

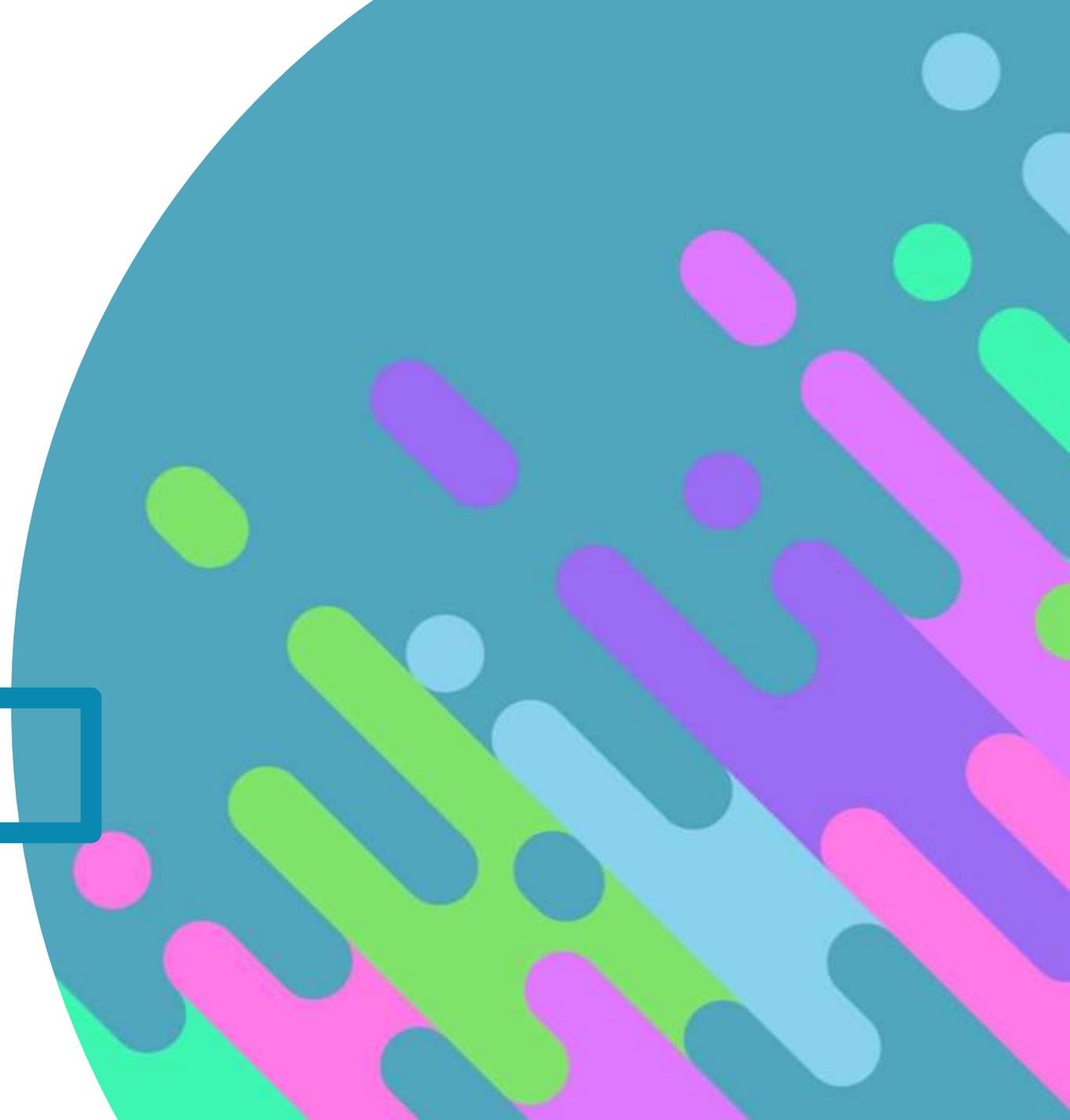


Breast

Anatomy & Physiology

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This Seminar covering the following subjects:

The position
of the breast.

The structure
of the breast.

