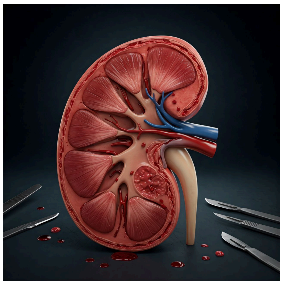
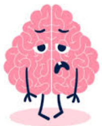


Written by: Dr. Ali Fahad Abu Jamil.

Anatomy, lecture title: the breast.



I will start by explaining in general about the subject.

Alright, so the breast is more than just what you see on the outside – it's got a full internal structure that's pretty complex but super interesting once you break it down. First off, location-wise, each breast sits on the front chest wall, between the 2nd and 6th ribs, and stretches from the edge of the sternum to about the middle of the armpit area (called the mid-axillary line), On the outside, there's the nipple (which is where milk comes out during breastfeeding) and the areola, which is the darker area around the nipple. The areola isn't just for looks – it has these little glands called Montgomery glands that release oil to keep the skin moisturized and protect the nipple, especially during breastfeeding. Now, inside the breast, there are three main parts:

1. Glandular tissue – this is where the milk is made. The breast has around 15 to 20 lobes, and each lobe has smaller units called lobules. Inside these lobules are alveoli, which are like mini sacs where the milk is actually produced. The milk travels through lactiferous ducts and eventually comes out the nipple.

2. Fibrous tissue – this provides structure and support. It includes something called Cooper's ligaments that kind of act like internal suspension wires keeping the breast in shape and attached to the chest wall.

3. Fatty tissue – this fills in the spaces between the glandular and fibrous tissue. It doesn't help with milk, but it's what mainly determines the breast's size and shape.

As for blood supply, the breast gets blood from arteries like the internal thoracic artery, lateral thoracic artery, and intercostal arteries. Veins that run alongside them take the blood back. The nerves that provide sensation mostly come from the 4th to 6th intercostal nerves – that's why nipple sensation can vary depending on nerve involvement; Lymphatic drainage is super important, especially when it comes to cancer. Around 75% of the lymph (which carries waste and immune cells) drains into the axillary lymph nodes in the armpit. The rest goes to nodes near the collarbone and behind the sternum, So overall, while the breast seems simple at first, it's got a really detailed anatomy with both functional (milk production) and structural (support, shape) parts. Knowing this is especially crucial in medicine – like understanding how cancer spreads or how breastfeeding works.

Let's start now in the slides, The positive side of the matter is that it is the last system.

the breast isn’t just a soft mass on the chest — it’s actually a highly organized structure with both supportive and functional roles, especially in females. It develops from the skin and is considered a modified sweat gland that specializes in milk production. What’s crazy is that both males and females have breasts, but due to hormonal differences, they only fully develop and function in females, Each breast is located in the superficial fascia of the chest wall, sitting on top of muscles like the pectoralis major, serratus anterior, and even partly on the external oblique in its lower part. Anatomically, the base of the breast extends vertically from the 2nd to the 6th ribs, and horizontally from the lateral edge of the sternum to the mid-axillary line. There’s also an extension called the Axillary tail of Spence, which shoots upward and laterally into the armpit through an opening in the deep fascia called the foramen of Langer; Deep to the breast, there’s a layer called the retromammary space, made of loose connective tissue that allows the breast to move slightly over the chest wall. Beneath that is the deep (pectoral) fascia, which covers the pectoralis major muscle. The medial 2/3 of the breast lies over this muscle, while the lateral 1/3 lies over the serratus anterior. Structurally, the breast is made up of three main components: the skin, stroma, and parenchyma.

The skin includes the nipple, which is located roughly at the 4th intercostal space. It contains 15–20 lactiferous ducts, each opening at the tip. The areola surrounds the nipple and contains modified sebaceous glands known as Montgomery’s tubercles, which secrete oils to lubricate the nipple during breastfeeding. Interestingly, the skin around the nipple and areola has no fat or hair beneath it.

