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Breast Anatomy

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Lecture Plan

- Breast Anatomy
  - Structure
  - Anatomical Changes
  - Neurovasculature
  - Lymphatic Drainage & Clinical

Learning Outcomes

➢ Macro Learning Outcomes:

- M2.I.COR.ANA2 – Describe the structure and histology of the breast and associated clinical abnormalities.

➢ Micro Learning Outcomes:

- Describe the structural components of the breast and nipple, including the histological components.
- Outline the changes to the breast during development and in later life.
- Describe the changes to the breast related to pregnancy and lactation.
- Outline the neurovasculature of the breast.
- Describe the lymphatic drainage of the breast and its related clinical conditions.
- Describe the clinical signs of clinical abnormalities related to the breast.

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Breast Anatomy
Structure

The Breast: Position and Structure

Paired structures on the anterior thoracic wall

Composed of **mammary glands** (modified sweat glands capable of producing milk), surrounded by a **connective tissue stroma**

Surface anatomy

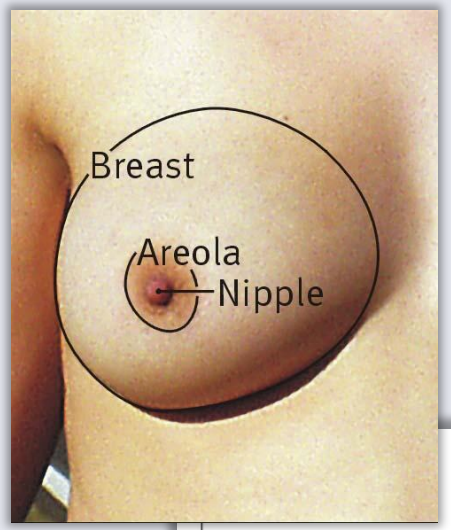
- **Horizontally** – Lateral border of sternum to mid-axillary line
- **Vertically** – Between 2nd-6th costal cartilages

- **Submammary/retromammary space** separates the breast from the chest wall muscles, providing a degree of movement

Regions include a **circular body** and **axillary tail (tail of Spence)**

Clinically divided into **quadrants**

Location of abnormalities often described relative to a **clock face**



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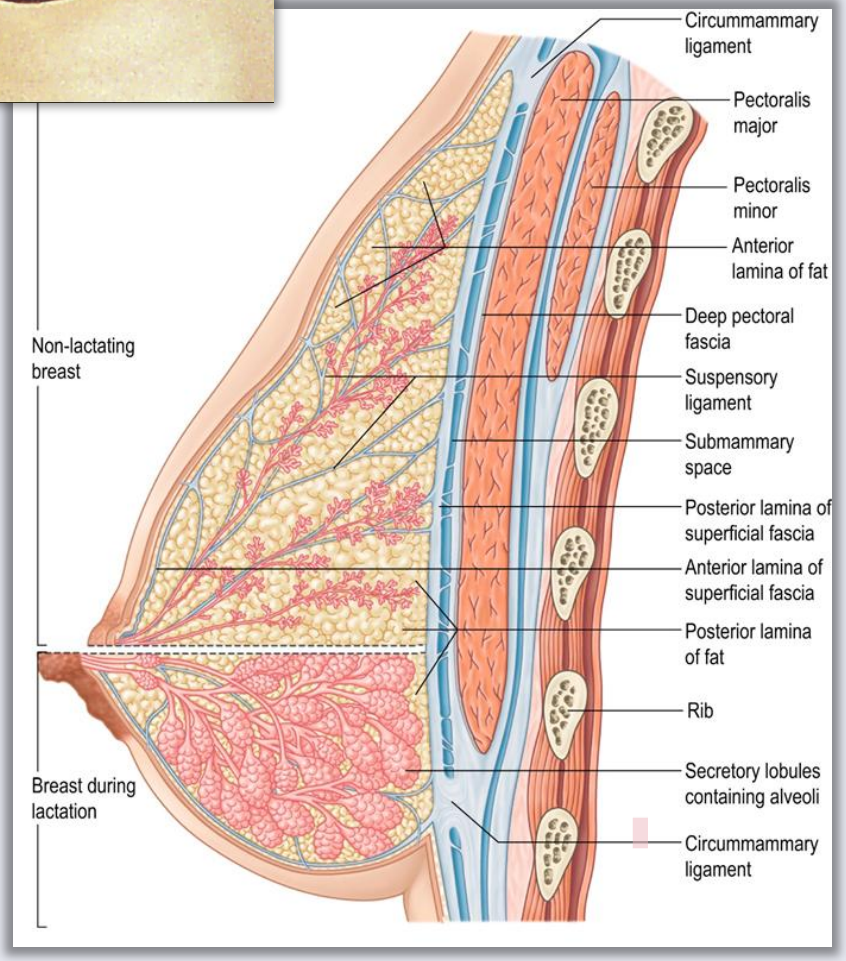
QUESTION: What factors may influence breast shape and size?



The Breast: Structure and functional components

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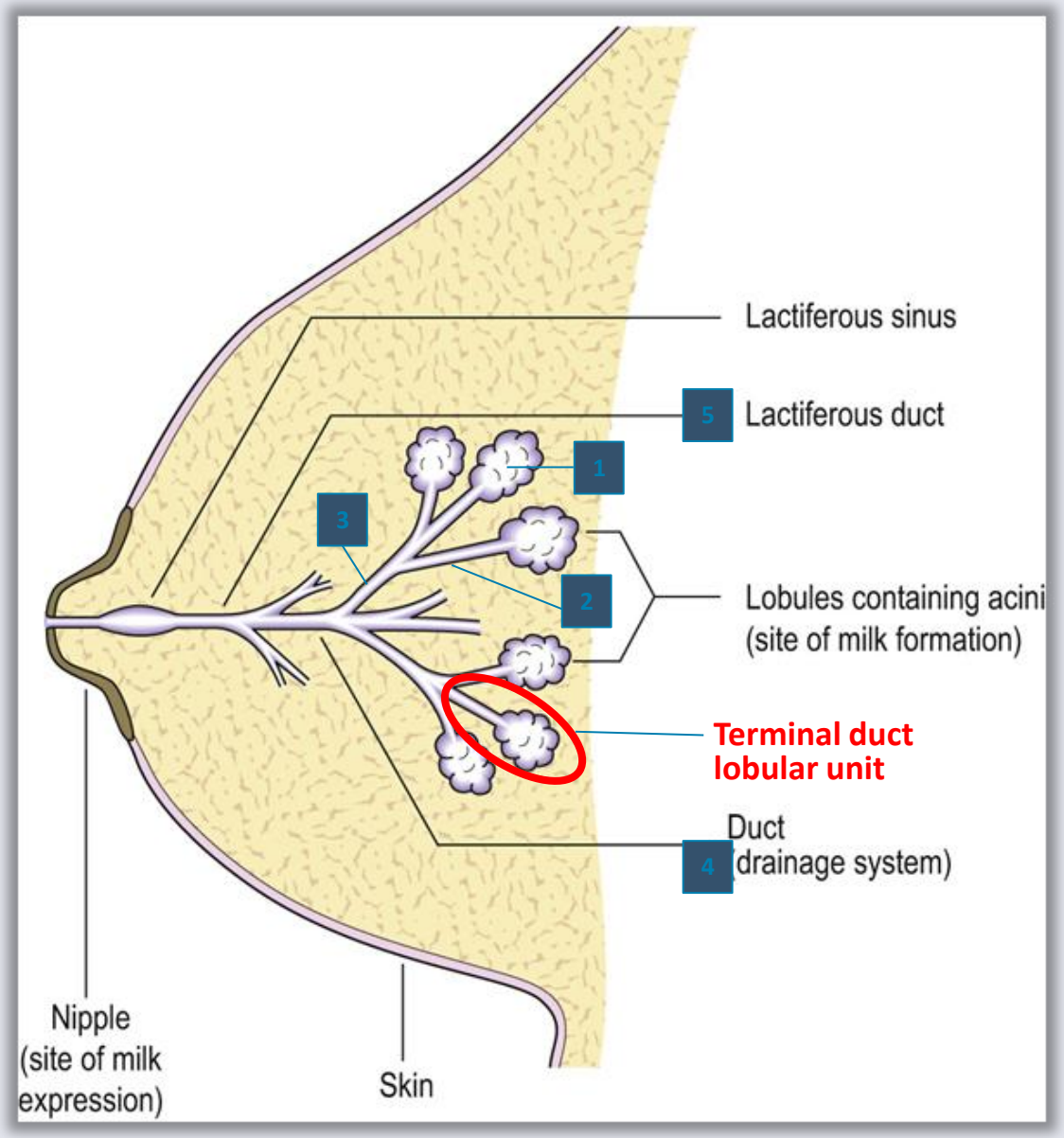