Blood supply
& Innervation
of the Breast

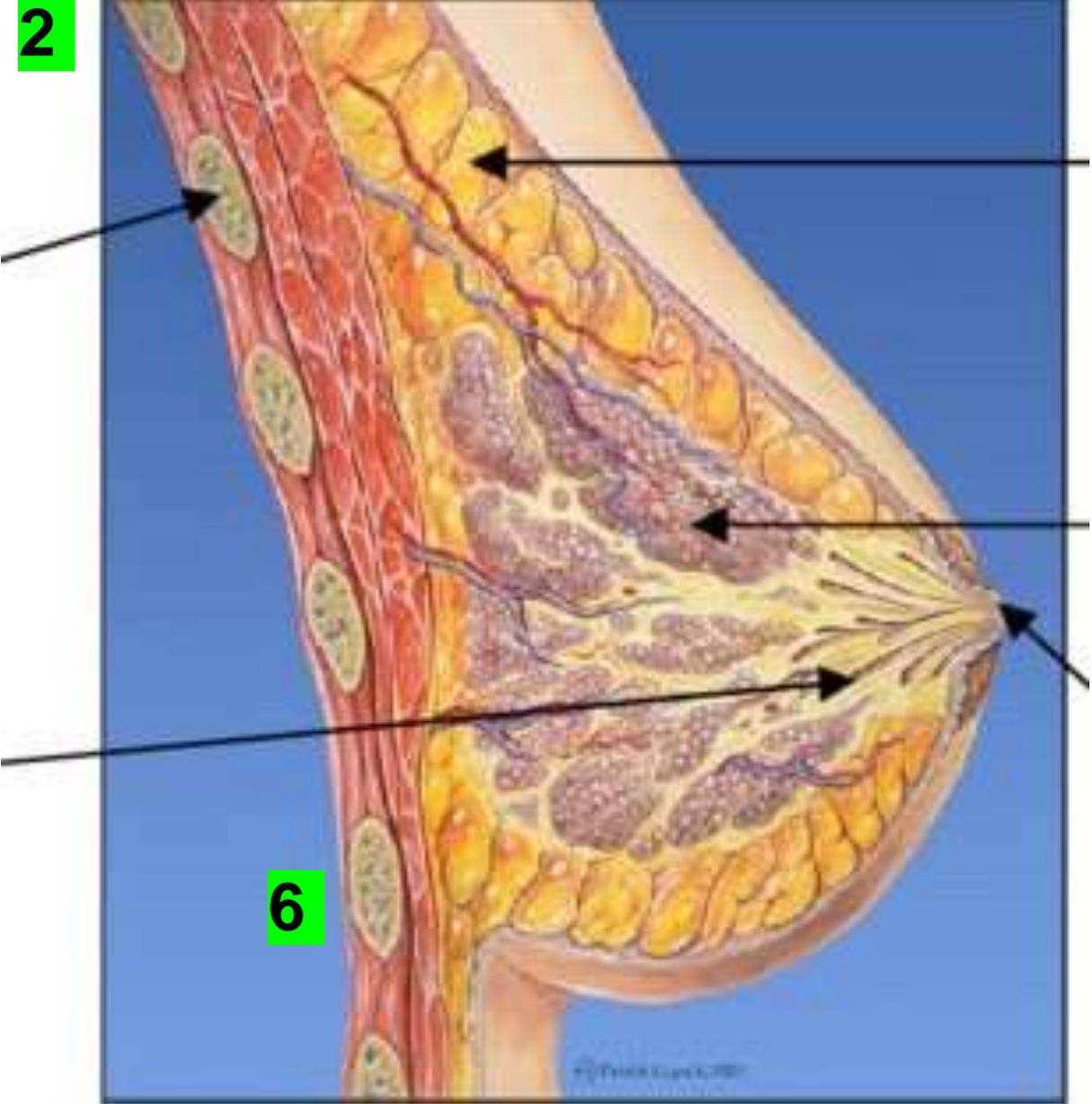
Lymphatic
drainage

Breast
Development

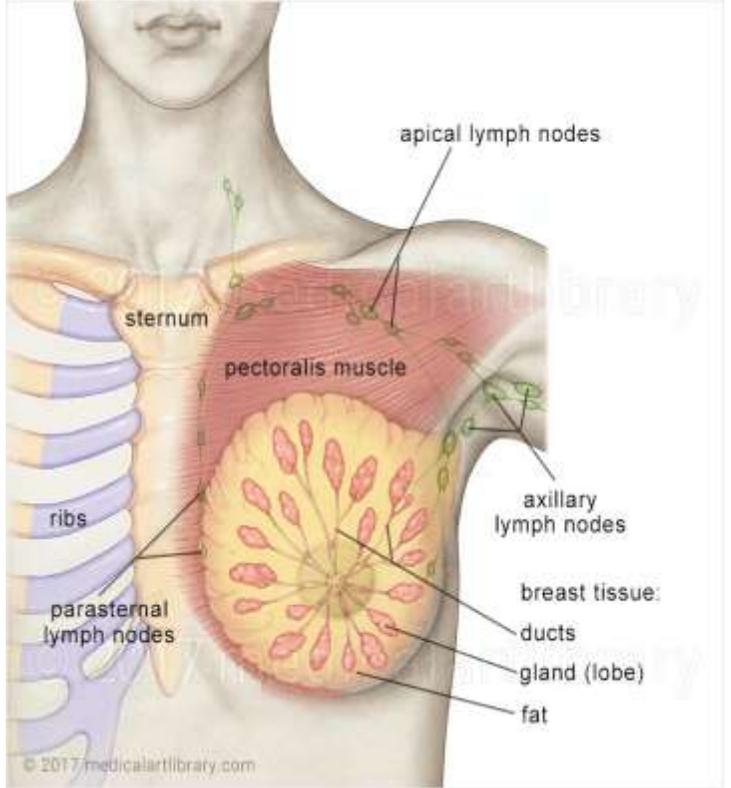
Congenital
Anomalies of
the Breast

Physiology of
the Breast

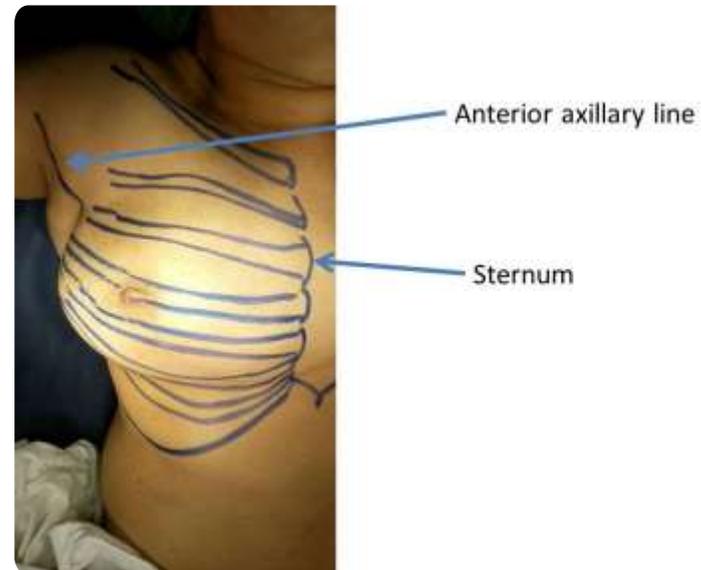
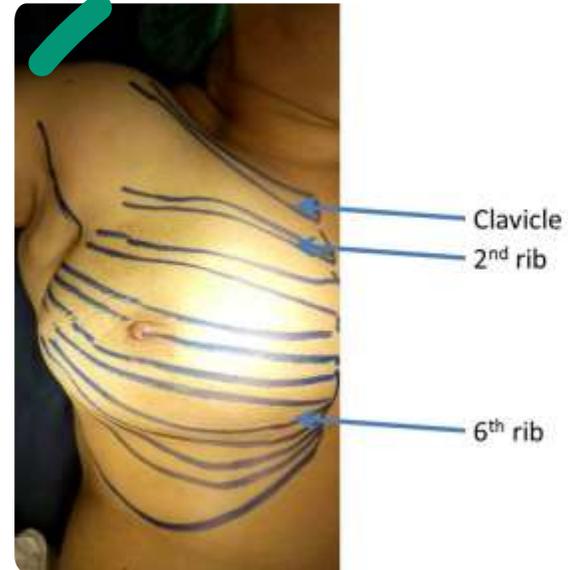
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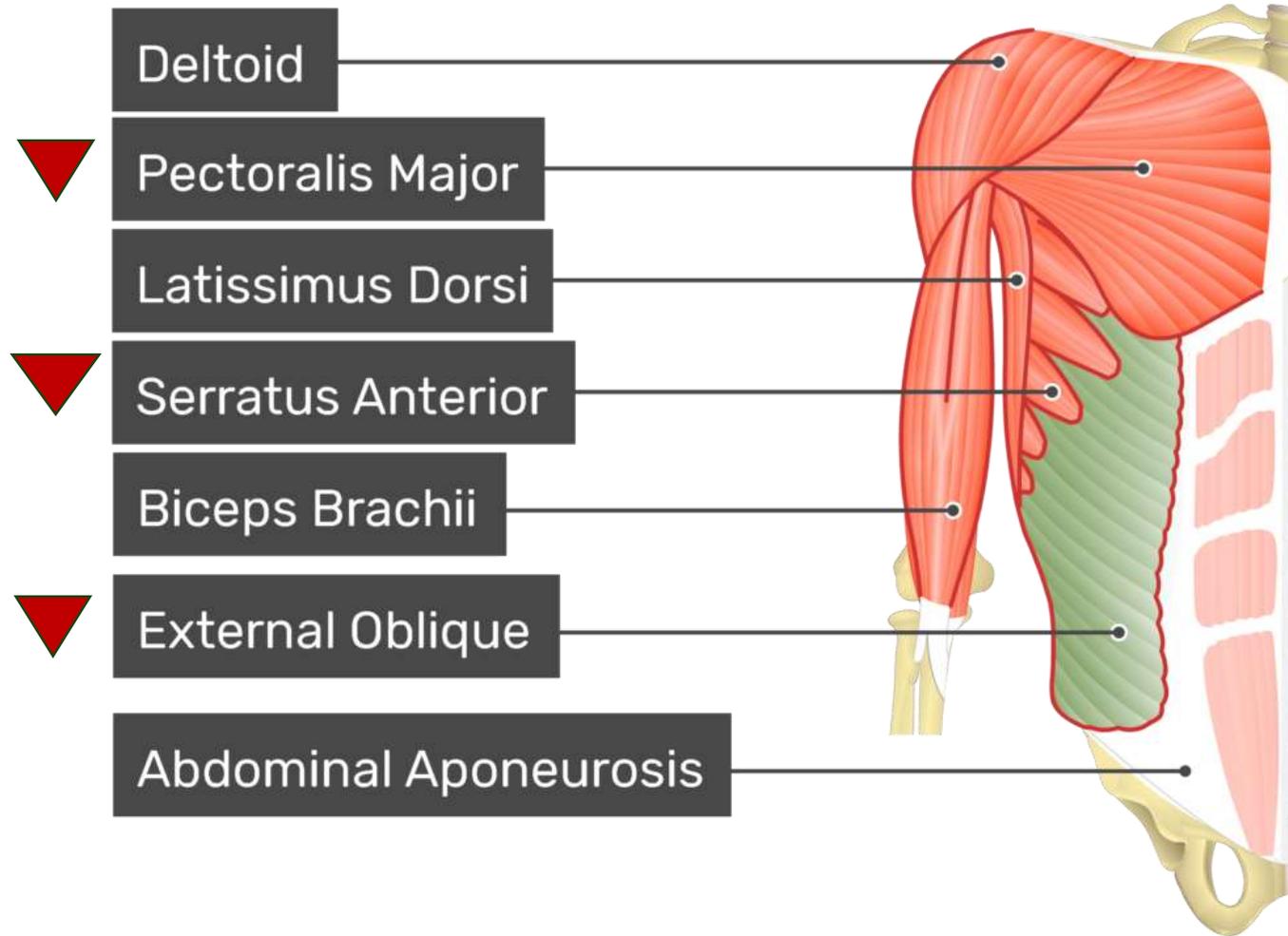


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- The mound of the adult female breast has a base, apex and tail.
- Its base extends from 2nd to 6th ribs
- Medially, it borders the lateral edge of the body of the sternum, and laterally it reaches the midaxillary line.

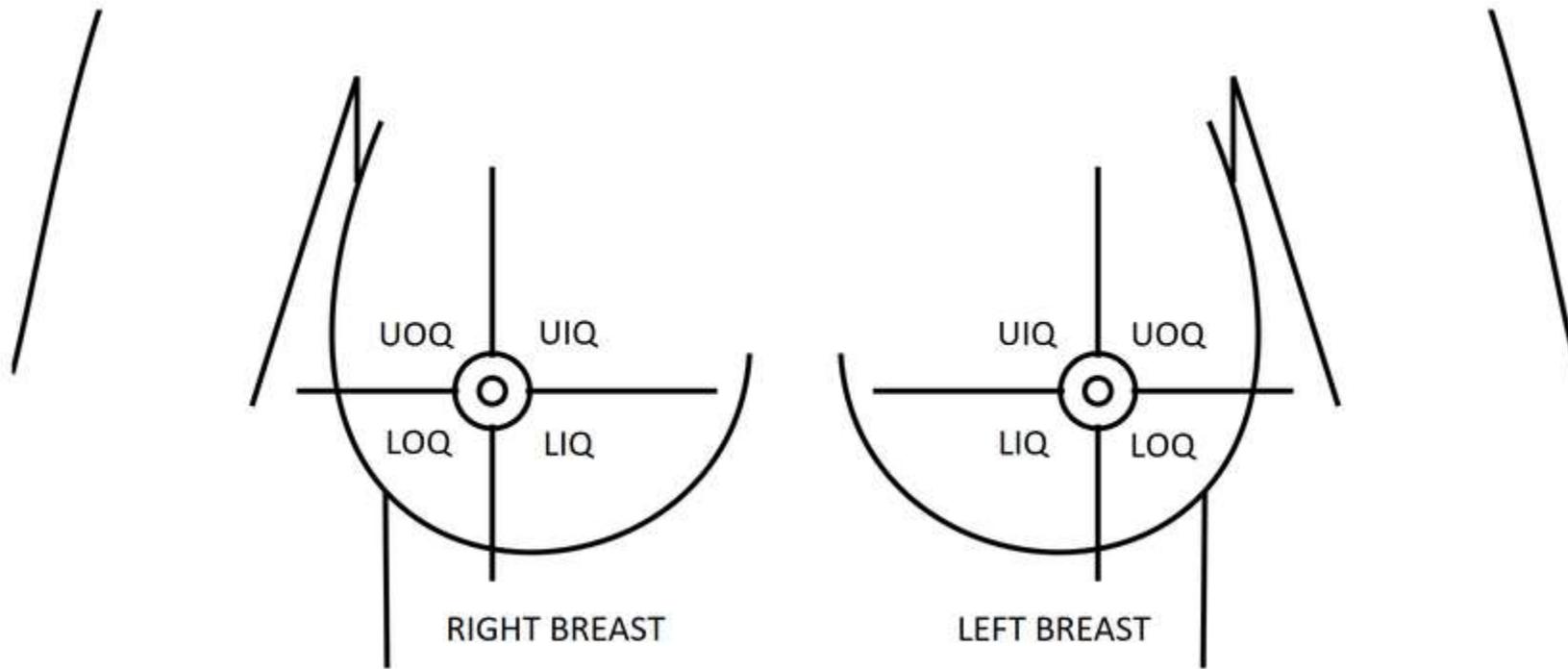




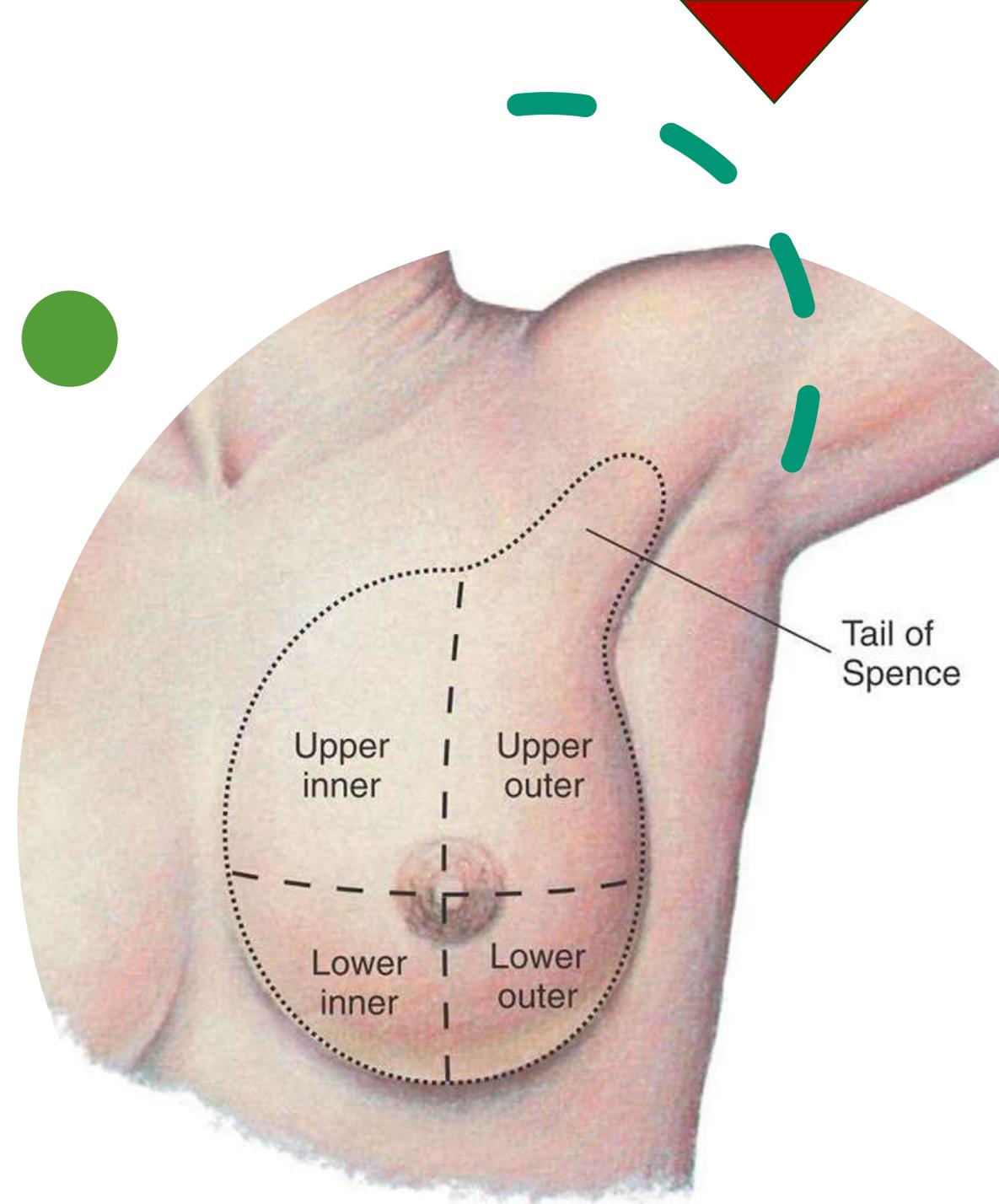
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- About two-thirds (superiomedially) of the breast lies on the **pectoralis major muscle**
 - while its inferolateral 1/3 lies on:
Serratus anterior & External oblique muscles

