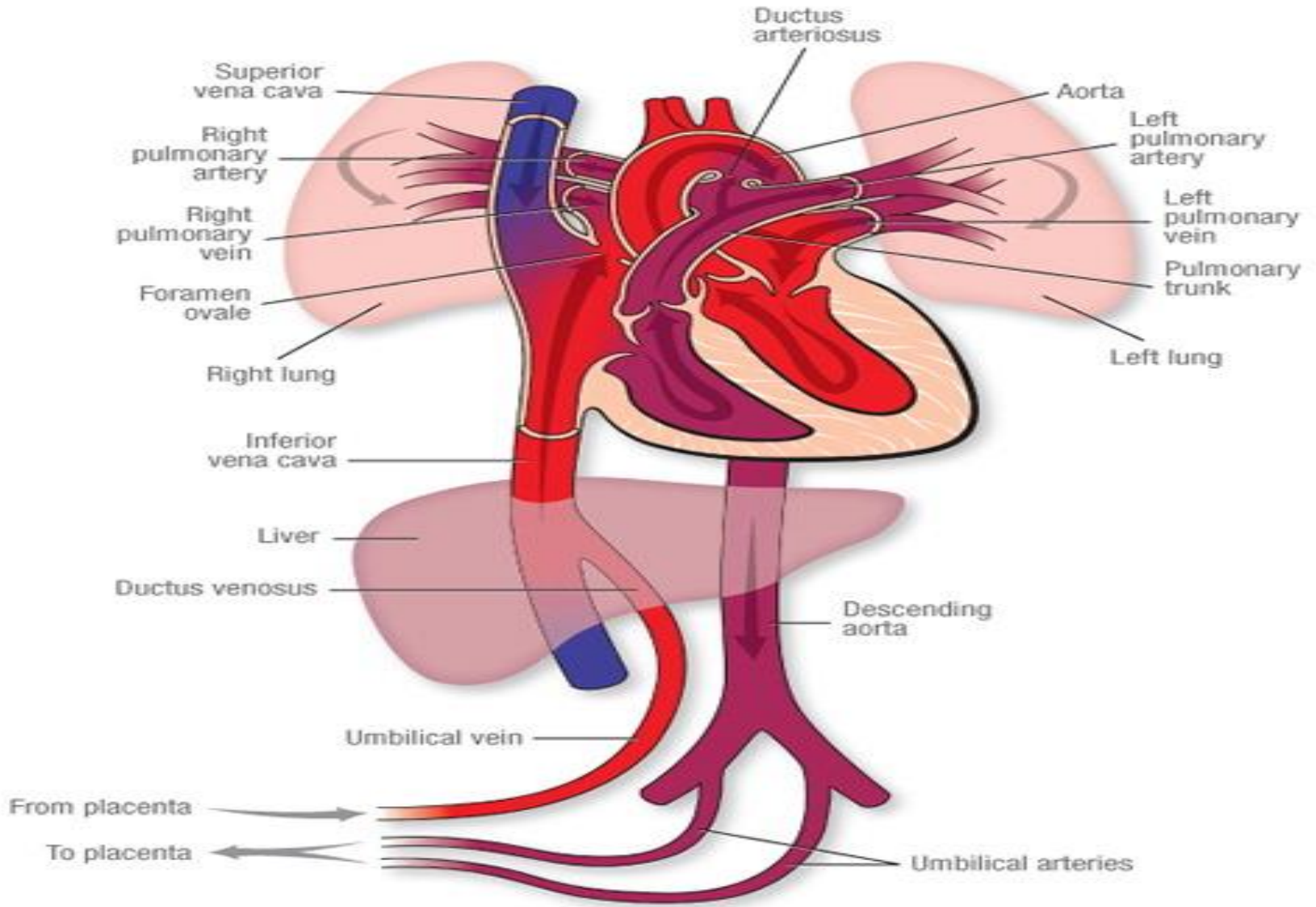
8. The blood that circulates up the arms and head returns through the superior vena cava to the right auricle(atrium) again, but instead of passing through foramen ovale as before, the current is deflected downward into the right ventricle and through the pulmonary arteries.