Two major breast parenchyma structures: Ducts & lobules

Two types of epithelial cells: Luminal epithelial & myoepithelial

Two types of stroma: **Inter**lobular & **intra**lobular

Breast lobes:

Each breast contains **12-20** secretory lobes

Each secretory lobe contains **20-40** lobules

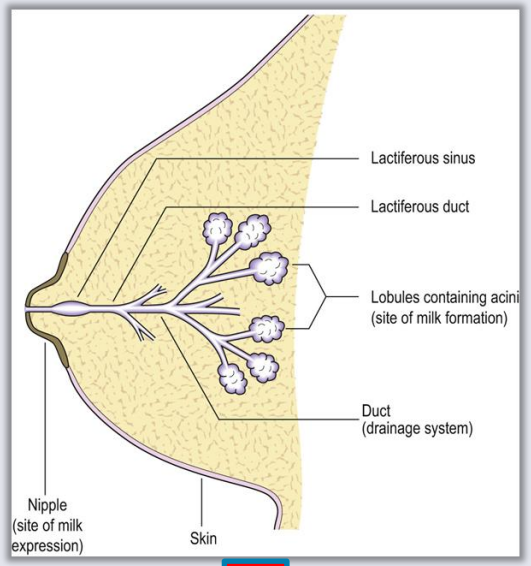
Each lobule contain **10-100** acini/alveoli

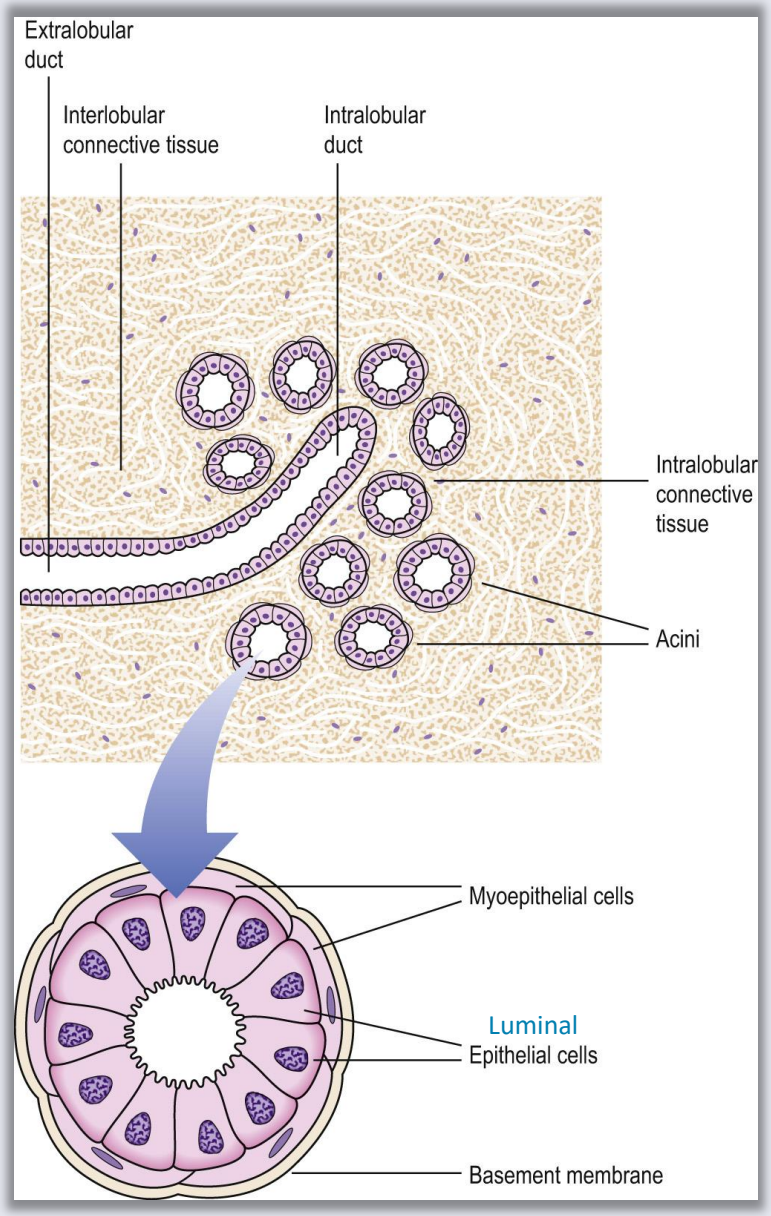
Duct system overview:

1. Intralobular terminal duct (within lobule)
2. Extralobular terminal duct (outside lobule)
3. Subsegmental duct
4. Segmental duct
5. Lactiferous duct

Terminal duct lobular unit (TDLU) = A terminal duct + a lobule

The Breast: Structure





Each TDLU contains:

- Acini (ductules)
- Terminal duct
- Intralobular stroma

Two types of cells exist within the acini:

1. Inner **luminal epithelial cells**
   - Columnar/cuboidal in shape
   - Secretory cells (produce milk)

2. Outer **myoepithelial cells**
   - Contract to assist luminal epithelial cells to express milk. Sit on a **basement membrane ,**enveloped by **stroma**

Interlobular stroma: Surrounds large ducts and TDLUs. Dense and collagenous.

Intralobular stroma: Surrounds acini *within* TDLUs. Loose, contains fibroblasts/ inflammatory cells

In malignancy, transgression of myoepithelial layer and basement membrane by tumour cells defines **invasion**