**** Breast shape and size depend upon genetic, racial and dietary factors, and the age, parity and menopausal status of the individual**





- Each breast is divided into four quadrants, with the *nipple* and *areola* at the centre.
 - **UOQ: Upper outer quadrant (superior and lateral)**
 - **LOQ: Lower outer quadrant (inferior and lateral)**
 - **LIQ: Lower inner quadrant (inferior and medial)**
 - **UIQ: Upper inner quadrant (superior and medial)**
- The main bulk of the breast tissue is usually localized to its *upper outer quadrant*. This quadrant is more often implicated in breast cancer and in most benign lesions of breast tissue
 - At its superolateral extremity, the breast tissue projects as a tongue into the axilla along the lower border of the pectoralis major - the axillary tail of Spence.



Nipple: Conical eminence that projects forwards from the anterior surface of the breast.

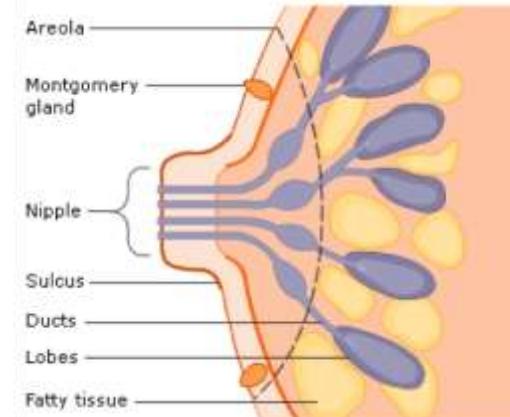
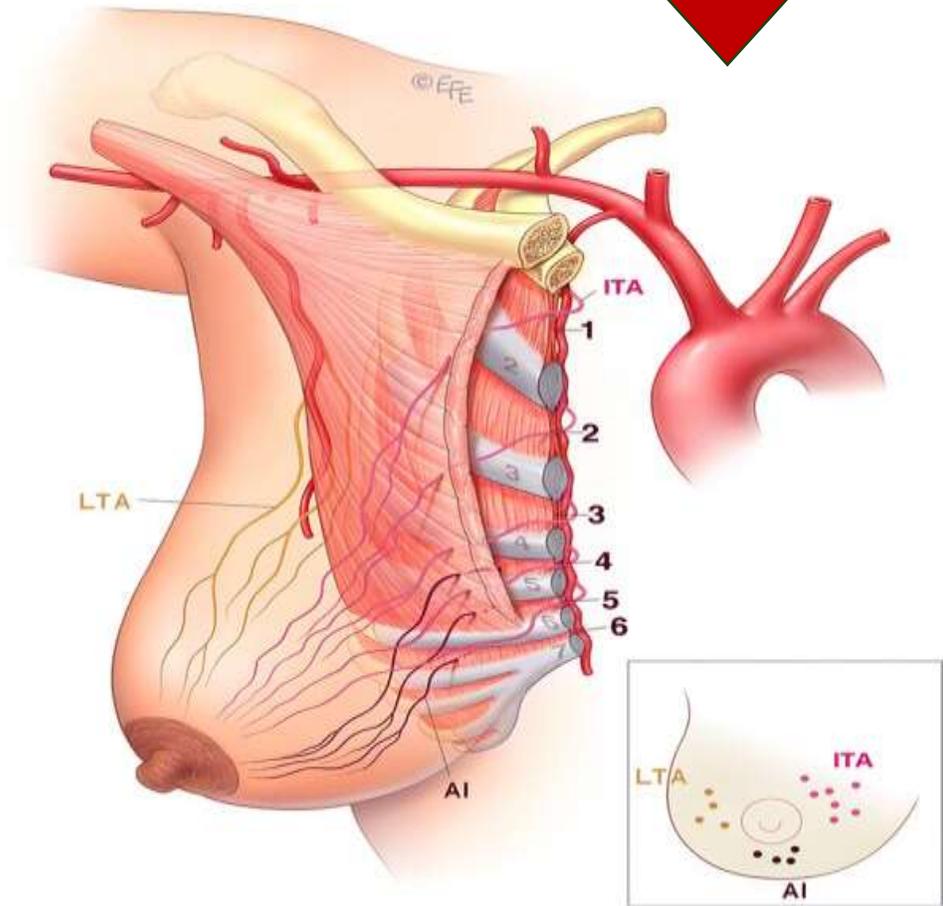
Nulliparous women ---> The nipple is usually situated at the level of the 4th -5 th intercostal space

BUT, In relation to the intercostal space when the breasts are pendulous, its position is inconstant

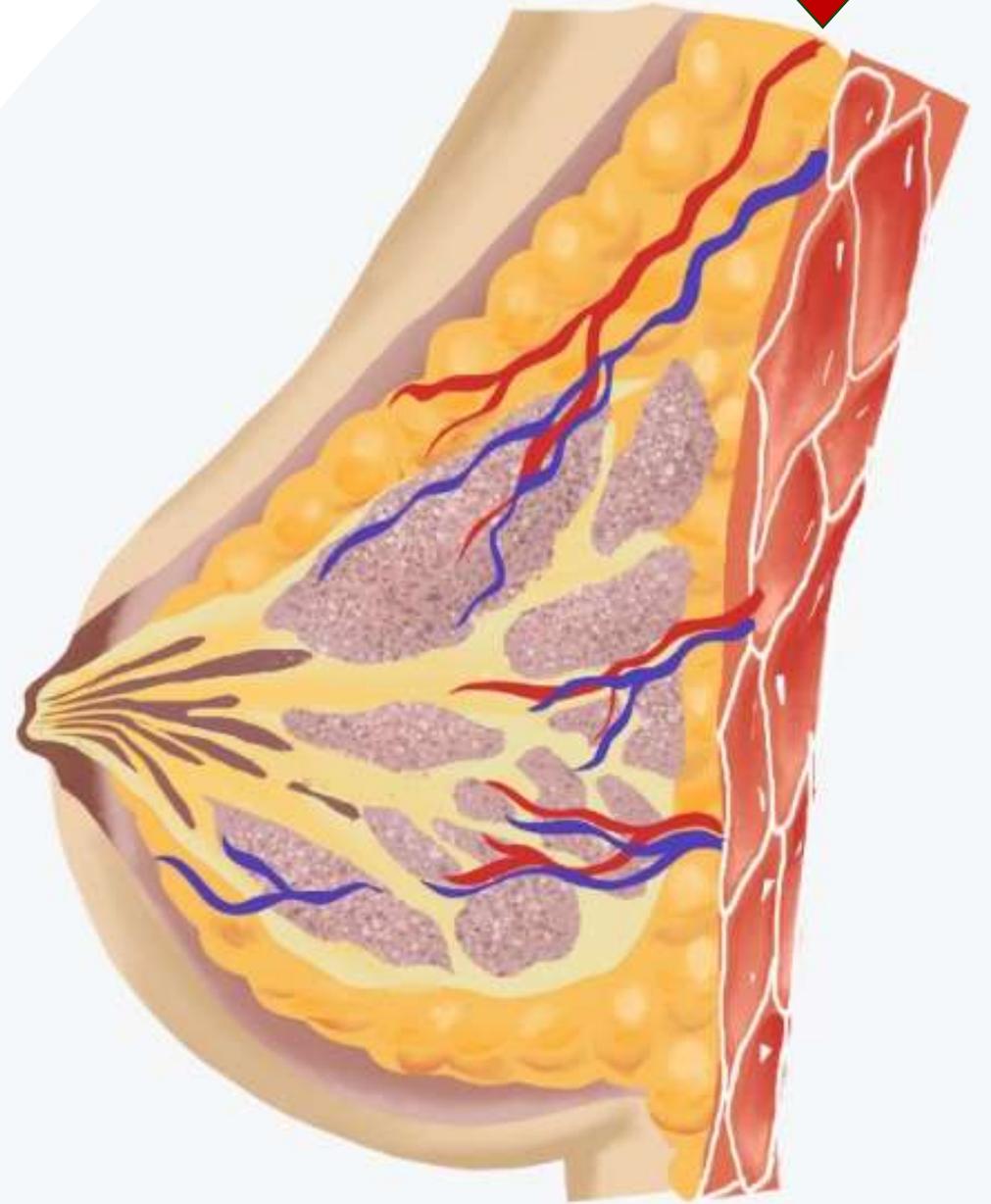
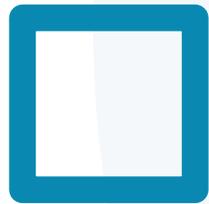
Areola:

