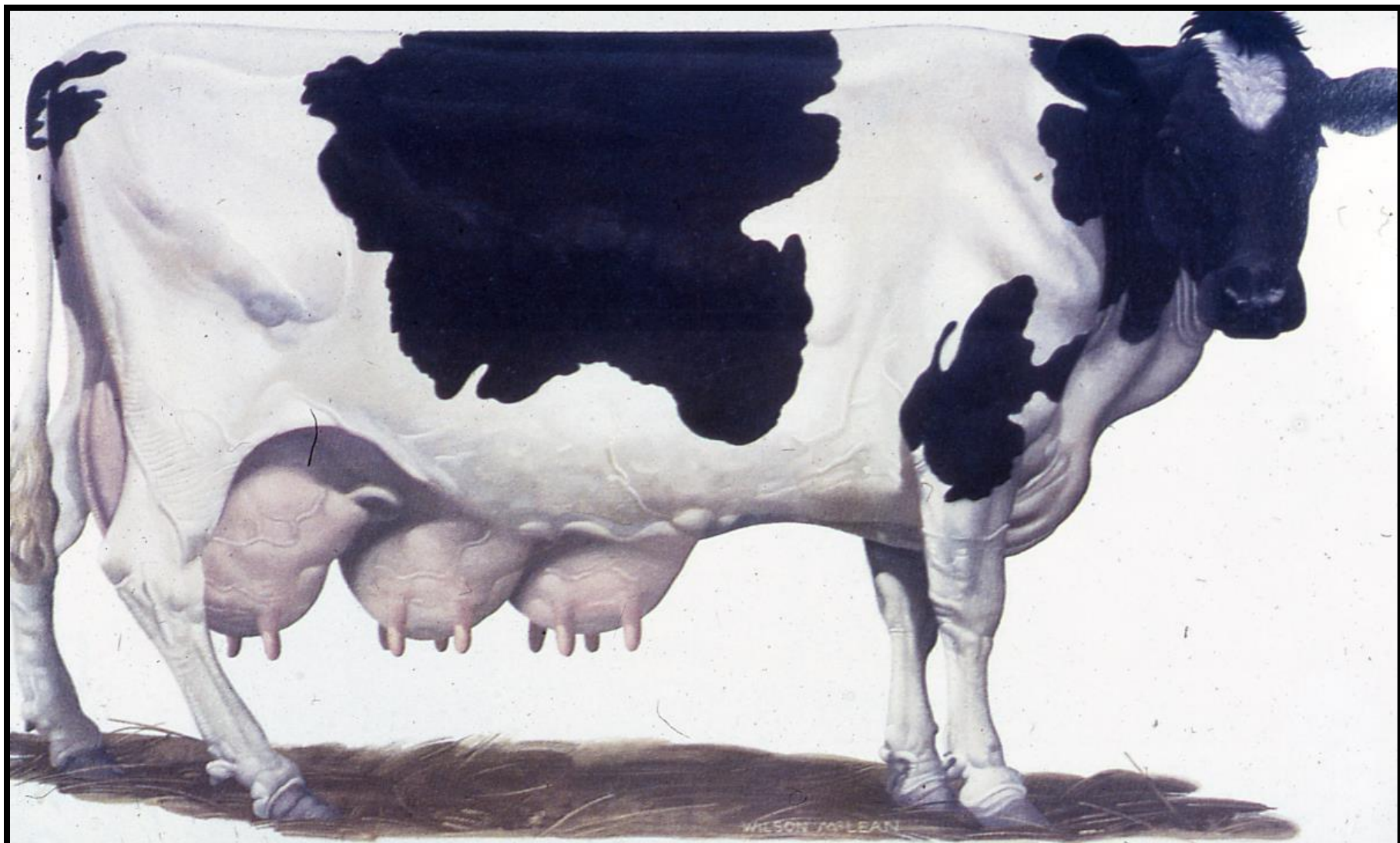

MAMMARY GLAND ANATOMY

Supernumerary teats

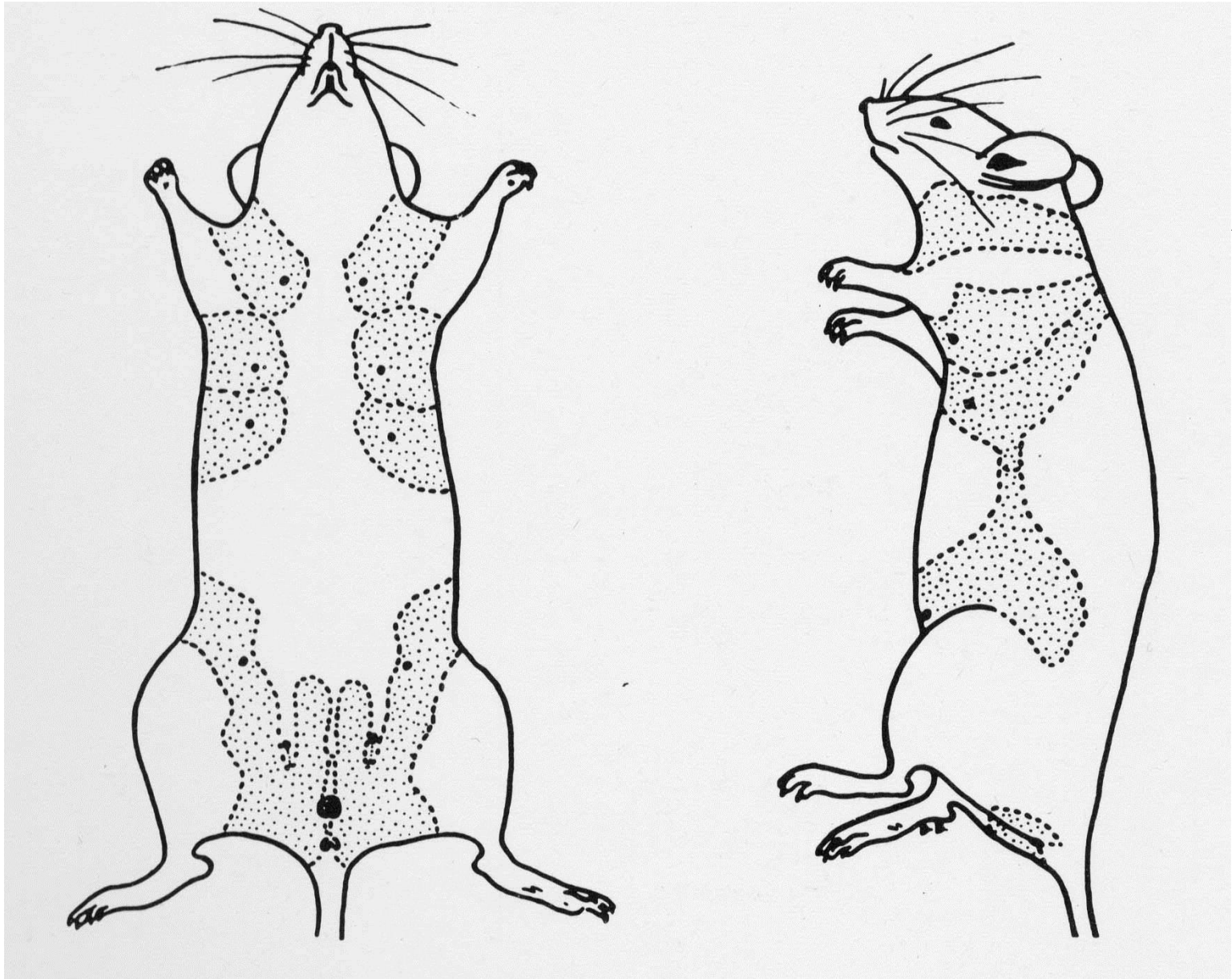




Maximum Productivity.

Number and Location of Glands Varies by Species

Species	Thoracic Region	Abdominal Region	Inguinal Region
Cattle	-	-	4
Goat, Sheep	-	-	2
Horse	-	-	2
Pig	6	6	4
Cat	4	2	2
Dog	4	4	2
Rat	6	2	4
Mouse	6	-	4
Guinea Pig	-	-	2
Human	2	-	-

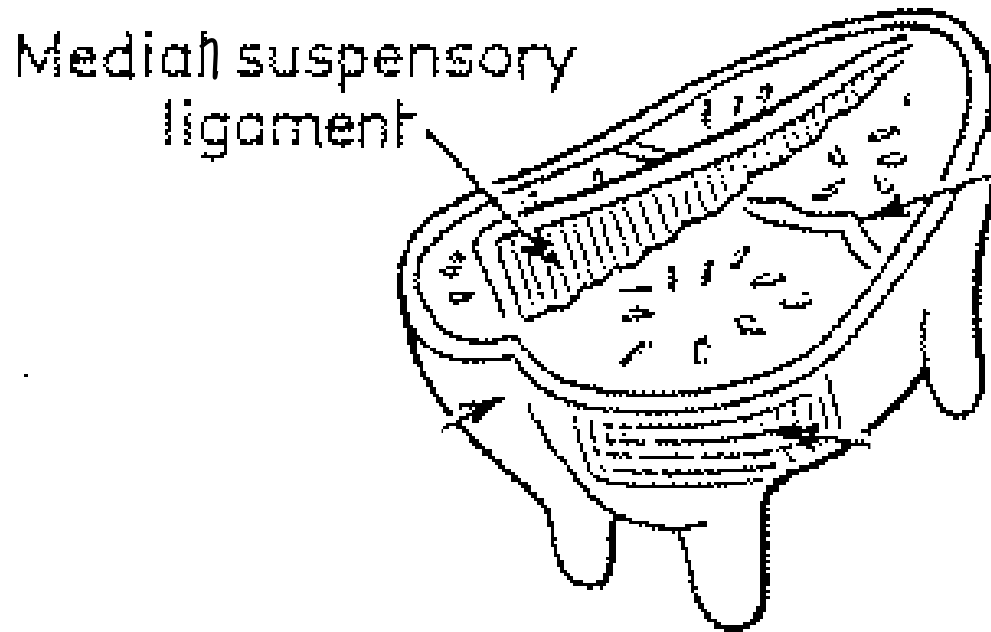


How does the udder stay on the cow?

- The udder of a cow producing 40 lbs of milk in a 12-hour period can weigh up to 100 lbs
- **Ligament:** A sheet or band of tough, fibrous tissue connecting bones or cartilages at a joint or supporting an organ

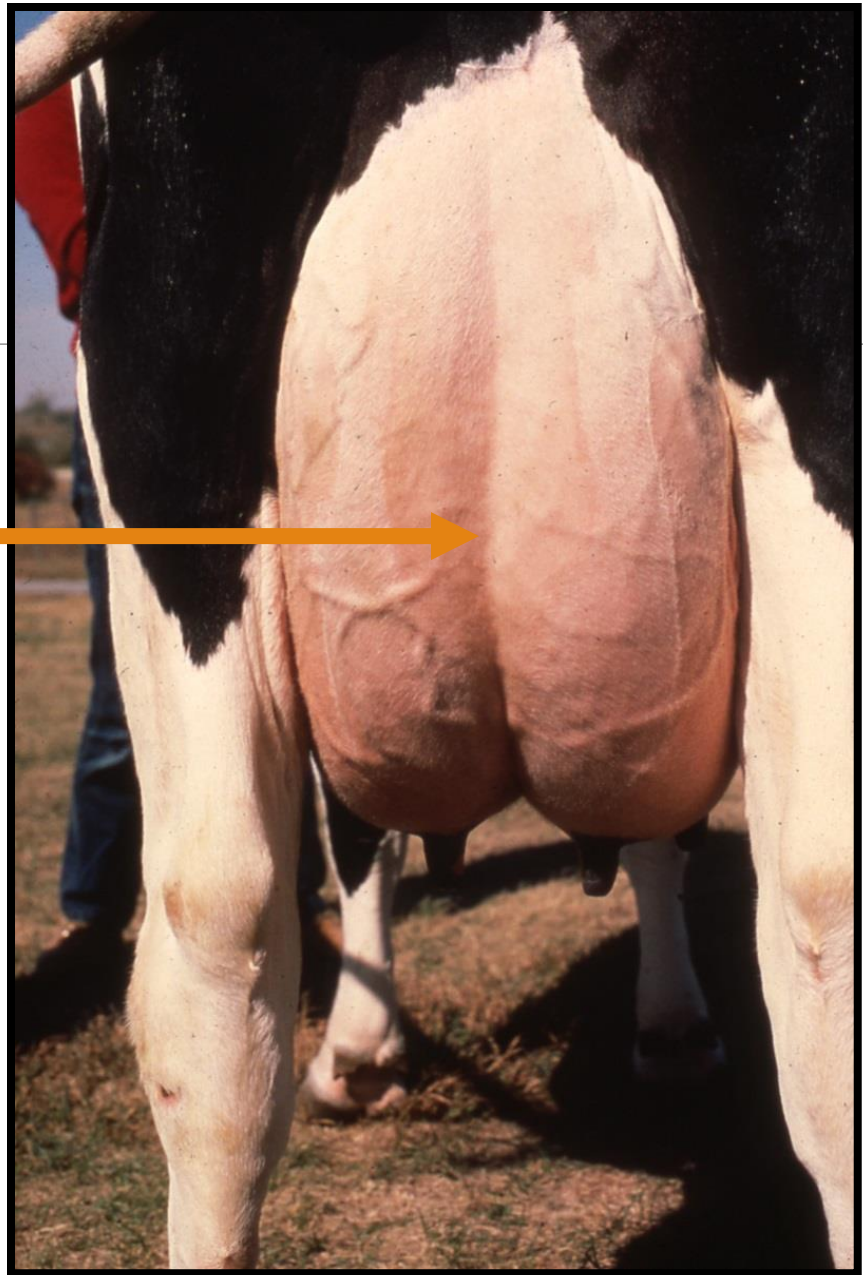
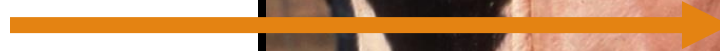


How does the udder stay on the cow?

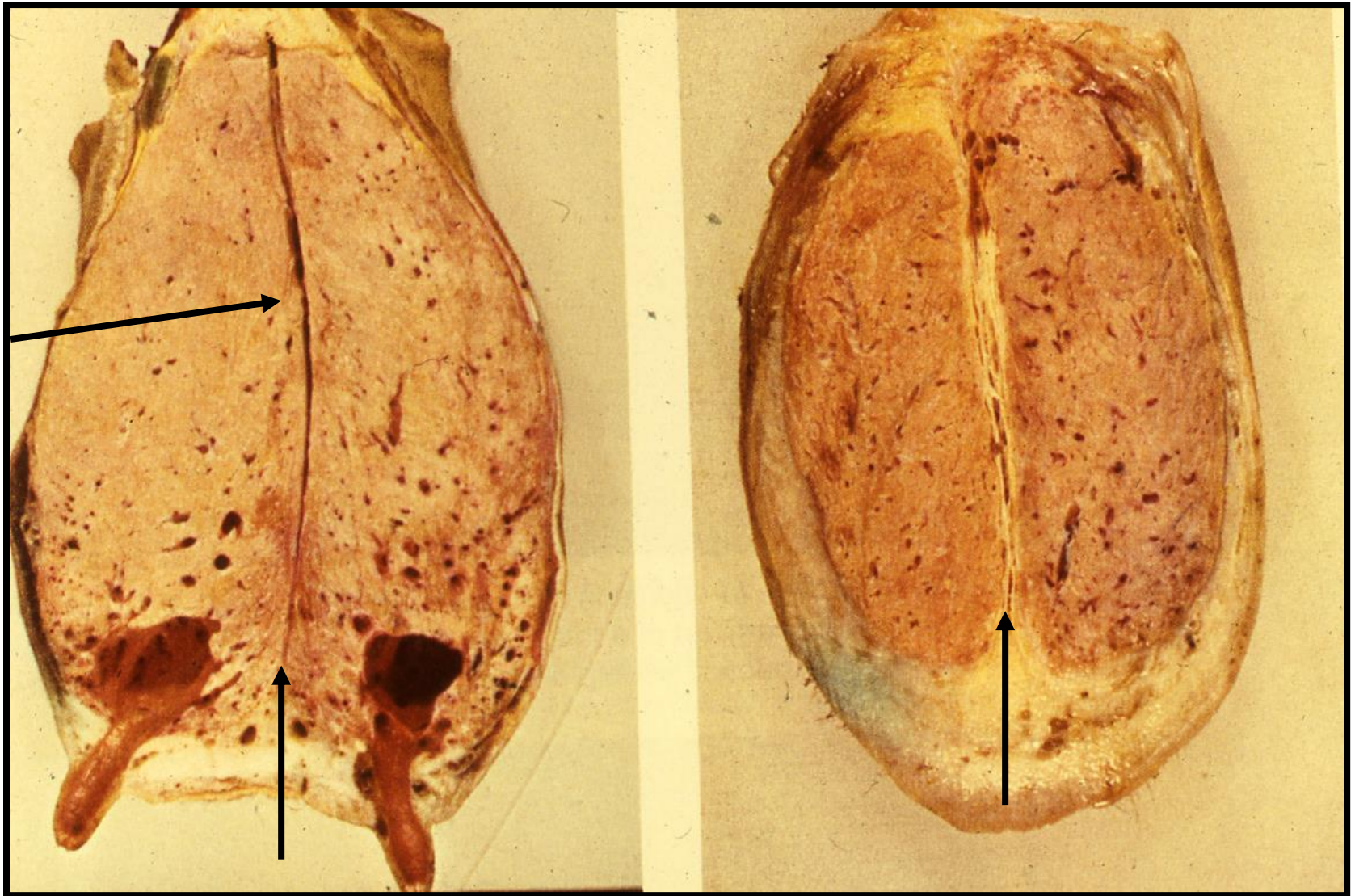


Rear View

Median
Suspensory
Ligament



Cross section



Side View

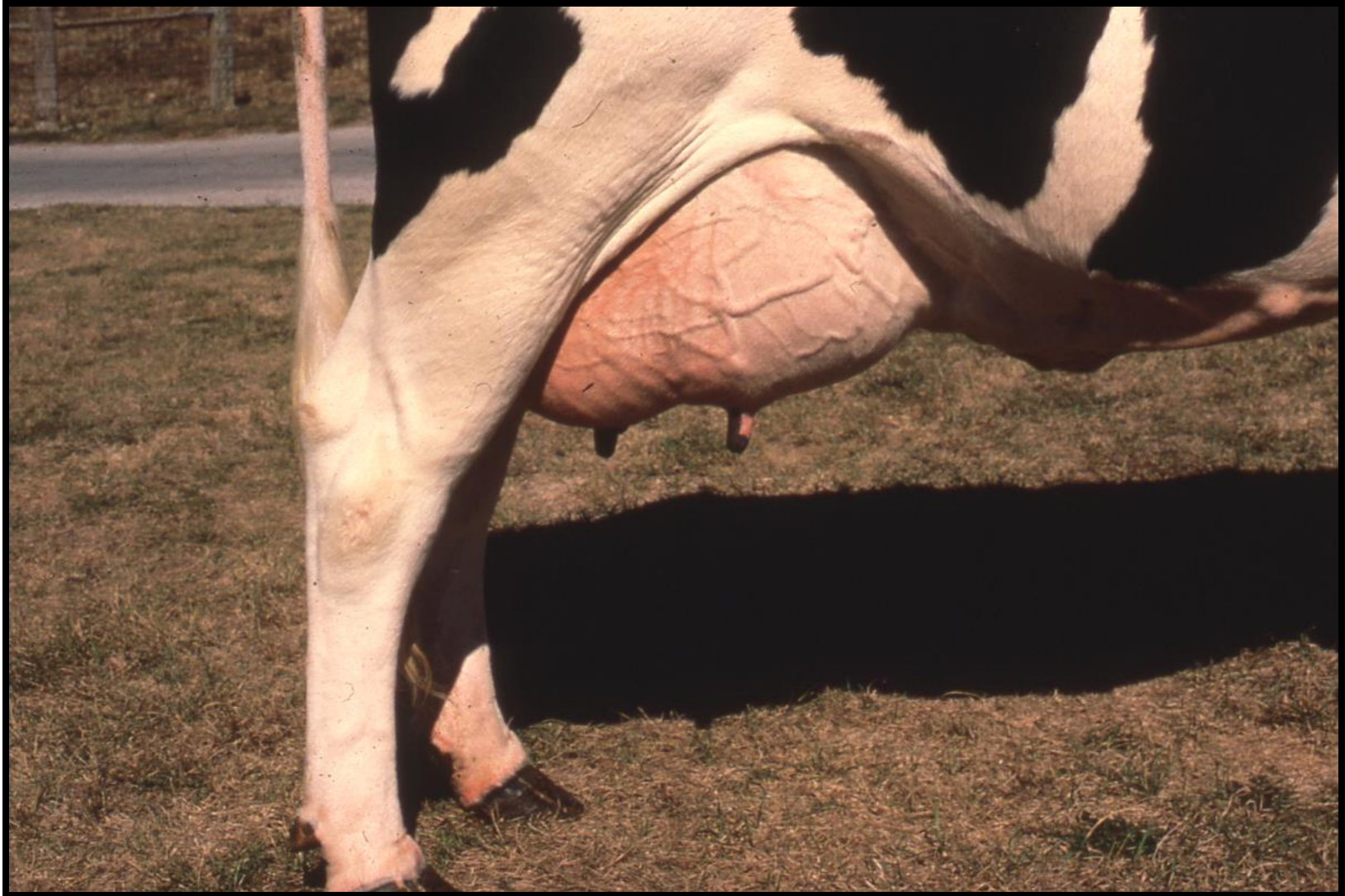
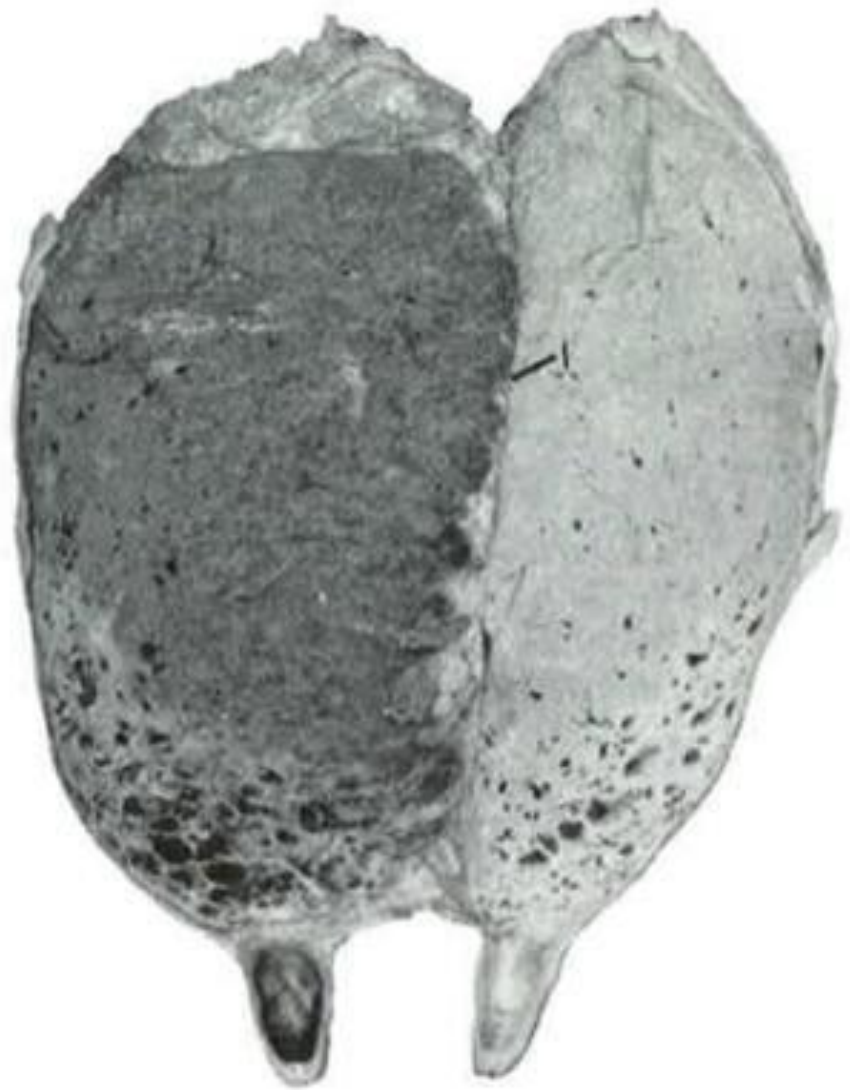
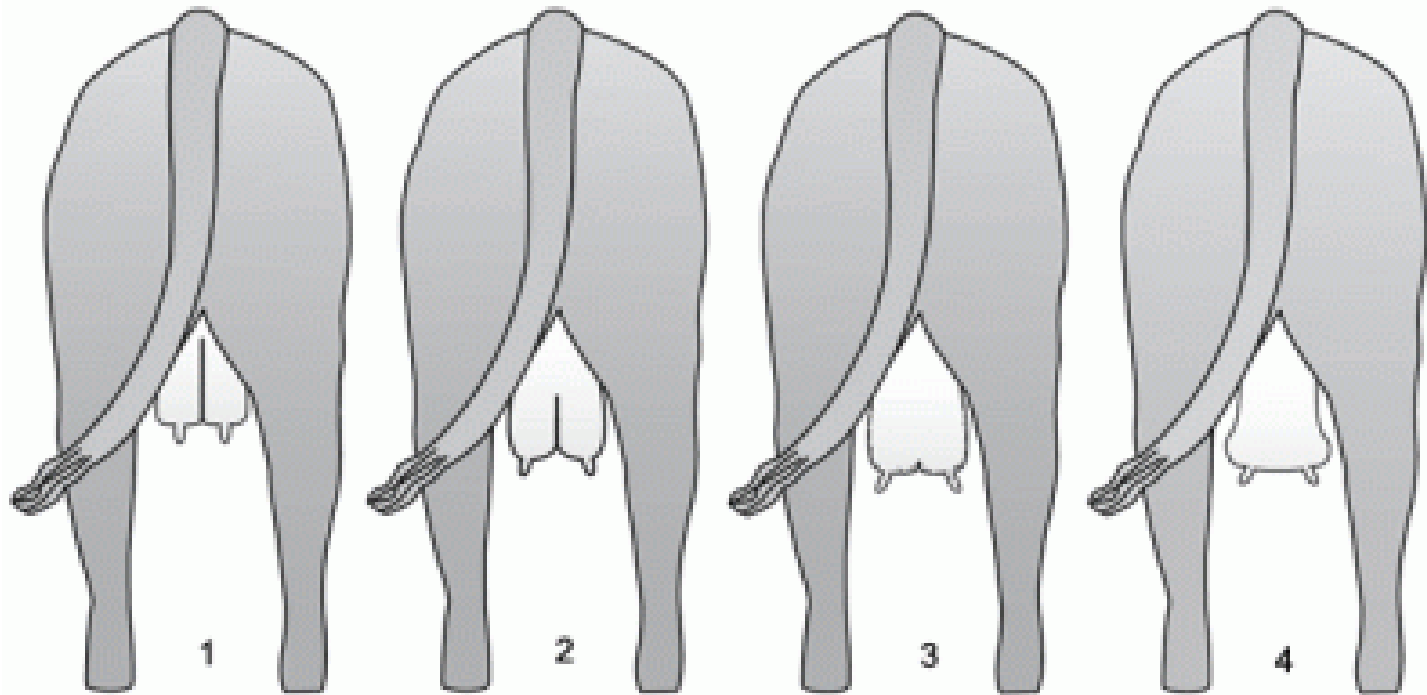


FIGURE 2-2
Cross section of the bovine mammary gland through the rear quarters, which are separated by the medial suspensory ligament (I). The quarters had been injected with two different color dyes.