The Breast: Normal Histology

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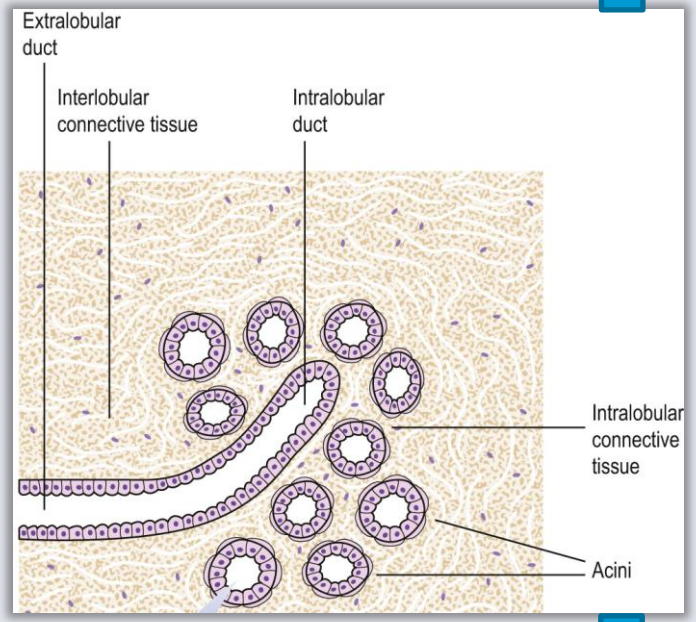
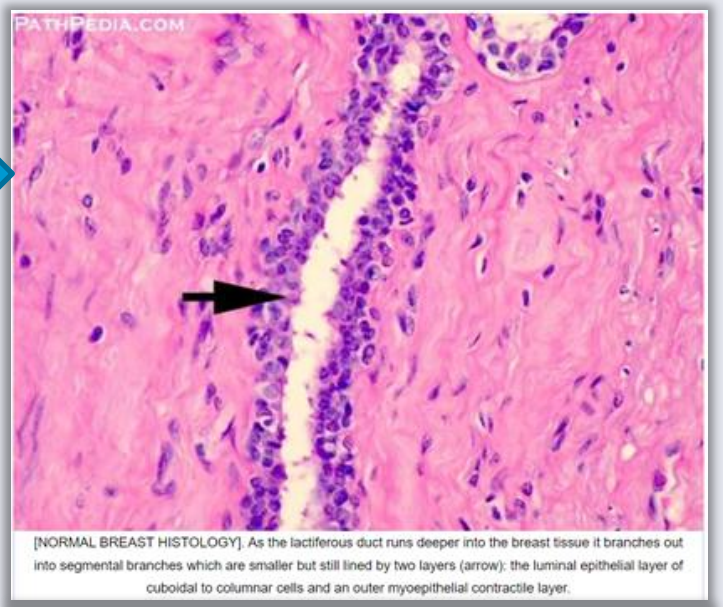
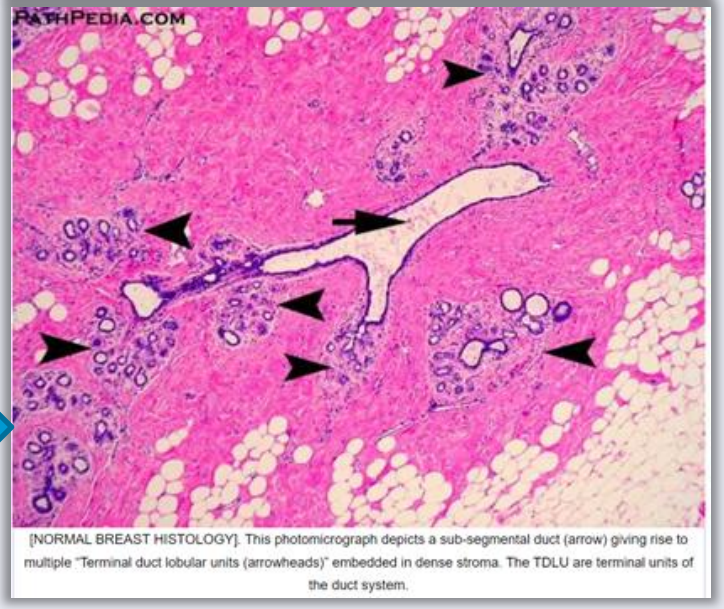
https://www.pathpedia.com/education/eatlas/histology/breast.aspx - Histology Images

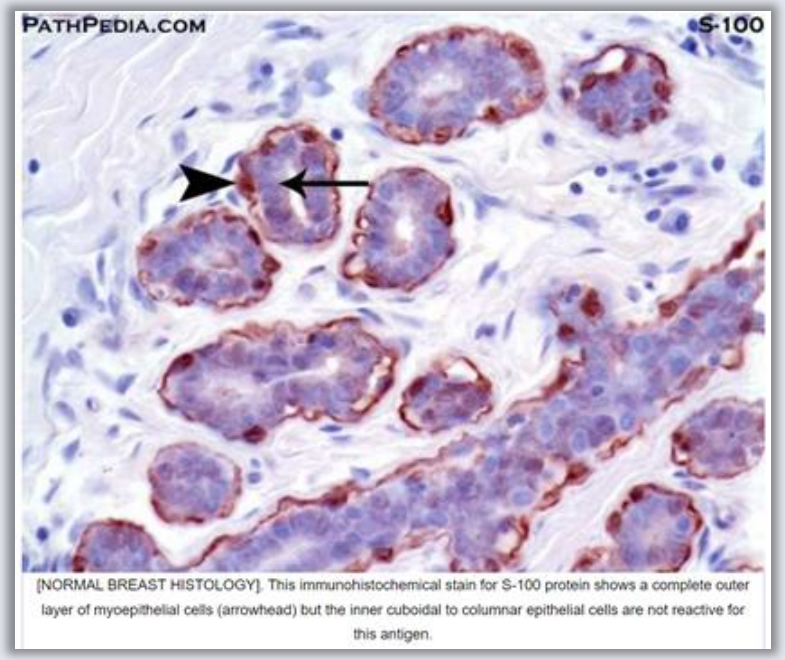




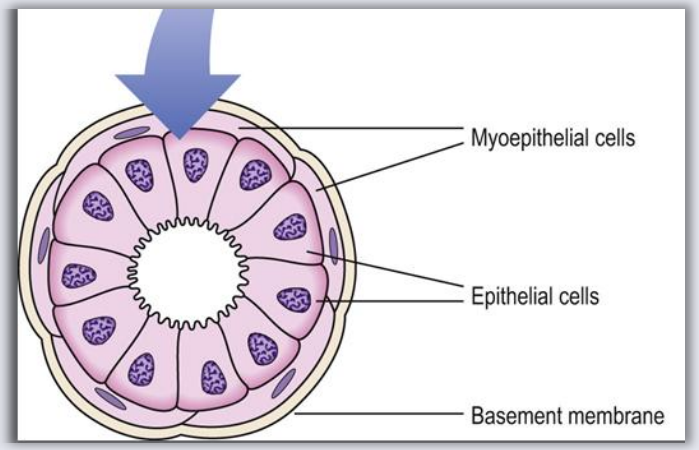
[NORMAL BREAST HISTOLOGY]. As the lactiferous duct runs deeper into the breast tissue it branches out into segmental branches which are smaller but still lined by two layers (arrow): the luminal epithelial layer of cuboidal to columnar cells and an outer myoepithelial contractile layer.



[NORMAL BREAST HISTOLOGY]. This photomicrograph depicts a sub-segmental duct (arrow) giving rise to multiple "Terminal duct lobular units (arrowheads)" embedded in dense stroma. The TDLU are terminal units of the duct system.



[NORMAL BREAST HISTOLOGY]. This immunohistochemical stain for S-100 protein shows a complete outer layer of myoepithelial cells (arrowhead) but the inner cuboidal to columnar epithelial cells are not reactive for this antigen.



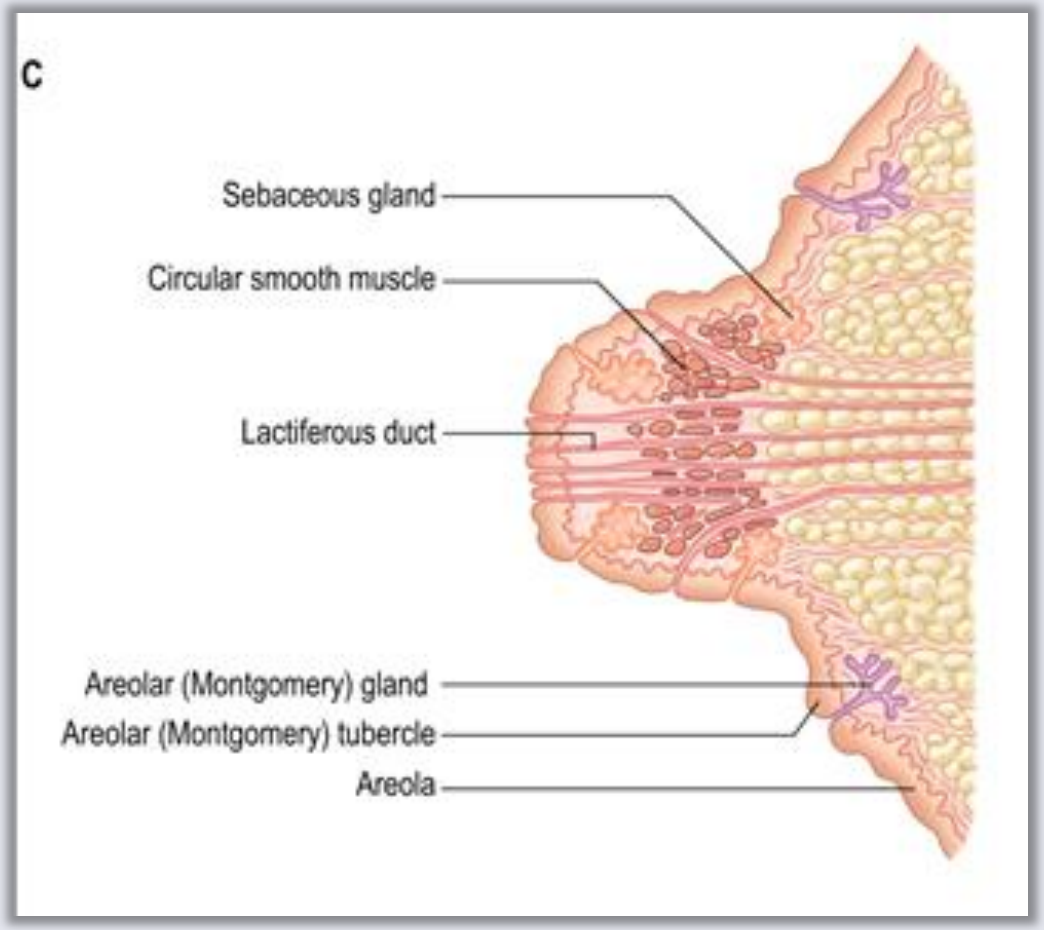
Shotgun Histology (video)
https://www.youtube.com/watch?v=0iNzWo2jW-8