It is a dark pink brownish circular area of skin that surrounds the nipple

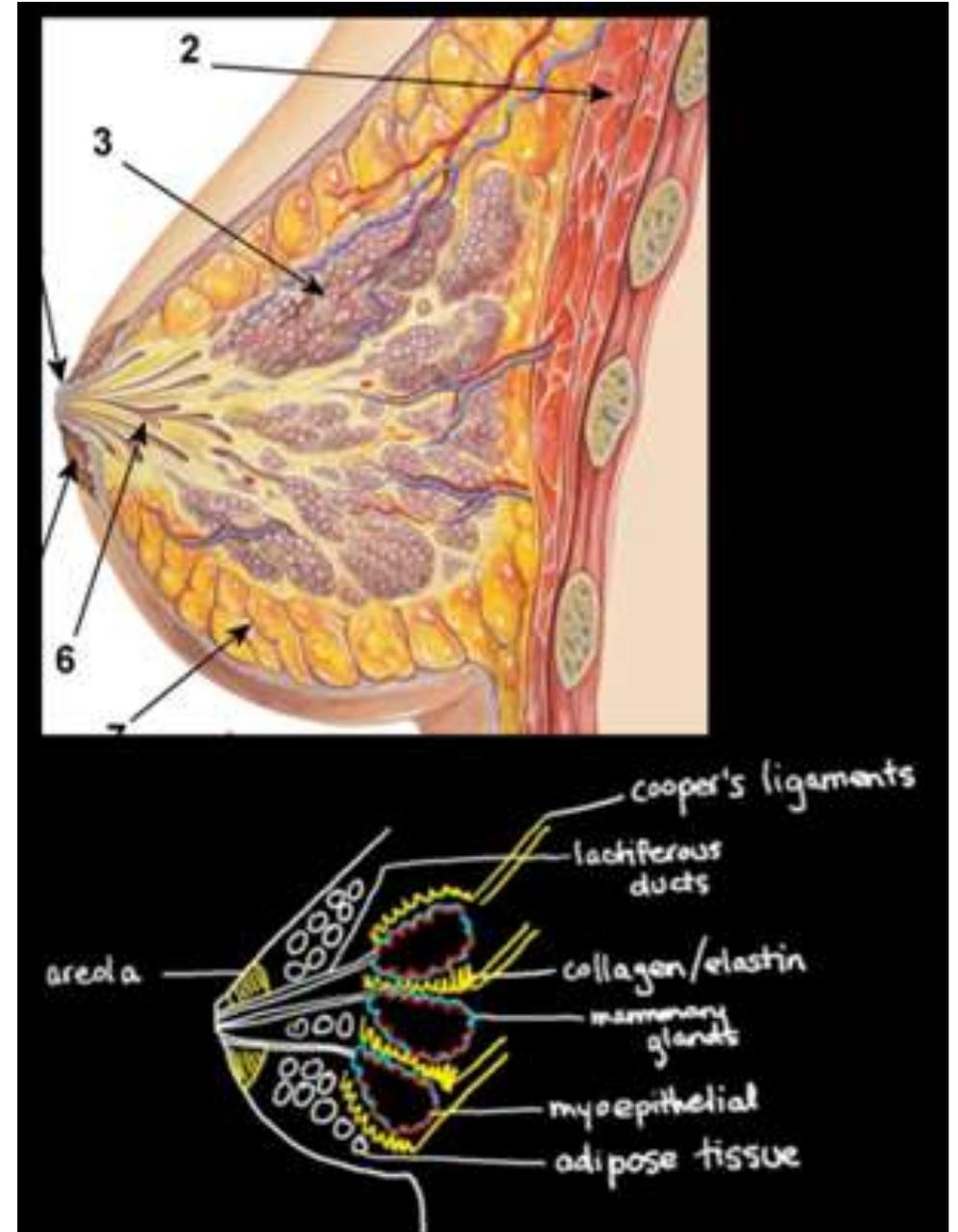
Contains the glands of Montgomery; a large sebaceous glands that are often visible to the naked eye

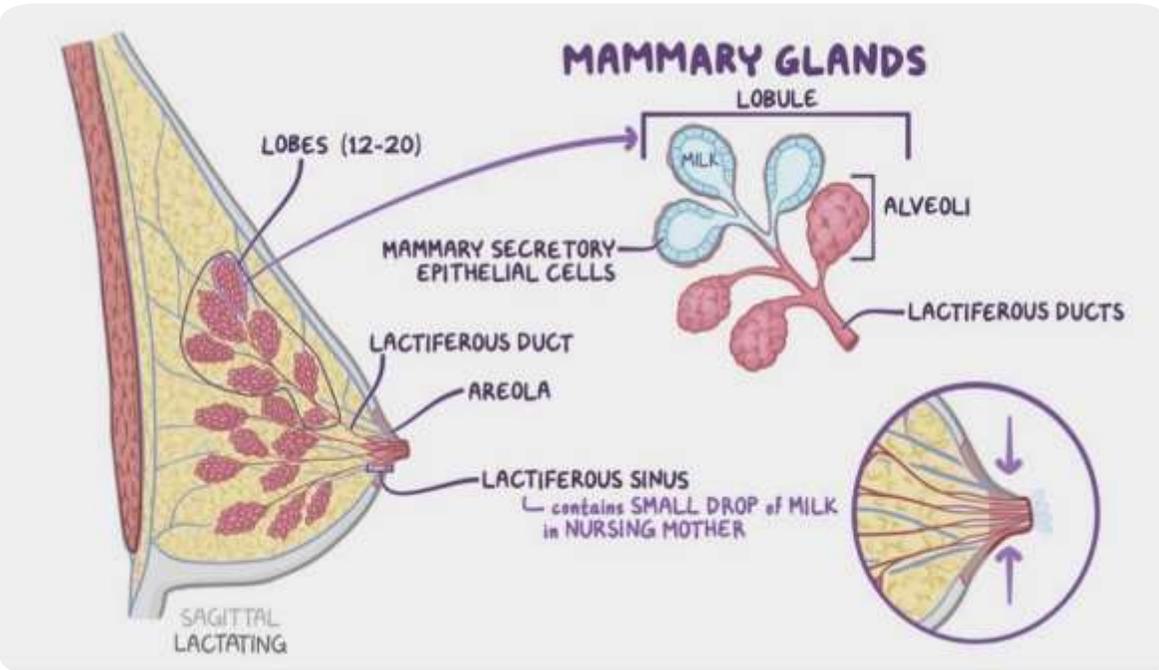


2. Structure of Breast



- The breast is an exocrine gland and it's called: **Mammary gland**, it exists in both **females** and **males**
- These glands develop around the age of puberty in **females**, but they remain undeveloped (rudimentary) in **males**.
- The main function of these glands is to secrete milk in females, the breast is also a vital accessory organ in female reproductive system.
- The breast is a **modified sweat apocrine gland** (non capsulated); modified because they open into the skin surface not into the hair follicle **unlike** the average apocrine glands





- The mammary gland structure (breast) is divided into three parts; skin, parenchyma and stroma.

Skin: consists of nipple and areola.

Parenchyma: The mammary gland's glandular tissue is made up of branching ducts and terminal secretory lobules.

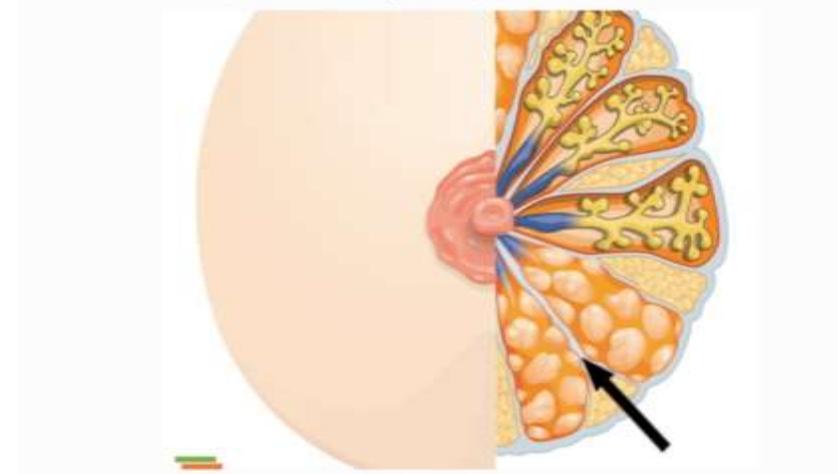
- So it's composed of 12 to 20 lobes within each breast. each lobe is formed of number of lobules, which are made up of collections of - milk producing- **alveoli**.
- Each lobule has own lactiferous duct--> that are responsible for carrying the milk from the lobule to the nipple from where it can be released
- these ducts enlarge to form the lactiferous sinus before they open separately into the nipple, there are 15-20 lactiferous ducts open into the nipple.
- The mammary glands lined with myoepithelial cells --> **contractile cells**; to contract and eject the milk to the lactiferous ducts.

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- The parenchyma is situated within the subcutaneous fatty tissue of the superficial fascia (stroma).

Stroma: it's the supporting framework of the breast around the parenchyma.

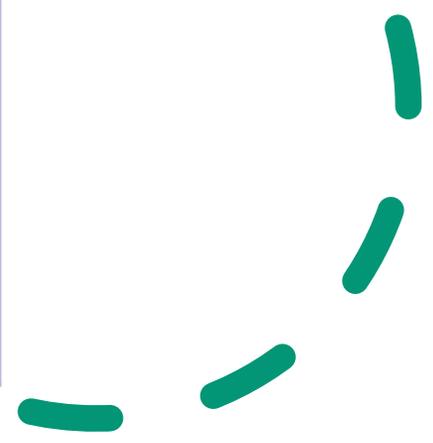
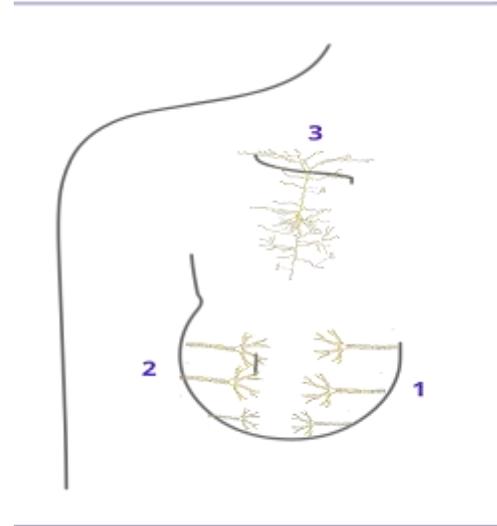
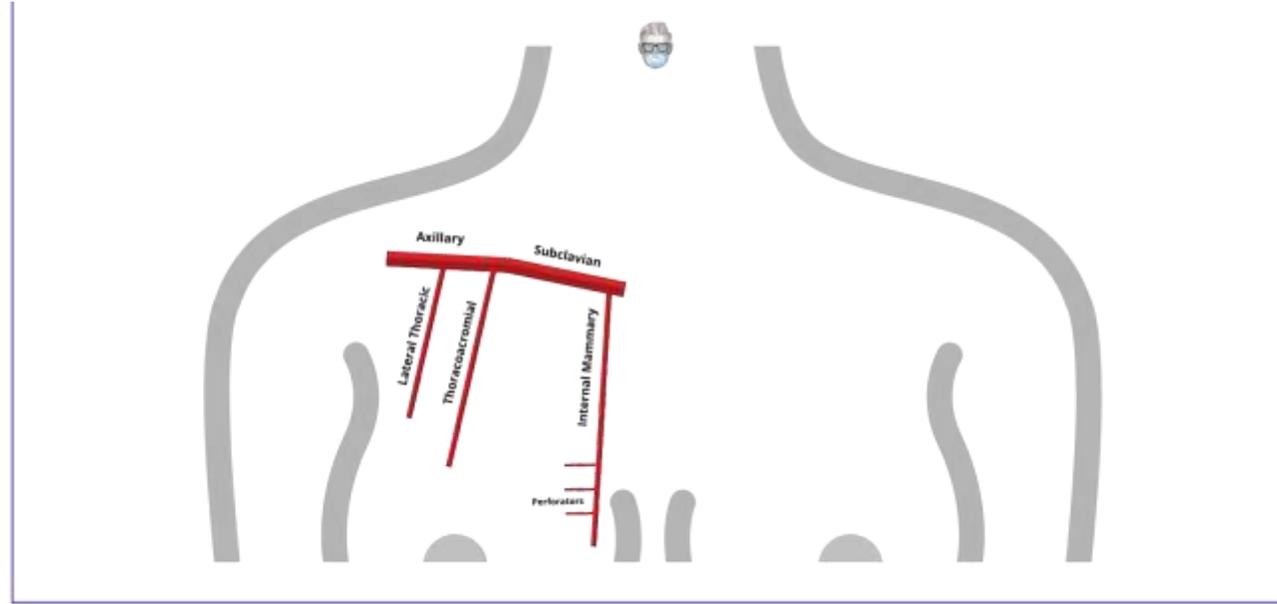
- **Fatty stroma:** it's the subcutaneous fatty tissue of the superficial fascia, the mammary gland's main bulk.
 - There is variable amounts of fat in different humans.
 - Layer of loose areolar tissue forms the retromammary space, separating the breast from the deep fascia that covers the underlying muscles. This space is essential for allowing unrestricted movement of the breast, ensuring its flexibility.
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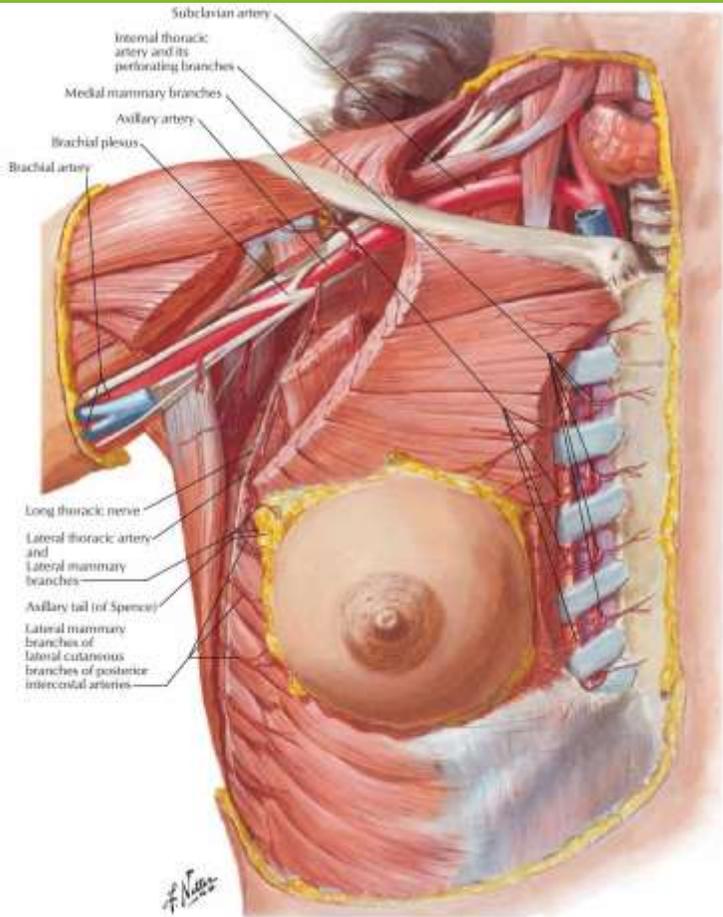
- **Fibrous stroma:** it's a connective tissue that made of collagen and elastin, this connective tissue gives rise to septa (ligaments) called **suspensory ligaments of Cooper / Cooper's ligaments** --> which separates lobes and suspends the mammary gland from the pectoral fascia (deep fascia --> fascia of pectoralis major muscle)
- these ligaments attach the breast to the chest wall , they extend from the deep fascia to the undersurface of the breast skin, creating a network that separates the lobes and lobules within the breast. They help maintain the structural integrity of the breast ,like that they play a crucial role in providing support to the breasts.
- These ligaments become more loose with aging.