Drawing 1: Prominent medium suspensory ligament which holds the udder tight to the body cavity. Teats suspend perpendicular to the ground.

Drawing 2: Intermediate prominent suspensory ligament. Udder suspended further from body cavity. Udders suspended about level with the hock and almost perpendicular to the ground.

Drawing 3: Very weak median suspensory ligament. Udder and teats suspended below the hock. When the udder and teats are engorged with milk, teats splay outward.

Drawing 4: Median suspensory ligament absent, udder and teats suspended below hocks. Udder balloons and teats splay outward.



Age—2 years



Age—5 years



Age—7 1/2 years



Age—9 years



Age—1 year, 10 months



Age—2 years, 10 months



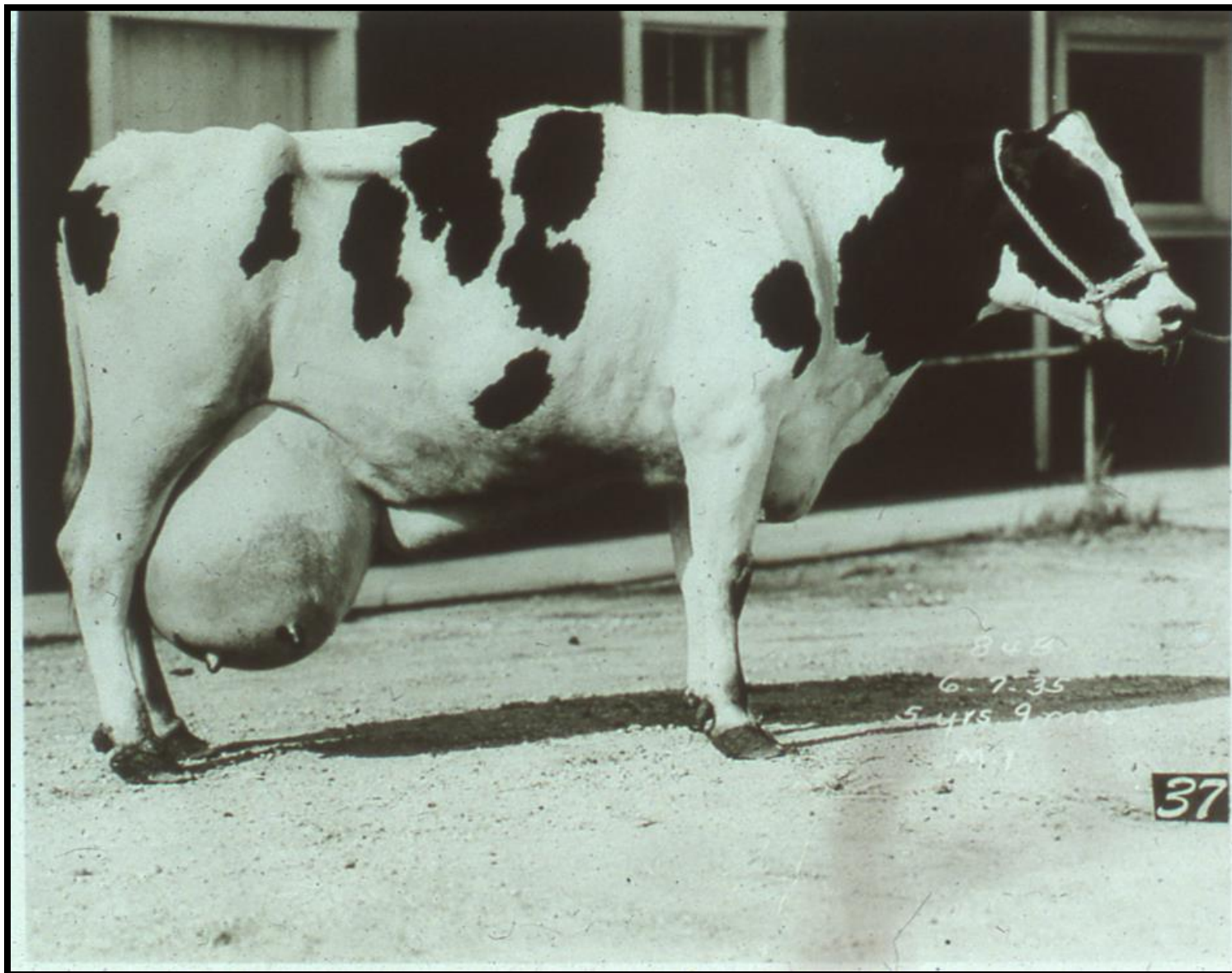
Age—5 years, 6 months



Age—8 years, 6 months

Fig. 8.7.—Udder showing weak attachment. (After Morgan.)

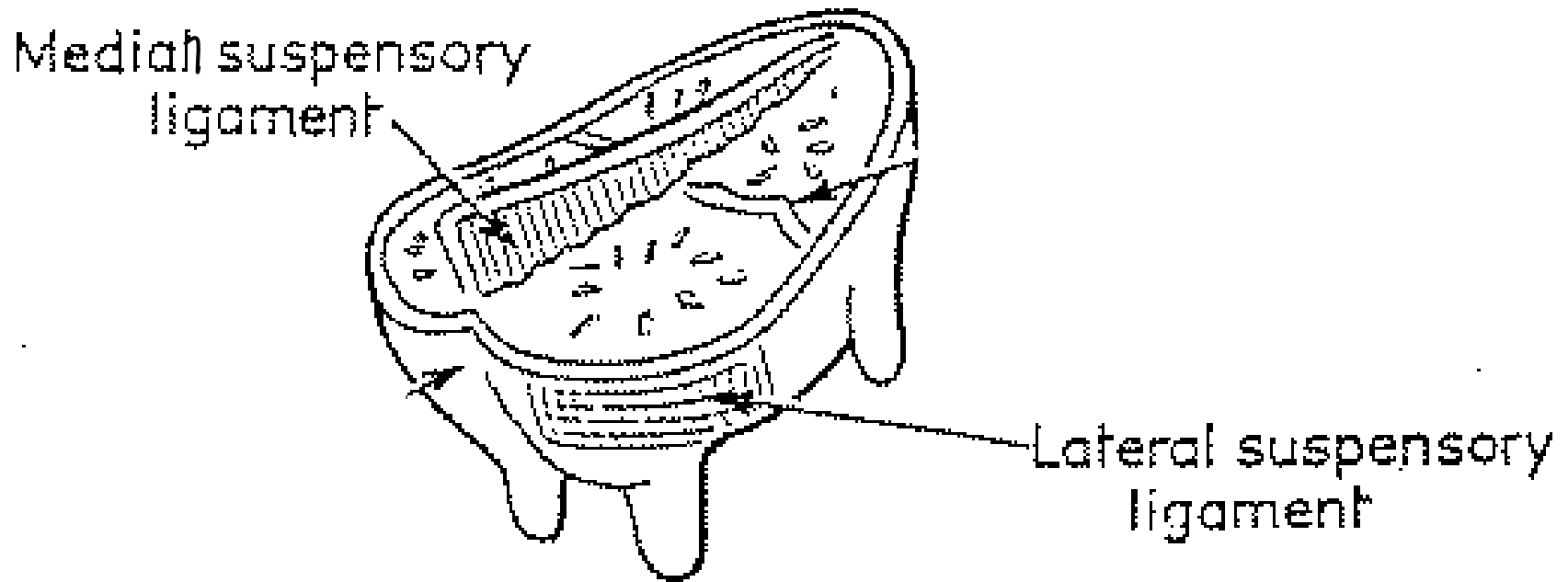
Pendulous udder



Is the
median
suspensory
ligament
the only
reason the
udder
stays on
the cow?



How does the udder stay on the cow?



Lateral suspensory ligament



Lateral ligament

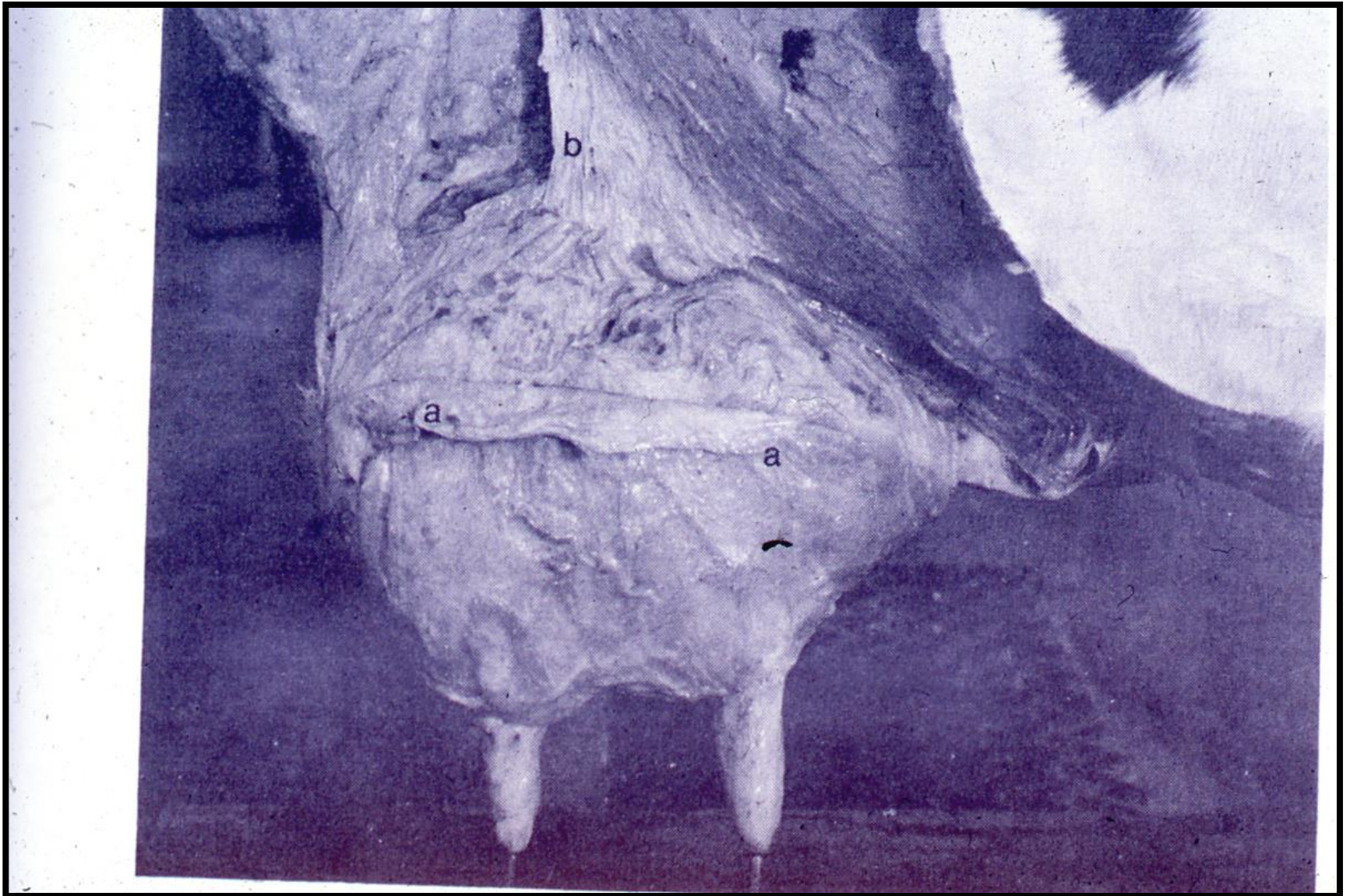


Ligament & fascia

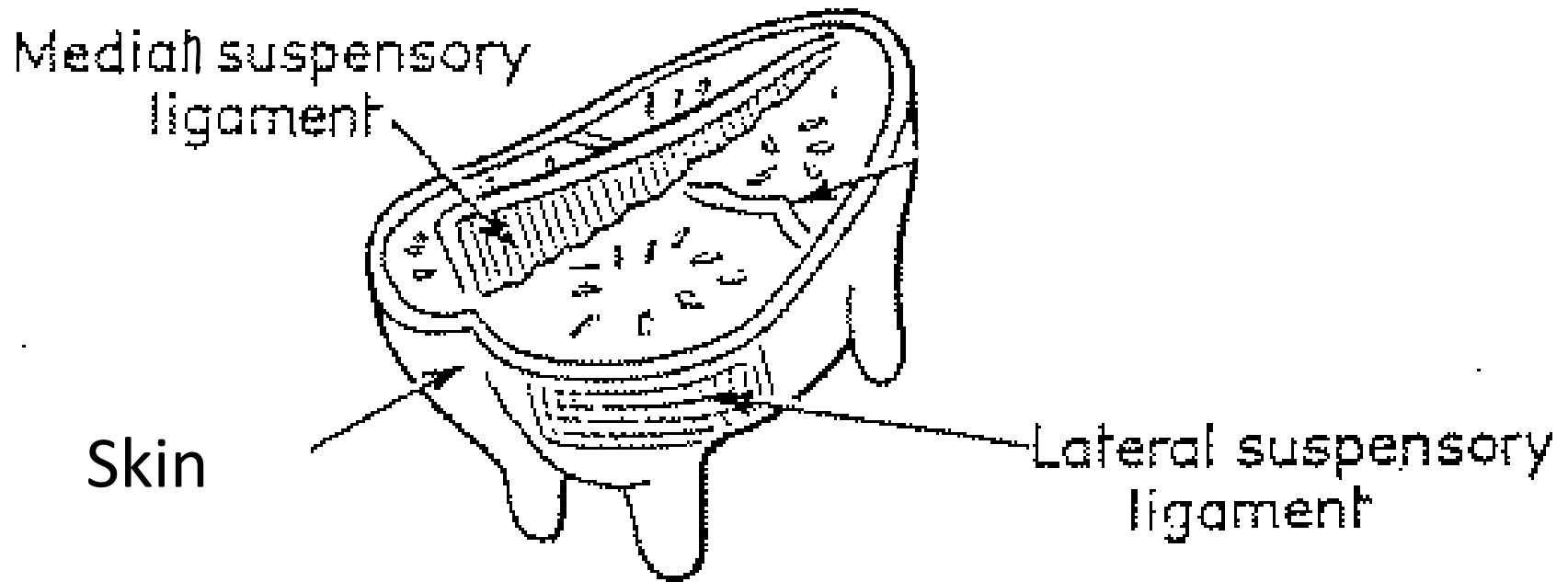


Fascia: sheet of connective tissue, primarily collagen, beneath the skin that attaches, stabilizes, encloses, and separates muscles and other internal organs

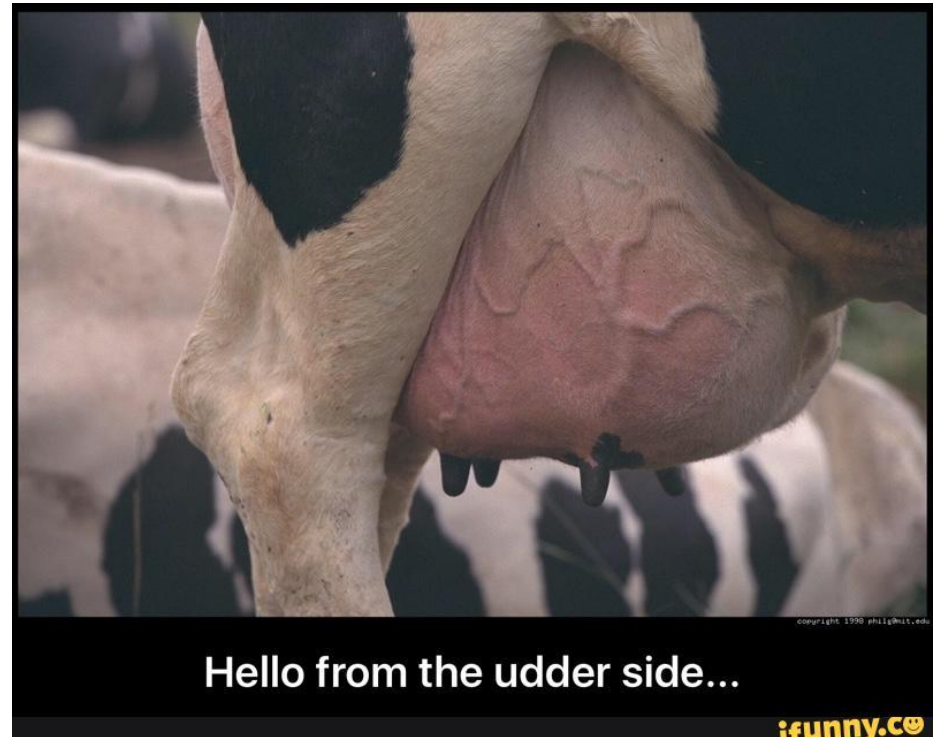
Lateral & median ligaments



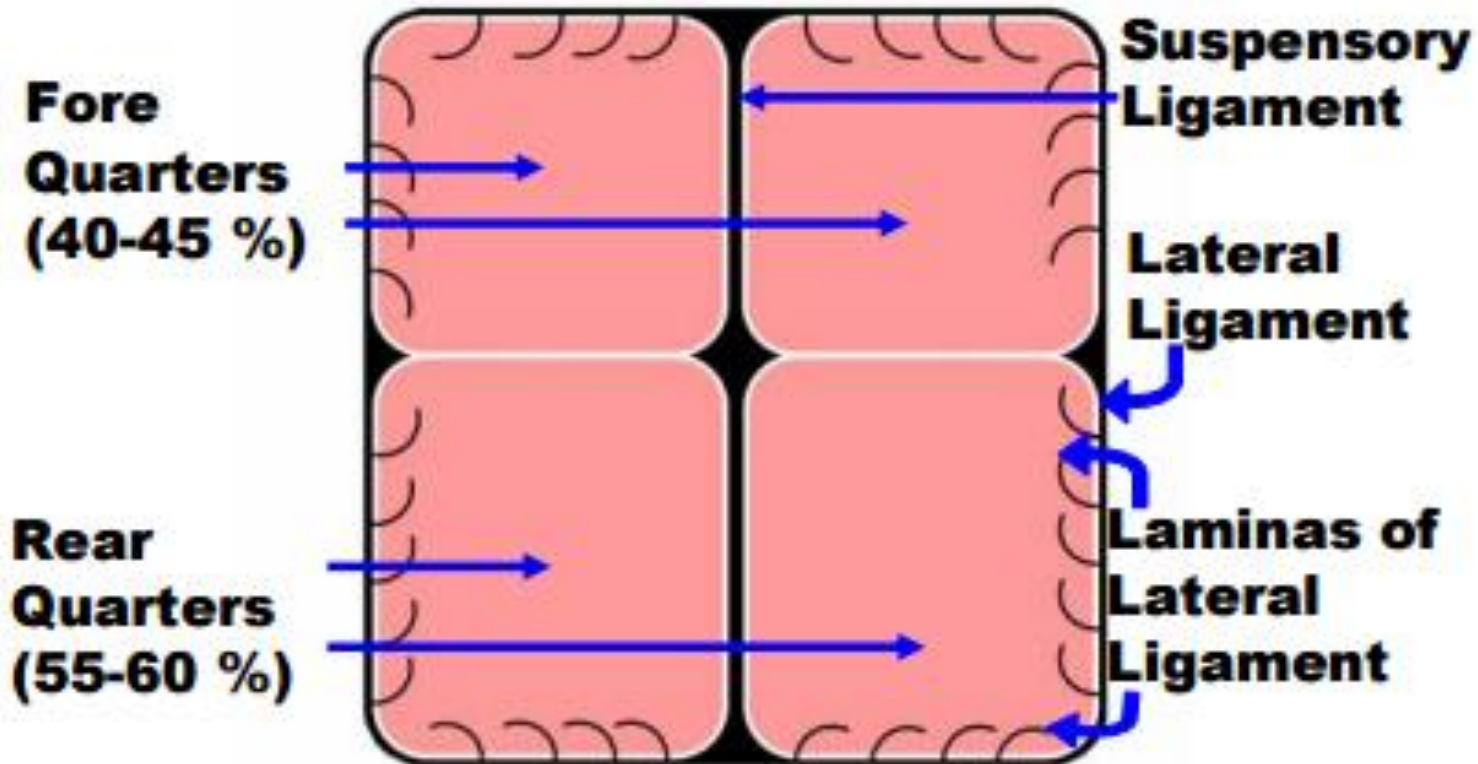
How does the udder stay on the cow?



Are Individual quarters also separated?



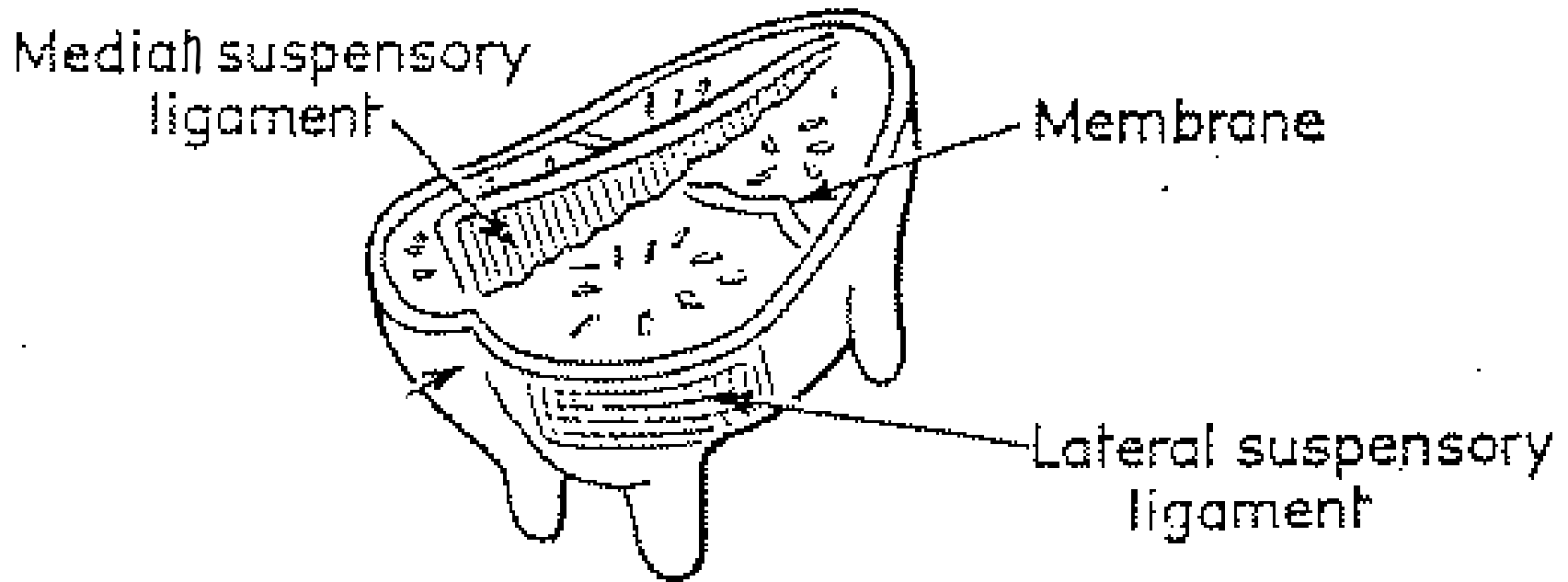
Are Individual quarters also separated?



Are Individual quarters also separated?



