



## ANATOMY

Sheet

Slide

Handout

Number

12

Subject

Breast

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In this sheet, we will talk about anatomy and histology of the breast;

Based on the record of section 1:

## -Breast :

-It is a modified sweat gland present in both sexes but it is rudimentary in Males.

-All the breast lies within the superficial fascia, so the surgical removal of the breast is easy and called simple mastectomy, we don't need to open the deep fascia, only a small extension called the **axillary tail** pierces the deep fascia of Axilla, this tail is not always present (could be absent ).

The clinical importance of this point is when you are asked to palpate the axillary lymph nodes, you might confuse the axillary tail with the axillary lymph nodes. The opening where the tail pierces the deep fascia is called "**Foreman of langer**".

The breast extend **horizontally** from the outer border of the sternum to the midaxillary line, and **vertically** extend from the 2<sup>nd</sup> rib to the 6<sup>th</sup> rib.

### Deep to the breast: (from anterior to posterior)

1. Between the breast and the pectoralis major fascia is a loose areolar tissue makes the breast freely movable over the pectoralis major muscle ,at one time it was believe that within this tissue the main lymphatics run through the fascia and muscle and known as **lake of Marcille**( this is an old concept.

2. Deep fascia that covers the pectoralis major called **pectoralis fascia**.

3. Deeper there are Pectoralis major, parts of serratus anterior and parts of external oblique muscle of the abdomen .

### Basic structure of the breasts :

Structure of the breast divide into Skin , parenchyma and stroma :

**Skin**→ it covers the glands and forms:

**1. Nipple**, is a conical projection just below the centre of the breast, at the level of fourth space.

It is covered by stratified squamous keratinized epithelium and contain smooth muscle both longitudinal and circular [In nursing mother, the nipple should be erected to help the baby in sucking the milk , this erection done by those smooth muscle].

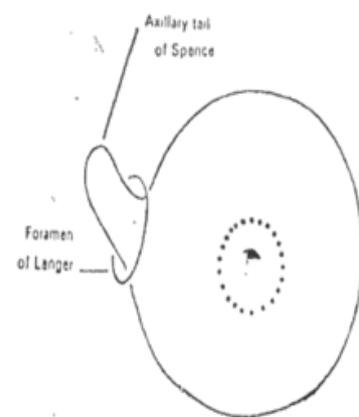
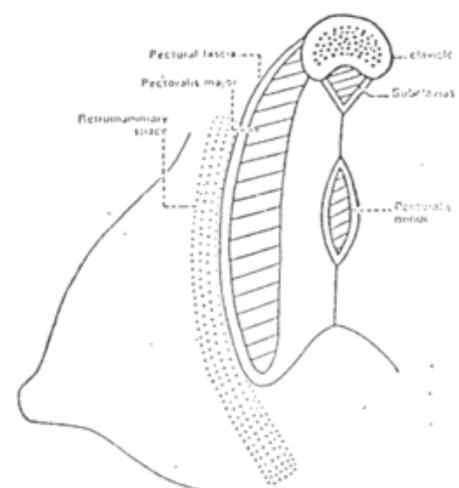


Fig. 4 Axillary tail of the breast lies deep to the deep fascia. The opening in the deep fascia is called 'foramen of Langer'.



The nipple is pierced by 15-20 lactiferous ducts. The nipple contains lots of sebaceous gland but lacks sweat glands, these sebaceous glands secrete an oily substance that lubricates the nipple and prevents its cracking especially during lactation.

-The Nipple is highly supplied with sensory nerve endings, involved in the suckling reflex.

Around the nipple there is the **2. Areola** → deeply pigmented skin, this pigmentation increases in pregnancy (the easiest way to tell that the lady is pregnant). Also, it contains modified sebaceous glands, they enlarge during pregnancy and lactation specially at the periphery of the areola forming raised tubercle called **tubercle of Montgomery**.

Tubercle of Montgomery secrete oily secretion that lubricates nipple and areola and prevents them from cracking during lactation.