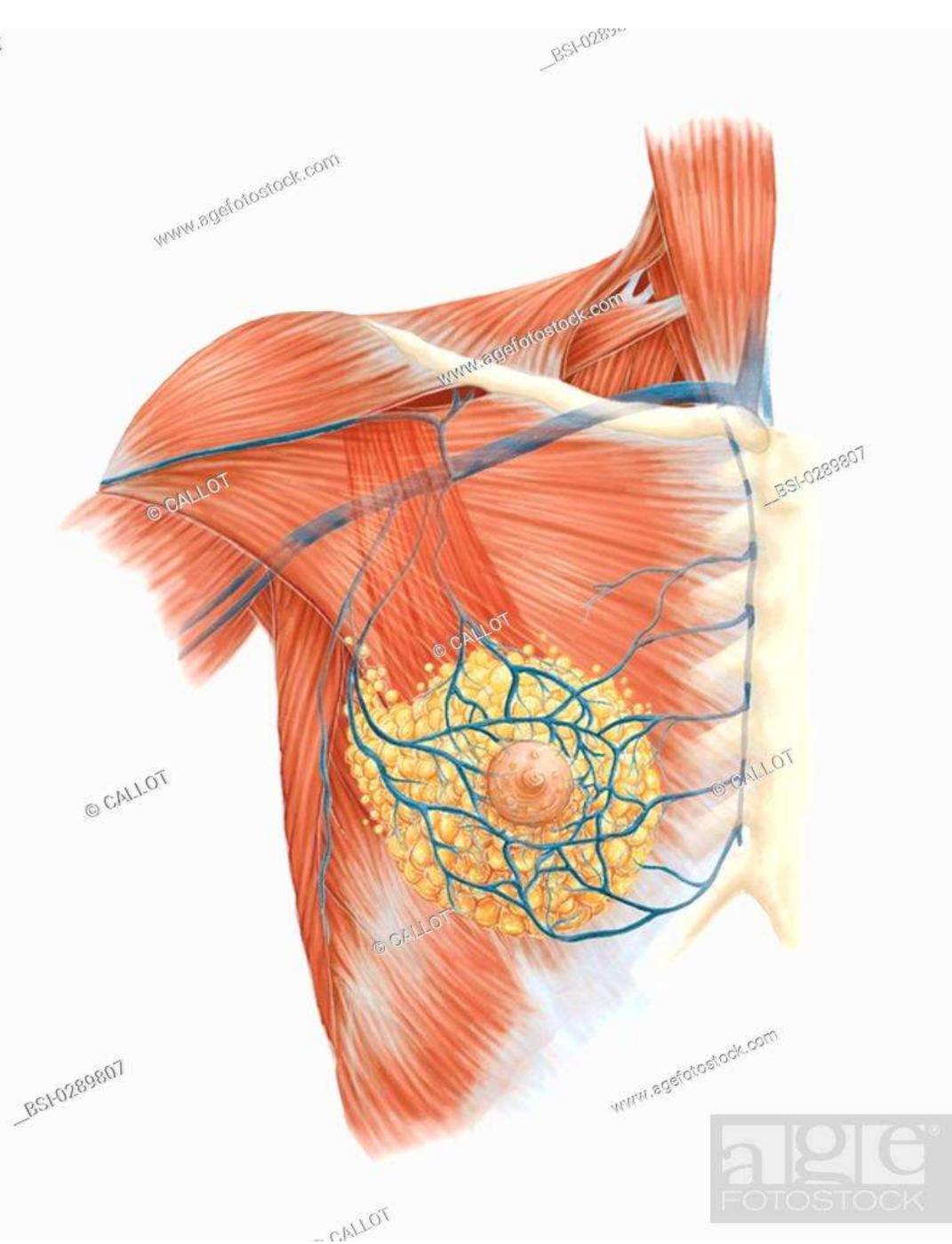
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- In patients with breast cancer, shortening and pulling of these ligaments causes rigidity of the breast and puckering of the skin over it. In association with cutaneous edema, the shortening of ligaments gives rise to a typical appearance that looks like an orange peel. Hence, it is called **peau d'orange** appearance.
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3. Blood supply & Innervation of the Breast



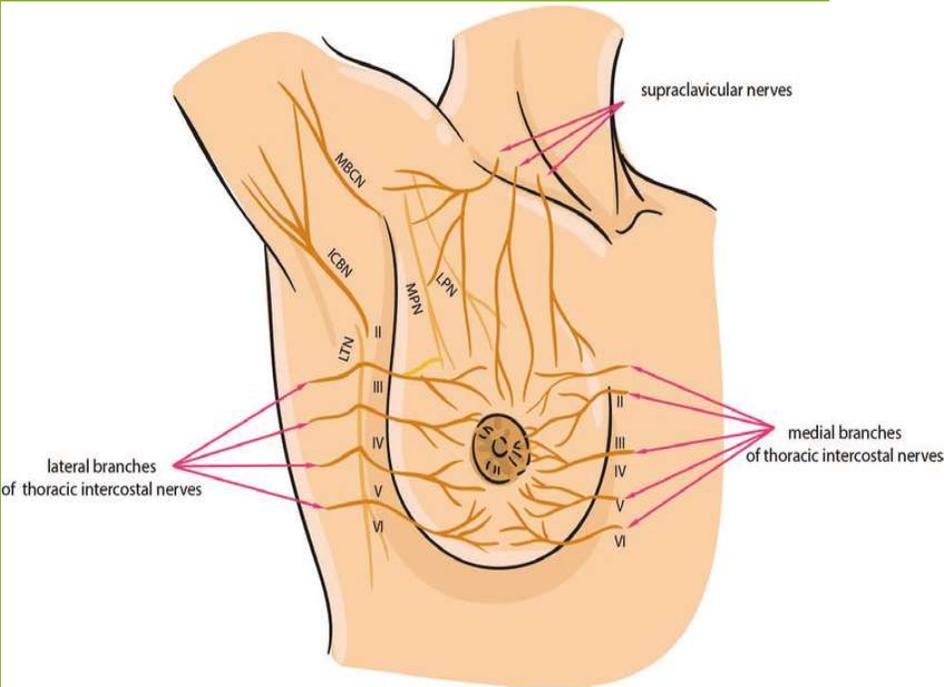


- The blood supply of the breast is a rich anastomotic network derived from the **axillary**, **internal thoracic** (or internal mammary in the old nomenclature) and intercostal arteries
- The largest vessels arise from **the internal thoracic artery**, the perforating branches of which pierce the chest wall adjacent to the sternal edge in the first to fourth intercostal spaces (2nd is the largest)
- The four branches from the **axillary artery** are the:
 - superior thoracic
 - pectoral branch of the acromiothoracic
 - lateral thoracic
 - subscapular



■ Venous drainage

- * **Veins** are corresponding to the **arteries**..
- **Circular venous plexus** are found at the base of nipple
- * Finally, veins of this plexus drain into:
axillary , internal thoracic and posterior intercostal veins.