How does the udder stay on the cow?



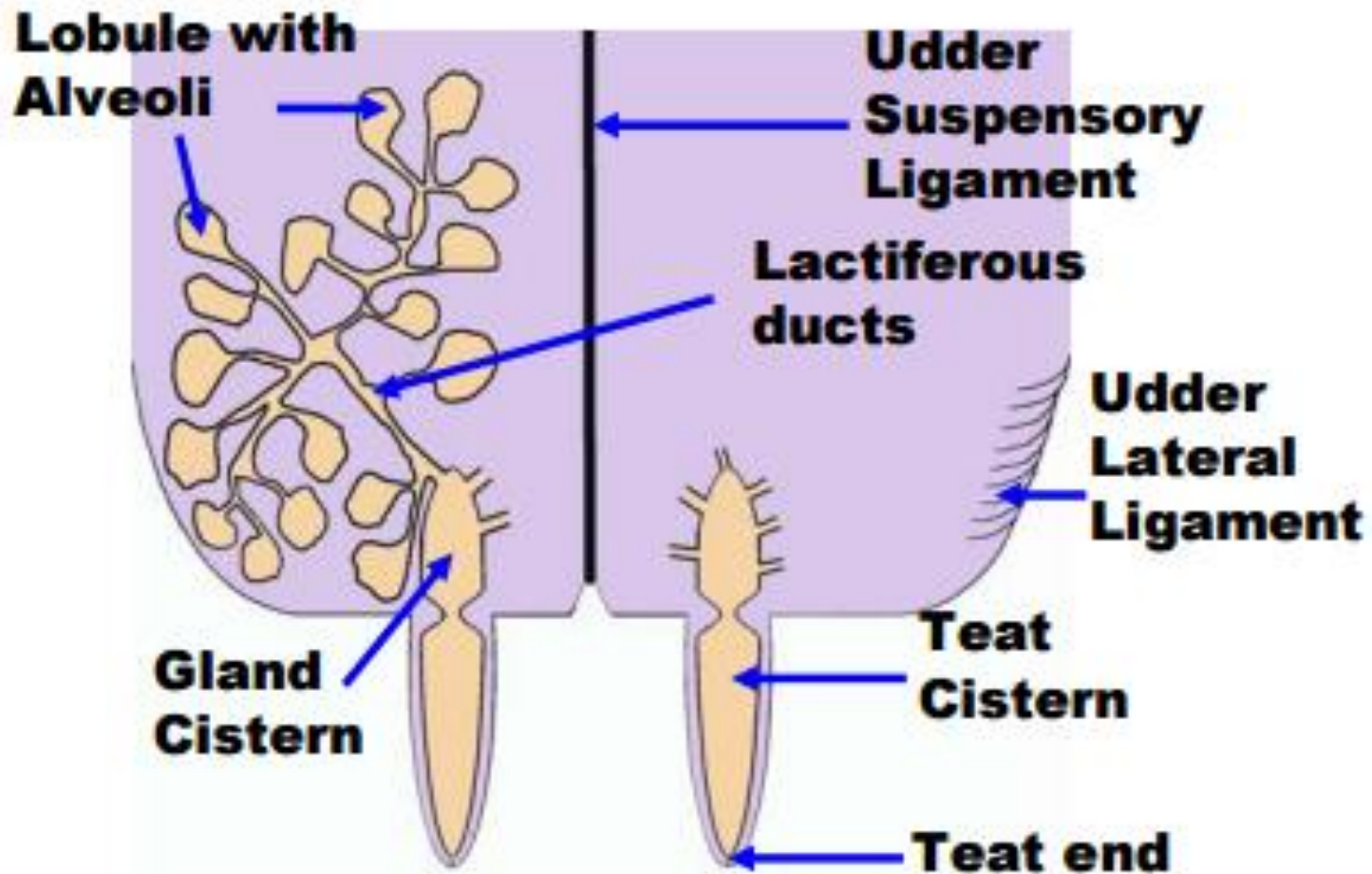
Are Individual quarters also separated?

- Left and right quarters are separated by the median suspensory ligament
- Front and rear quarters are separated by a thin membrane
- There is NO internal crossover of the milk duct system of the quarters (glands)

Do antibiotics stay only in the quarter you insert them into?



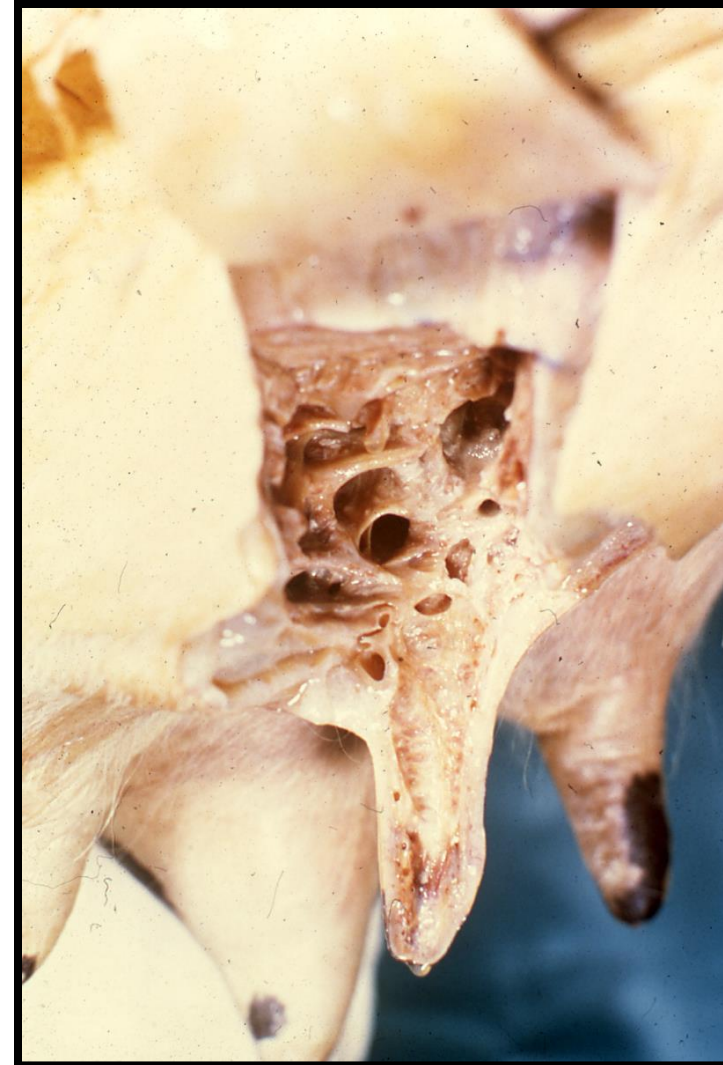
What's Going On Inside Each Gland?



Gland Structures

- **Gland cistern aka udder cistern**
 - Opens directly into the teat cistern
 - Stores milk
- **Teat cistern**
 - Cavity within the teat
 - Continuous with the gland cistern
 - Holding chamber where milk accumulates before being removed
 - Lined with numerous longitudinal and circular folds in the mucosa, which form pockets on the inner lining of the teat
 - Refills continuously during milking
 - Holds 0.5 to 1.5 ounces of milk, depending on the size of the teat

Gland cistern



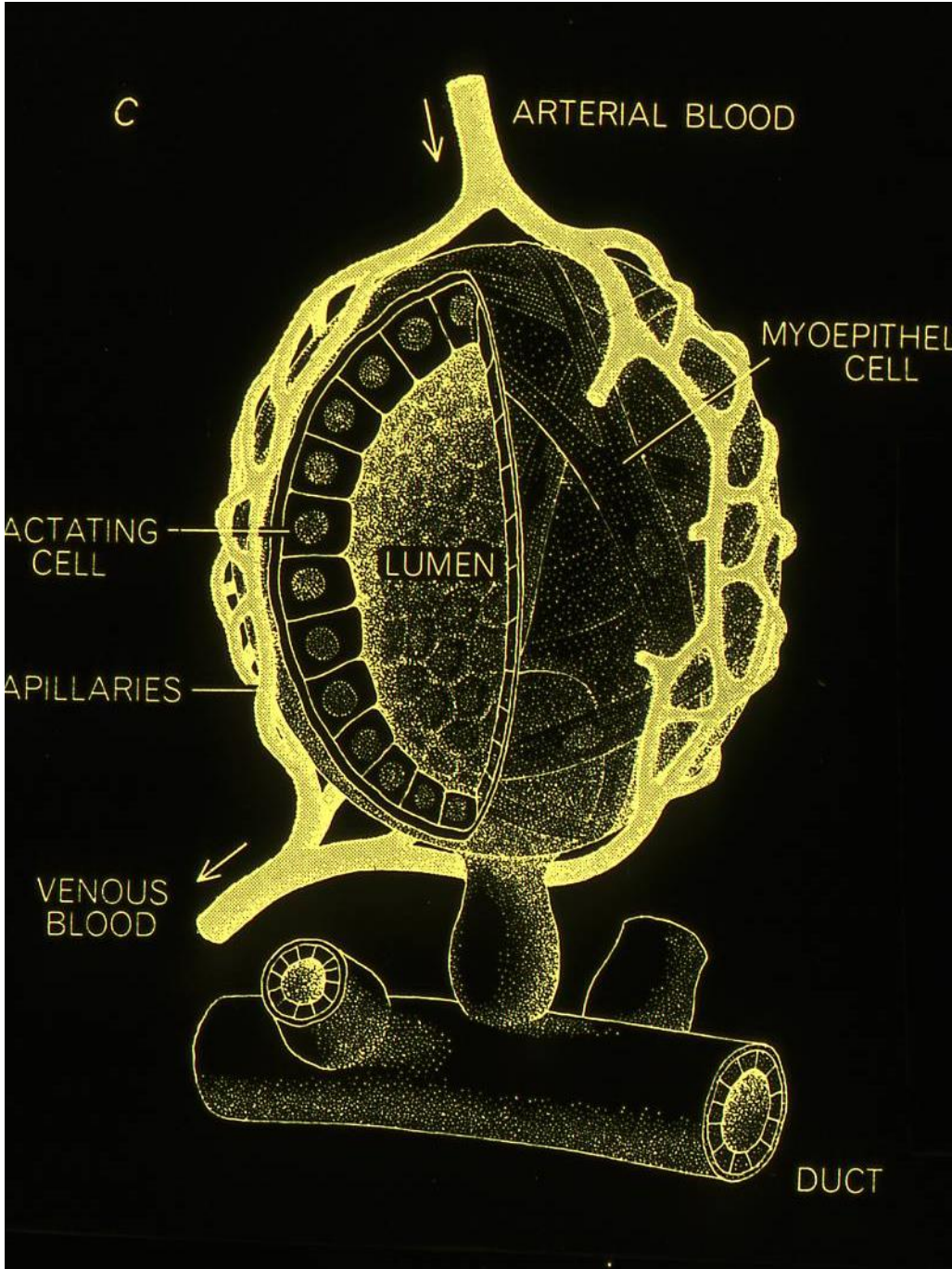
Gland Structures

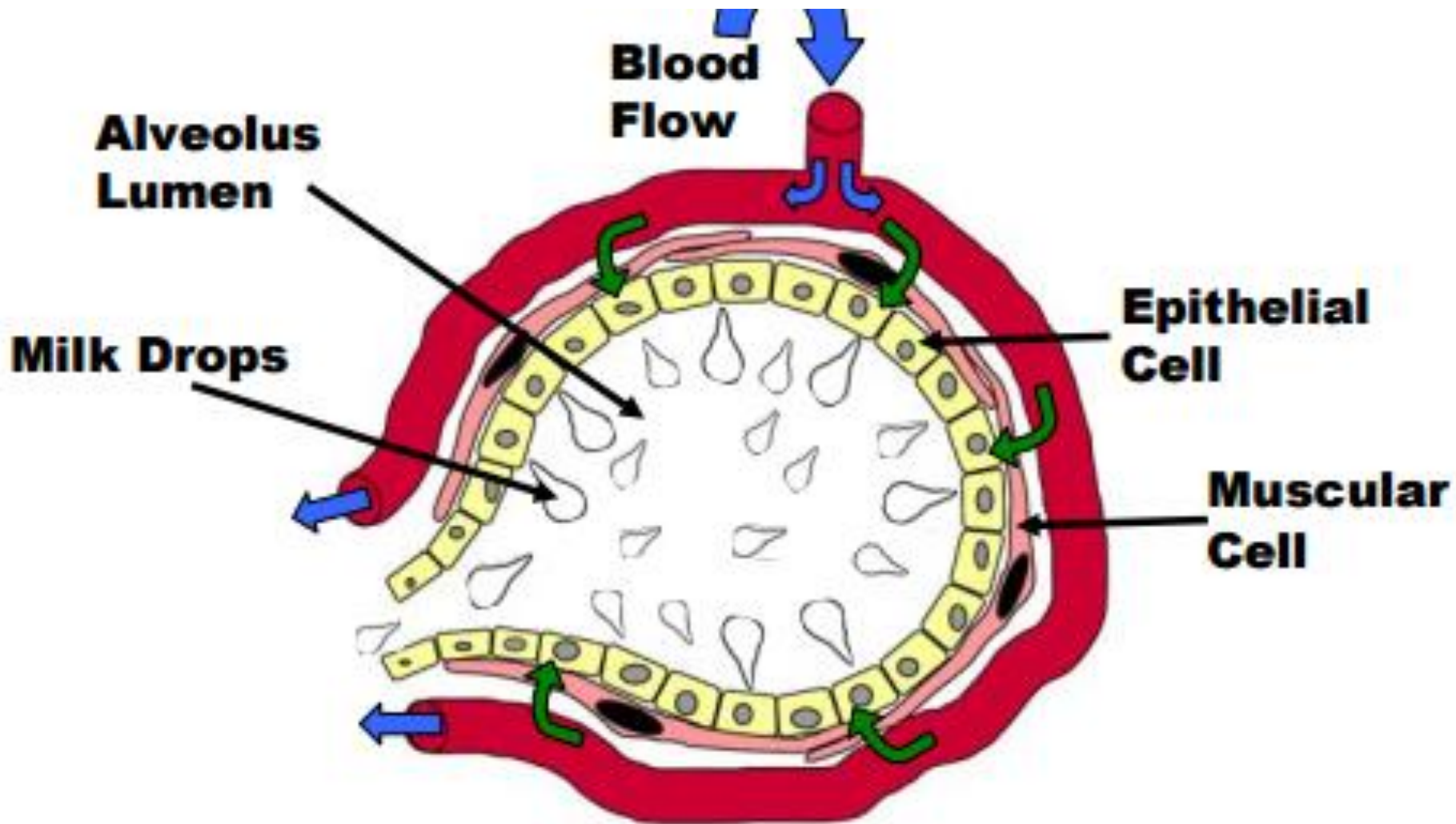
- **Alveoli**
 - Sack-like structures where milk is synthesized and secreted
 - Each one only holds a small amount of milk
- **Lobule**
 - Cluster of 150-220 alveoli encapsulated by a connective tissue sheath
- **Lobe**
 - Group of lobules

Alveoli

- **Lumen of the alveolus lined with single layer of secretory epithelial cells**
- **Single layer of epithelial cells surrounded by contractile myoepithelial cells**
 - **Cells absorb nutrients from the blood, transform them into milk and discharge the milk into the cavity of the alveolus**
 - **Myoepithelial cells contract and milk being is out of the alveolar lumen**
- **Outside of the myoepithelial cells the alveolus is surrounded by a connective tissue basement membrane**
- **Capillary bed on the outside of the alveolus is part of the stromal tissue (connective tissue) between alveoli**

Alveolus





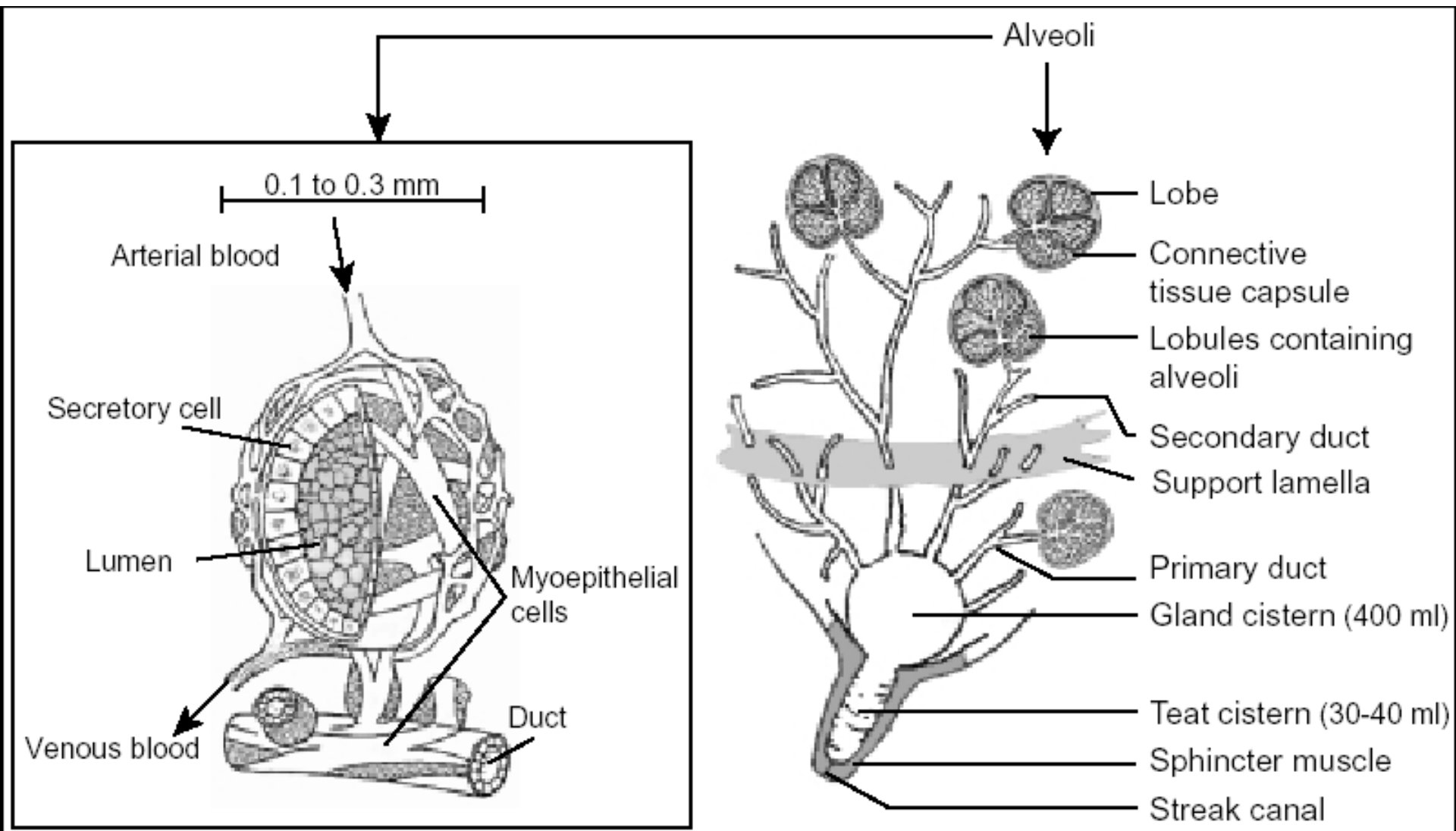
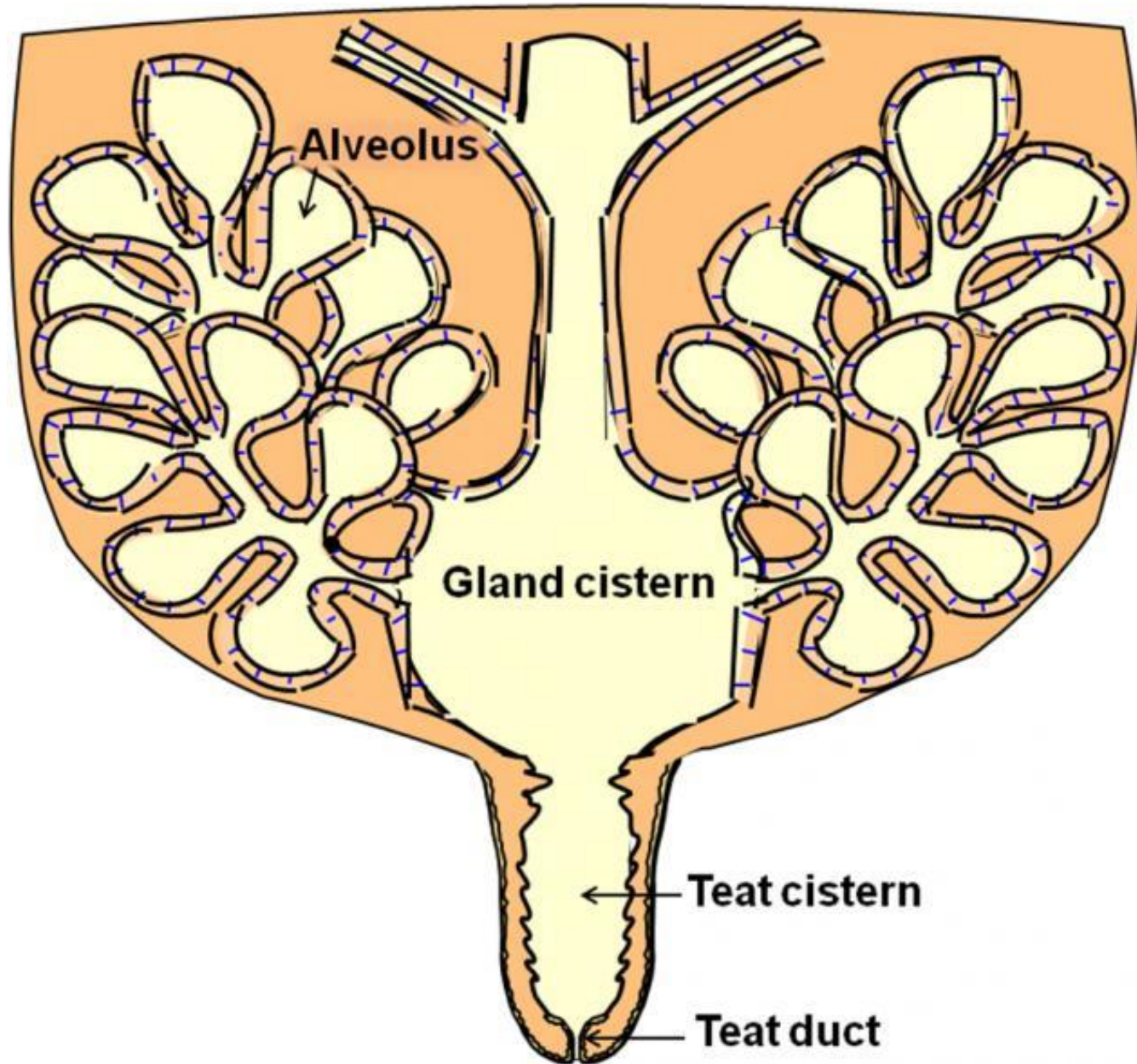
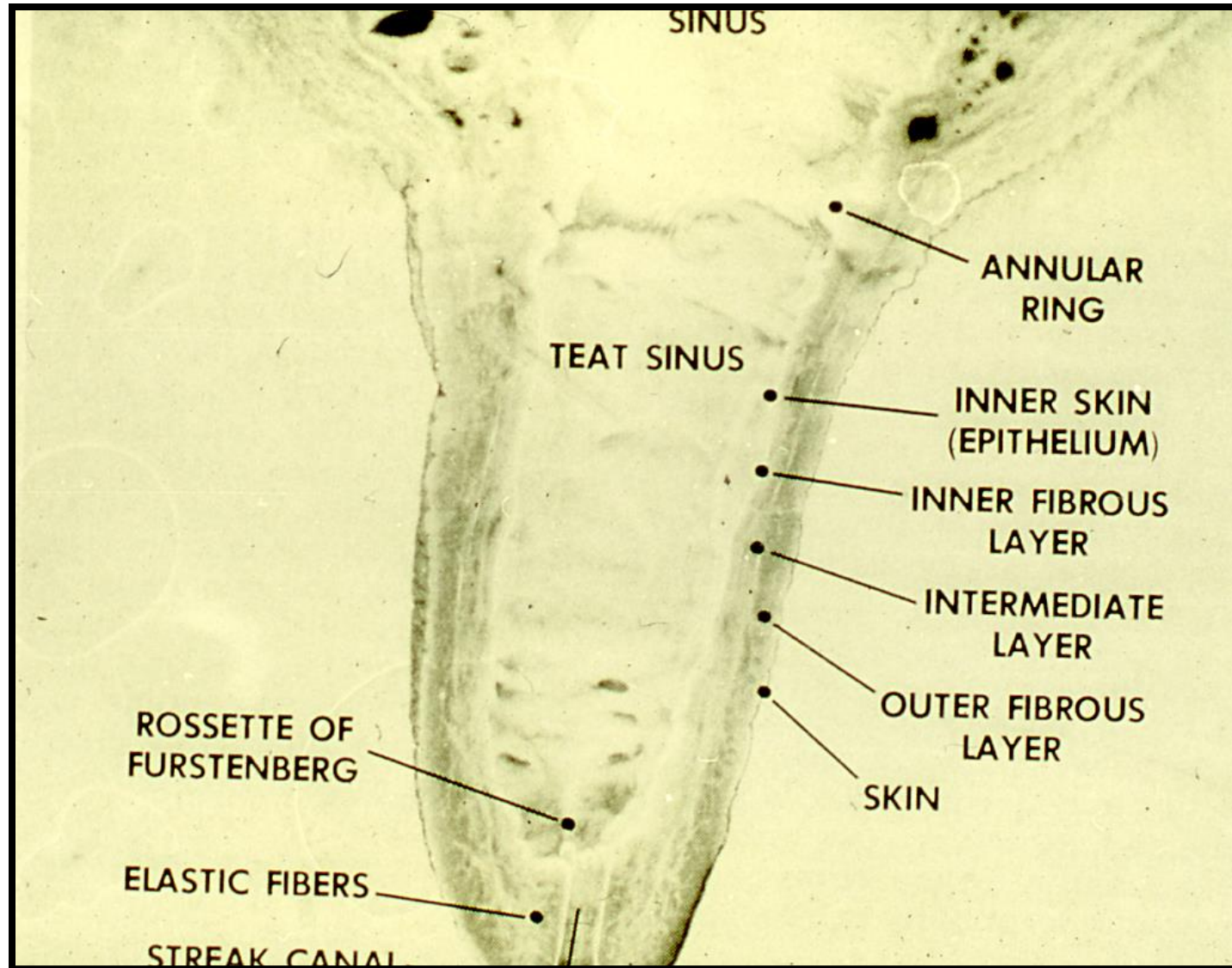