The Breast: The Nipple

Variable shape/appearance (be suspicious of a newly inverted nipple)
Approximate (variable) position**: 4th intercostal space**.
The 15-20 lactiferous ducts converge, draining through a *smaller* number of openings on the nipple itself
NB - Keratin debris can block these openings during breastfeeding.

Contains concentric circles of **smooth muscle**
- Responsible for nipple erection
- Assists with milk ejection during breast feeding

Surrounded by the **areola**
Pigmented area of skin
Age, race, hormonal changes and parity affect size and colour
Montgomery glands and **apocrine sweat glands** open on to its surface
Hair follicles reside around its edge



The Breast: Overview of structural components

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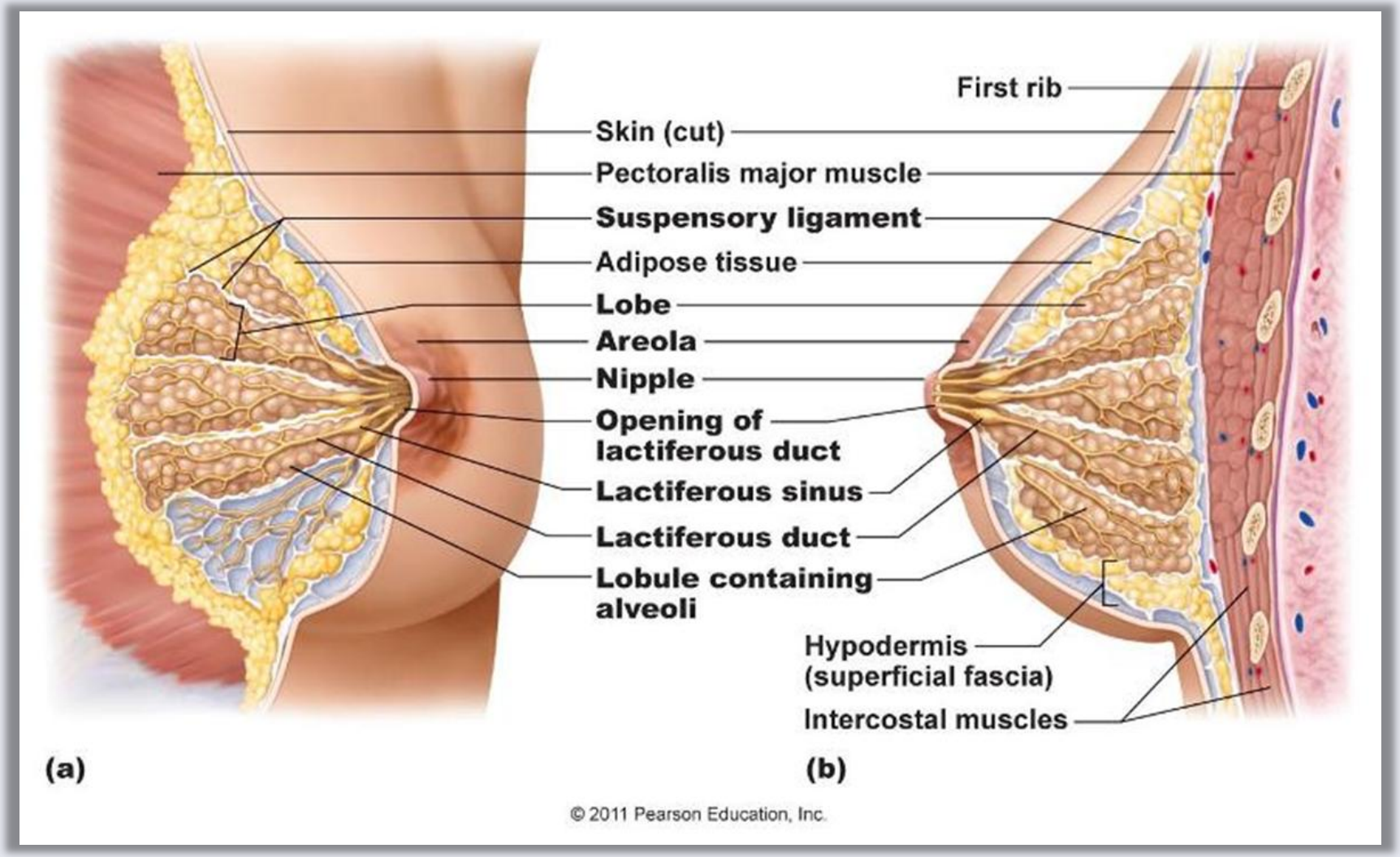

Review in Complete Anatomy

https://3d4medic.al/HJK0SbCf

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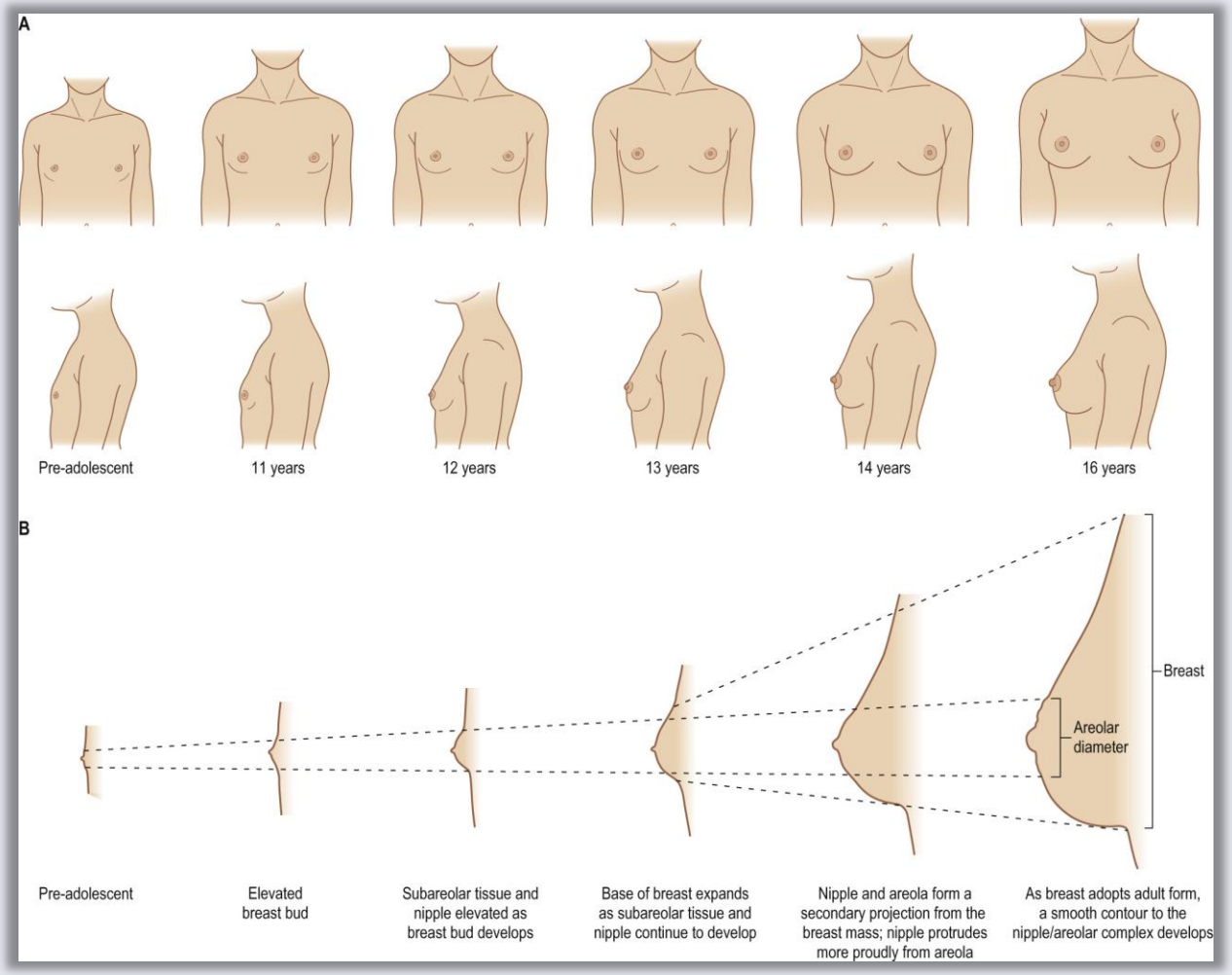
Breast Anatomy
Anatomical Changes