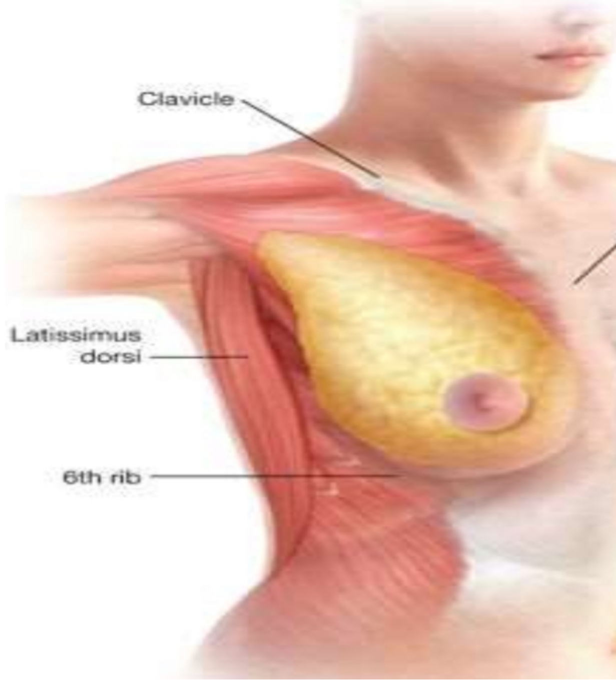
The stroma is the supportive framework. It has two parts: The fibrous stroma, which includes Cooper’s ligaments that support the breast and keep it anchored to the overlying skin and underlying fascia and The fatty stroma, which fills the space between lobules and gives the breast its shape and size.

The parenchyma is the functional part of the breast — the glandular tissue that actually produces milk. It’s divided into 15–20 lobes, and each lobe contains alveoli, where the milk is made. The milk flows through the lactiferous ducts, which widen under the areola into lactiferous sinuses and then narrow again to open at the nipple.

Blood supply to the breast comes from multiple sources: The medial part gets blood from the internal mammary artery and anterior intercostal arteries while The upper lateral part gets it from the thoracoacromial artery and The lower lateral part is supplied by the lateral thoracic artery. Veins mirror this pattern and drain into the axillary and internal thoracic veins.

Lymphatic drainage is especially important because it’s the main pathway for breast cancer to spread. There are superficial lymphatics that drain into a network under the areola (called the subareolar plexus), and deep lymphatics that form a network on the deep fascia. Drainage patterns are as follows: Most of the breast (central and lateral parts) drains into the pectoral group of axillary lymph nodes and The upper part drains into the apical axillary nodes and The medial part drains into the internal mammary (parasternal) nodes, and some of it even crosses the midline to the opposite breast and The lower medial quadrant connects to the lymphatics of the rectus sheath, linea alba, and subdiaphragmatic nodes.

Clavicle: or collarbone, is a horizontal long bone that runs between the sternum and the scapula. In this context, it marks the superior (upper) boundary of the female breast. It plays a key role in shoulder movement and stability by connecting the arm to the trunk.

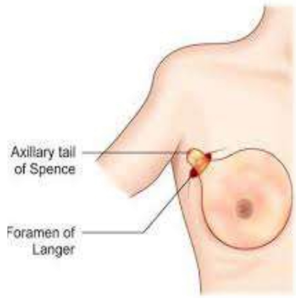


6th rib: is one of the true ribs, connected directly to the sternum. It typically marks the inferior (lower) boundary of the female breast, and serves as an anatomical reference point in thoracic assessments.

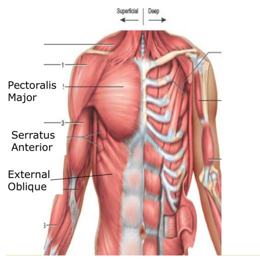
Intermammary sulcus (also called intermammary cleft): This is the vertical groove between the two breasts, running over the sternum. It represents the medial (inner) border of each breast. It’s mainly a surface anatomical landmark that helps define the separation between the two breasts.(not apparent)

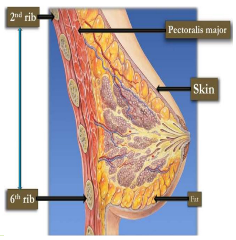
Latissimus dorsi: is a large, flat, triangular muscle on the back that extends to the sides and partially wraps around the lower part of the chest. In the context of breast surface anatomy, it may mark the lateral or posterior boundary of the breast. Functionally, it helps in arm extension, adduction, and internal rotation, and it contributes to movements like pulling or climbing.