Figure 2: Alveoli and ducts form the milk secretory system

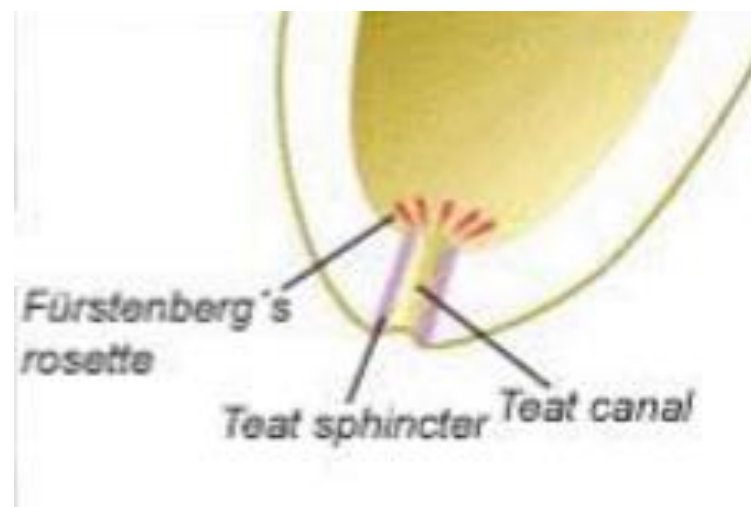
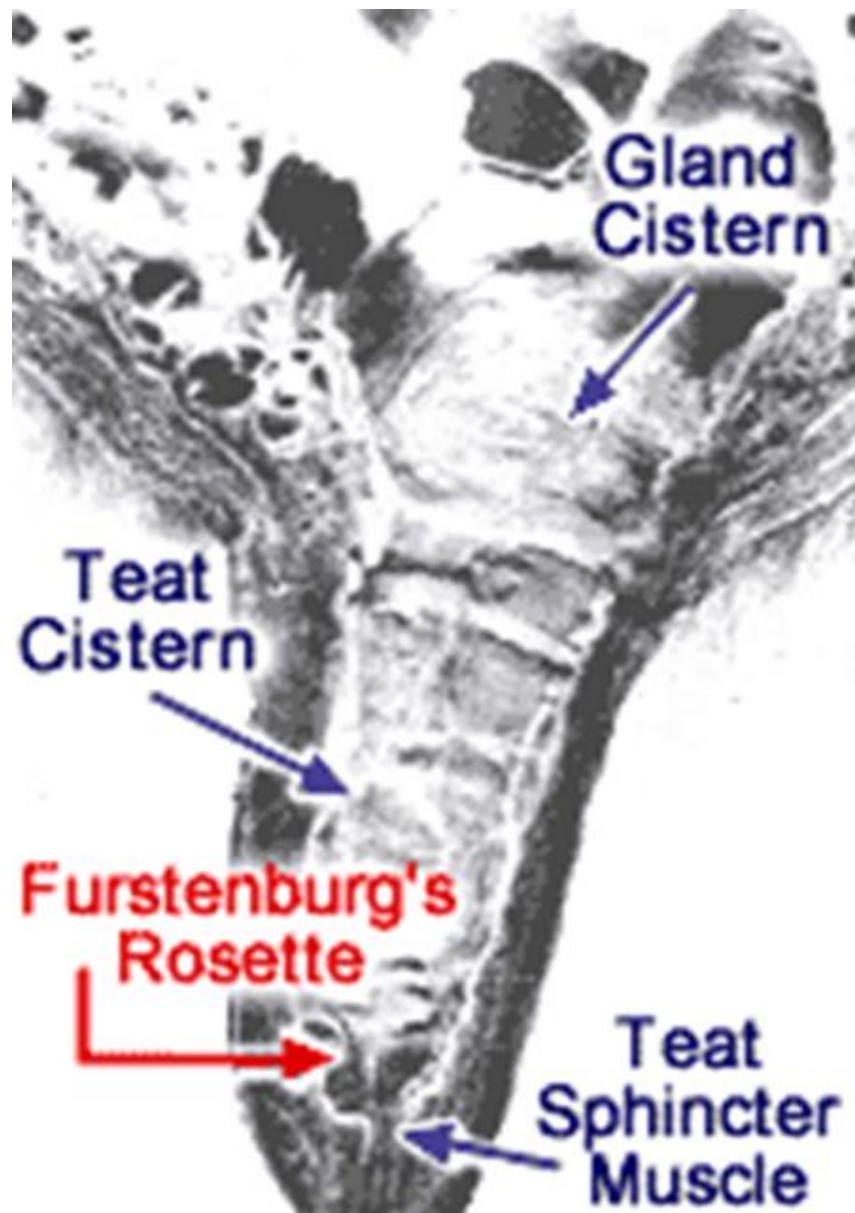


Teat Structures

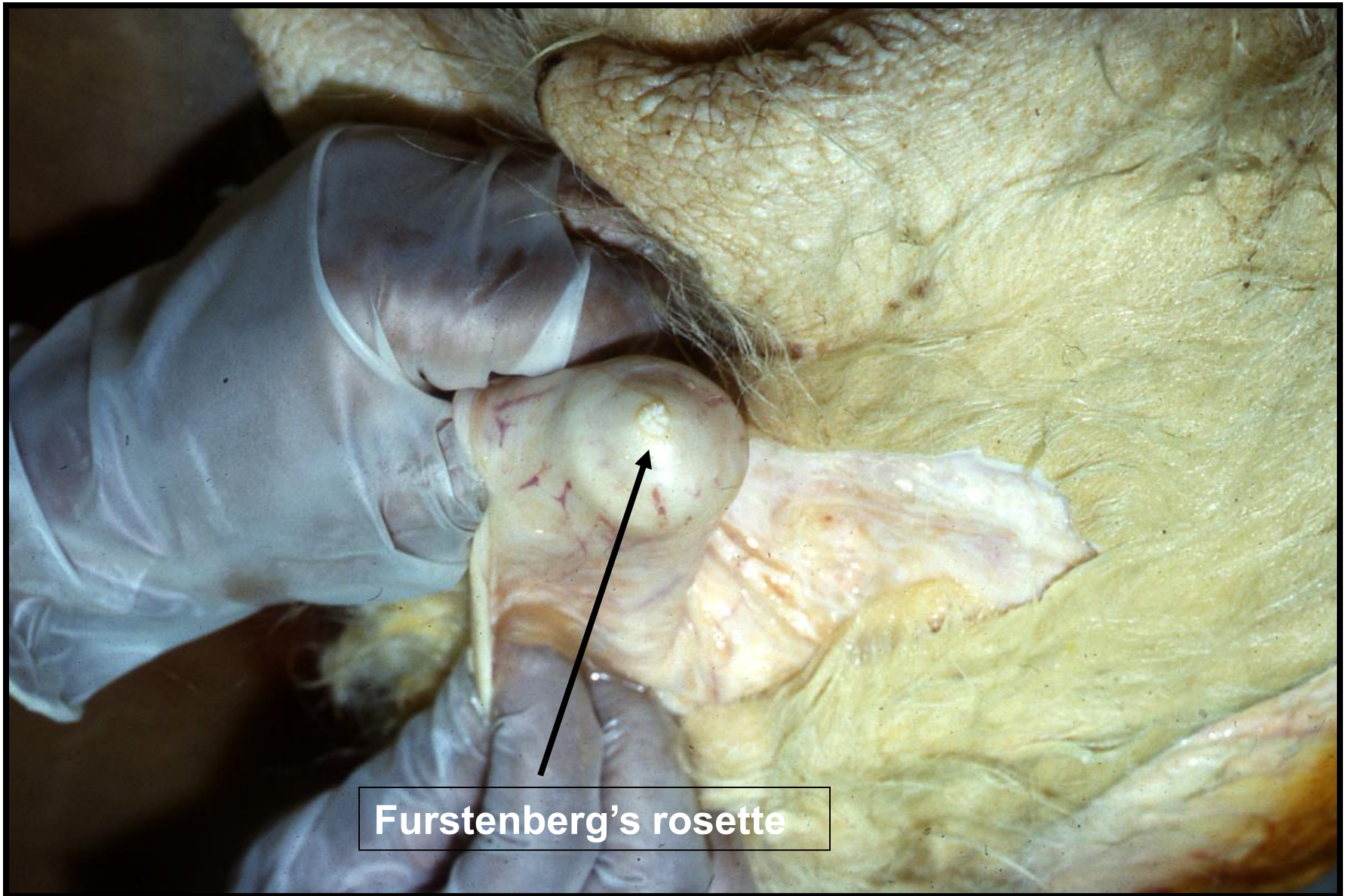


Teat Structures

- **Furstenberg's Rosette**
 - Located in the internal streak canal of the teat
 - Mucosal folds of streak canal lining at the internal end of the canal
 - Often considered a barrier for pathogens
 - May be a major point of entry for leukocytes entering teat cistern
- **Annular ring aka cricoid rings**
 - Region at proximal end of the teat cistern marking boundary between teat cistern and the gland cistern

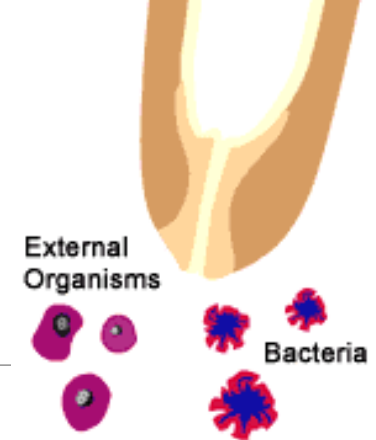


Internal teat cistern



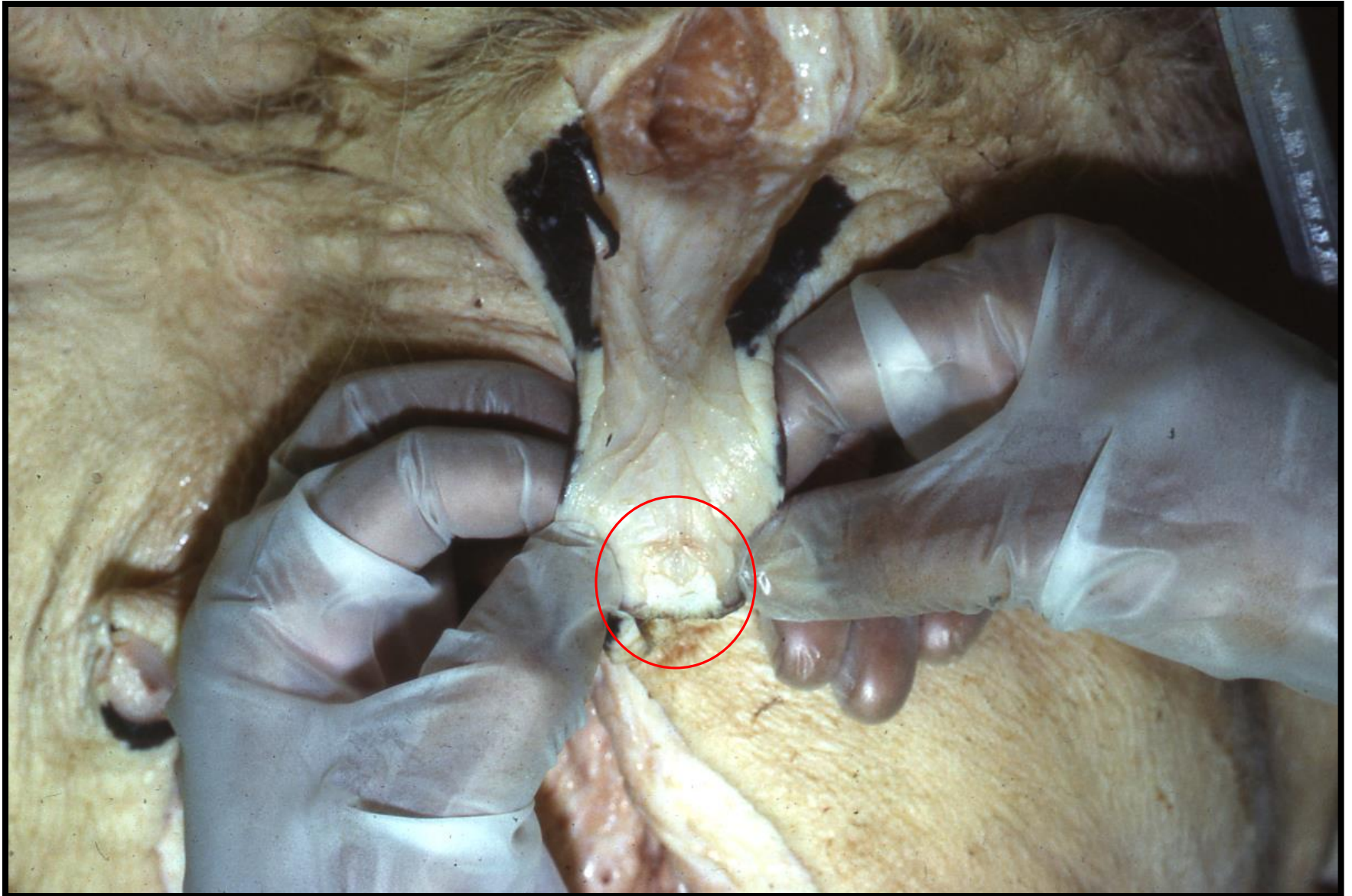
Furstenberg's rosette

Teat Structures



- **Streak canal aka teat canal**
 - Only orifice between the gland's internal milk secretory system and the external environment
 - Main barrier against intramammary infection (mastitis)
 - Kept closed by sphincter muscles around the streak canal
 - Prevents milk leakage between milkings
 - Milking speed is related to the size of the canal and tightness of the sphincter muscles
 - Streak canal remains open for an hour or more after milking
 - Post-milking germicidal teat dips are designed to help minimize the chance of bacteria gaining access to the gland after milking

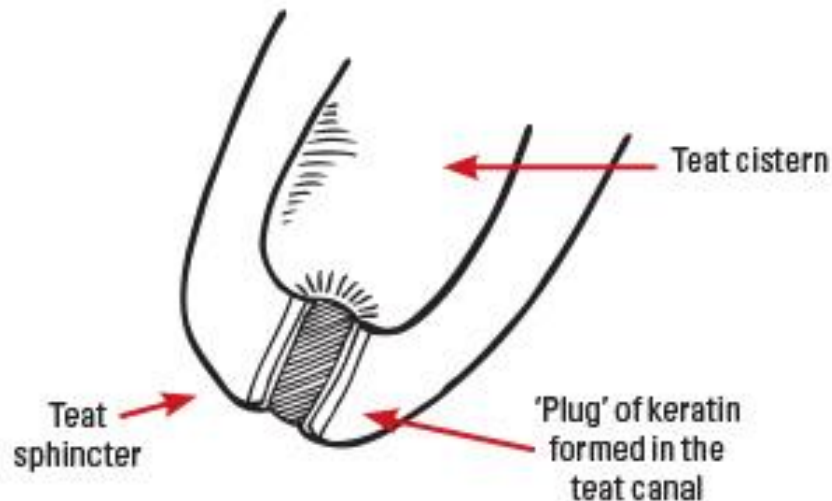
Streak canal

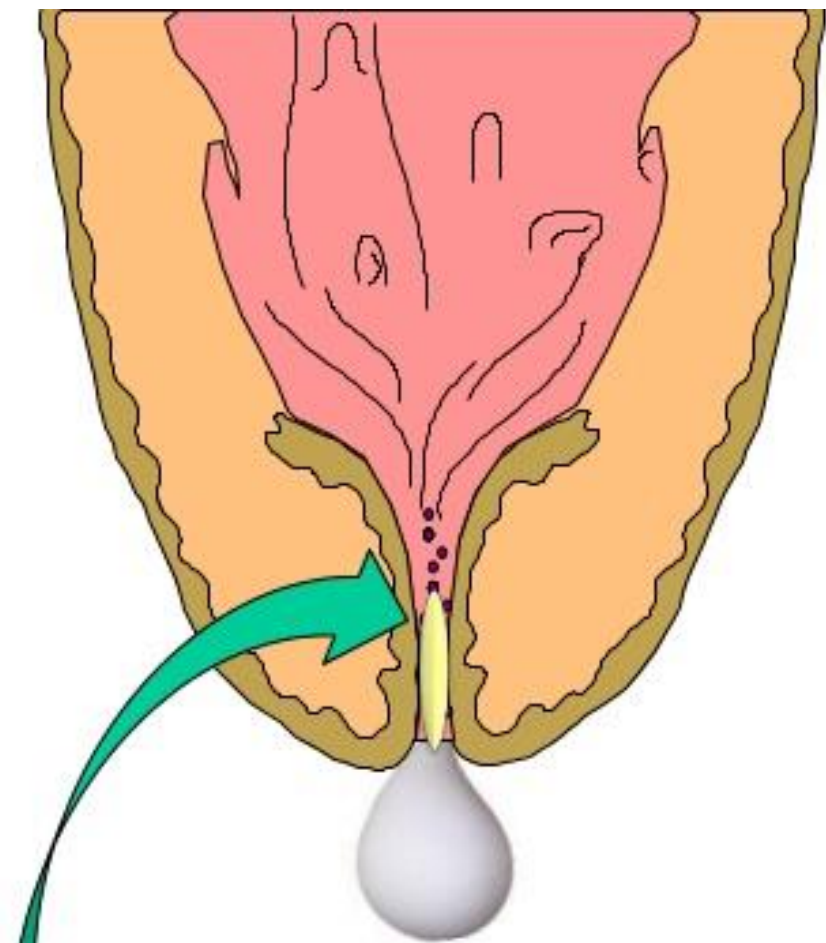


Teat Structures

- Streak canal lined with skin-like epidermis that forms keratin
 - Waxy structure similar to ear wax
 - During the dry period, the epidermal tissue lining the streak canal forms a keratin plug that effectively seals off the canal

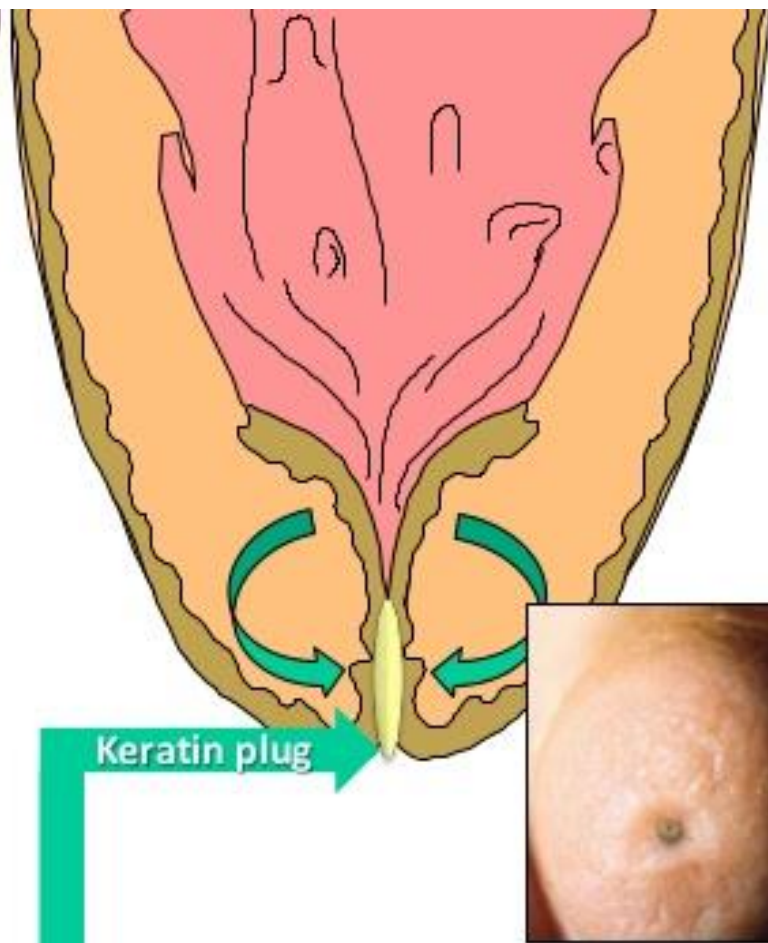
Cross section of the teat end





Cows with greater milk yield at dry-off → leak milk → incomplete keratin plug formation at teat end

Increases chances for bacterial entry through the teat canal



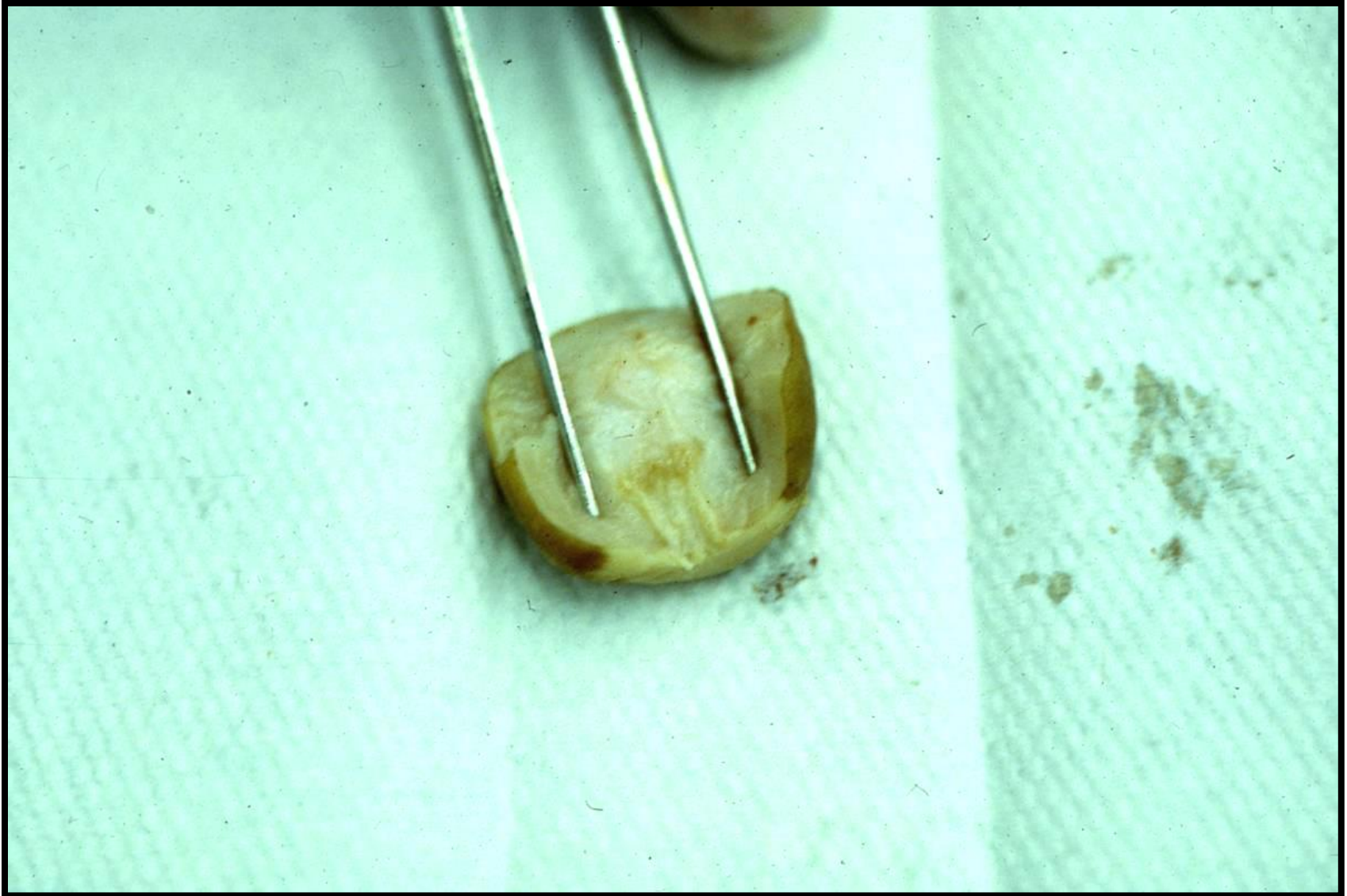
Keratin plug

Within several days-weeks, teat canal closes up, with the formation of a keratin plug