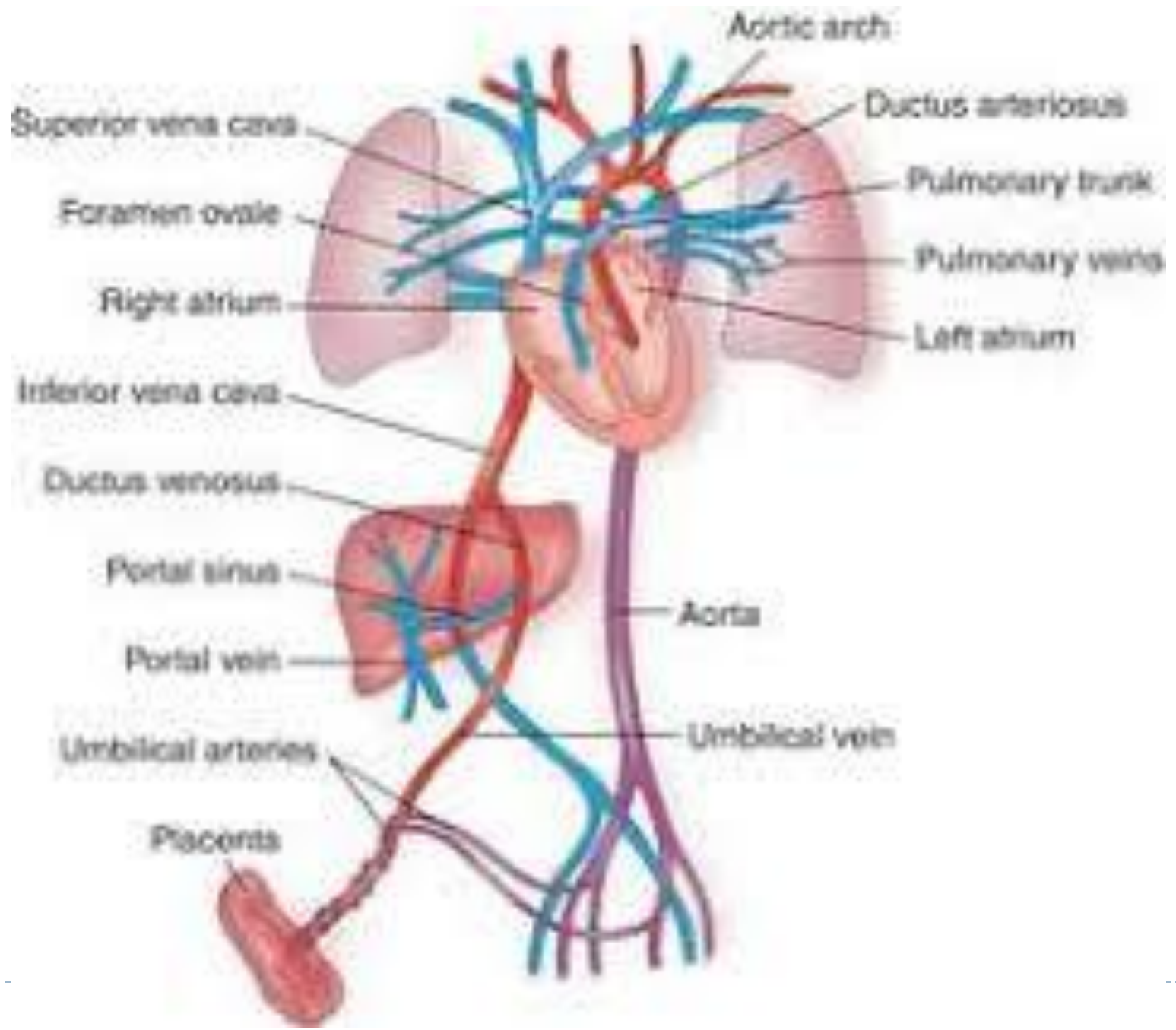
Part of it goes to the lungs (for purpose of nutrition only), but most of it goes into the aorta through the ductus arteriosus.



9. The blood in the aorta, with the exception of that which goes to the head and upper extremities (blood has been accounted for) passes downward to supply the trunk and the lower extremities .Most of this blood finds its way through the internal iliac, or hypogastric arteries and back to the cord to the placenta, where it is again oxygenated, but a small amount passes back into the ascending vena cava to mingle with fresh blood from the umbilical vein and again makes the circuit of the entire body.







CHANGES IN FETAL CIRCULATION AFTER BIRTH PATH

Before Birth

Umbilical vein Brings arterial blood to liver
and heart ,

umbilical arteries brings venous blood to placenta



After Birth

Obliterated; becomes
round ligaments on
anterior abdominal
wall.



Ductus venous

Before Birth

Shunts arterial blood into inferior venacava

After Birth

Obliterated: becomes ligamentum venosum



Foramen ovale

Before Birth

Connects right & left auricles arterial

After Birth

Obliterated usually; At times open



Lungs

Before Birth

Contain no air and Very little blood

After Birth

Filled with air and well Supplied with blood



Pulmonary arteries

Before Birth

Bring little blood to Lungs.

After Birth

Bring much blood to Lungs



Aorta

Before Birth

Receives blood from Both ventricles

After Birth

Receives blood only From left ventricles



Aorta

Before Birth

Receives blood from Both ventricles

After Birth

Receives blood only From left ventricles



Inferior vena cava

Before Birth

Brings various blood from
body & arterial blood from
placenta

After Birth

Brings venous blood Only to right auricle



THANK YOU