-In addition to the sebaceous glands, there are some sweat glands and accessory mammary glands. Fat is absent beneath the nipple and areola while most of the breast is formed by adipose tissue. The nipple and the areola are devoid of hair.

**Parenchyma:** It is made up of 15-20 lobes projected **radially**, each of the lobes is formed by a cluster of alveoli that send their secretions through a lactiferous duct, that open into the nipple. Before it opens into the nipple, the lactiferous duct enlarges forming a lactiferous sinus. Lactiferous ducts converge at the nipple like the spokes of a wheel, that's why the incision should be Radially when there is an abscess in the breast, otherwise the lactiferous ducts will be damaged.

**Stroma** → [ it forms supporting framework of the gland ]

**1. Fibrous stroma:** The stroma is formed from fibrous tissue containing septa that run from the skin to deep fascia, they are called suspensory ligaments of Cooper ( Cooper's ligament ). The clinical significance of this ligament is that cancer cells might grow over it and infiltrate it inducing fibrosis and shortening of the ligament making the skin uneven and puckered (irregular skin), and this is a sign of carcinoma.

**2. Fatty stroma :** it forms the main bulk of the gland and is distributed all over except beneath areola and nipple.

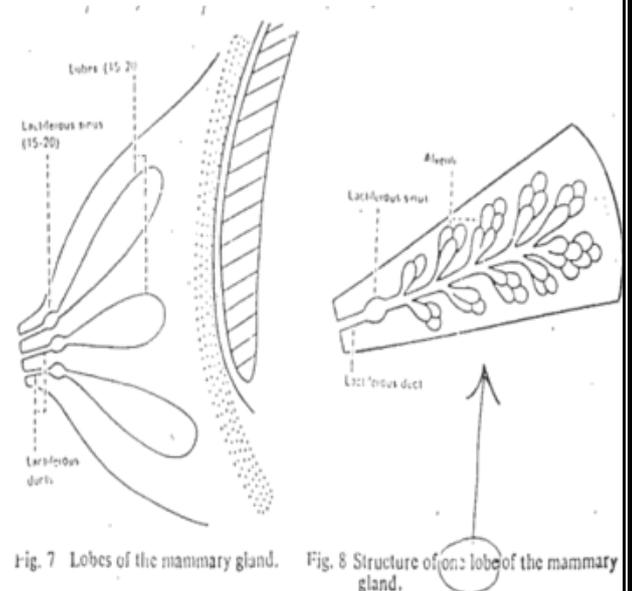


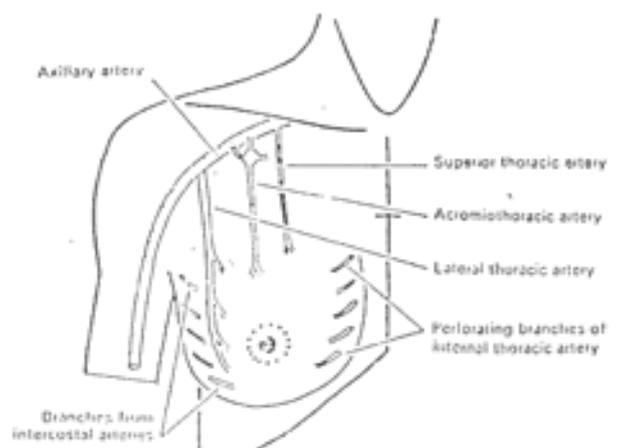
Fig. 7 Lobes of the mammary gland.

Fig. 8 Structure of lobe of the mammary gland.

## Blood supply of the breast:

The breast is highly vascular, it receives blood supply from:

1. Perforating branches of internal thoracic artery [ internal thorax artery, located inside the thorax outside the pleura and behind costal cartilage, which is a branch from the 1<sup>st</sup> part of the subclavian artery .]
2. Branches from axillary artery : lateral thoracic , superior thoracic and acromio-thoracic .
3. Branches from the posterior intercostal artery .



-The arteries converge on the breast and are distributed from the anterior surface. Posterior surface is Relatively Avascular .

## Venous drainage:

-Veins accumulate around the nipple and areola then radiating forming **superficial and deep vein** .