Decreases bacterial penetration: Physical barrier, antimicrobials

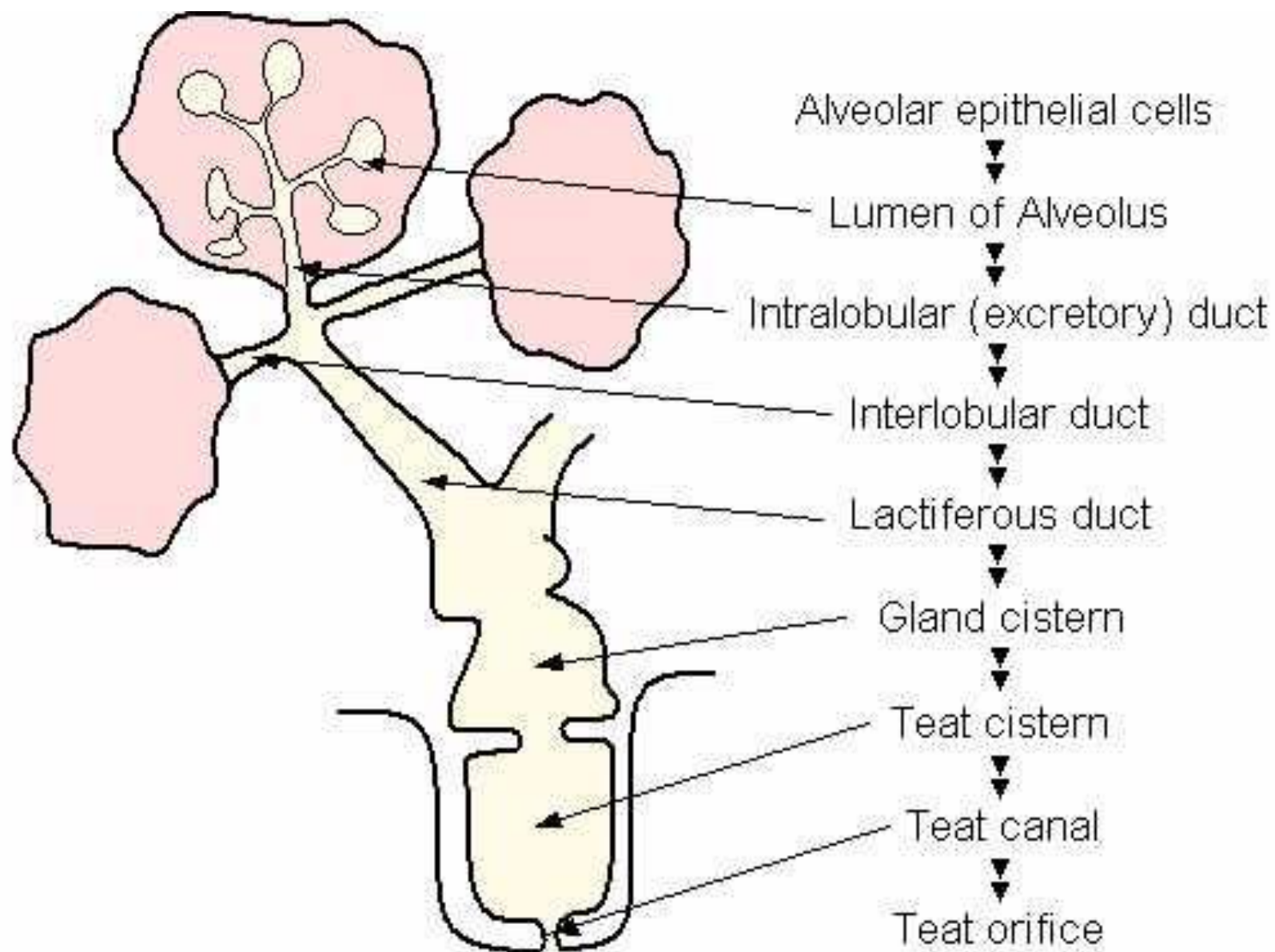


Mammary anomaly

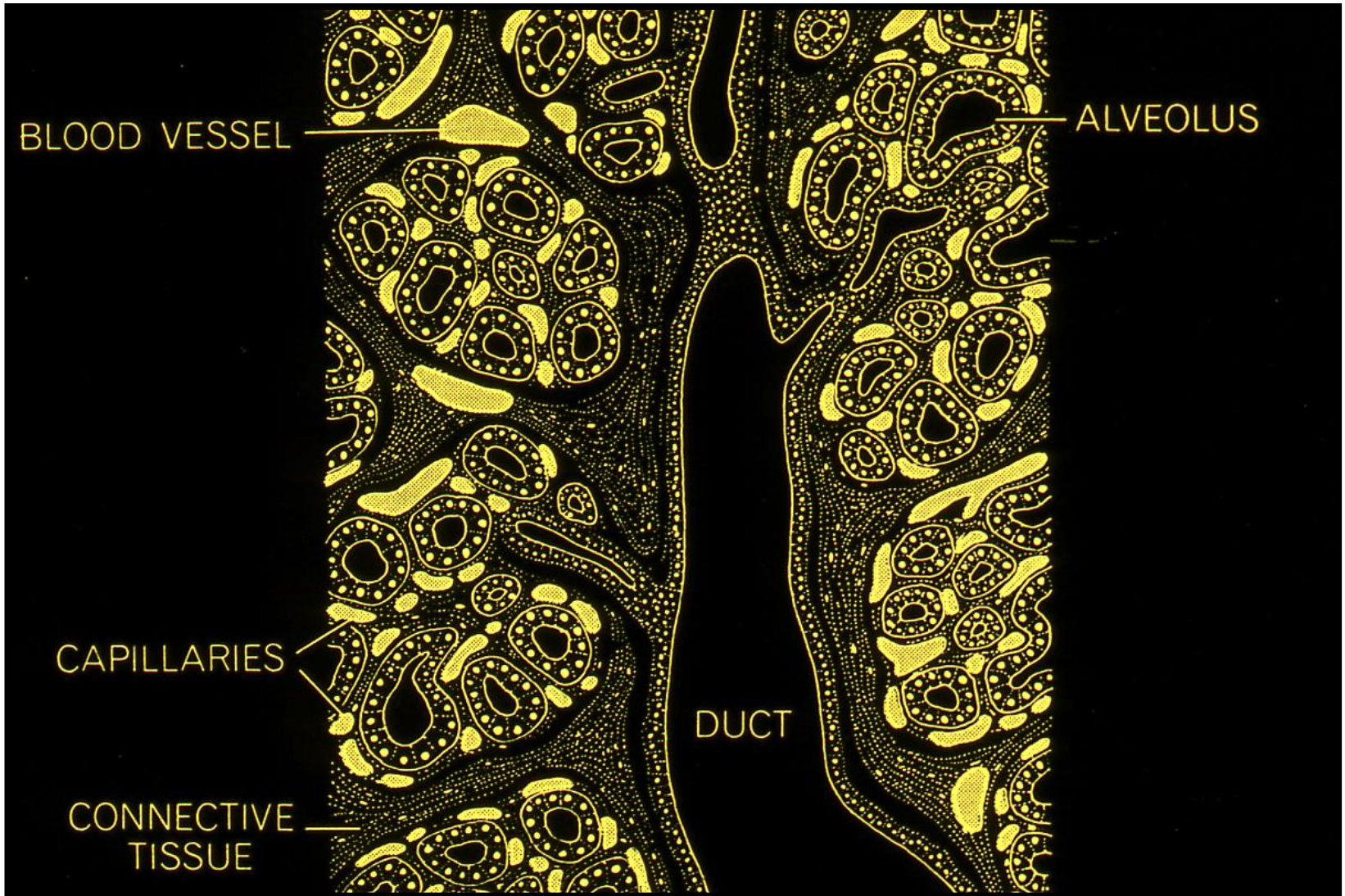


Mammary anomaly

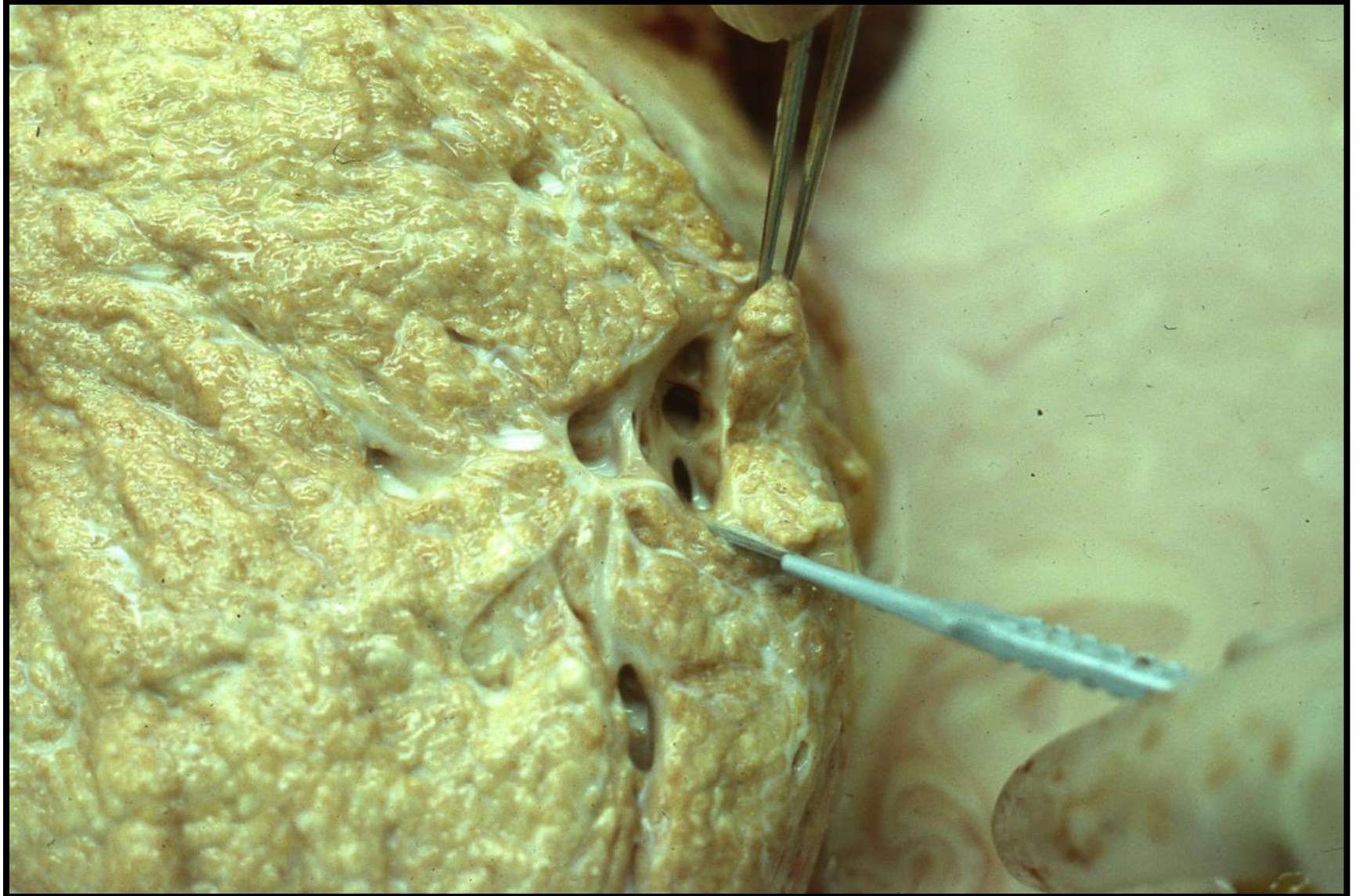




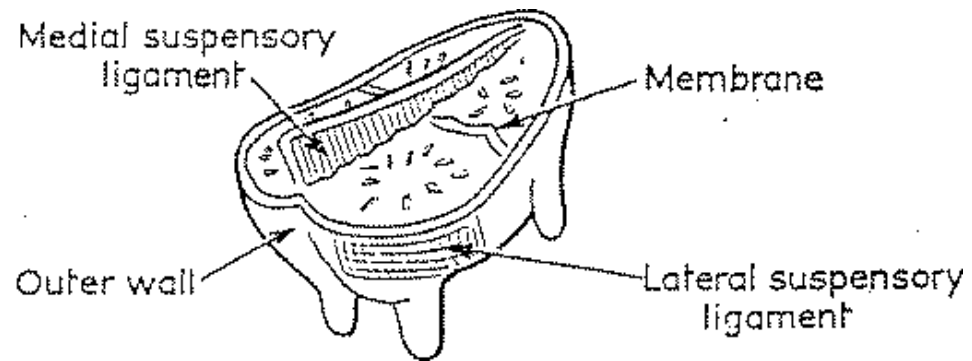
Ducts



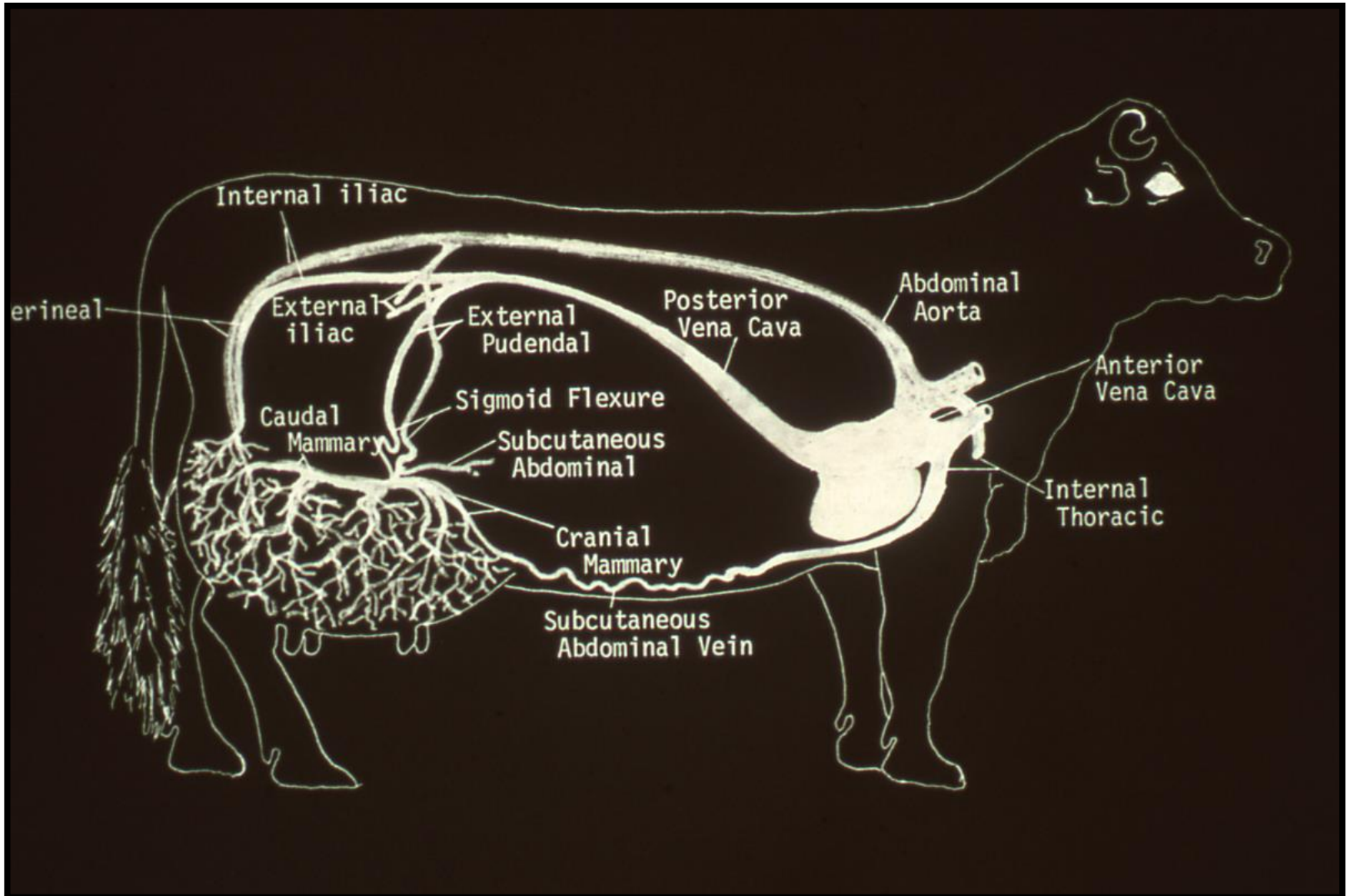
Large ducts



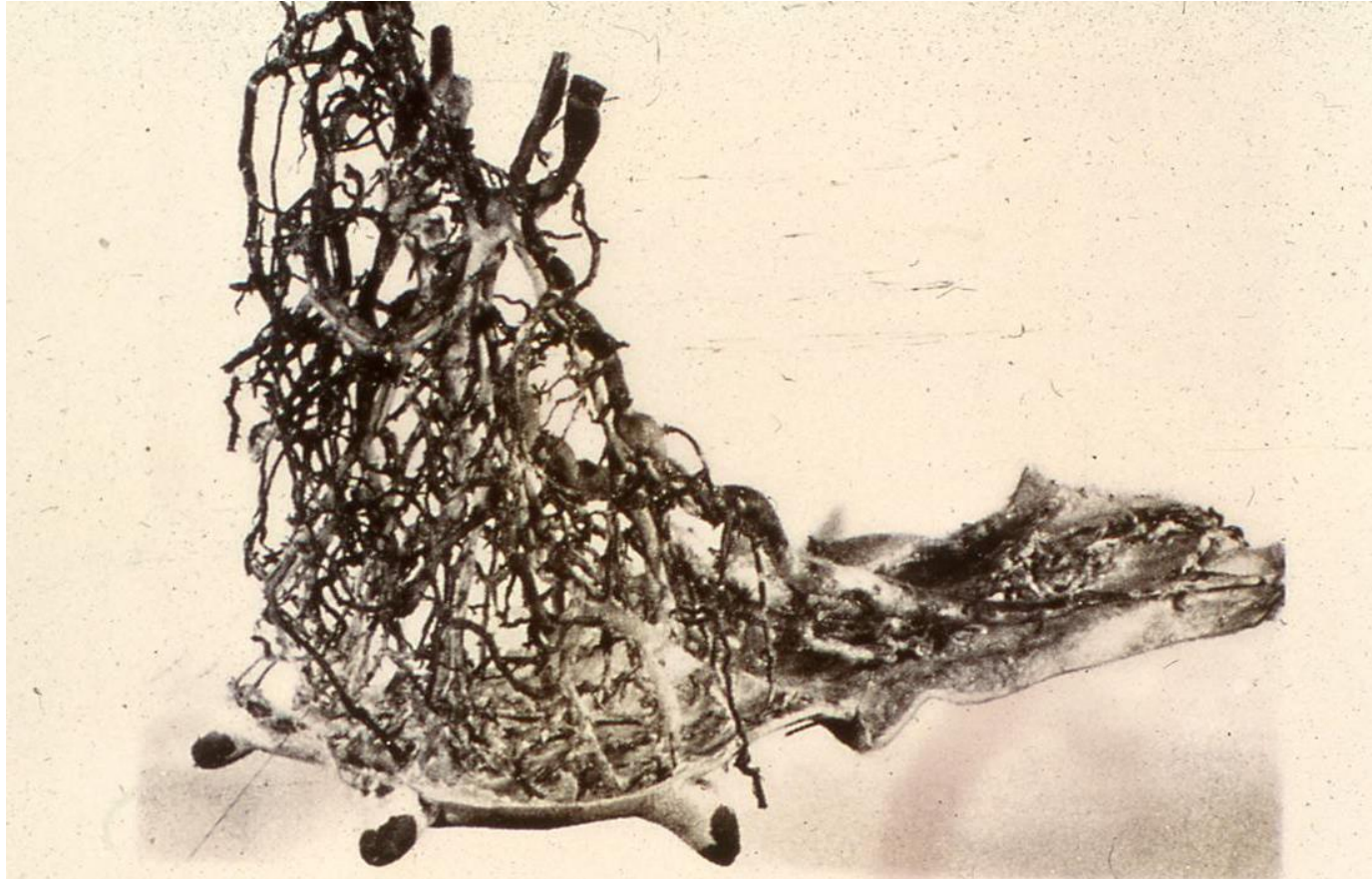
Why do antibiotics show up in other quarters after treating only one?