The Female Breast: Changes during puberty



Breast development begins approx. **11 years of age**

Takes between **3 and 5 years** to complete

Tanner staging describes typical changes observed

Parenchyma (functional units of breast)

Ducts elongate and develop their branching appearance

The **inner luminal layer** further differentiate into ductal luminal epithelial cells (lining the ducts) and alveolar luminal cells (capable of secretory function)

Increased numbers of **alveoli**

Histological changes:

Stroma

Increase in size and elasticity of the **connective tissues**

Enhanced **vascularity** and **adiposity**

The Female Breast: Changes during pregnancy & lactation

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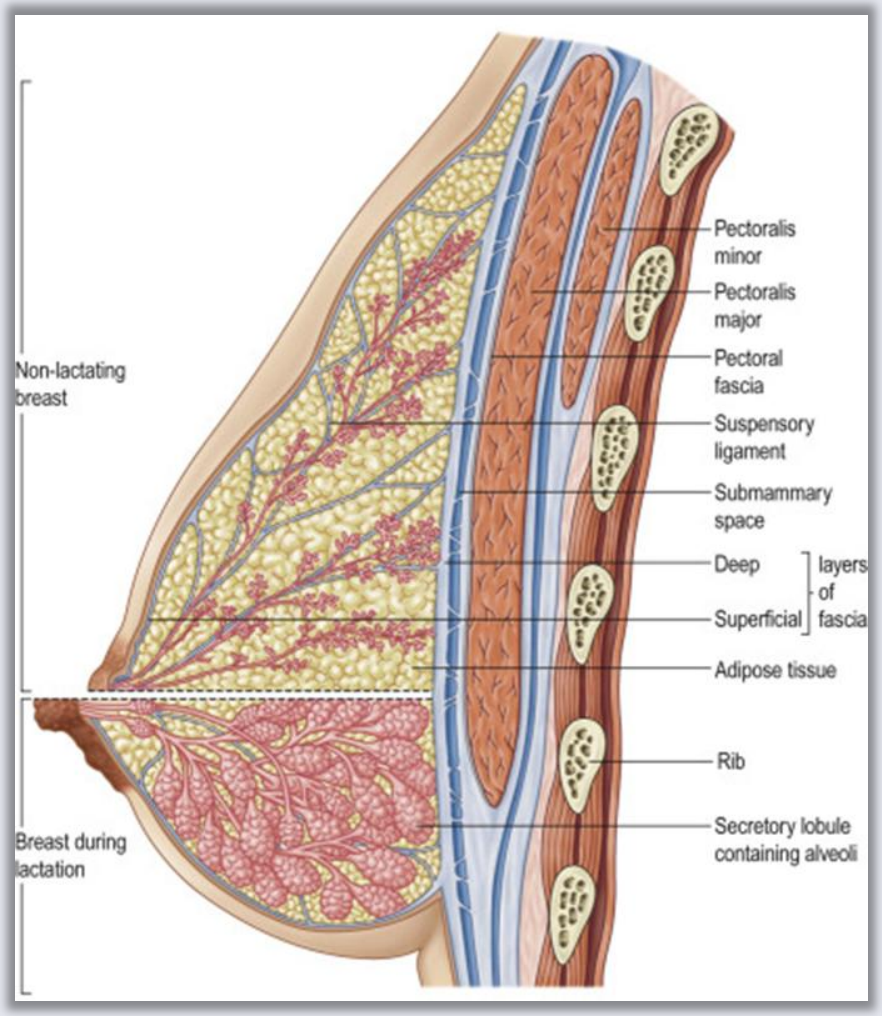
QUESTION:
What micro- and macroscopic changes are found within the breast during pregnancy and breastfeeding?

Pregnancy/Lactation: Microscopic changes

Further duct and lobule formation
Secondary and tertiary ductal branching formation
Increased numbers of secretory acini
Increase in alveoli numbers and individual size
Reduction in the stromal adipose tissue

Pregnancy/Lactation: Macroscopic changes

Significant breast enlargement
Dilation of superficial veins
Increased pigmentation of the nipple/areolar complex

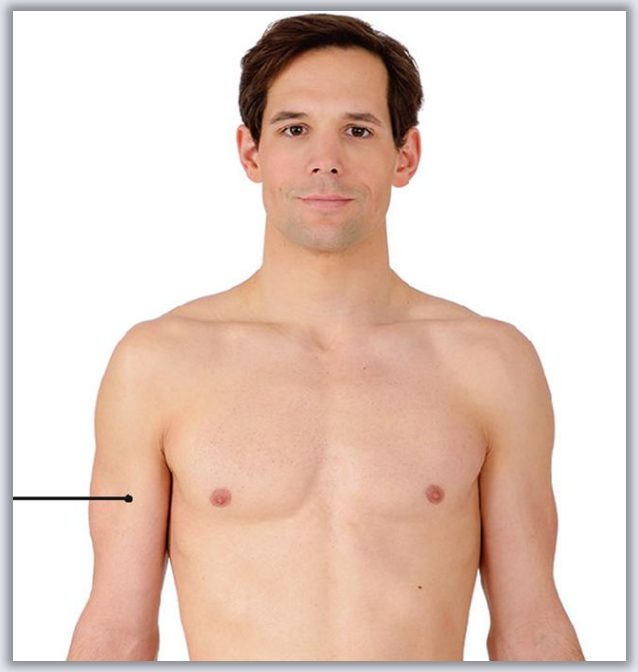


Lactation

Lactation usually begins at 1–4 days post-partum (prolactin and oxytocin dependent)
When lactation ceases, involution and atrophy of the glandular tissue occurs due to apoptosis of epithelial cells. This, alongside increased adipocyte deposition, returns the breast to a pre-pregnant state

The Breast: Male

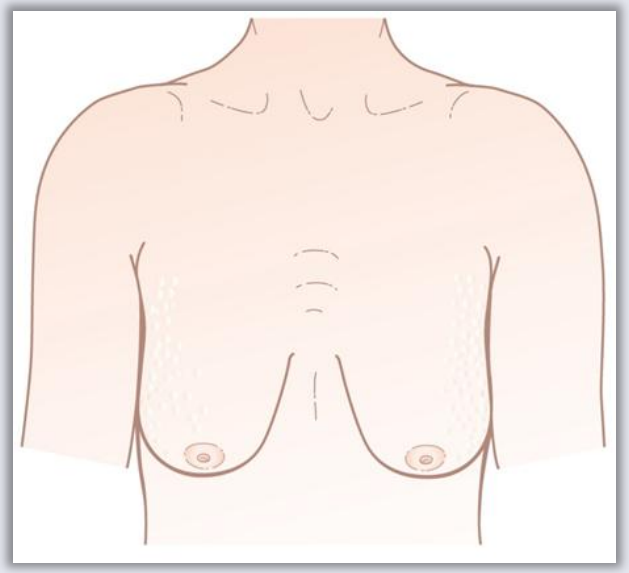
QUESTION:
What anatomical differences exist between the male and female breast?