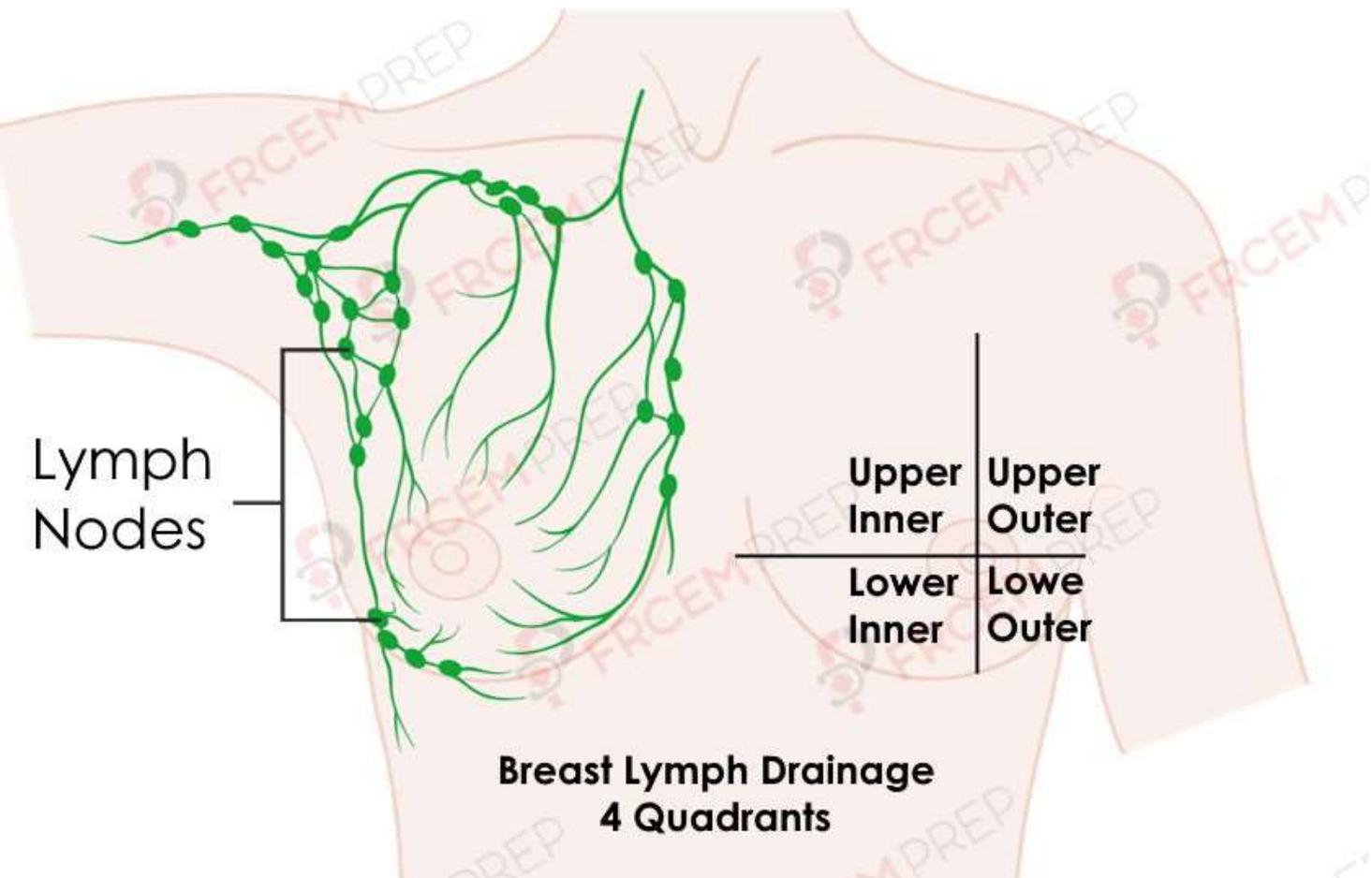


The innervation of the breast is principally by **somatic sensory nerves and autonomic nerves** accompanying the blood vessels

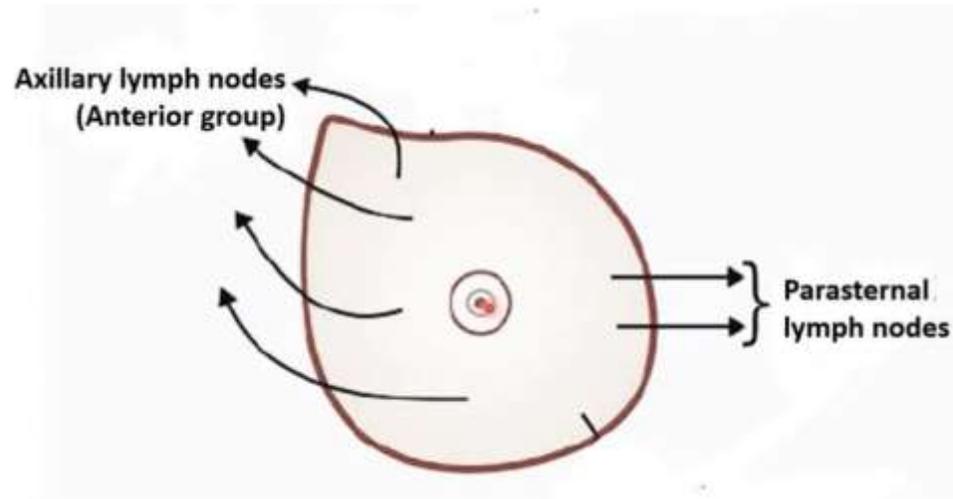
The **somatic sensory nerve** supply is via the supraclavicular nerves (C3, C4).

The medial aspects of the breast receive supply from the anterior branches of the thoracic intercostal nerves, which penetrate the pectoralis major to reach the breast skin. These lateral and medial cutaneous branches come from the second through to the sixth intercostal nerves.

The major supply of the upper outer quadrant of the breast is via the **intercostobrachial nerve** (C8, T1).



4. Lymphatic drainage



The lymphatic drainage of the breast originates from the breast lobules and flows into two groups:

- **Superficial lymphatic plexus:**

- Skin of medial part of mammary gland drain into parasternal/internal mammary LNs of same side but few lymphatics cross to opposite side.
- Skin of rest of the mammary gland drain into anterior group of axillary LNs



- **Deep lymphatic plexus :**

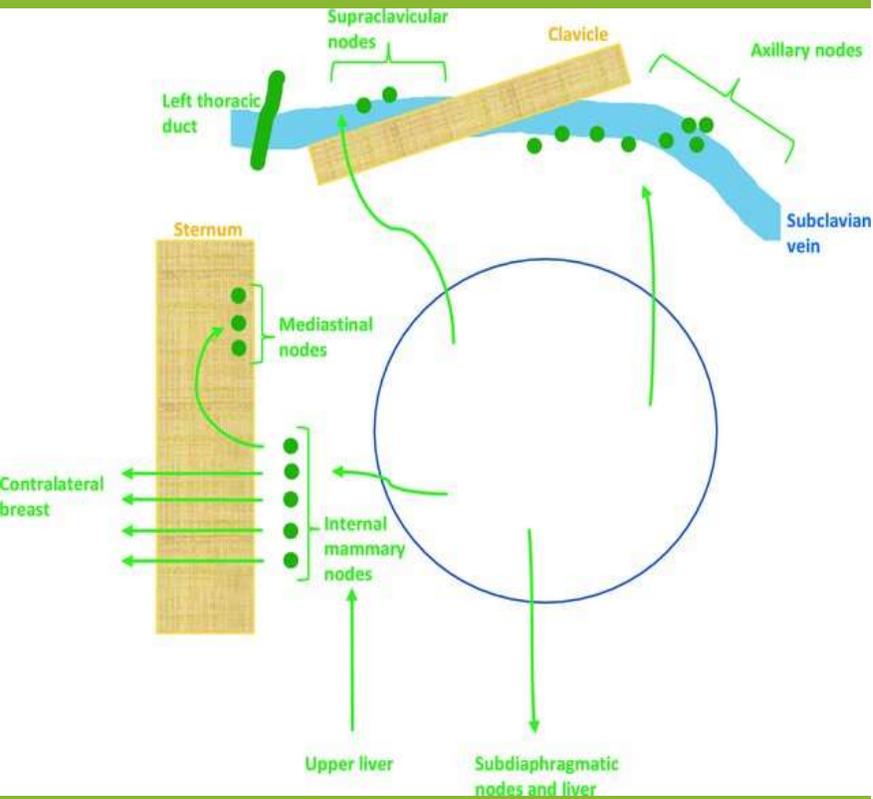
Lies on the deep fascia covering pectoralis major.

- **Subareolar plexus (Sappey plexus) :**

Lies beneath the areola.

- **Each plexuses, radiate in many directions and drain into different lymph pathways (cont..):**





- **Axillary** (Lateral) Pathway:

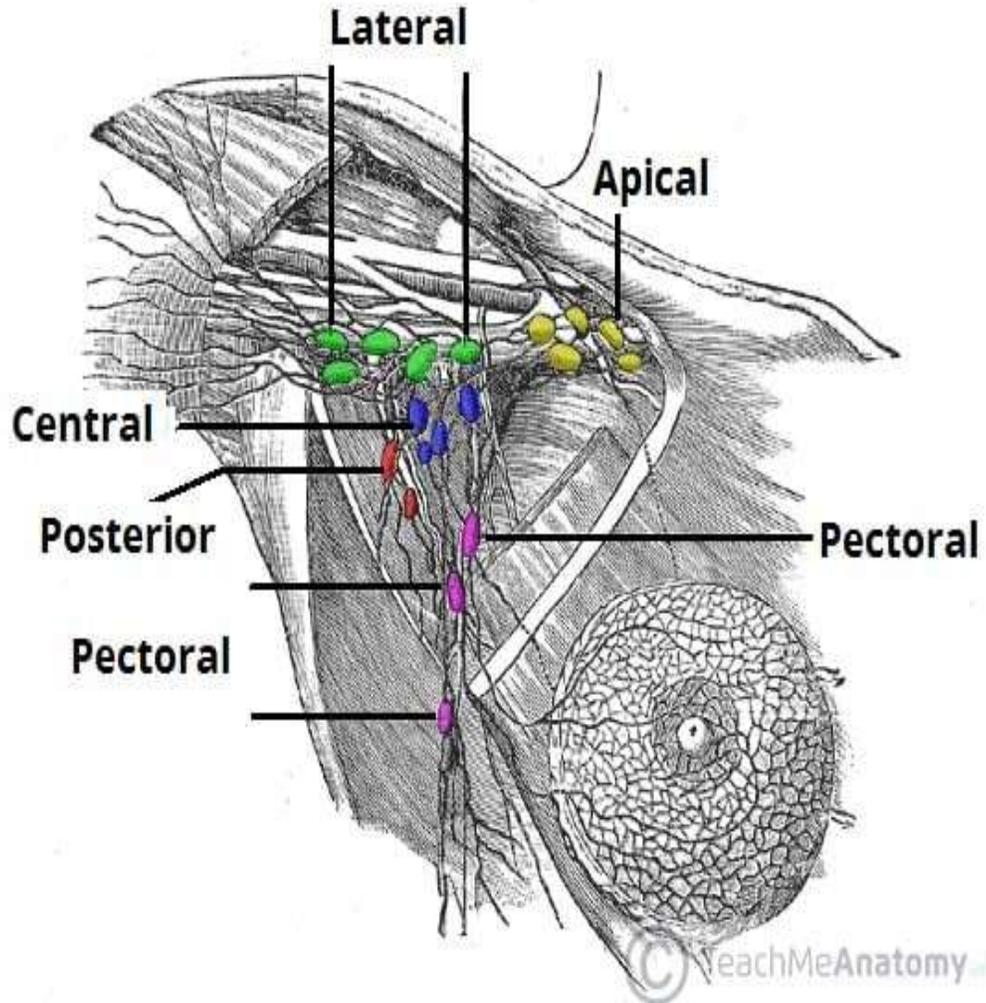
- (**75%** of the breast lymphatic drainage) : The lymph channels extend along the inferior edge of the **pectoralis major** to reach the pectoral group of the axillary nodes. The lymphatics further drain to the central and apical axillary nodes and finally to the deep cervical and the subclavian nodes.