It is of high yield to notice that the superficial veins communicate with superficial veins of the neck , while the deep vein drain into axillary vein , internal thoracic and the posterior intercostal veins . The posterior intercostal veins opens freely to the vertebral venous plexus, remember when we talked about prostate carcinoma metastasizing to the vertebral column. The communication between veins of the breast with the vertebral plexus explain the early spread of breast carcinoma to the vertebral column and nervous system.

## Nerve supply :

-4<sup>th</sup>, 5<sup>th</sup> & 6<sup>th</sup> intercostal nerves bring sensation from the skin of breast but has no role in lactation .There are two hormones responsible for the lactation process 1. Prolactin : synthesis of milk . 2. Oxytocin: secretion of the milk . The nerves have nothing to do with the lactation process, they only convey sensory fibers to the skin and autonomic fibers to the smooth muscle and blood vessels.

## Lymphatic drainage:

-The breast drains into two major groups of lymph nodes:

**1.Internal mammary (thoracic)** lymph node which are present inside the thorax along the internal thoracic artery draining the medial half of the breast. The lymphatics of the breast runs between the intercostal spaces and drain in these internal thoracic lymph node.

**2.Axillary nodes:** drain the lateral half of the breast (chiefly the anterior group) .. They contain anterior (pectoral) group, posterior group, lateral nodes, central and apical group of nodes, which are interconnected either directly or indirectly.

The anterior group is located at the lower border of pectoralis major( the easiest to feel in the patient ),these nodes send lymphatics to the posterior or subscapular nodes which are located anterior to subscapularis muscle.

From the anterior and posterior group, lymphatics will pierce the pectoralis major muscle and fascia to reach the apical and supraclavicular groups, and eventually to the major lymphatic ducts (thoracic duct on the left, right lymphatic duct on the right), lymphatic ducts will empty into the the junction of the internal jugular and thoracic vein (i.e into the venous circulation).

The lateral and central axillary lymph nodes receive lymph nodes from the upper limb and partially from the breast, so lymph coming from the anterior and posterior groups will pass through the lateral and central groups before reaching the apical groups. So if you have a patient with carcinoma, you should try to feel all these groups ( the anterior, lateral and posterior groups are easily felt, the central is a bit harder to feel and the most difficult to feel is the apical group).

When there's carcinoma with metastasis to these lymph nodes, they become enlarged, stony-hard, non-tender (not painful) and fixed.

The lower quadrant of the breast drains it lymphatic deep into the abdomen.



Fig. 11 Lymph nodes draining the breast.

Also, there is a lymphatic connection between the two breasts .So a cancer occur in one breast you should examine the second breast .

## Clinical Correlations :

### Signs of carcinoma:

1. Retraction of the nipple due to infiltration of the lactiferous ducts by carcinoma, inducing their fibrosis and shortening.( In very advanced stages)
2. Retraction and puckering of the skin due to the invasion of the ligaments of Cooper.
3. Peau d'orange or Oedema with pitting: oedema due to the obstruction of the cutaneous lymphatics by cancer cells, and pitting due to fixation of the hair follicles to the subcutaneous tissue .(Early sign)
4. Breast become fixed to the deep fascia , pectoralis muscle and chest wall , due to direct spread of the growth to the subjacent structure . (late sign)
5. Axillary lymph node may be involved, become stony hard and fixed.
6. Carcinoma may spread to distant places, like Liver, lung, bones and ovaries.

## Development of the breast :

### The parenchyma of the breast is ectodermal (sweat gland). While the stroma is mesodermal.

Breast develop from an ectodermal thickening called mammary line or milk line or line of Schultz [ at the 4<sup>th</sup> week of development] ,which extend from the axillary region to the inguinal region. Multiple breasts appears at this line but all will disappear and single breast will remain at the level of pectoral region. [ If the multiple breast don't disappear an accessory breast appears along the mid line].

-The Ectodermal thickening (mammary bridge) becomes depressed forming a **mammy pit (ectodermal)** . From the floor of pit lots of buds emerge (15-20 bud) , each bud will form a **lobe**. Entire system is canalized. At birth or later nipple is everted.