- The male breast is mostly undeveloped.
- Consists of small ducts and some supporting connective tissue.
- Ducts do not extend beyond the areola.
- Areola is well developed but the nipple is relatively small.
- It **does** contain small amount of glandular tissues and is **therefore still susceptible to breast cancer**.

The Breast: At Menopause

Decreased overall volume of the breast
Involution of the glandular breast tissue.
Increased deposition of fatty tissue
Regression of stromal connective tissues



QUESTION:
What anatomical changes occur in the post-menopausal female breast?

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Breast Anatomy
Neurovasculature

The Breast: Blood and nerve supply

Arterial supply:

- **Medially:** Internal thoracic artery
- **Laterally:** Branches of axillary artery (& lateral thoracic artery)
- **Perforating chest wall:** 2nd- 4th IC arteries

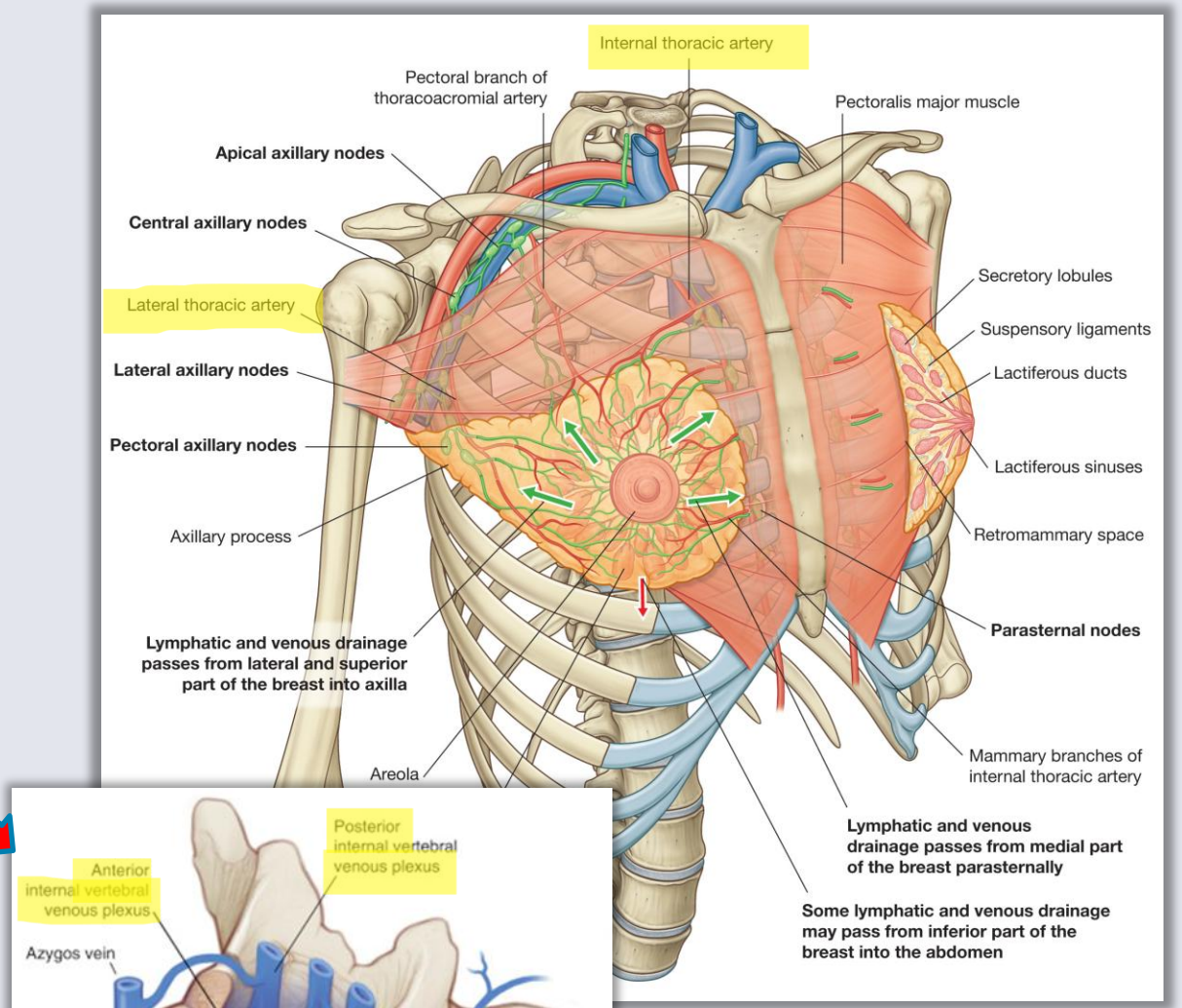
Venous drainage:

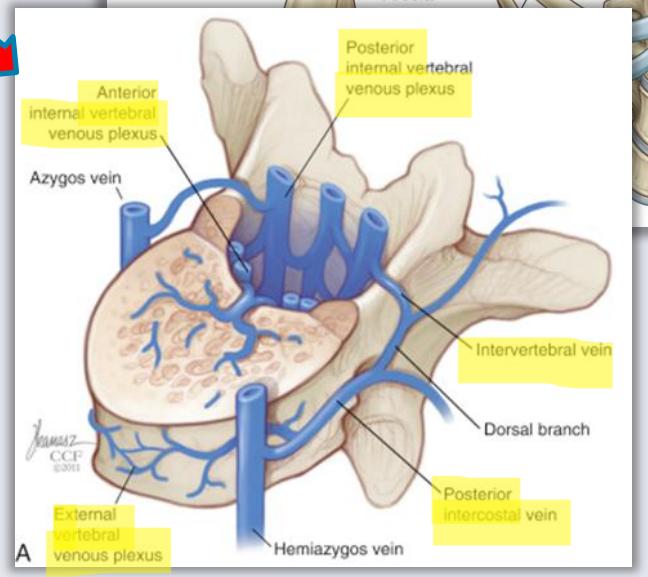
- Parallels arterial supply
- Common route of metastases to **lungs, bone, liver and brain**

BATSONS VENOUS PLEXUS

Sensory innervation:

- **Anterior skin** >> 2nd-6th IC nerves
- **Superior breast** >> contributions from supraclavicular nerves
- **Nipple and areola** >> mainly by 4th IC nerve (some from 3rd and 5th IC nerve)