- **Internal mammary** pathway:

- (**20%** of the breast lymphatic drainage) : The lymphatics originate from both the lateral and medial halves of the breast and pass through the **pectoralis major** to drain to the parasternal nodes

- **Retromammary** pathway:

- (**5%** of the breast lymphatic drainage) : The lymphatic drainage comes from the posterior portion of the breast. The lymphatics may reach the sheath of **the rectus abdominis** and the subperitoneal and subhepatic plexuses



Axillary Lymph Nodes

They are arranged into **5** groups which lie in axillary fat :

1. **Pectoral (Anterior) group** : which lies on the pectoralis minor along lateral thoracic vessels.
2. **Subscapular (Posterior) group** : which lies on posterior wall of axilla on lower border of subscapularis along subscapular vessels.
3. **Brachial (Lateral) group**: lies on lateral wall of axilla along 3rd part of axillary vessels.
4. **Central group** : lies in axillary fat at the base of axilla.
5. **Apical group** : lies at apex of axilla

**** Subclavian lymph trunk:** it is formed by union of efferent lymph vessels of apical group. It usually opens in **subclavian vein**. On the left side it usually opens into thoracic duct.

Clinical Anatomy:

- **peau d'orange appearance:**

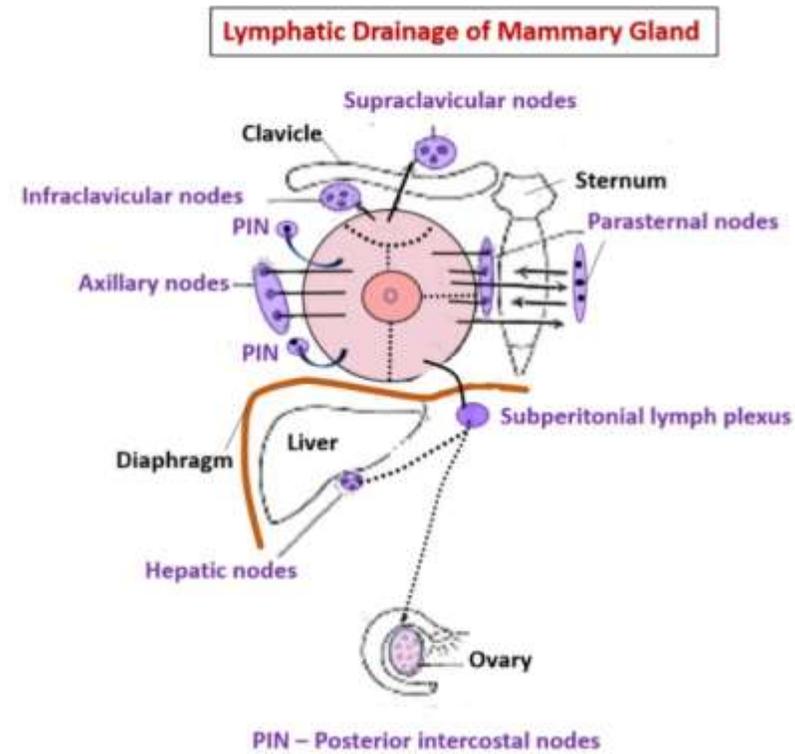
Obstruction of superficial lymph vessels leads to stagnation of lymph resulting in oedema of skin (like the skin of orange).



- krukensberg's tumor

Lymph vessels from inferomedial quadrant communicate with subperitoneal lymph plexus.

Cancer cells therefore may drop into the pelvis and produce secondary tumor in the ovary (krukensberg's tumor)



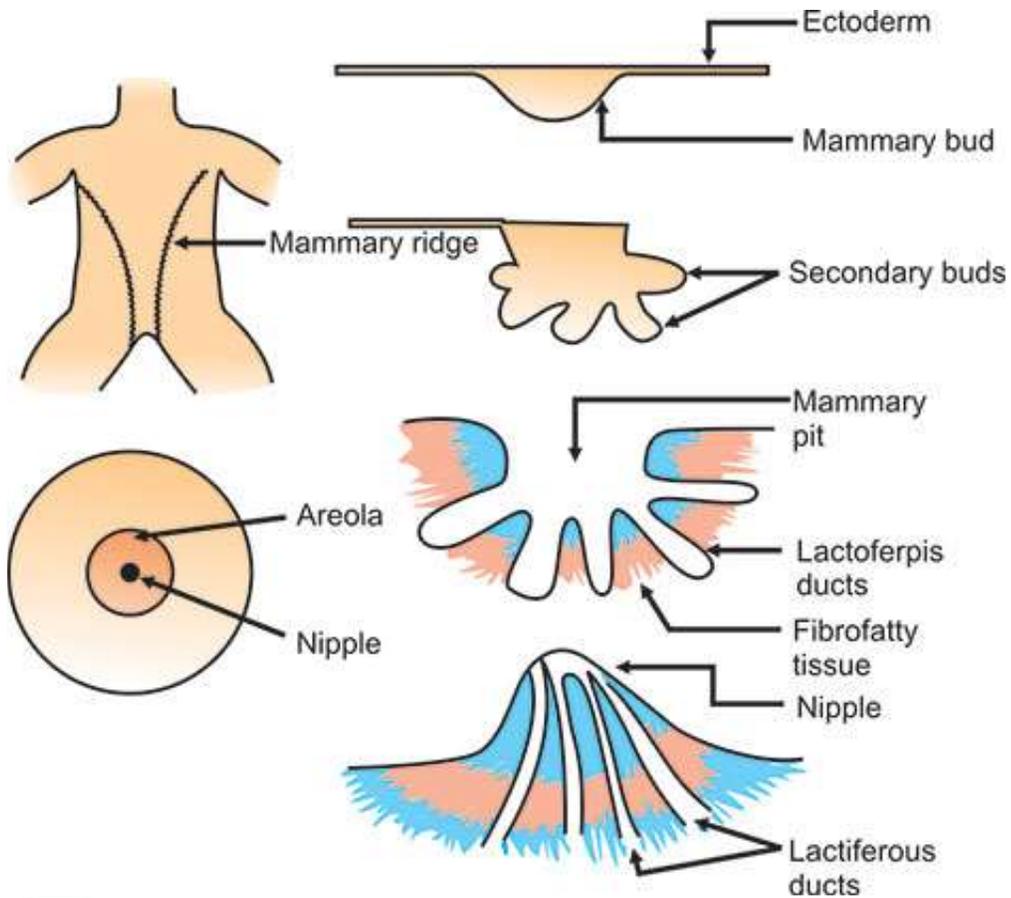


You must take these facts:

- 60% of carcinomas of breast occur in the upper lateral quadrant.
 - 75% of lymph from the breast drains into the axillary lymph nodes.
 - In case of carcinoma of one breast, the other breast and the opposite axillary lymph nodes are affected because of the anastomosing lymphatics between both breasts.
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5. Breast Development



- In the 5-week-old human fetus, an ectodermal 'milk streak' -the mammary ridge - develops along the trunk on either side from the axilla to the groin.

- In many mammals, a series of paired mammary glands develop along this ridge, but in the human it regresses to the definitive site of the adult nipple.

- This specialized epithelium buds into 15-20 branches. They first consist of solid epithelial columns, but then canalize before birth to form the lactiferous ducts.

- At the point of invagination of epithelium from the skin, there is initially a small mammary pit, but at about the time of birth it evaginates to form the definitive nipple. Failure to do so results in a congenitally inverted nipple, which may be unilateral or bilateral, and is not uncommon.

- The epithelial system becomes surrounded by invading mesenchyme, which develops into the supporting connective tissue and fat of the breast.

Stages of Development

From birth until puberty:

- The breast consists of lactiferous ducts, with no alveoli.
- At puberty, the ducts start to proliferate, and their terminations form solid masses of cells -the future breast lobules.

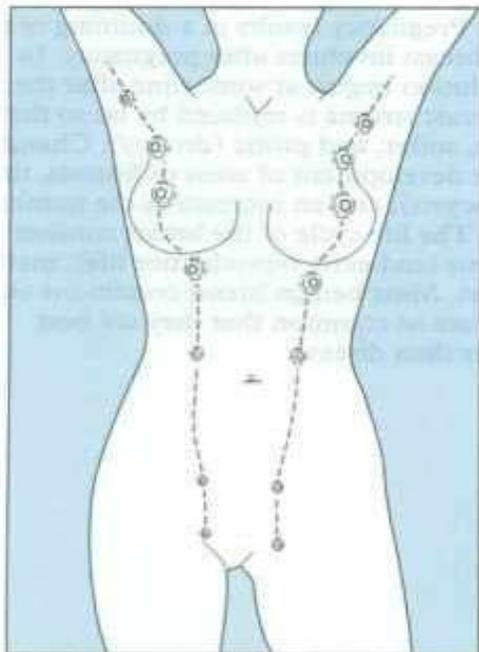
During pregnancy:

- Secreting alveoli appear.
- During the early weeks, ductal sprouting and lobular proliferation occur, with increased nipple and areolar pigmentation.
- The alveoli now display a lumen surrounded by the secretory cells.
- In the last days of pregnancy, the breasts secrete colostrum, a yellow, sticky, serous fluid, which is then replaced by true secretion of milk.
- When lactation ceases, the glandular tissue returns to its resting state.

After the menopause:

- **The glandular tissue of the breast atrophies, the connective tissue becomes less cellular, and the amount of collagen decreases.**
- **In some women, marked fatty infiltration of the breast occurs at this stage; in others, the breasts shrink considerably**

Congenital abnormalities



Usual sites of accessory nipples and breasts along milk lines.

Extra nipples and breasts

Between 1% and 5% of men and women have supernumerary or accessory nipples or, less frequently, supernumerary or accessory breasts. These usually develop along the milk line: the most common site for accessory nipples is just below the normal breast, and the most common site for accessory breast tissue is the lower axilla. Accessory breasts below the umbilicus are extremely rare. Extra breasts or nipples rarely require treatment unless unsightly, although they are subject to the same diseases as normal breasts and nipples.



Patients with an accessory nipple (left) and bilateral accessory breasts (right).



Left breast hypoplasia.



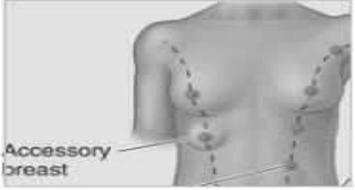
Breast asymmetry.

Absence or hypoplasia of the breast

One breast can be absent or hypoplastic, usually in association with defects in pectoral muscle. Some degree of breast asymmetry is usual, and the left breast is more commonly larger than is the right. True breast asymmetry can be treated by augmentation of the smaller breast, reduction or elevation of the larger breast, or a combination of procedures.