Blood supply

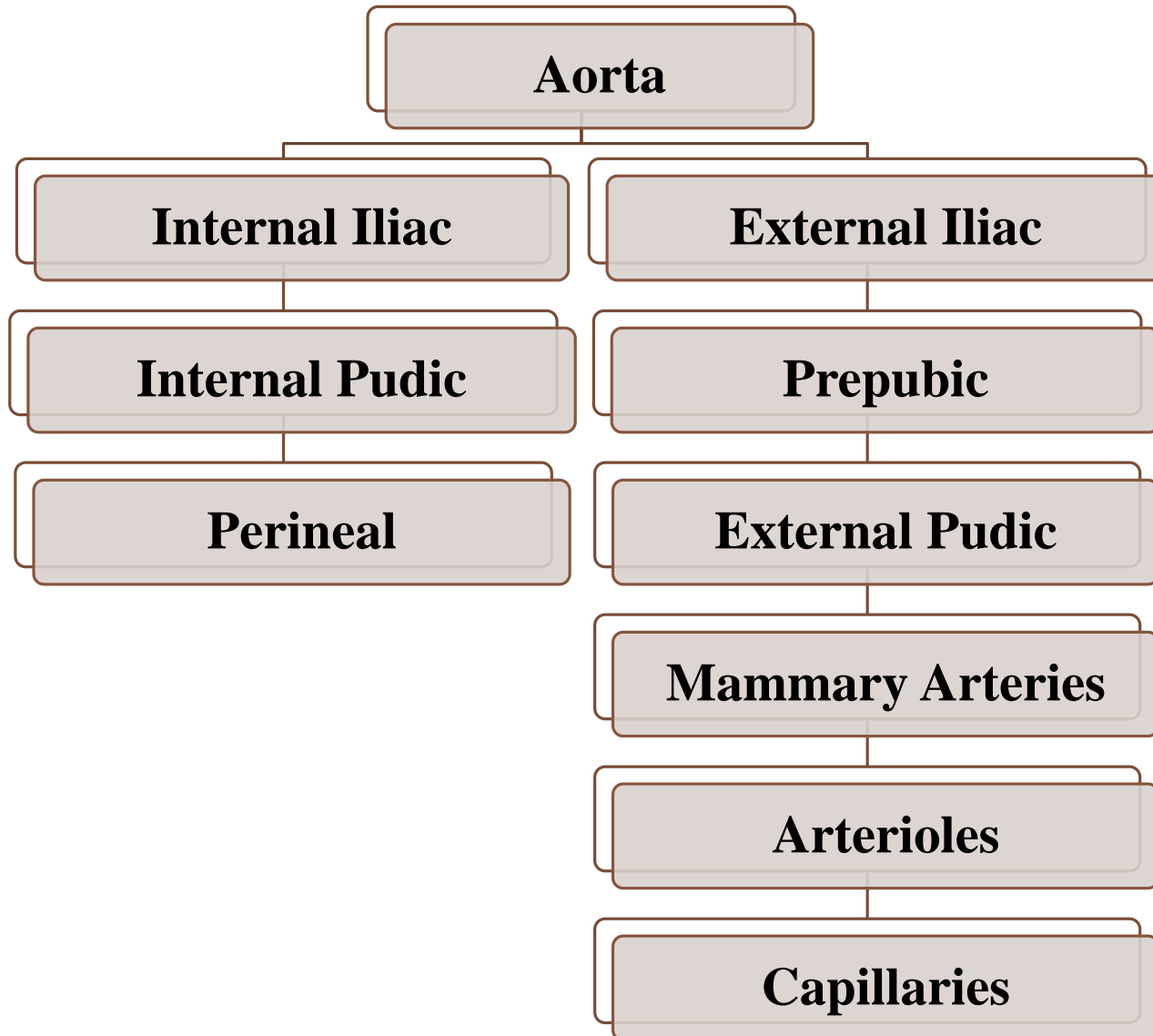


Extensive vascular system

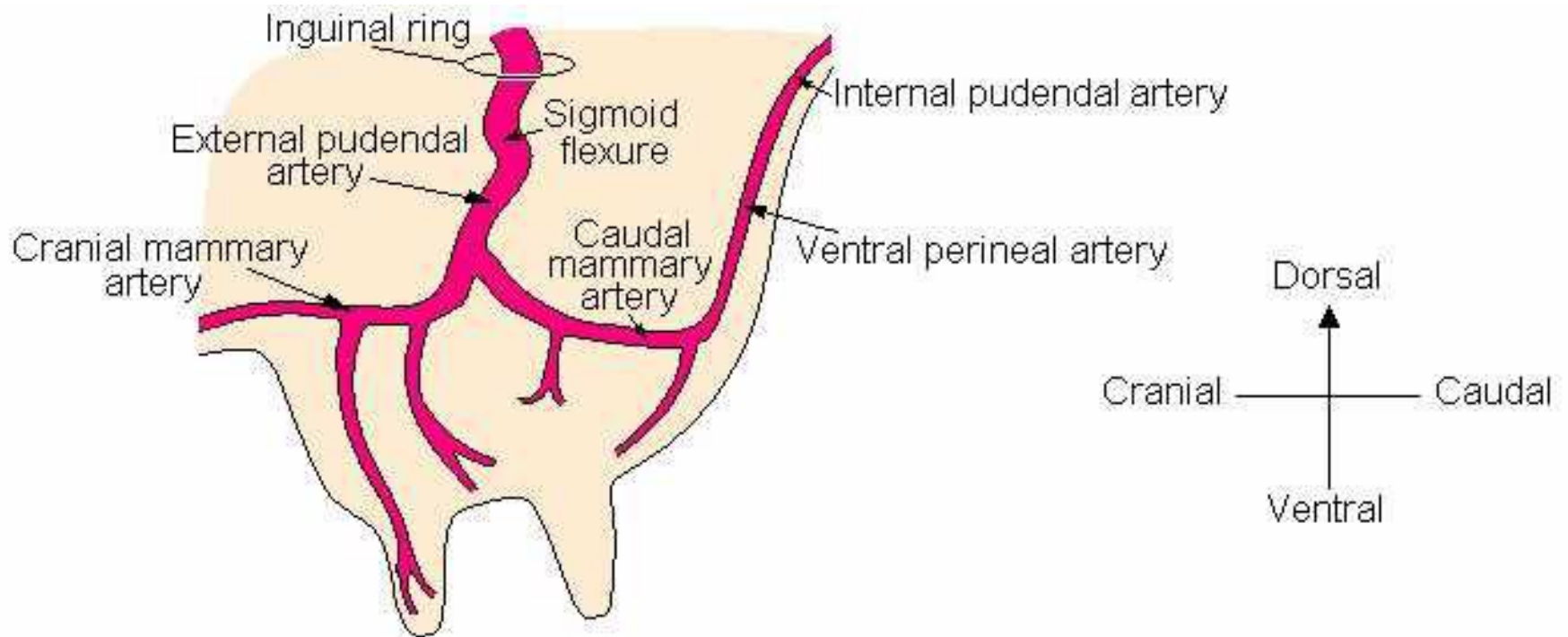


52-pound udder from lactating cow

Arterial Supply



Arteries



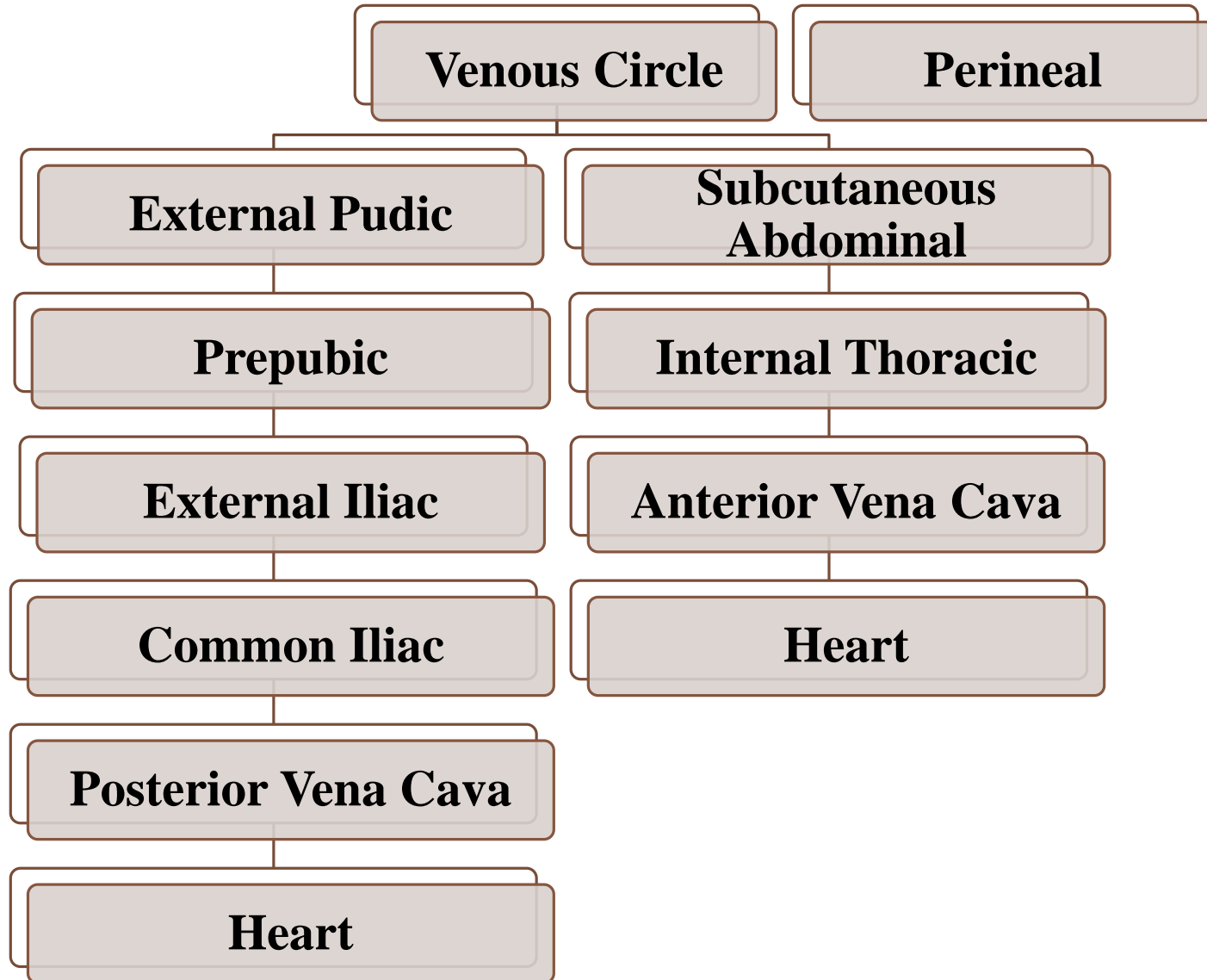
External pudic



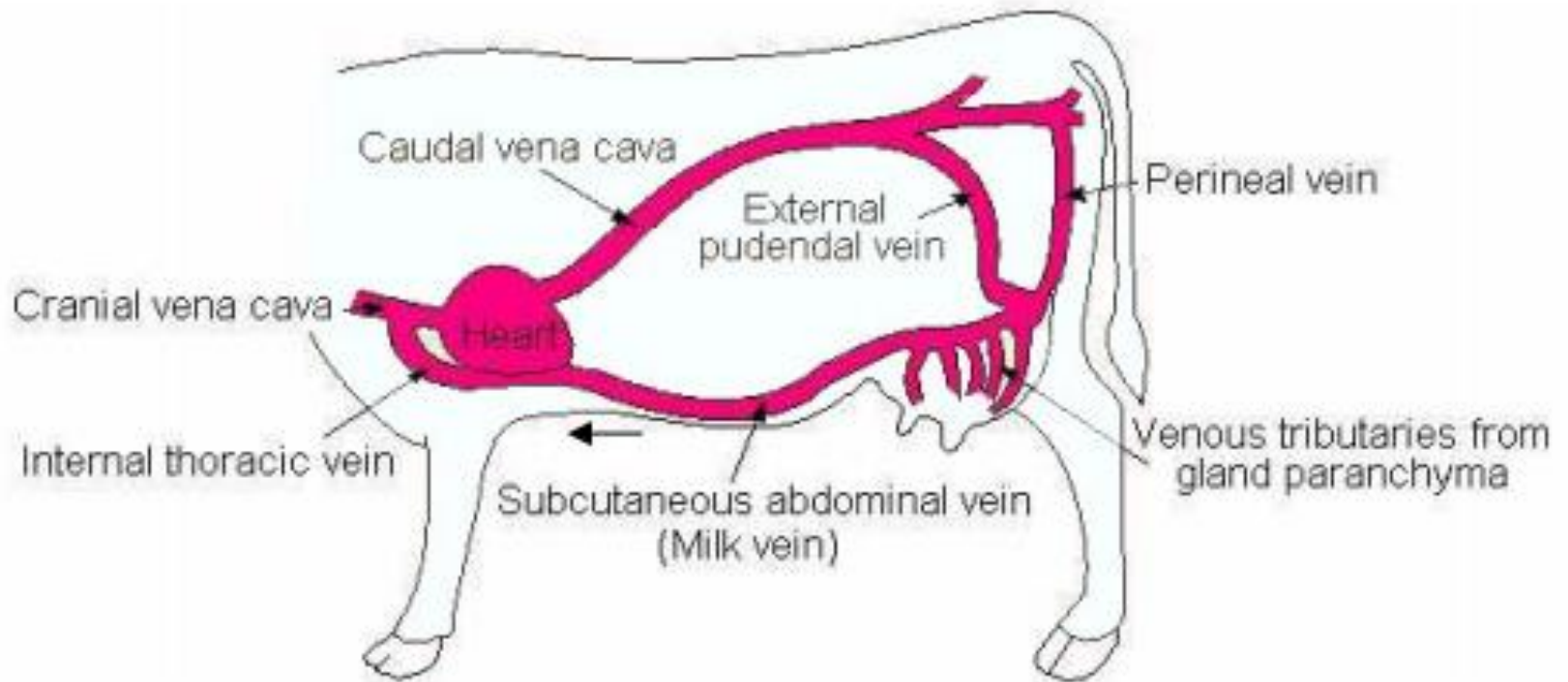
External pudic to mammary



Venous Supply



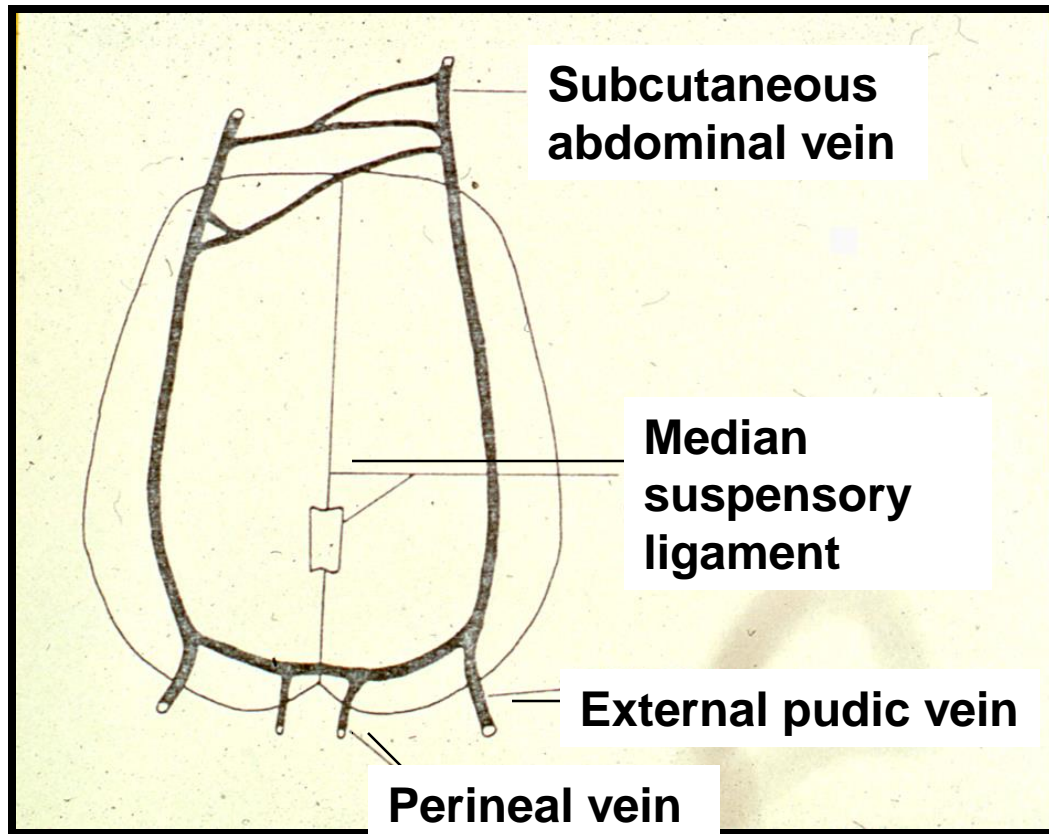
Veins



Milk Vein

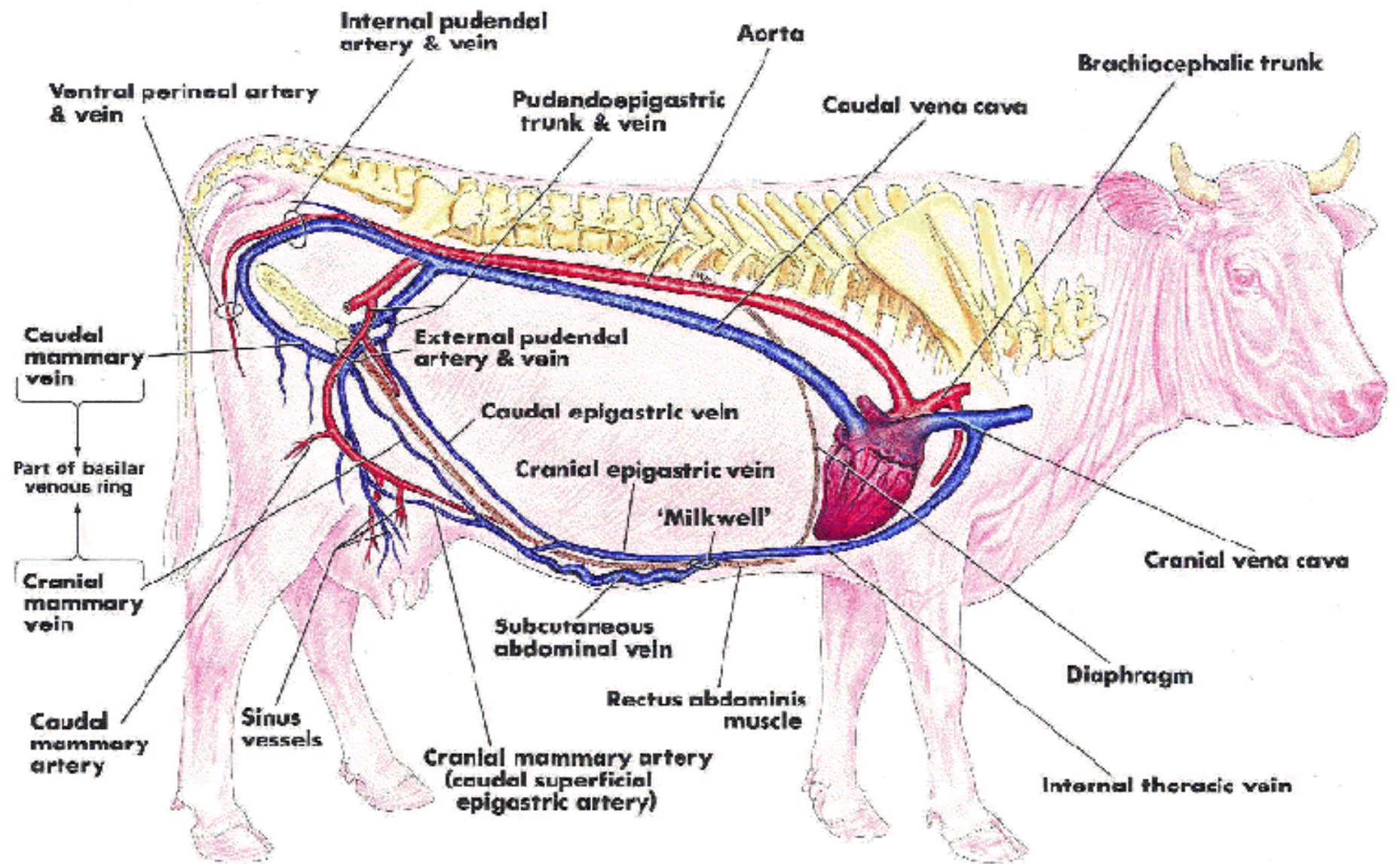


Venous circle



Artery and vein



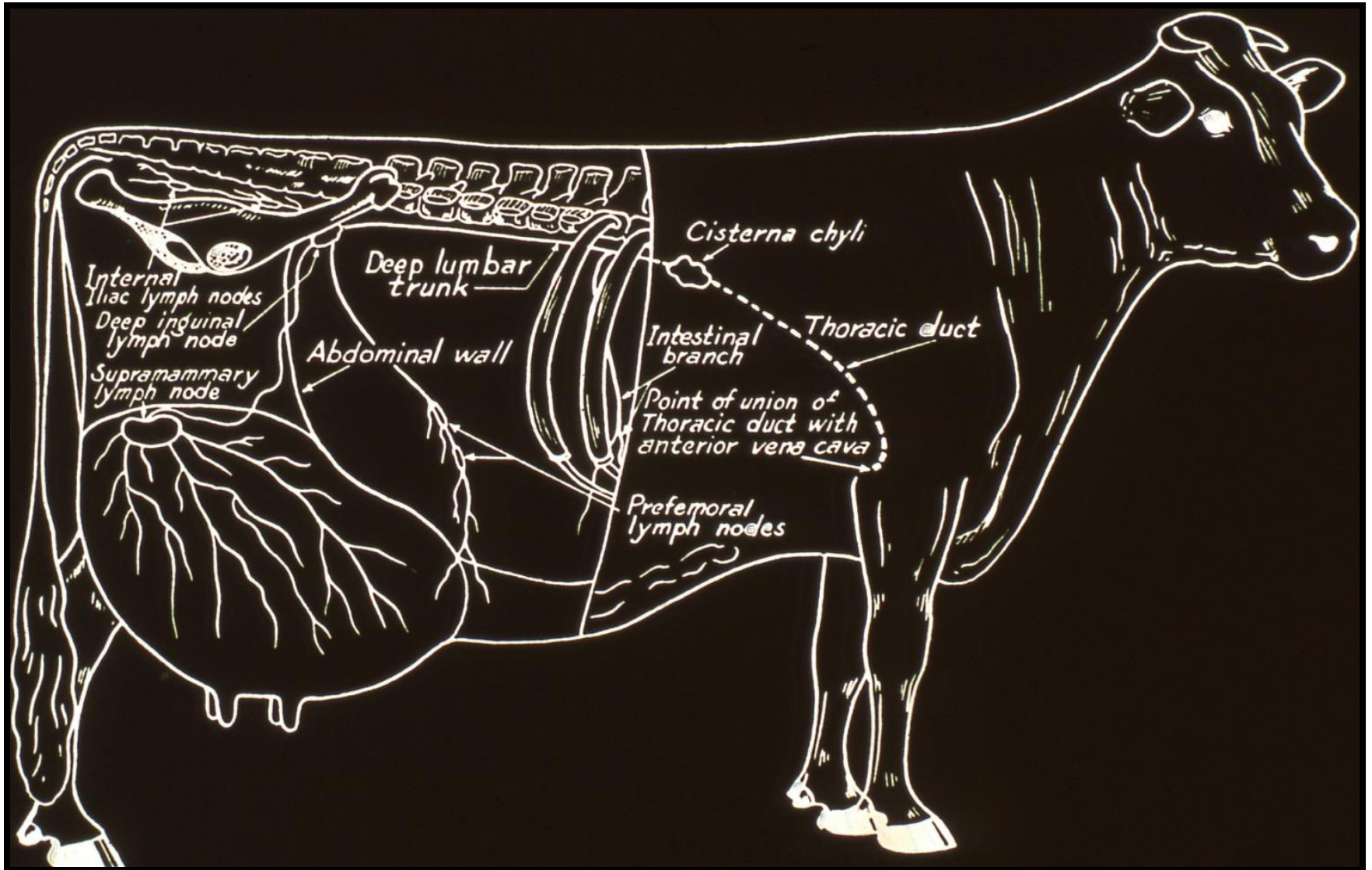


SEMISCHEMATIC DIAGRAM OF BLOOD SUPPLY OF COW'S UDDER

Lymphatic System

- **Lymph nodes**
 - **Round or bean-shaped structures**
 - **Imbedded in connective tissue or fat**
 - **In humans, concentrated mainly in the neck, armpits, and groin**
 - **Filter lymph before returning it to the veins**
 - **Hold lymphocytes**
 - **In cows, we will refer to the nodes in the udder but there are others throughout the animal**