The axillary tail of Spence is an extension of breast tissue that projects laterally into the axilla (armpit). It passes through a small opening in the deep fascia called the foramen of Langer. This tail is important because it can contain glandular tissue and may be involved in breast diseases, including cancer. The foramen of Langer allows this part of the breast to extend into the axillary region, making it a key area during physical examination or imaging of the breast.

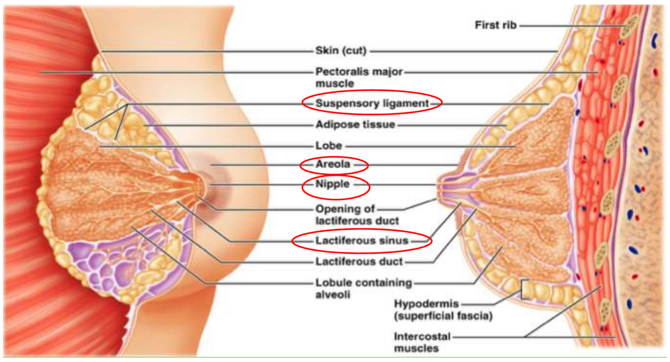


First image – Surface anatomy and anterior breast wall layers: This illustration defines the vertical boundaries of the female breast, typically from the 2nd rib superiorly to the 6th rib inferiorly. From superficial to deep, the layers include the skin, then a layer of fat (subcutaneous tissue) which gives the breast its shape and volume, followed by the pectoralis major muscle. The pectoralis major lies deep to the breast tissue and forms a muscular base on the anterior chest wall. This structure is important both for anatomy and for clinical relevance, such as in surgeries or imaging.

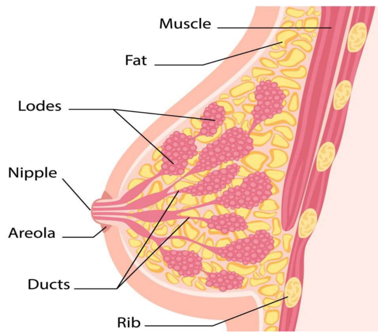




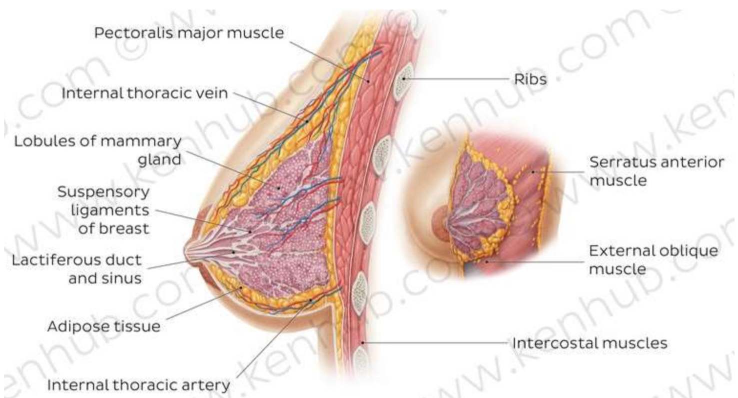
Second image – Chest muscles related to the breast: This diagram focuses on the muscles located beneath or around the breast area. The pectoralis major is the large, fan-shaped muscle directly under the breast and is primarily responsible for moving the arm (like adduction and internal rotation). Just underneath it is the serratus anterior, a muscle with a finger-like appearance that wraps around the side of the chest and helps in moving the scapula (shoulder blade). Inferior-laterally, you can also see the external oblique, which is part of the abdominal wall muscles and contributes to trunk rotation and stabilization. These muscles form the deep foundation beneath the breast and are significant in surgeries and structural support.