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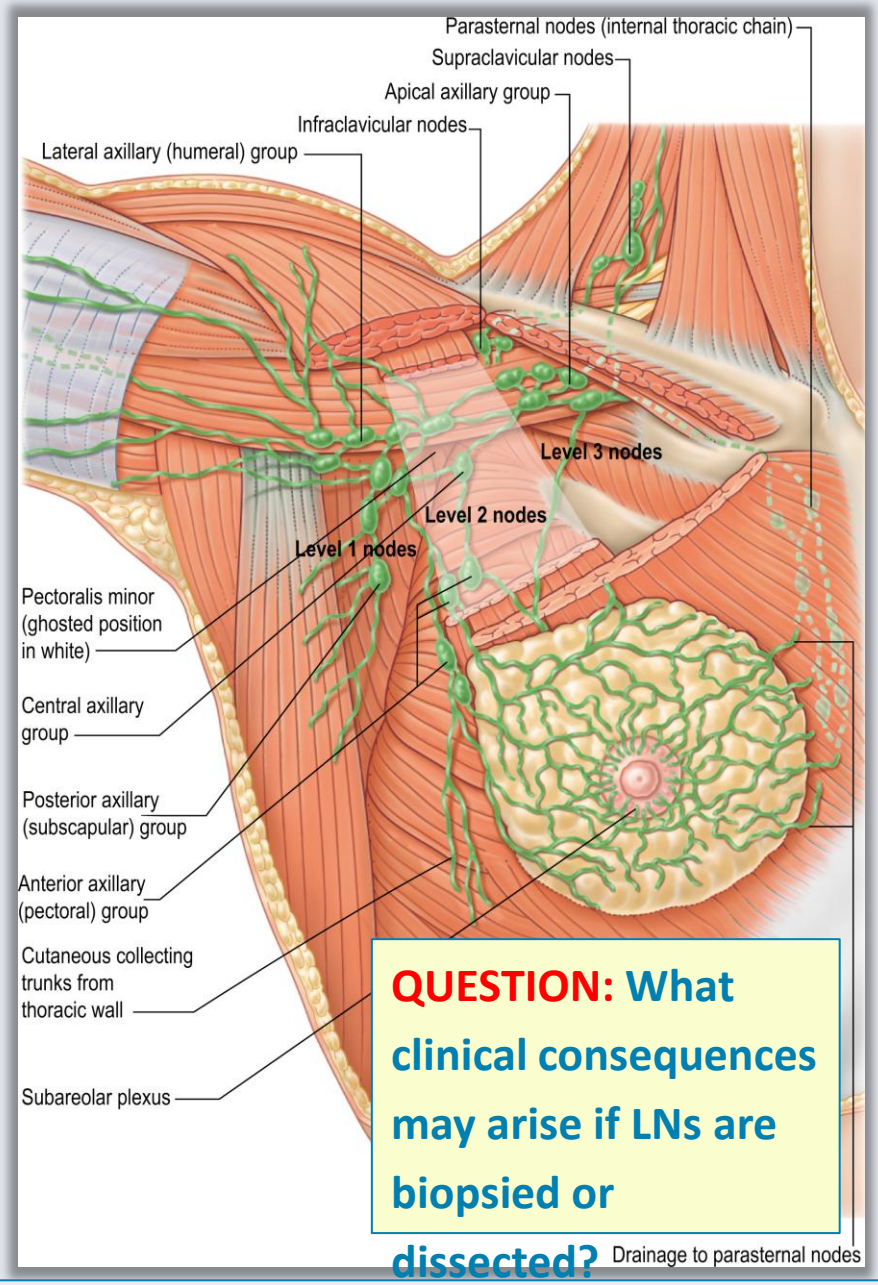
Breast Anatomy
Lymphatic Drainage & Clinical

The Breast: Lymph Drainage

Lymph nodes (LNs)	Area drained:	Drains into:	Notes
Intramammary (i.e., within breast lobules)	**Nipple and areola**	Subareolar (Sappey's) plexus	From here, lymph drains into **3 main pathways** (see 1. 2. and 3. below)
1.Axillary (also called pectoral)	**>75%** of total breast (Particularly **lateral/ superior** quadrants)	Subclavian lymph trunk	**Anterior** LNs receive the majority of lymph so is most commonly the **sentinel node**
2.Parasternal (also called internal mammary)	**20-25%** of total breast (Particularly **medial** quadrants)	Bronchomediastinal lymph trunk	Breast ca typically metastasises to **contralateral breast** via this route
3.Retromammary	**Deep** portion of breast	Sunclavicular plexus	-
OTHER – Subdiaphragmatic (also called inferior phrenic)	Small proportion (Particularly **inferio-medial** quadrant)	Abdomen	Commonly metastasises to **liver**
OTHER - Mediastinal	Small proportion (particularly **inferio-medial** quadrant)	Mediastinum	Commonly metastasises to **lungs**



QUESTION: What clinical consequences may arise if LNs are biopsied or dissected?

Surgical Levels (in relation to pectoralis minor): **Level 1** – Lateral or inferior; **Level 2** – Posterior; **Level 3** – Superior and medial

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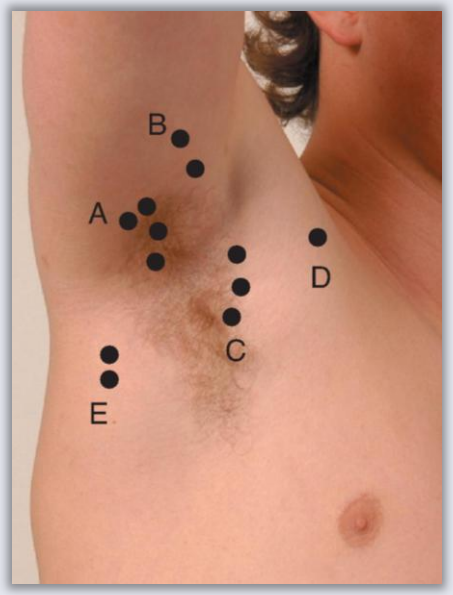
Axillary LNs

A - Central
B – Lateral/ humeral
C – Pectoral/ anterior
D - Infraclavicular
E – Posterior/ subscapular