Lymphatic system



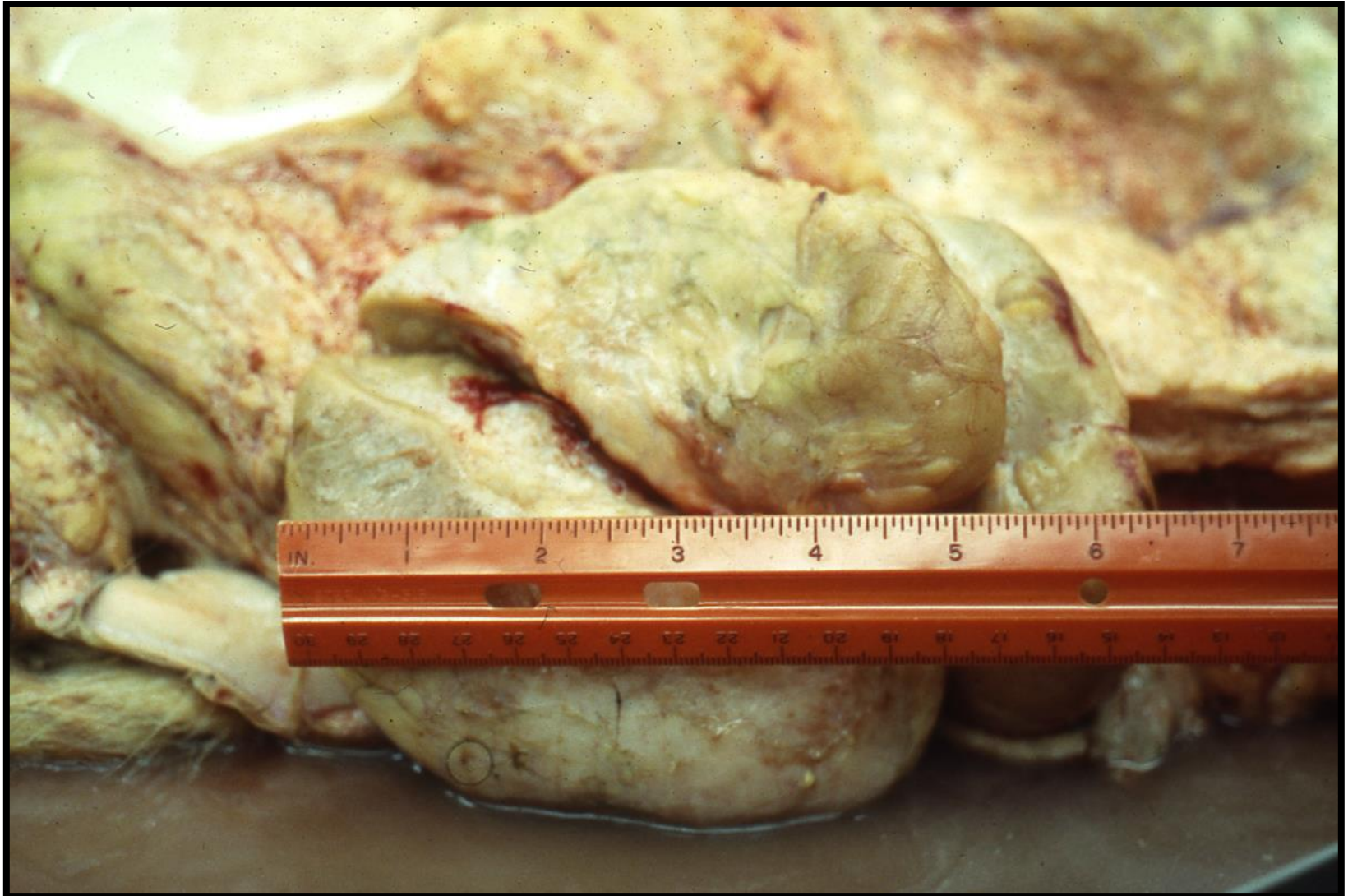
Supramammary lymph node



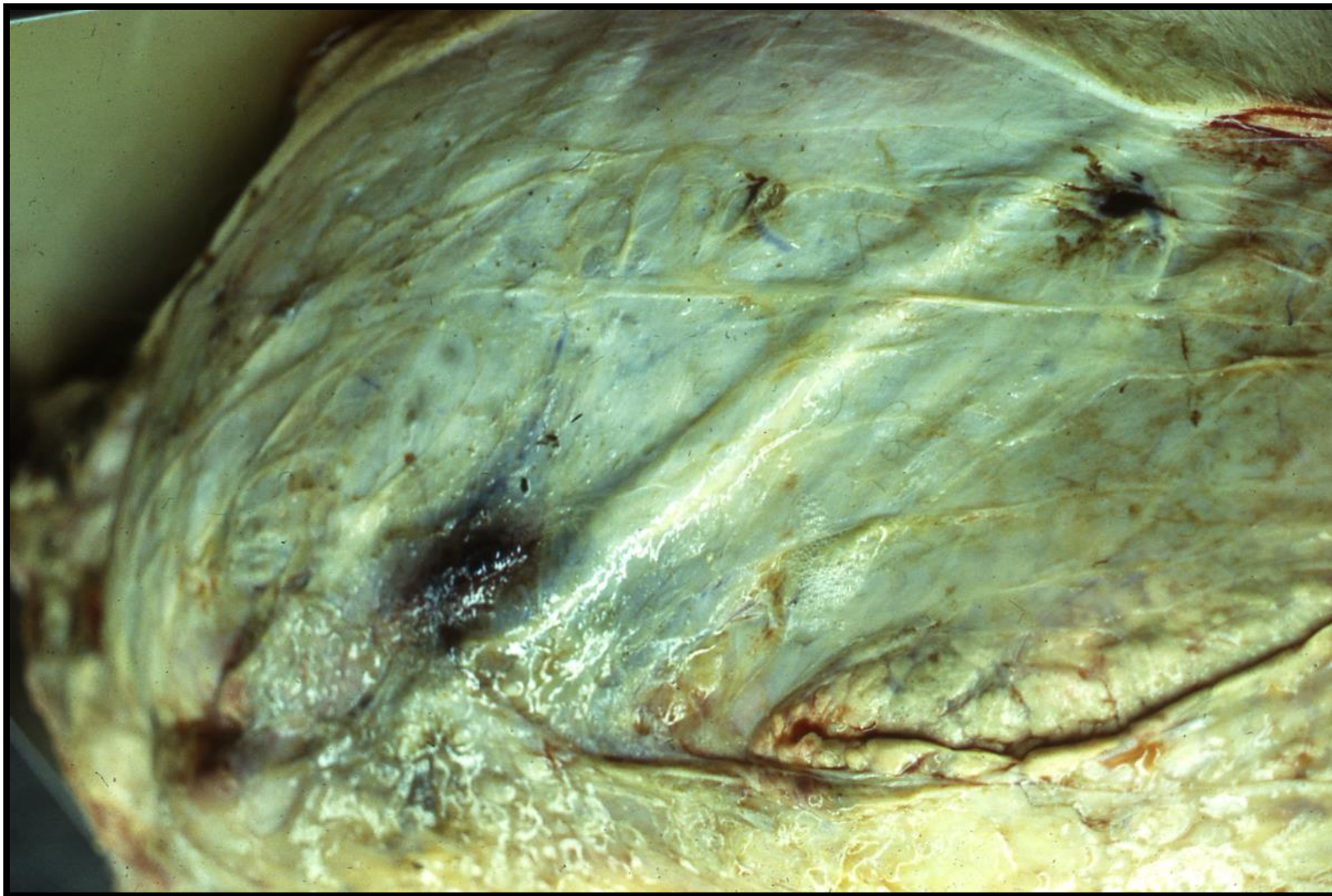
Supramammary lymph node



Supramammary lymph node



Lymph vessel



Edema

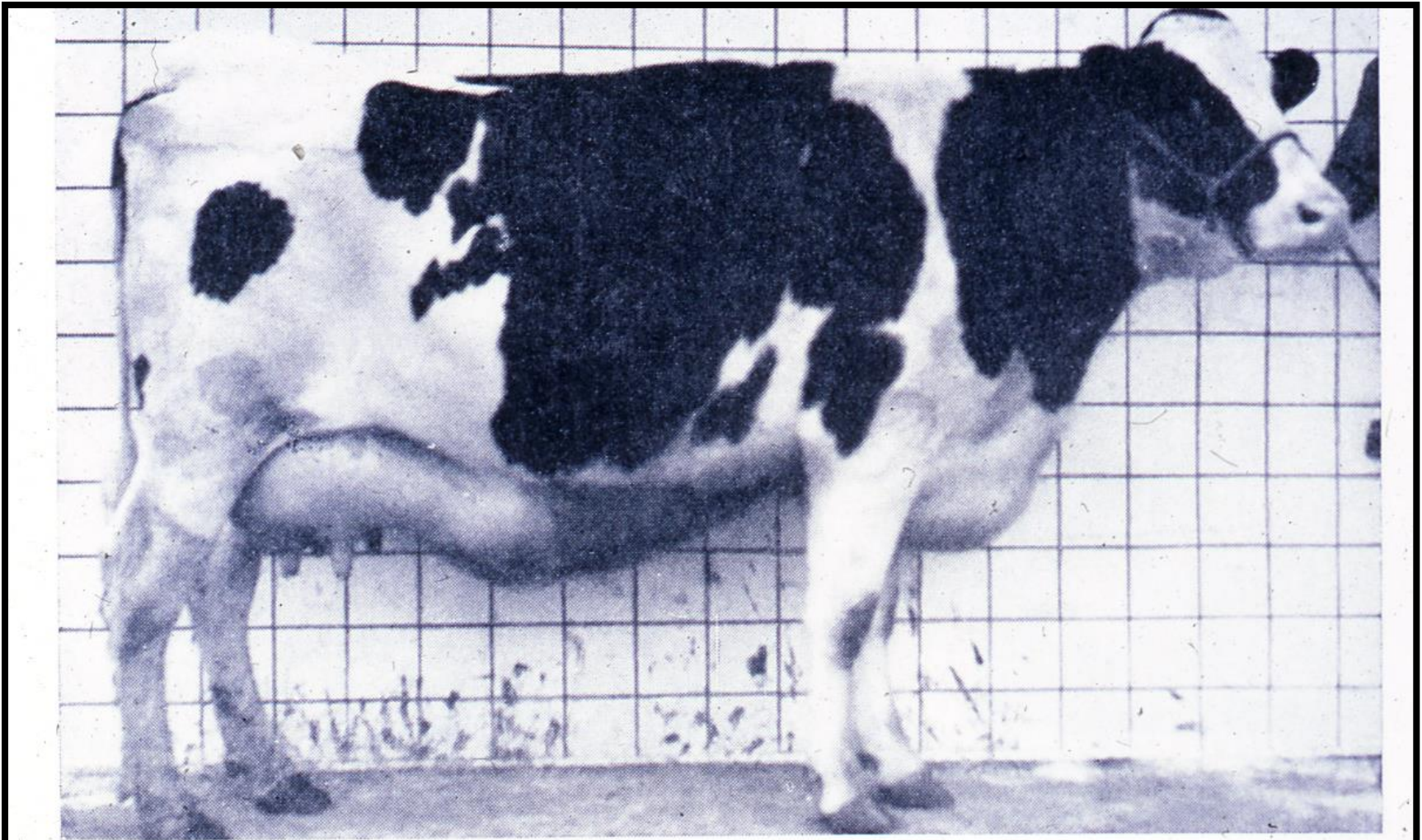
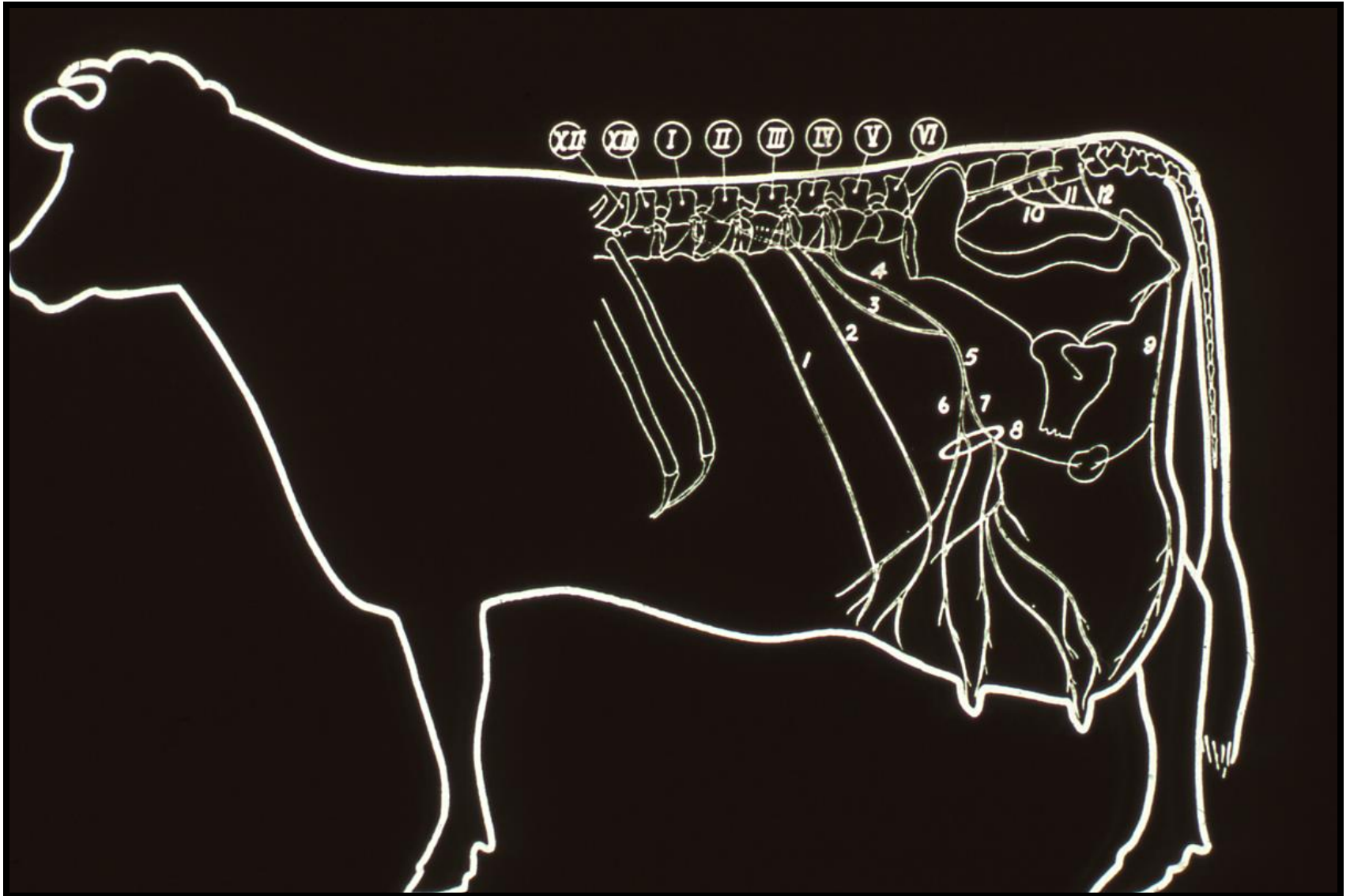
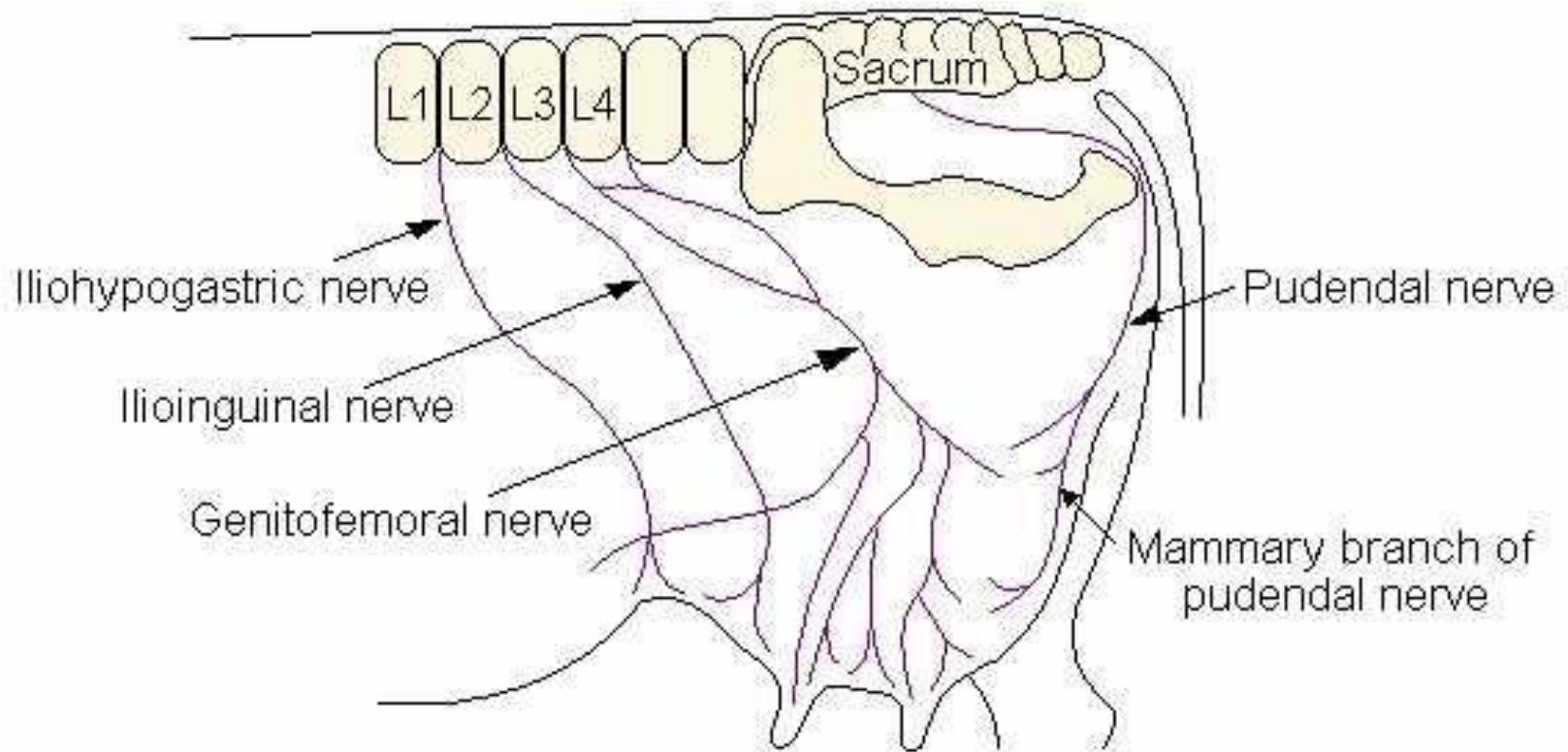


Fig. 2.17.—Heifer showing large accumulation of lymph in front of udder. (After Morgan)