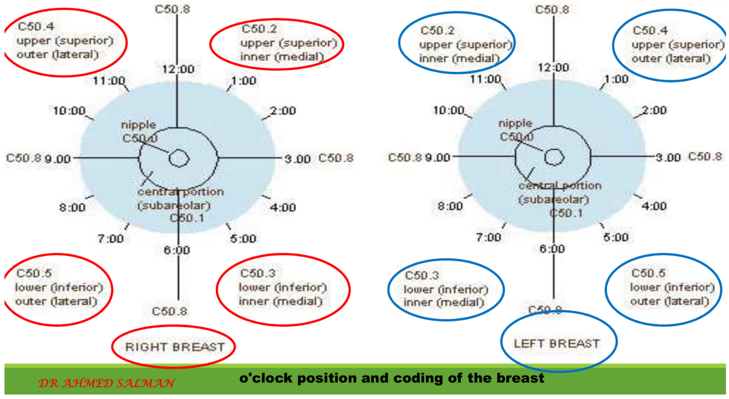
This image shows the detailed internal anatomy of the female breast. Starting from the surface, we see the skin, the areola (the pigmented area surrounding the nipple), and the nipple, which contains openings of lactiferous ducts—tiny holes where milk exits during breastfeeding. Just beneath the nipple, the ducts widen into lactiferous sinuses, which act as small reservoirs for milk. These then lead into lactiferous ducts, which further branch into lobules containing alveoli—the milk-producing units of the breast. Surrounding these structures is adipose tissue (fat), which gives the breast its soft shape and volume. Supporting the breast internally are the suspensory ligaments (of Cooper), which connect the skin to the superficial fascia and help maintain the structural shape of the breast. Beneath all that lies the pectoralis major muscle, with the first rib and intercostal muscles (intercostal muscles) deeper in the chest wall, contributing to breathing and rib support. The superficial fascia separates the skin and fat from the deeper muscle layers. Also shown are hydroderms—fluid-filled or glandular areas involved in milk production, though this term is less common and might refer to glandular activity in context.



This image shows a simplified cross-section of the female breast, moving from the deepest layers outward. At the core, we have the muscles, specifically the pectoralis major, which provides support and movement for the chest and underlies the entire breast structure. Covering the muscles is a layer of fat, which surrounds the glandular tissue and helps shape the breast. Within the fat, there are lobes (loops), which are clusters of glandular structures responsible for producing milk. These lobes drain into ducts that transport the milk toward the nipple. Closer to the surface, we see the rib underneath the muscle, providing structural support to the chest wall. Finally, on the skin's surface, we find the areola, the darker pigmented area, and the nipple (nibble), where the ducts open to release milk. The areola also contains glands that protect and lubricate the nipple during breastfeeding.



This image presents a detailed view of the female chest anatomy focusing on the breast and surrounding structures. At the center, the pectoralis major muscle forms a thick muscular layer beneath the breast tissue, essential for arm movement and chest wall stability. Running internally are the internal thoracic artery and internal thoracic vein, which supply blood to the chest wall and breast. The breast contains lobules of the mammary gland, where milk is produced, supported by the suspensory ligaments of the breast (Cooper's ligaments) that help maintain the breast shape. Milk travels through the lactiferous ducts and sinuses, channels that convey milk to the nipple during breastfeeding. Surrounding the breast tissue is adipose tissue, giving the breast its size and softness. Deep to the pectoralis major lie the intercostal muscles between the ribs, which aid in breathing. The rib cage provides the bony framework for the chest. Laterally and superficially, the serratus anterior muscle wraps around the side of the chest to help move the scapula, while the external oblique muscle is part of the abdominal wall, contributing to trunk movement and stability.