### →Some congenital anomalies :

- 1 . Absence of the breast = amastia
2. Absence of nipple = athelia
3. polymastia [ multiple breast ]= supernumerary breast
4. polythelia [ multiple nipple ]= supernumerary nipples
5. gynecomastia, is a developed breast in males .[ might be congenital as in klinefilter syndrome, or acquired caused by some drugs, such as **in patients with prostate carcinoma taking estrogen**, some analgesics and some psychiatric drugs , can be seen as advanced liver disease] .

## Histology of the breast :

### 1. Resting breast :

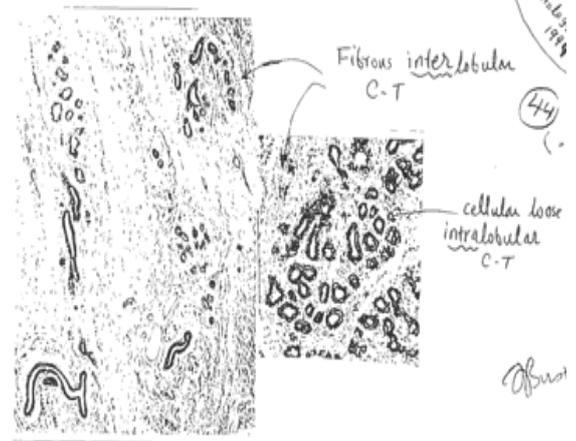
- Is a postpubertal female breast (non-lactating) that had not yet been hormonally stimulated to secrete and therefore, still in the inactive state. The estrogen and progesterone here enlarge the breast .It's largely formed of adipose tissue and the internal epithelium tissue consisting of **Ducts** which group together forming **Lobules**. You'll hardly find alveoli. Between the duct there is intralobular loose connective tissue devoid of fat which derived from down growth of papillary layer of dermis.

While the interlobular connective tissue between the lobule is Abundant Dense connective tissue full of fat (derived from reticular layer of dermis).

The duct is lined by simple cuboidal or low columnar .

In large ducts → arranged as a double layer.

In small ducts → arranged as a single layer .



### 2. Breast of pregnancy ( the active proliferative breast )

-its growth corresponds to the progesterone and estrogen produced by placenta. The significant thing here is the growth of alveoli [ in the resting breast hardly find an alveoli ] . Those alveoli arise by budding off from the end of the intralobular ducts, lined by simple cuboidal epithelium + myoepithelium cells around them, which are able to contract and evacuate the alveoli.

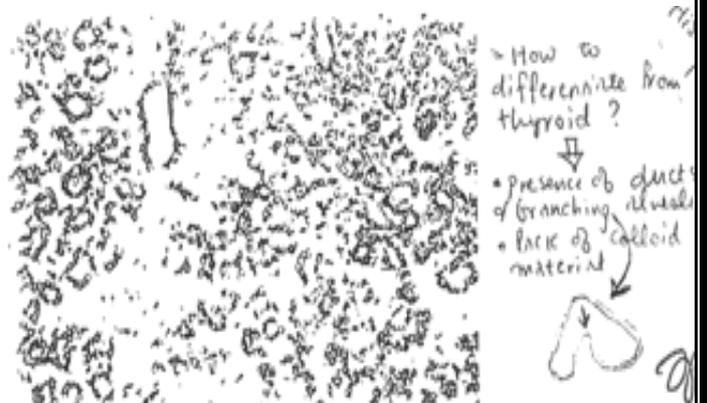
\*So we can notice in the picture that the duct that found in the resting breast now are replaced by alveoli in pregnancy breast.

Due to the formation of those alveoli, the amount of the connective tissue has decreased.

How can we differentiate between alveoli in pregnancy breast and thyroid follicle ?!

The presence of the duct is enough to say it is a breast because thyroid doesn't contain duct (you'll never see ducts in an endocrine gland) and the presence of branching alveoli with no colloid ( in breast) while in thyroid gland → branched alveoli full of colloid .