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- **Accessory nipples (polythelia)**, are not uncommon along the milk line and are most often found on the chest wall below the breast. These form due to a failure of the regression of the milk streak.
 - **Inverted nipples** are not uncommon, and they are caused by a failure of the evagination of the small mammary pit at birth.
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- **❑ Accessory mammary glands** (polymastia), also due to a failure of the milk line to completely atrophy, are usually found in the axilla and cause the patient to complain of a mass or pain in this area.
 - **❑ Absence of the breast** (amastia) is a rare congenital anomaly; it occurs as a result of an arrested mammary ridge at about the 6th week of gestation.
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<p>1 Polythelia</p>		<p>Presence of accessory nipples.</p>
<p>2 Polymastia or polymazia</p>		<p>Presence of accessory breast tissue.</p>
<p>3 Symmastia</p>		<p>Webbing between the breasts, at the midline.</p>
<p>4 Athelia</p>		<p>Congenital absence of nipples.</p>
<p>5 Amastia</p>		<p>Congenital absence of the breast and nipple.</p>
<p>6 Amazia</p>		<p>Breast tissue – Absent Nipple , Areola – Present</p>



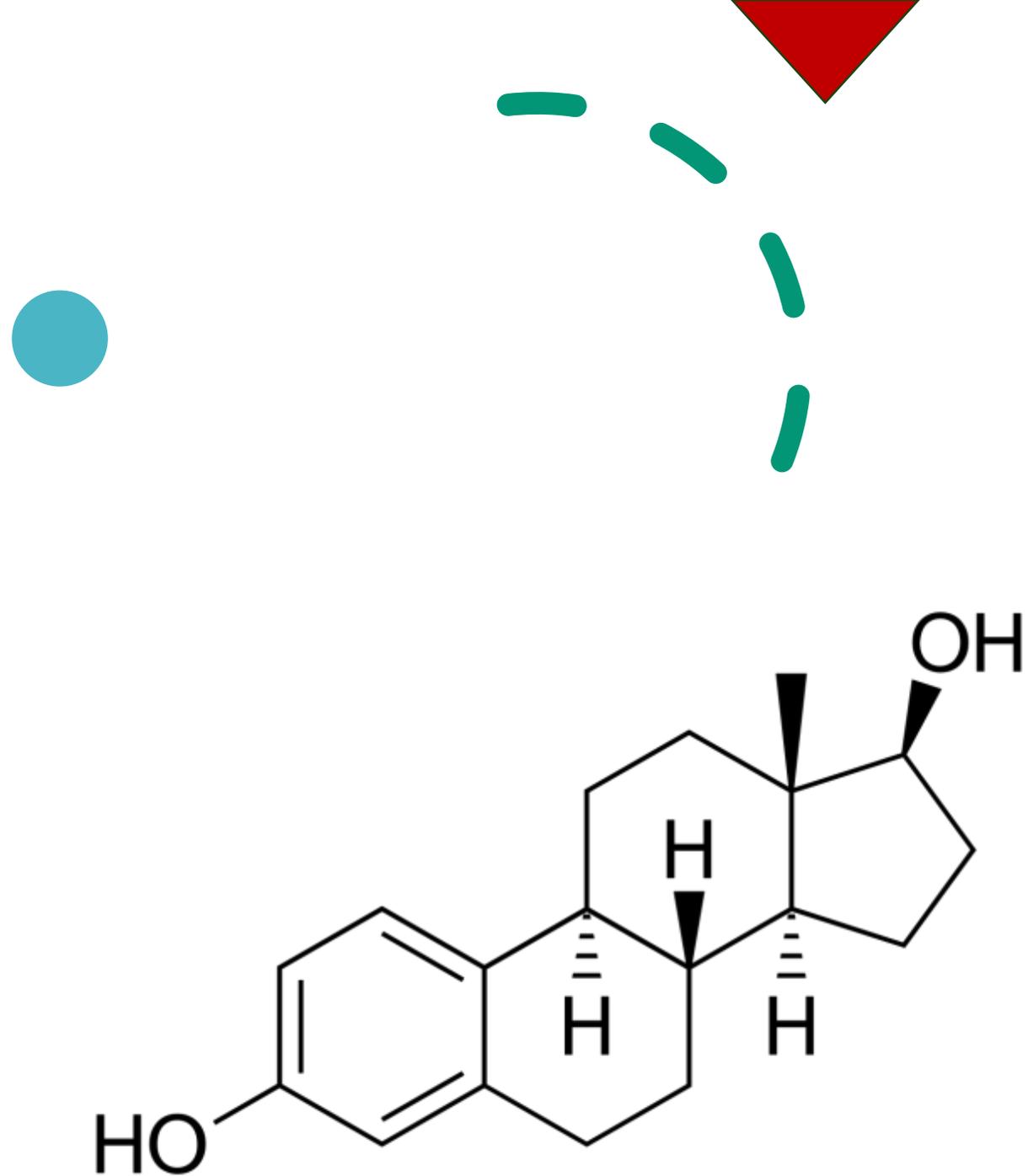
7. Breast Physiology

- ❑ The breast is an organ specialized for milk formation (lactation), including *synthesis, secretion and ejection* of milk
 - ❑ The secretory units of the breasts are the **alveoli**
 - ❑ A complex network of hormones and growth factors controls the production of milk by these *secretory units*.
 - ❑ The fluctuation of these hormones results in important histologic changes in the breast during pregnancy and during the menstrual cycle.
- ❑ During pregnancy, the breasts may become larger, feel tender, the veins become more visible and nipples may darken and stand out.
- ❑ Changes during menstrual cycle include enlargement, pain, the breasts become very lumpy, changes in texture; this is because the glands in the breasts enlarge to get ready for possible pregnancy.

- Estrogen and progesterone produced by ovaries placenta during pregnancy, small amounts of these hormones produced by adrenal glands

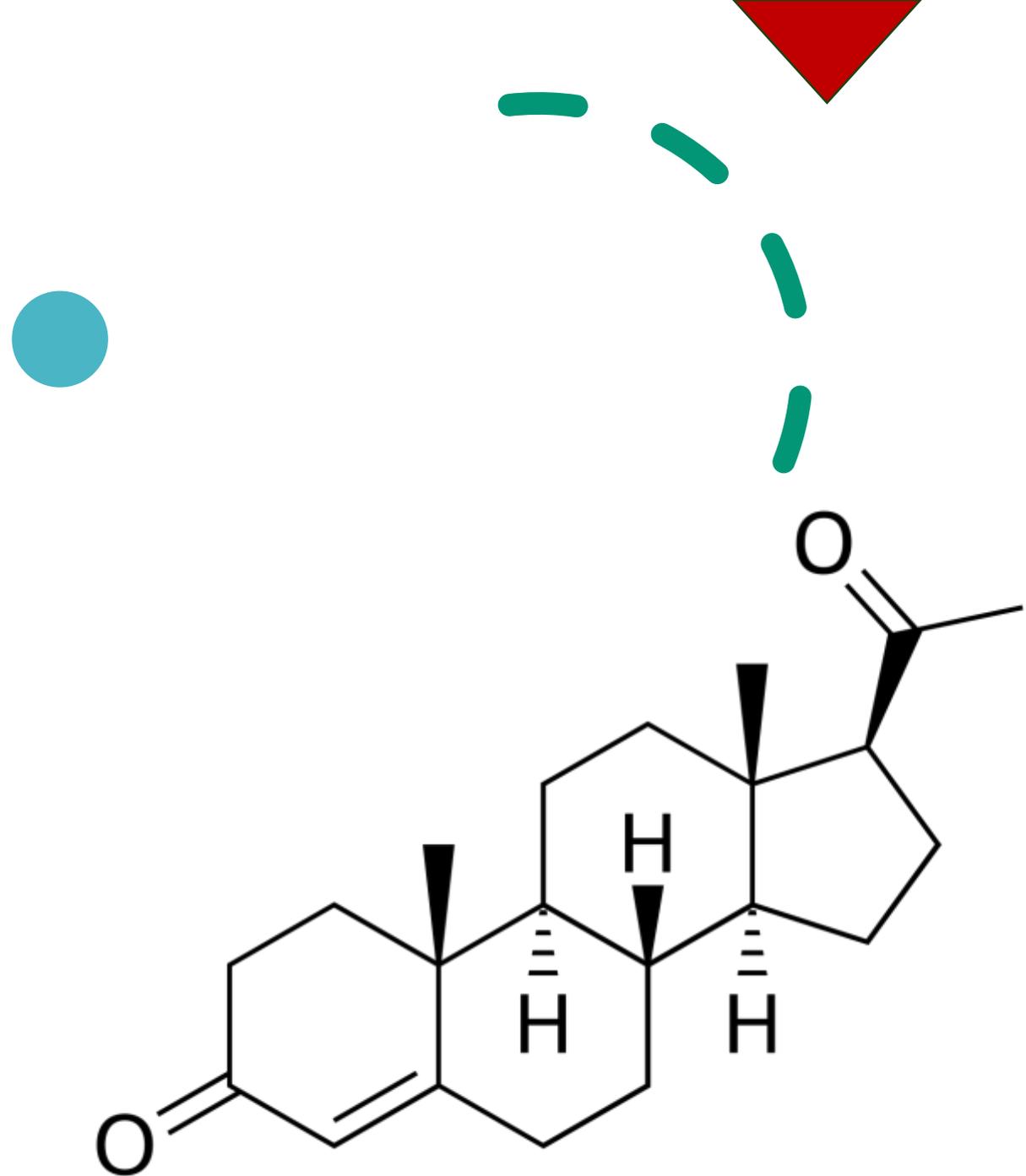
Estrogen:

- ❑ The **main** female hormone responsible for breast development and maintenance.
- ❑ Growth of the ductal system and also maturation and prominence of the nipples, resulting in proliferation of the ductal epithelium, myoepithelial cells and surrounding stroma.
- ❑ Estrogen is lipid soluble and in a woman's body is made by the ovaries and to a lesser extent by the adrenal glands.
- ❑ It is stimulated to act in the presence of other hormones such as hydrocortisone, insulin-like GFs and growth hormones.



Progesterone:

- ❑ Released by the **ovaries** and induces development of the terminal ducts and lobulo-alveolar structures.
- ❑ Similar to estrogen, it needs the presence of the other hormones, such as *growth hormones and insulin*, to respond.
- ❑ Both estrogen and progesterone can increase connective tissue and fat in the breast, thereby leading to the rounded form of the fully developed breast



Hormone (others)	Action	Notes
<p>Prolactin</p> <p>**produced by pituitary gland</p> <p>**promoted by estrogen and inhibited by progesterone</p>	stimulates mammary growth and differentiation and ultimately milk production	<ul style="list-style-type: none"> <input type="checkbox"/> Cooperates with estrogen in ductal development <input type="checkbox"/> Cooperate with progesterone in lobulo-alveolar development. <input type="checkbox"/> Together with cortisol and insulin prolactin helps to differentiate alveolar cells into milk-secreting cells.
<p>Oxytocin</p> <p>**produced by hypothalamus gland</p>	Contraction of myoepithelial cells, which squeezes milk out from the lobules into the lactiferous ducts.	
Lactogenic hormones	Act alongside the actions of glucocorticoids, insulin and thyroxine for milk production	<ol style="list-style-type: none"> 1. Human placental lactogen (hPL) 2. Prolactin 3. oxytocin

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- When the infant suckling the nipple, sensory impulses from the nipple will travel to the spinal nerves up to the **hypothalamus**.
 - The **hypothalamus** will send electrical signals to the **posterior pituitary gland** thereby the stored oxytocin will release causes the contraction of myoepithelial cells in the breast pushing milk from the alveoli, through the milk ducts and toward the nipple.
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THANK YOU

لا تنسوا أهلنا في غزّة