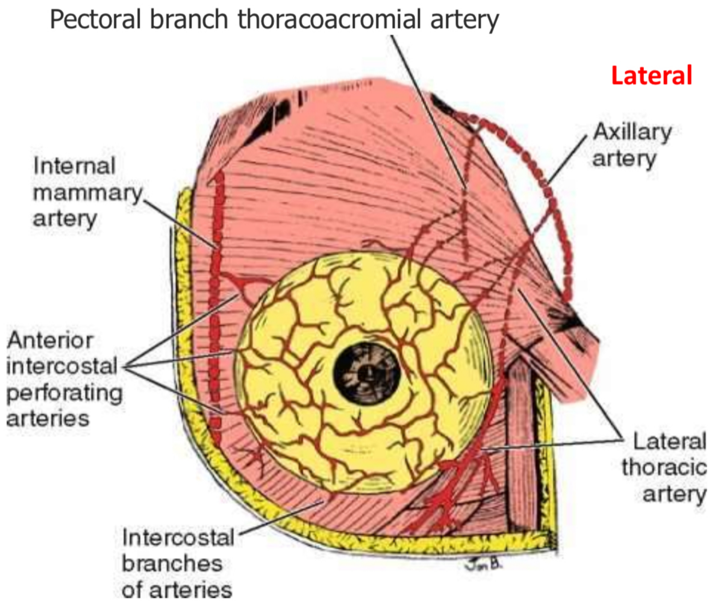


The O'Clock Position and Coding of the Breast system is used to locate specific areas within the breast, just like how a clock tells time. Imagine looking straight at the breast as if it's the face of a clock. The nipple is the center, and the positions around it are marked like clock hours (1 o'clock, 2 o'clock, all the way to 12 o'clock).

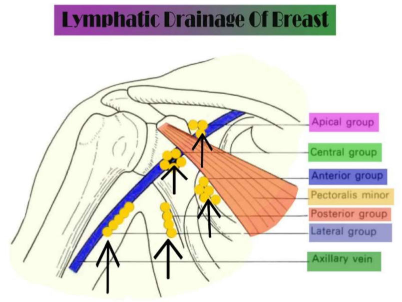
For the right breast, the clock is read like a regular clock:12 o'clock is at the top (toward the head),6 o'clock is at the bottom (toward the abdomen),3 o'clock points outward (toward the arm), 9 o'clock points inward (toward the sternum).

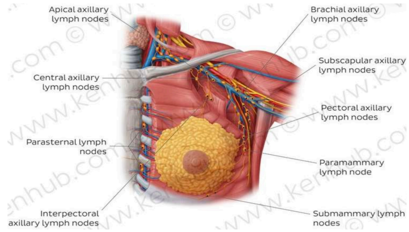
For the left breast, it's reversed (like a mirror image): 12 o'clock is still at the top, 6 o'clock is still at the bottom, 3 o'clock now points inward (toward the sternum), 9 o'clock points outward (toward the arm).

This system helps doctors accurately describe the location of a lump or abnormality. For example, if a mass is found at "2 o'clock, 3 cm from the nipple," they know exactly where to check or document. This method is super important in imaging (like mammograms), surgery, and reports so that everyone uses the same language when talking about specific spots in the breast.



This image shows the arterial blood supply to the female breast, which comes from multiple sources to ensure rich and reliable circulation. One key vessel is the axillary artery, a major artery in the armpit region that gives rise to several important branches. Among these is the thoracoacromial artery, which supplies the upper chest area and gives off the pectoral branches that directly nourish the pectoralis major muscle and overlying breast tissue. Another vital contributor is the internal mammary artery (also known as the internal thoracic artery), which runs along the inner side of the chest and sends out anterior intercostal perforating arteries—small branches that penetrate the chest wall to supply the medial part of the breast. Additionally, the intercostal branches of the artery (arising from the aorta) contribute lateral perforators that reach the deep surface of the breast. On the outer side, the lateral thoracic artery, another branch of the axillary artery, supplies the lateral (outer) portion of the breast, especially the area extending into the axilla. Together, these vessels create a rich arterial network that supports the metabolic demands of breast tissue, especially during physiological changes like lactation.