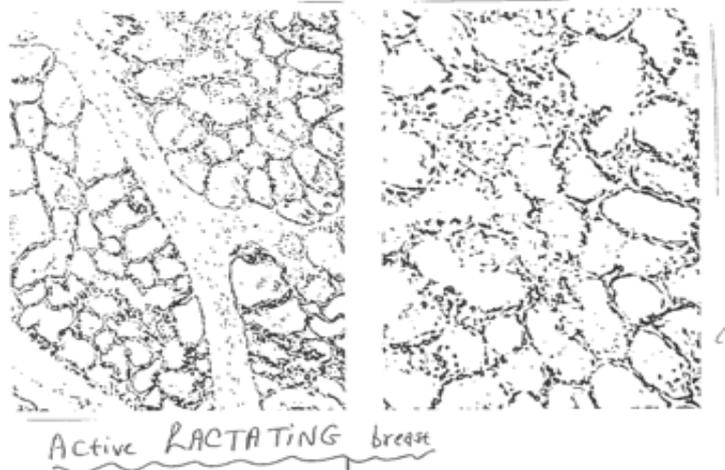
-When you look at the section, you'll notice that not all the alveoli are distended to the same level, in the 3<sup>rd</sup> trimester : these alveoli become filled with serous fluid rich in protein and low fat called Colostrum .( the milk isn't produced until 2 or 3 days after delivery ) . So in the last three months of pregnancy the breast secretes secretion rich in protein and antibody (colostrum) , that's why we advise each mother to breastfeed her baby immediately after delivery because colostrum contains antibody important for the baby ,Also this will activate the suckling reflex that activates different hormones needed for the synthesis of milk. (explained later in this sheet)



### 3.Lactating breast :

After 2-3 days of delivery, the milk is now produced . if we take a section we will notice that the interlobular connective tissue is reduced to thin septa between lobules and the alveoli are enlarged ( saccular ) and the lining epithelium becomes flattened epithelium rather than cuboidal epithelium .

\*\*Important note that the alveoli in pregnancy breast or in lactating breast not uniformly distended. This means that some alveoli filled with secretion and others are empty, as if they are working in shifts), and this is normally found.[ this is called Uneven Rates of Secretion ] .



**In order for lactation to occur, what do we need ?!!**

**1.Estrogen and progesterone,** produced by the placenta ,needed for the growth of alveoli from the duct [ don't forget that alveoli surround by myoepithelial cells ] .

**2.Prolactin,** coming from the anterior pituitary gland, helps in Milk production ( synthesis of protein found in milk )

**3.Oxytocin,** coming from the posterior pituitary, aids in milk ejection.

Other hormones have a permissive action, such as insulin, cortisol and thyroid hormone. So a patient having hypothyroidism or diabetic and not taking insulin regularly will have problems in lactation.

#### Suckling reflex:

-We always encourage the lady after delivery to put the child on the breast even before the secretion of milk, to induce the suckling reflex which aids in milk secretion.

#### The principle of suckling reflex:

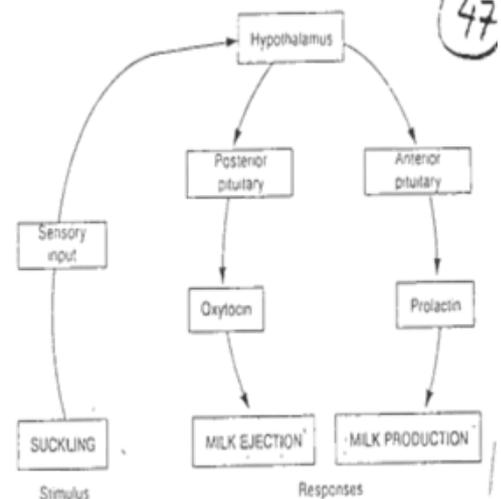
Impulses emerge from the nipple→ to the hypothalamus -→ from the hypothalamus, impulses are sent to:

1. Anterior pituitary that releases prolactin, responsible for milk production .
2. To posterior pituitary and release Oxytocin needed for milk ejection, because oxytocin causes contraction in the myoepithelial cells around the alveoli .