The Breast: Clinical application of vascular and lymphatic systems

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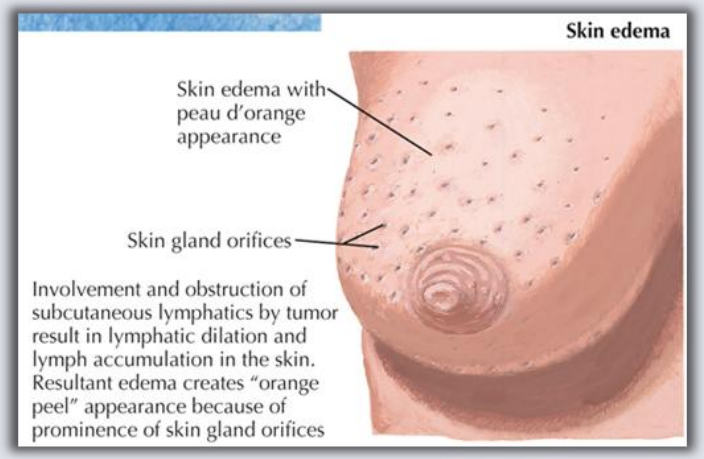
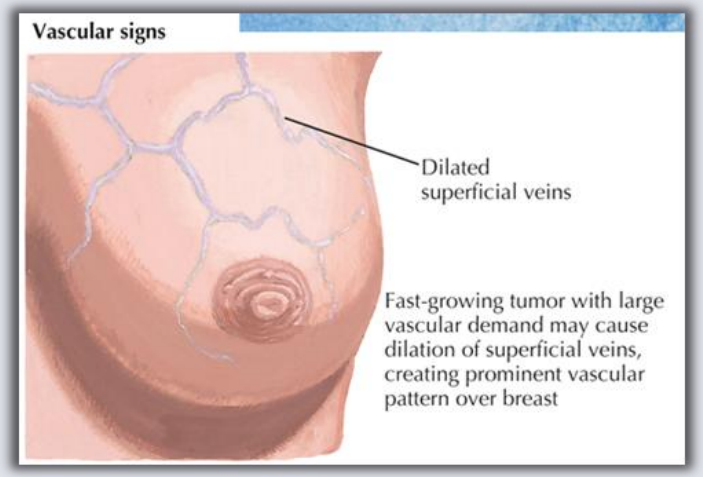
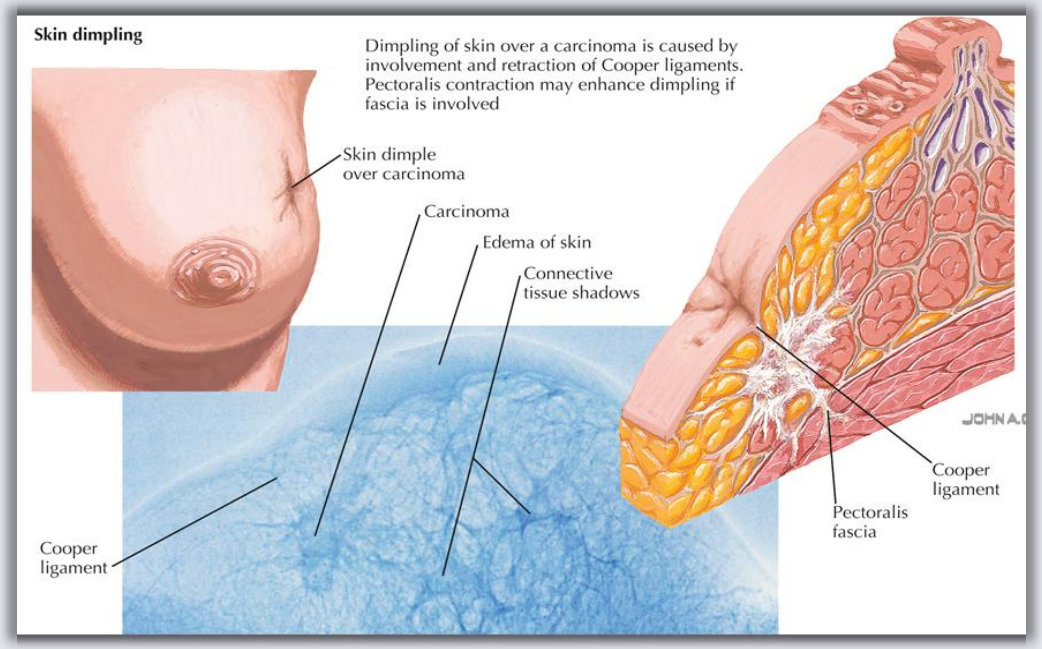
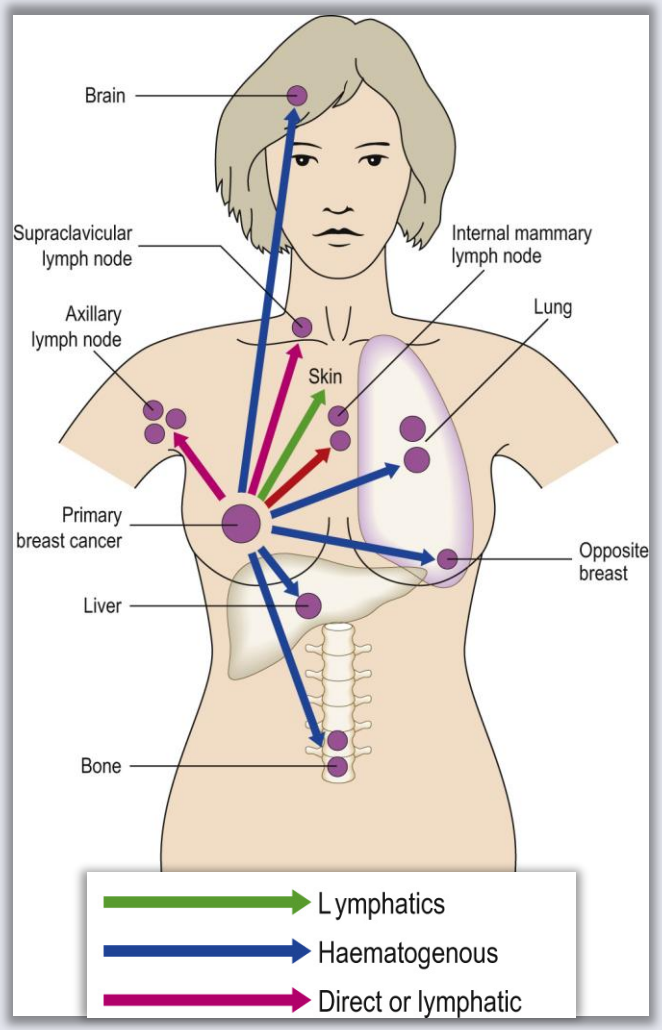


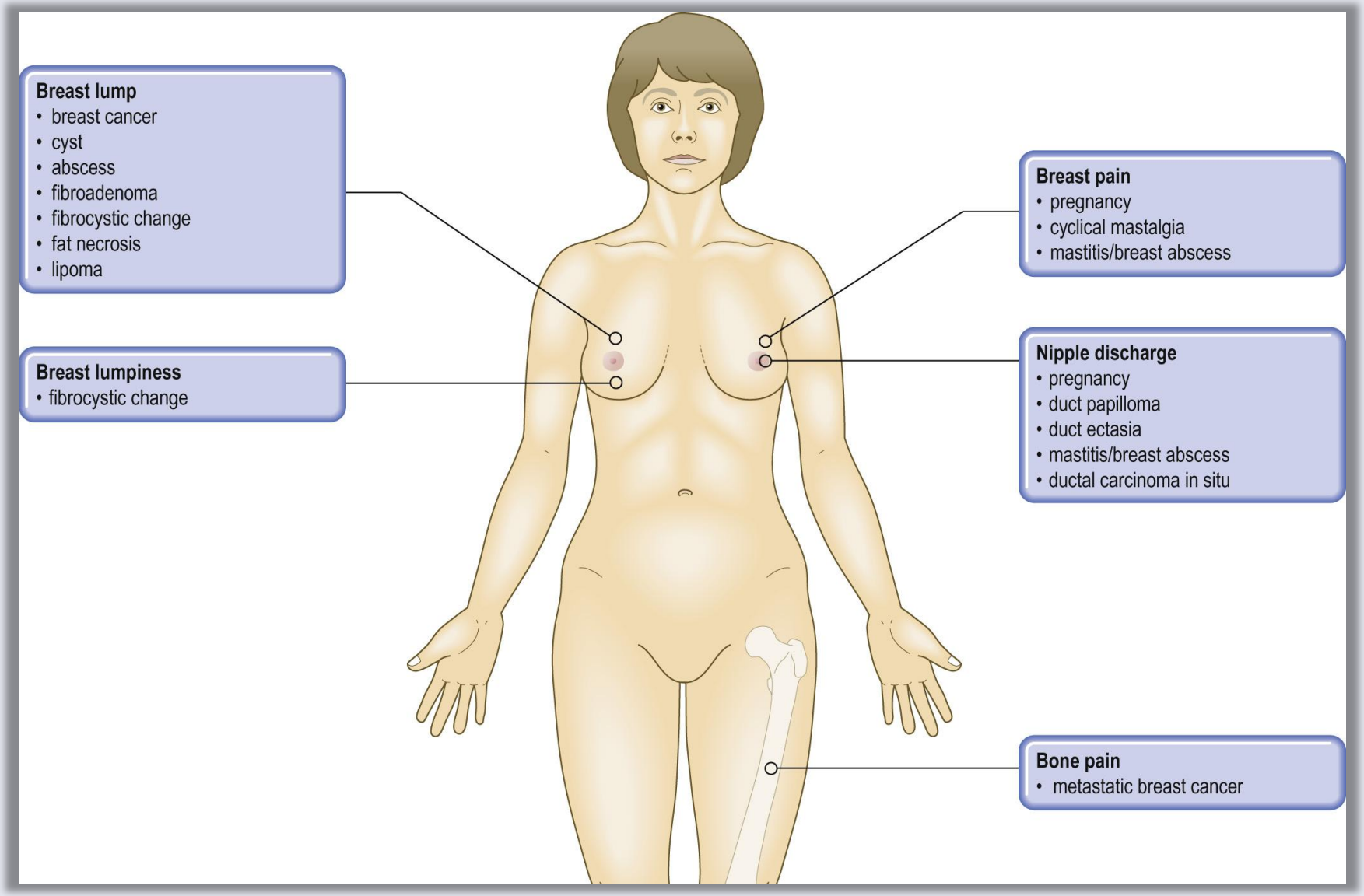


Route of metastases	Destination
Direct infiltration	Skin/muscle
Lymphatics	Axillary and other local LNs
Blood stream	Lungs, bone, liver and brain





The Breast: Clinical Signs of Breast Pathologies



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