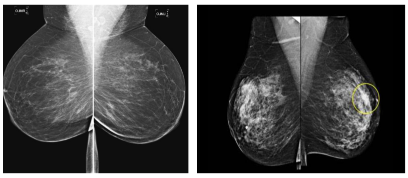
These two images demonstrate the lymphatic drainage of the female breast, focusing on the axillary (armpit) and surrounding lymph nodes. The lymph from the breast—especially from the lateral and inferior parts—primarily drains into the axillary lymph nodes, which are grouped anatomically around the pectoralis minor muscle and the axillary vein. These groups include: The anterior (pectoral) nodes, located along the lateral edge of the pectoralis major, receive lymph from the anterior chest wall and most of the breast; The posterior (subscapular) nodes receive lymph from the back and posterior chest wall; The lateral nodes, found along the axillary vein, drain the upper limb; The central nodes, located in the fat of the axilla, receive lymph from the anterior, posterior, and lateral groups; The apical nodes sit near the top of the axilla, above the pectoralis minor, and collect lymph from all lower groups, eventually draining into the subclavian vein.

The submammary and paramammary lymph nodes lie beneath or near the breast tissue and help drain lymph locally; The parasternal nodes (along the internal thoracic vessels) receive lymph from the medial side of the breast and may serve as a pathway for cancer to spread to the opposite breast; The intrapectoral lymph nodes lie within the pectoralis major muscle itself; The subscapular (sometimes written as suspecular) and infraclavicular (possibly listed as abracal) nodes represent variations or extensions depending on anatomical interpretation; Together, this lymphatic system plays a crucial role in immune defense and is clinically important in breast cancer, where the spread to specific lymph node groups determines staging and treatment.

Clinical Features of Breast Carcinoma & Mammography

When it comes to breast carcinoma, it’s not just about a lump in the breast — the changes it causes can be very distinct and tell us a lot about how advanced the disease is. One of the first signs doctors look for is skin retraction or puckering. This happens when the tumor invades the suspensory ligaments of Cooper, which are these fibrous bands that normally help hold the breast tissue in place. When cancer infiltrates them, it pulls on the skin and causes a visible dimple or indentation; Another important feature is something called peau d’orange which is French for orange peel skin, This happens due to blockage of the cutaneous lymphatics by cancer cells. Since lymph fluid can’t drain properly, fluid builds up in the skin causing swelling (edema), but because the hair follicles stay anchored, the skin looks pitted — kind of like the texture of an orange peel. It’s a classic sign of more advanced disease and lymphatic involvement; Nipple retraction is another red flag. Normally, the nipple sticks out, but in some cases of breast cancer, the nipple starts pulling inward. That’s because the tumor spreads along the lactiferous ducts (the milk-carrying channels), and the accompanying fibrosis (scar tissue formation) pulls the nipple inward; If the tumor continues growing and invades deeper structures, like the pectoral fascia or pectoralis major muscle, the entire breast can become fixed — meaning it won’t move freely when the doctor tries to shift it during an exam. This is a serious sign that the cancer has infiltrated underlying tissues and possibly the chest wall, And of course, the lymph nodes in the axilla (armpit) are critical. These nodes act like filters for lymph fluid, and they’re often the first place cancer spreads. In breast cancer, affected nodes become stony hard, enlarged, and fixed, which usually means the disease is progressing.

Now, to detect all these changes — especially early before symptoms even appear — we use a tool called mammography. It’s a type of X-ray imaging specifically designed for the breast. Mammograms are especially useful for screening — meaning they help detect breast cancer in people who don’t yet show any signs. It’s a vital tool because early detection dramatically improves the chance of successful treatment. Mammography can pick up tumors when they’re still very small or even just microcalcifications, before a lump can be felt. To summarize, recognizing the clinical features of breast carcinoma — like skin dimpling, peau d’orange, nipple retraction, breast fixation, and axillary node involvement — is crucial for early diagnosis. Combined with regular mammography, we have a strong chance of detecting cancer early and improving outcomes for patients.