Oxytocin also acts on the uterus causing contraction in its wall and these contractions will help after delivery to remove any clots remains in the uterus.

During pregnancy, HCG hormone maintains the function of corpus luteum instead of LH . HCG hormone can be detected in the urine of a pregnant female 8 days after fertilization. So If you collect urine from a female that has a typical cycle of 28 days at the 23<sup>rd</sup> day ( i.e 5 days before menstruation, 8 days after ovulation), HCG will be detected if she's pregnant.

يعني ممكن معرفة ان الانثى حامل قبل فترة الحيض الثاني في اليوم 23 او 24 و مش شرط نستنى لليوم 28 مشان نفحص .



-HCG peaks at the 12<sup>th</sup> week

In pregnancy, there is an interaction between estrogen , progesterone , prolactin and oxytocin : -

-progesterone and estrogen → → → for the growth of breast ( formation of alveoli from the duct )

-Estrogen stimulate prolactin secretion → once there is a prolactin there should be milk production but estrogen blocks the action of prolactin on the breast , so no milk production.

إذا الاستروجين يحفز خروج البرولاكتين ولكن يمنع تأثيره على الثدي .

-Immediately after delivery, placenta goes down .The release of estrogen and progesterone will be decreased, prolactin become active now and milk will be produced.

Always keep in mind that **Lactation is maintained by suckling & as long there is proper lactation there is no Ovulation ( no pregnancy )**, that was a way of contraception used in the past. This occurs because prolactin inhibits the release of GnRh → So no LH or FSH release → NO ovulation → NO PREGNANCY .

## **Embryology of the Renal system:**

In 3<sup>rd</sup> week of development the embryo is said to be Trilaminar germ disk, means the embryo has 3 layers:

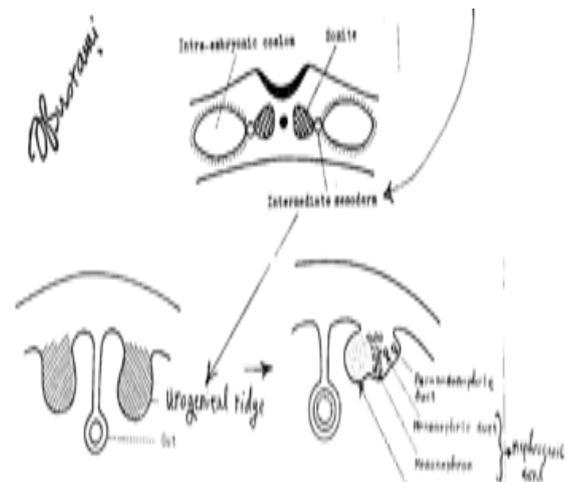
-Ectoderm, endoderm and intraembryonic mesoderm in between.

The intraembryonic mesoderm will differentiate into three parts: -

- Paraxial mesoderm → forms Somites that form the muscle of the body.

-intermediate mesoderm that help in the formation of urogenital system.

- lateral mesoderm that forms celom which forms pleural cavity , peritoneal cavity and the cardiac cavity.



We concentrate on intermediate mesoderm, this intermediate mesoderm Forms a ridge or longitudinal elevation (growth) on the posterior abdominal wall called urogenital ridge on both of the side of the mesentery of the gut.

This urogenital ridge divides into:

1. Gonadal Ridge that forms the gonads (ovaries and testis ) , the inner part .

2. Nephrogenic cord, the outer part. Inside this nephrogenic cord we can see: mesonephric duct and the paramesonephric duct. (to be discussed)

So first sign of the formation of urogenital system is when the intermediate mesoderm forms the urogenital ridge and its inner part gives us the testes and ovaries, and its outer part gives us the kidney .