Normal Mammography

Inverted nipple

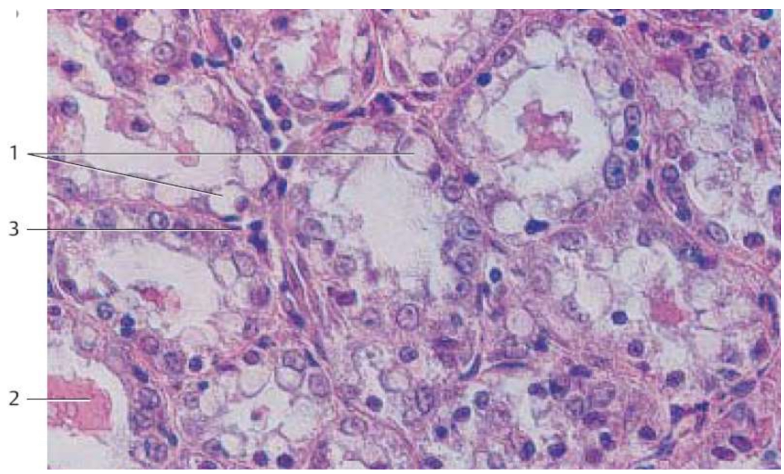
Retracted nipple

puckering of the skin

Peau d'orange

The development of the breast actually starts way before birth — it begins during embryonic life. At first, a structure called the milk ridge or mammary ridge forms. This is a thickened line of ectoderm (the outer layer of the embryo), and it runs from the armpit (axilla) down toward the groin (inguinal region). Interestingly, even though the milk ridge stretches all that way, most of it disappears later — except for the small part in the chest area where the actual breast will form. In that remaining area, the ectoderm thickens more, sinks slightly, and starts sending down 15 to 20 solid cords into the mesenchyme (the underlying embryonic connective tissue). These cords are the early form of the future milk ducts. Then, the mesenchyme starts to multiply and push up that sunken area, creating what will become the nipple. By the fifth month of fetal life, the areola (the dark pigmented area around the nipple) starts to form too. Now, looking at the histology (microscopic structure) of the breast, it’s considered a compound tubuloalveolar gland — which means it’s made of tubes and little sac-like structures (alveoli). It’s organized into lobes that are further divided into lobules, and these are separated by both dense connective tissue and fatty tissue. When the breast is not lactating (resting phase), it’s mostly made up of ducts and a lot of fat. The alveoli are pretty much inactive — they look like solid clumps of cells. During the menstrual cycle, the epithelial cells lining the ducts may show slight changes or vacuoles, but no real milk production is happening. During lactation (when the breast is actively producing milk), everything changes. The breast has way more active acini (the milk-producing units), and the connective tissue decreases. Some acini are distended with milk, while others are empty depending on the timing of milk secretion. The cells lining these acini can either be tall columnar or low cuboidal, depending on how active they are. Inside the acini, you can see vacuoles which represent fat droplets in the milk. Surrounding each acinus are myoepithelial cells — these are special contractile cells that help push the milk out toward the ducts when they contract (usually in response to oxytocin during breastfeeding). So overall, breast development is a combination of embryological blueprinting and hormone-driven activation — and its structure is finely tuned to switch between inactive and active states based on the body's needs (like pregnancy and lactation).

These two histological images show microscopic structures of breast tissue. In the first image, we see components like (1) sinus lactiferous, which is a widened part of the duct that stores milk before it exits through the nipple. (2) Connective tissue sheath surrounds ducts and lobules, providing support and shape. (3) Coarse fibrous collagen connective tissue gives the breast its strength and structure through thick collagen fibers. In the second image, the focus shifts to glandular activity: (1) secretory product inside a gland cell, which shows active milk or fluid being produced; (2) secretory production, likely referring to the accumulated product inside the ducts or alveoli; and (3) myoepithelial cells, which are contractile cells that help eject the secretions from the alveoli into the ducts. Together, these elements highlight how the breast functions both structurally and in milk production, especially during lactation.



To be the first doctor in neurosurgery, this is my dream