Here, we say that kidney goes through 3 stages (emerge from the nephrogenic cord ) during its development :

1-Pro-nephros

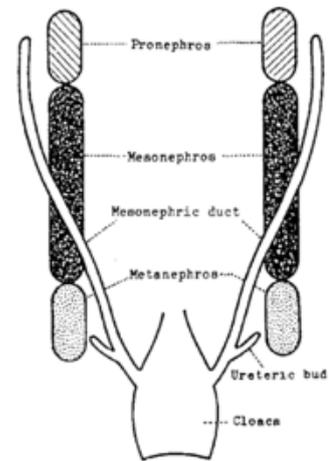
2-Mesoneohros

3-Metanephros

-In the first 5 weeks, kidney in Pronephros stage, that originate from the differentiation of mesoderm of urogenital ridge ( is the cranial most nephric structure) .

This kidney contains pronephric tubules and pronephric duct .This pronephros largely disappears it is not functional in humans .

-The 2<sup>nd</sup>stage , mesonephros, ( is the middle nephric structure ), formed in the thoracic and upper lumbar region. The kidney here is made up from mesonephric tubule and duct (wolffian duct) and it **functions temporarily**. --Mesonephric ducts will persist while most of the tubules will disappear. These mesonephric ducts open in the cloaca [cloaca : is the caudal part of the hindgut , where the rectum and urinary bladder will form].



-The 3<sup>rd</sup> stage is the prominent kidney , Metanephros develops from an outgrowth of the mesonephric duct called the **Uretric Budd** , and from a condensation of mesoderm within the nephrogenic cord, called the **metanephric blastema**. It is the caudal most nephric structure . Begins to form at week 5 and it is functional in the fetus at about week 10 of development. It Develops into the **definitive adult kidney** .

-If the uretric bud doesn't develop, the kidney will not be formed (renal agenesis).

\*\*So the first step in the formation of permanent kidney is by the formation of uretric bud from the previous stage (mesonephric duct).

From now on whenever you hear Mesonephric duct, you should know that it forms the genital ducts in Male ( epididymis , vas deference, seminal vesicle and ejaculatory duct) . But the most important derivative of the mesonephric duct is the uretic duct that forms the kidney, **without the uretric bud there is No Kidney** .

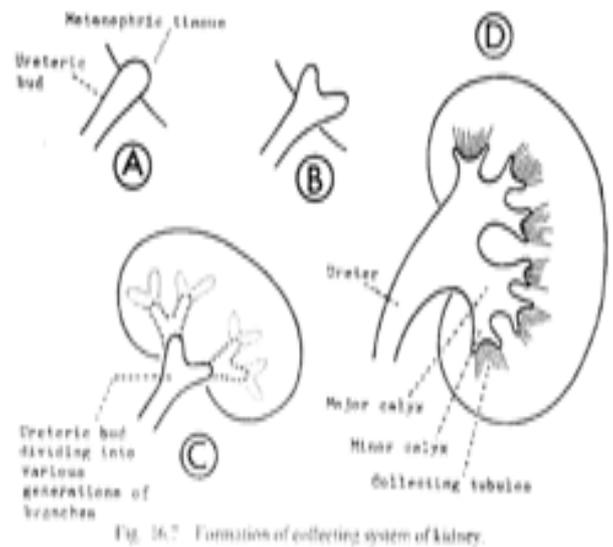


Fig. 36.7 Formation of collecting system of kidney.

The uretic bud [mesoderm] emerges and penetrates the metanephric blastema [mesoderm] then starts dividing into several branches . If this uretic bud branches before entering the metanephric blastema, **Duplication** occurs. (The most common duplication is double ureter, double calyces and a single kidney) .

When the uretric bud branches, it gives us the ureter, the pelvis of ureter, Major calyx , minor calyx and Collecting Tubules. ←so all those originate from the mesoderm of uretric bud .

Once this uretic bud enter the metanephric blastema it will induce the formation the nephrons .This uretic bud branches until it give us the collecting duct , these collecting duct become near to the metanephric blastema, inducing it to divide into small metanephric vesicle [ for each collecting tubule in the uretic duct, there is a metanephric vesicle in the metanephric cap].

**So, the collecting tubules are responsible for the induction of metanephric cap to form vesicles that will form the nephron.**

We used to say that the kidney is made up from uninefrous tubules, each tubule is made up from nephron( from the metanephric blastema) + collecting tubule(from the uretric bud).