Nervous supply



Nervous supply



Normal mammary tissue



Mastitis



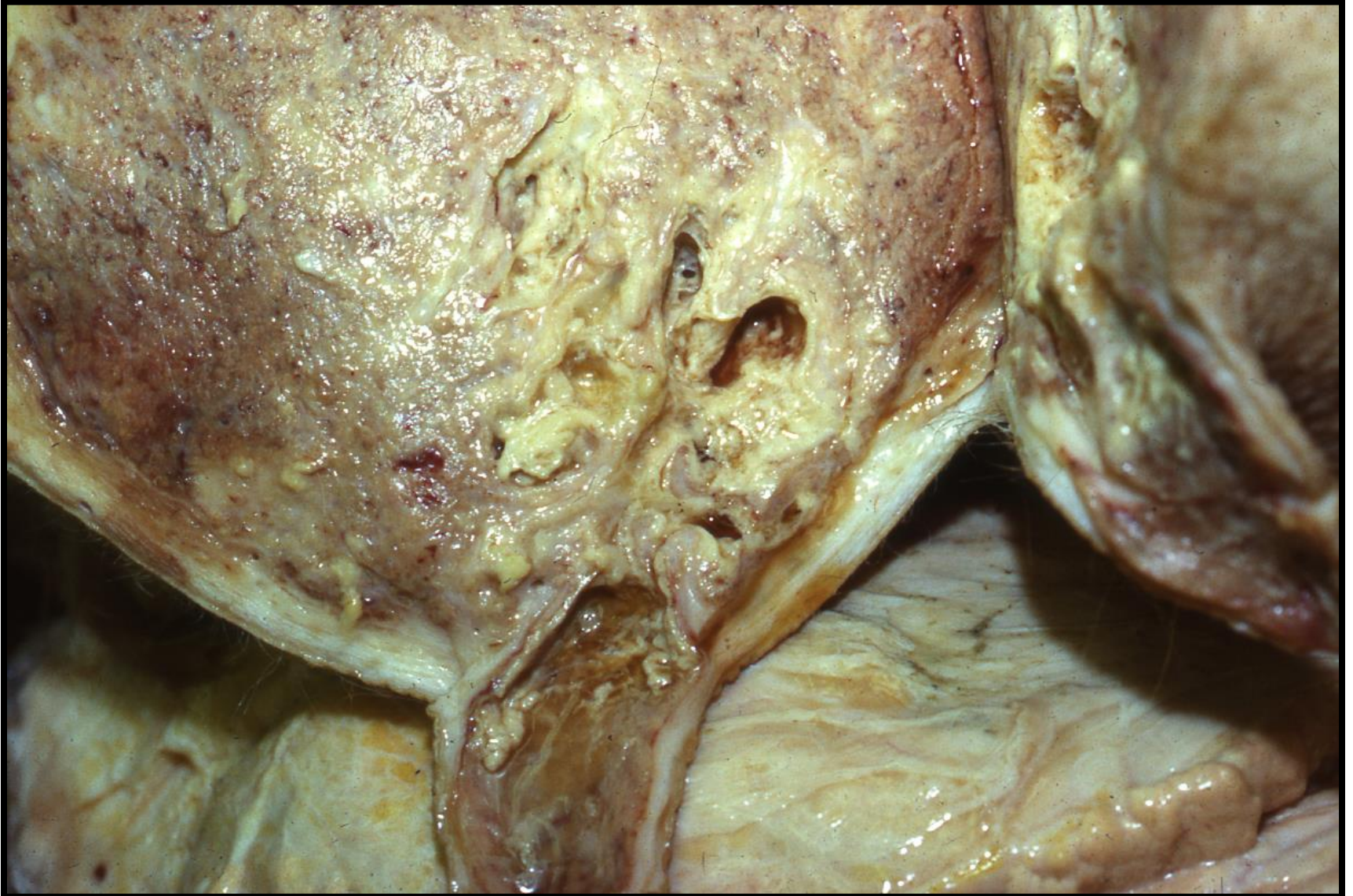
Mastitis



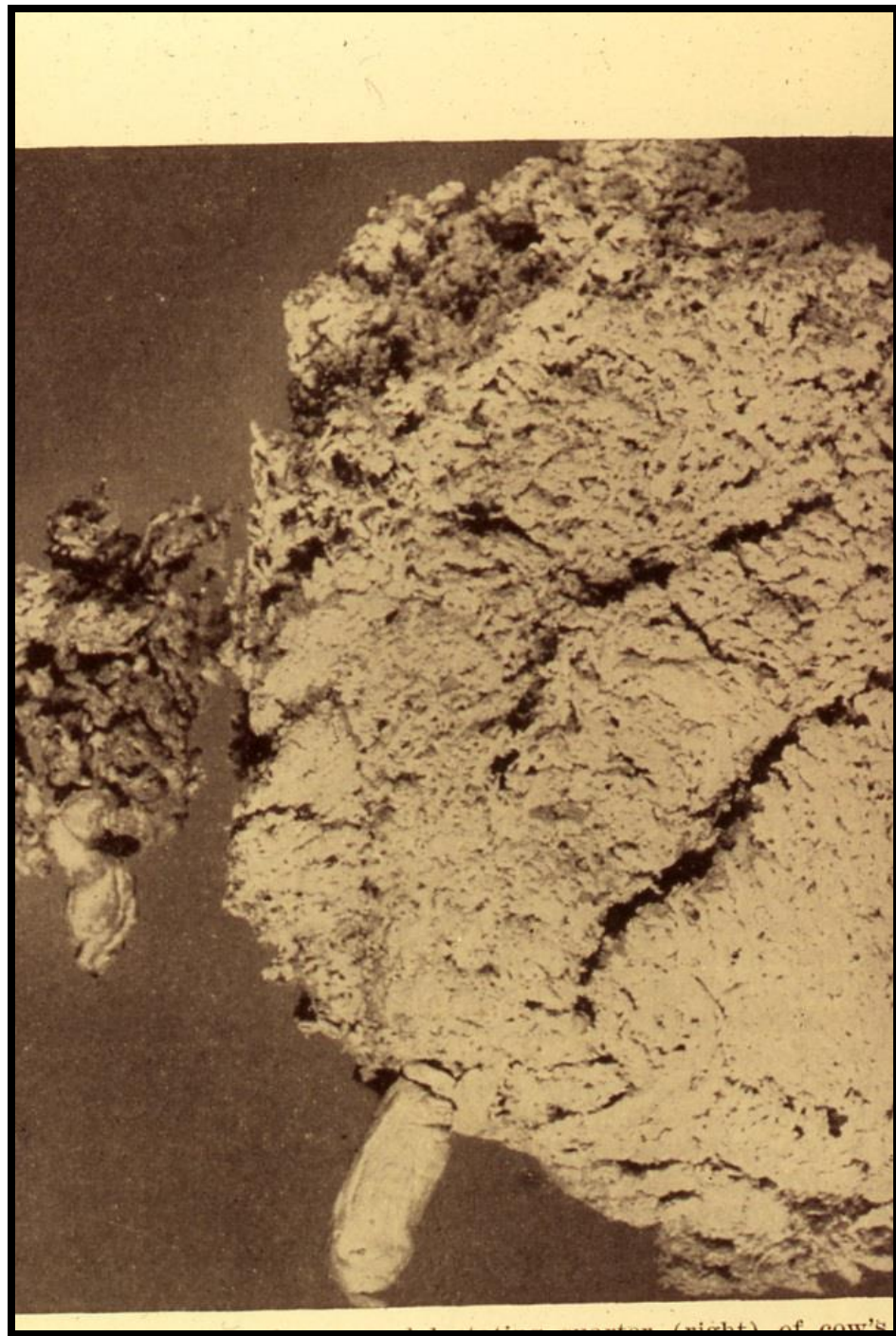
Mastitis



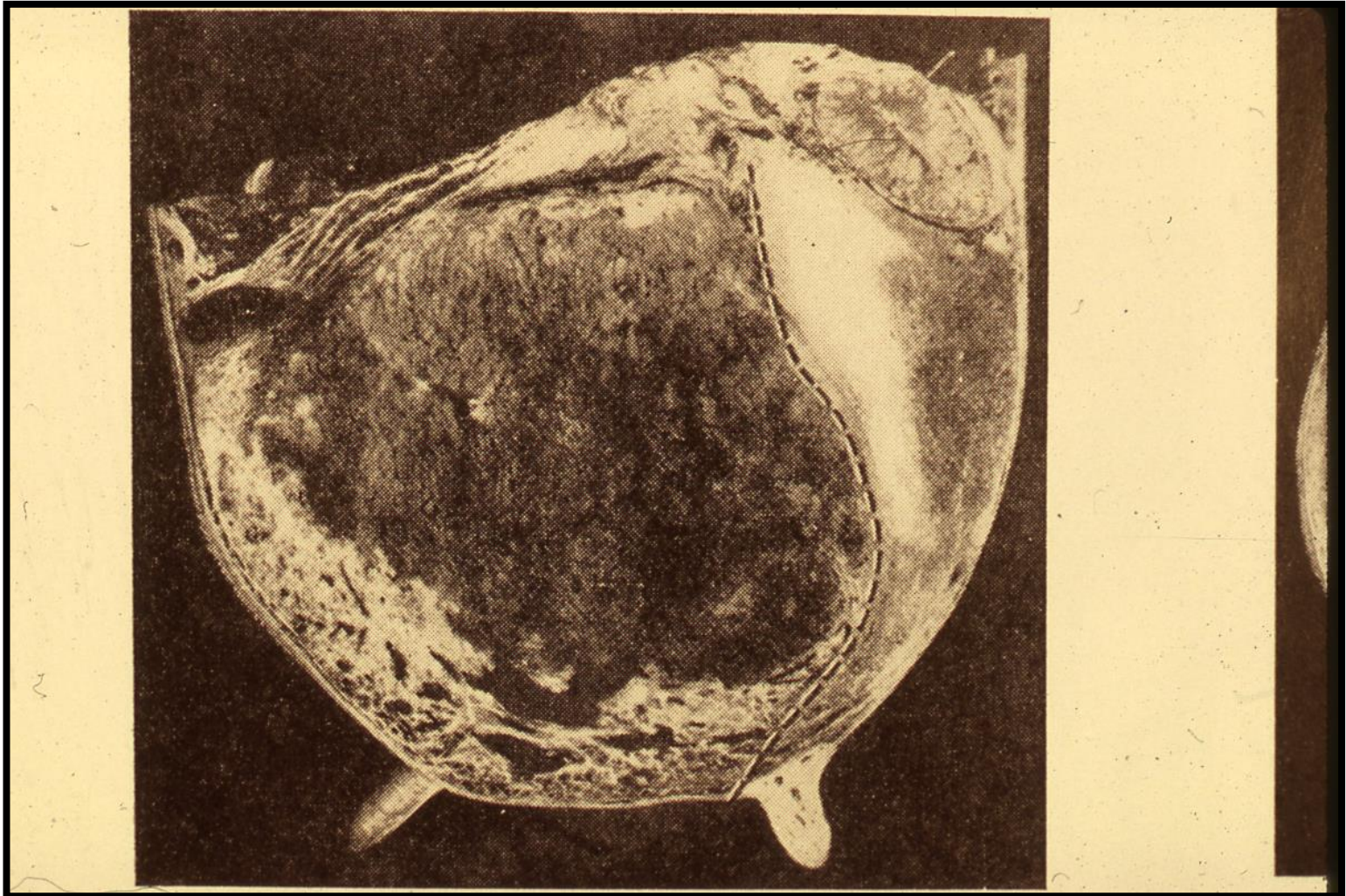
Mastitis



Atrophied gland



Compensatory hypertrophy

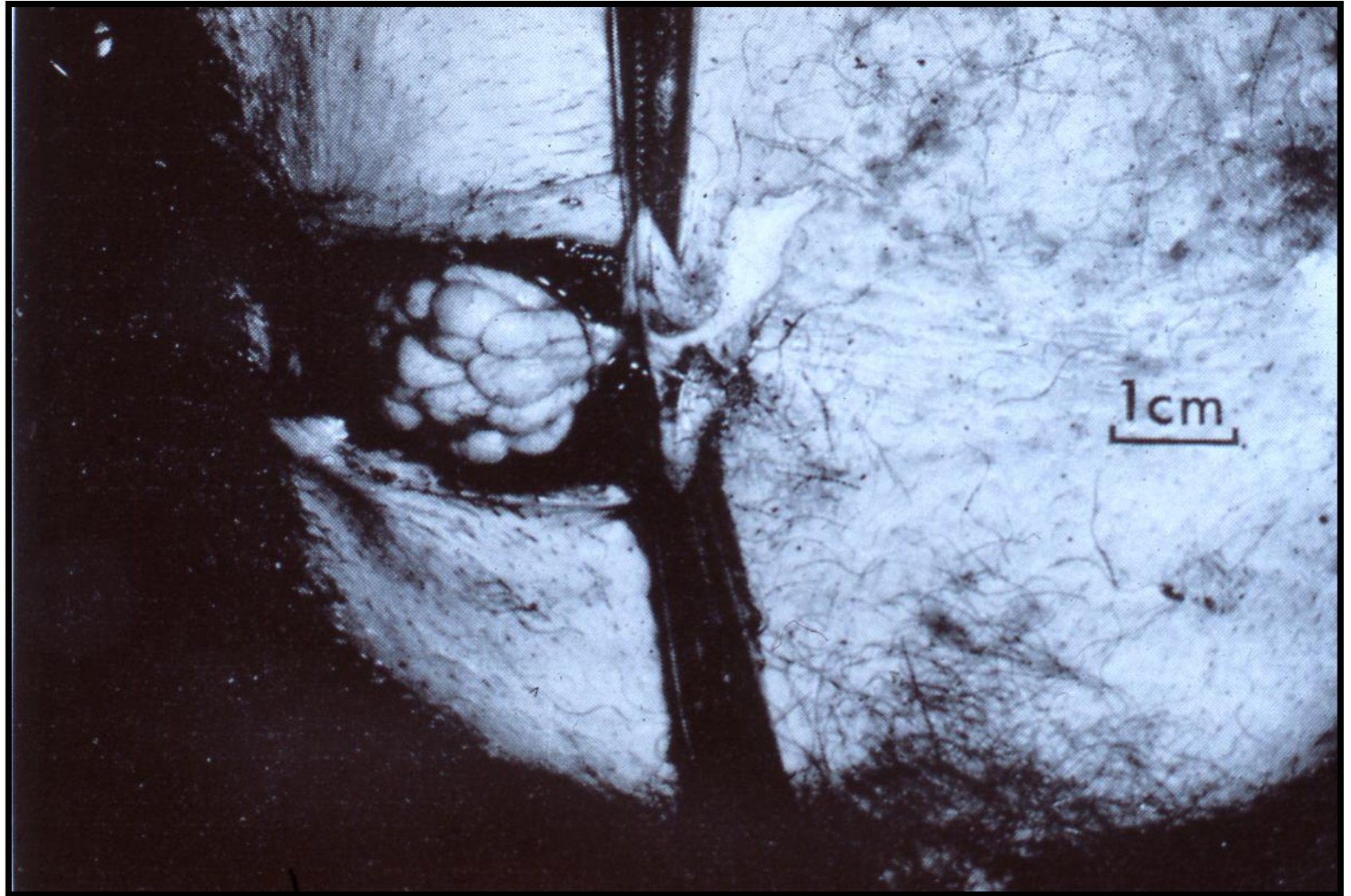


MAMMARY ANATOMY

SPECIES VARIATION



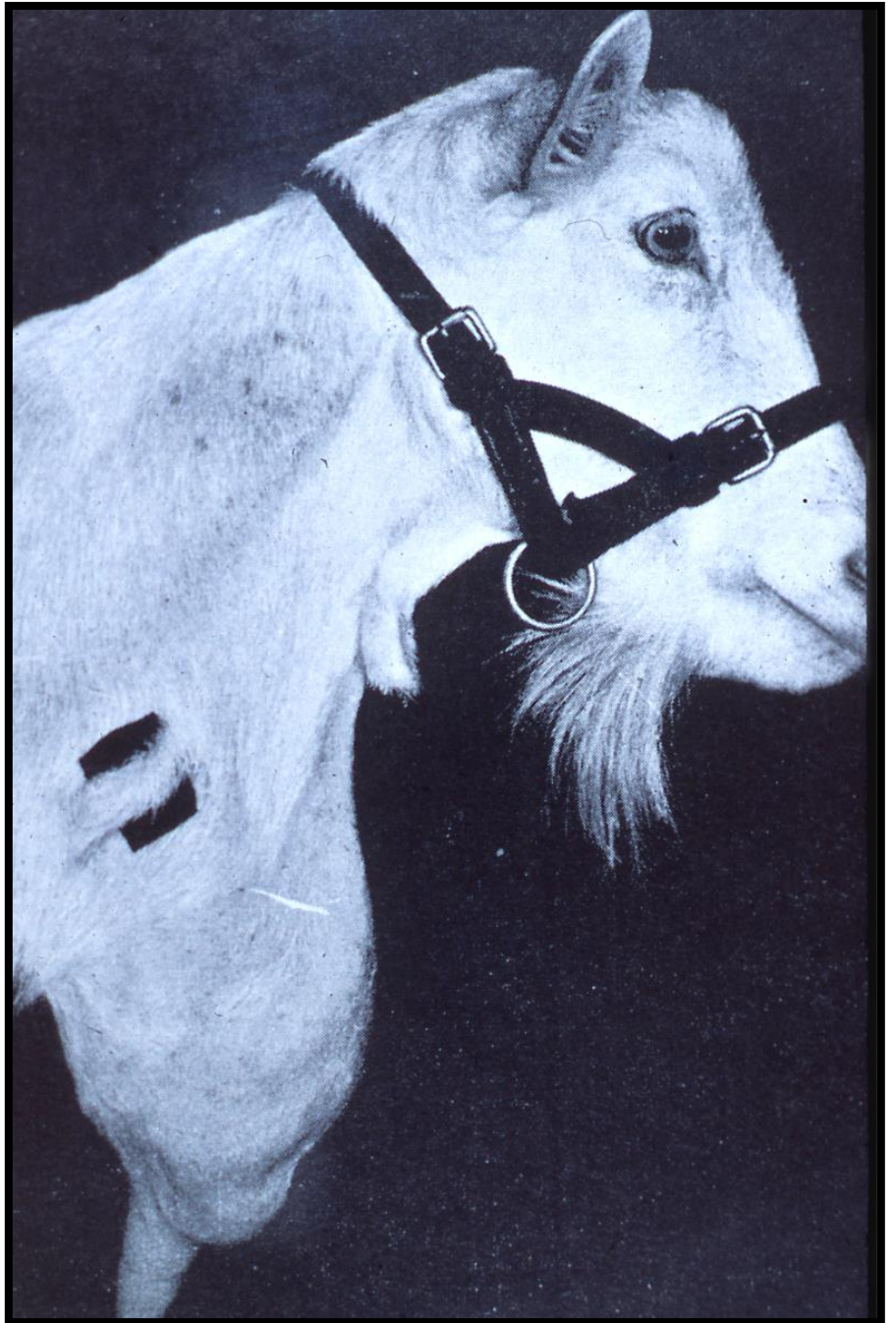
Echidna



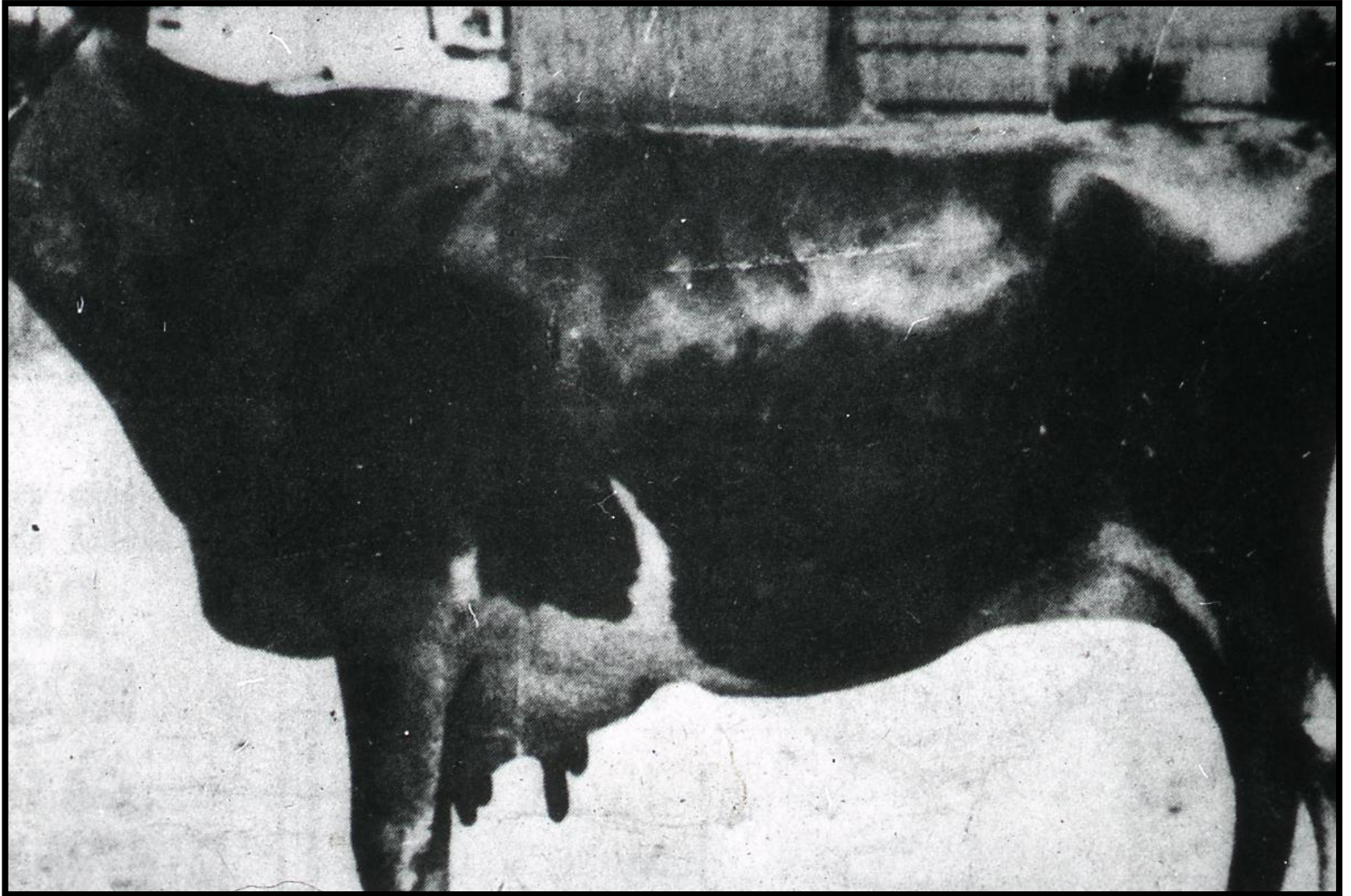
Kangaroo



Goat?



Bovine oddity



Rabbit

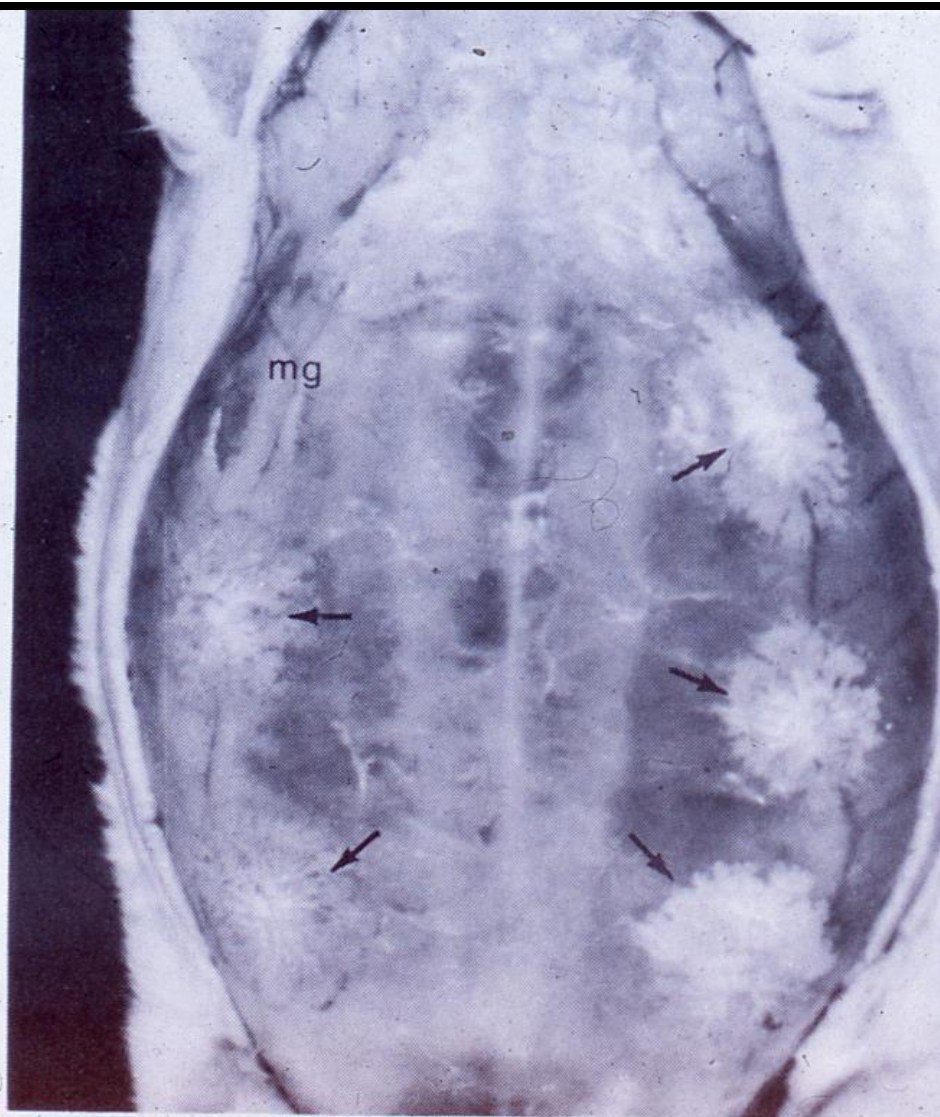
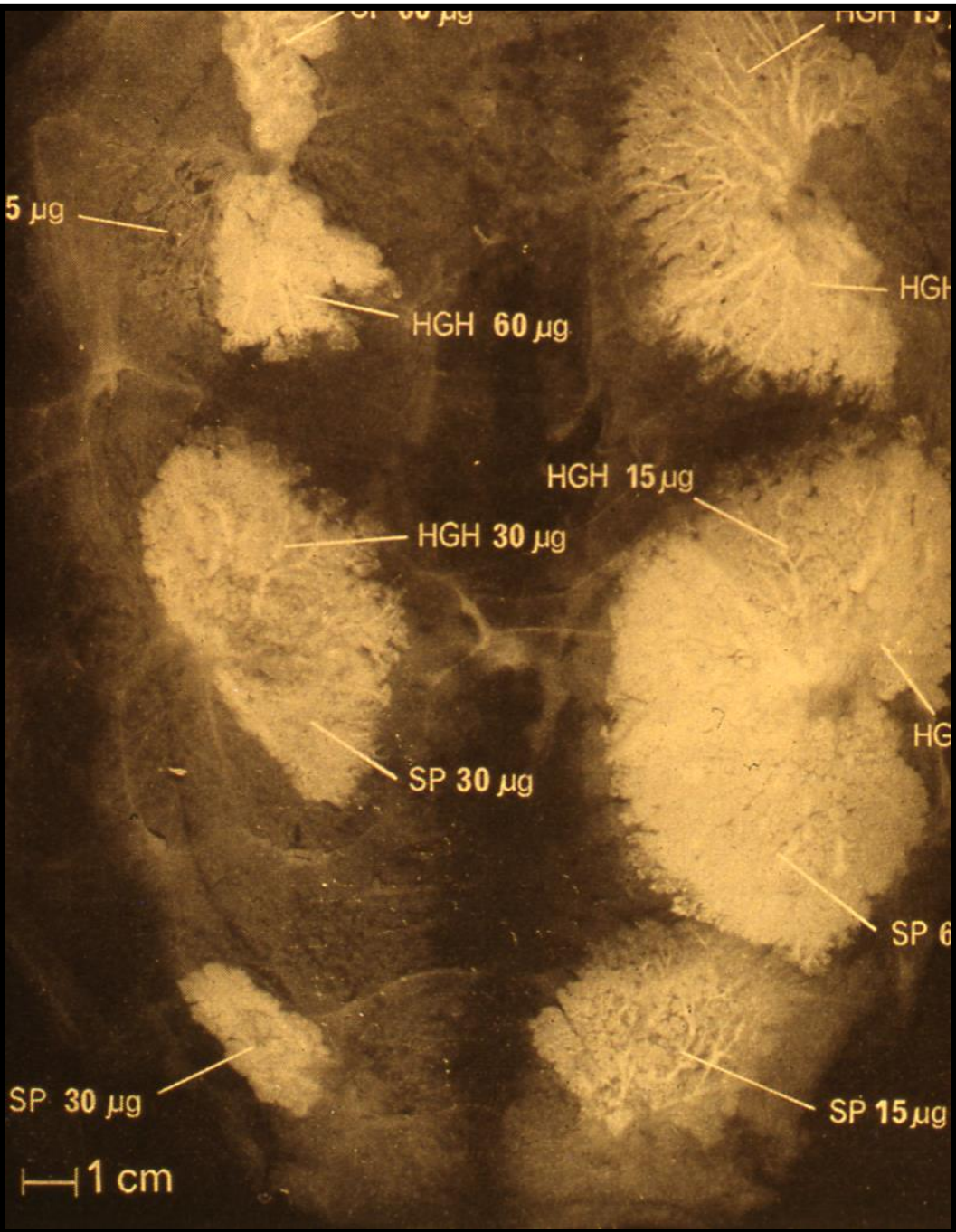
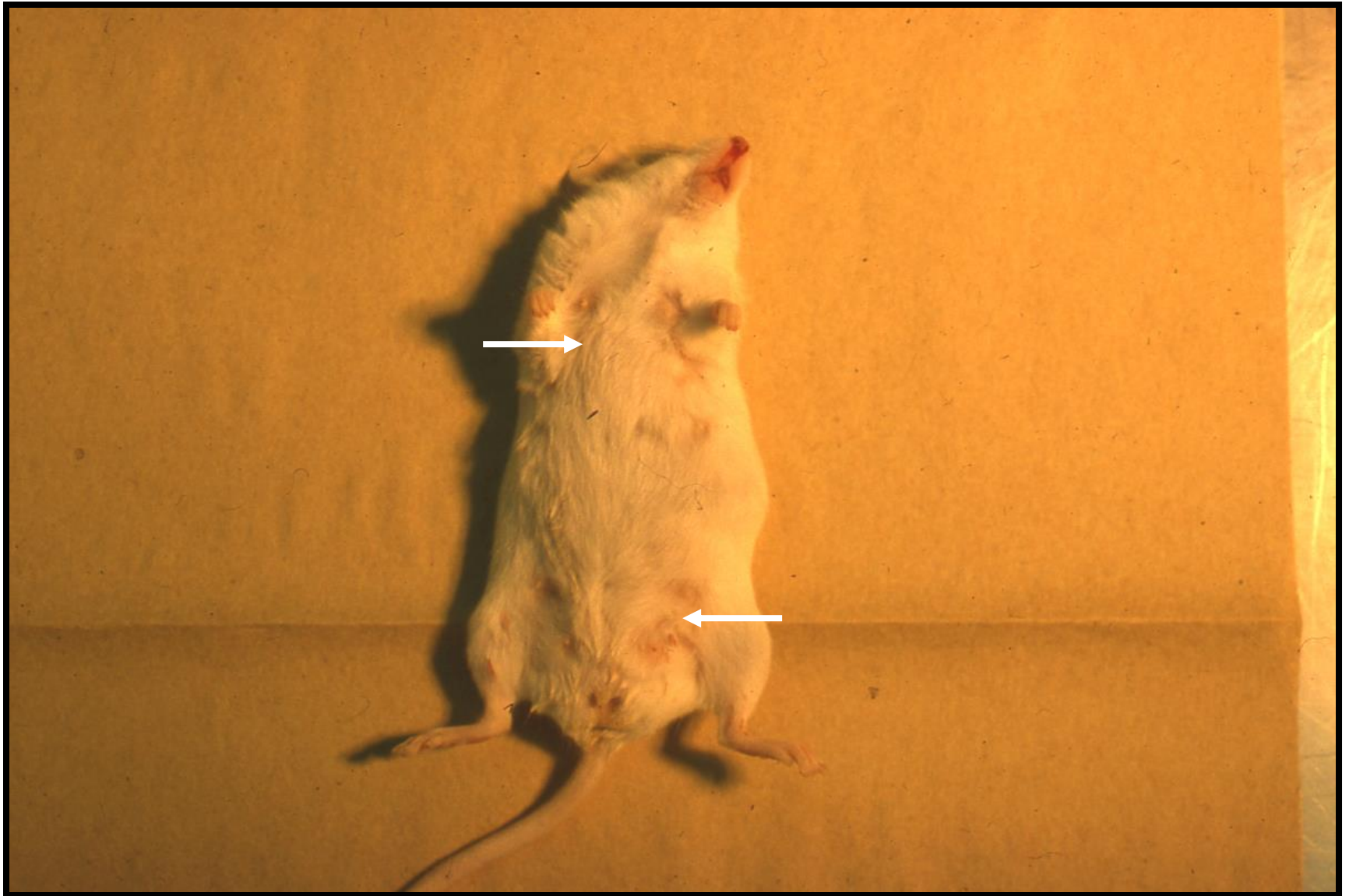


FIGURE 2-15

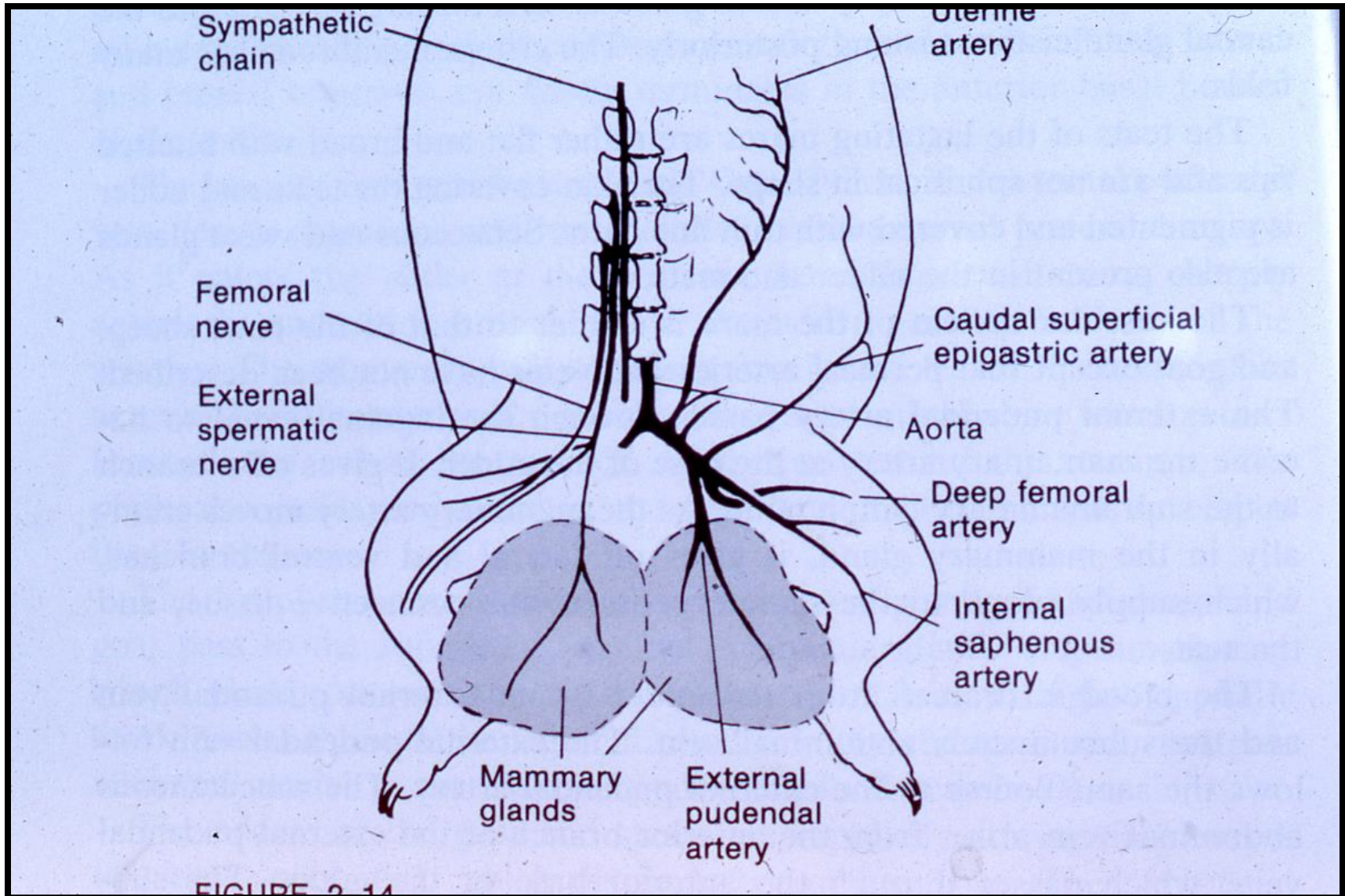
Rabbit



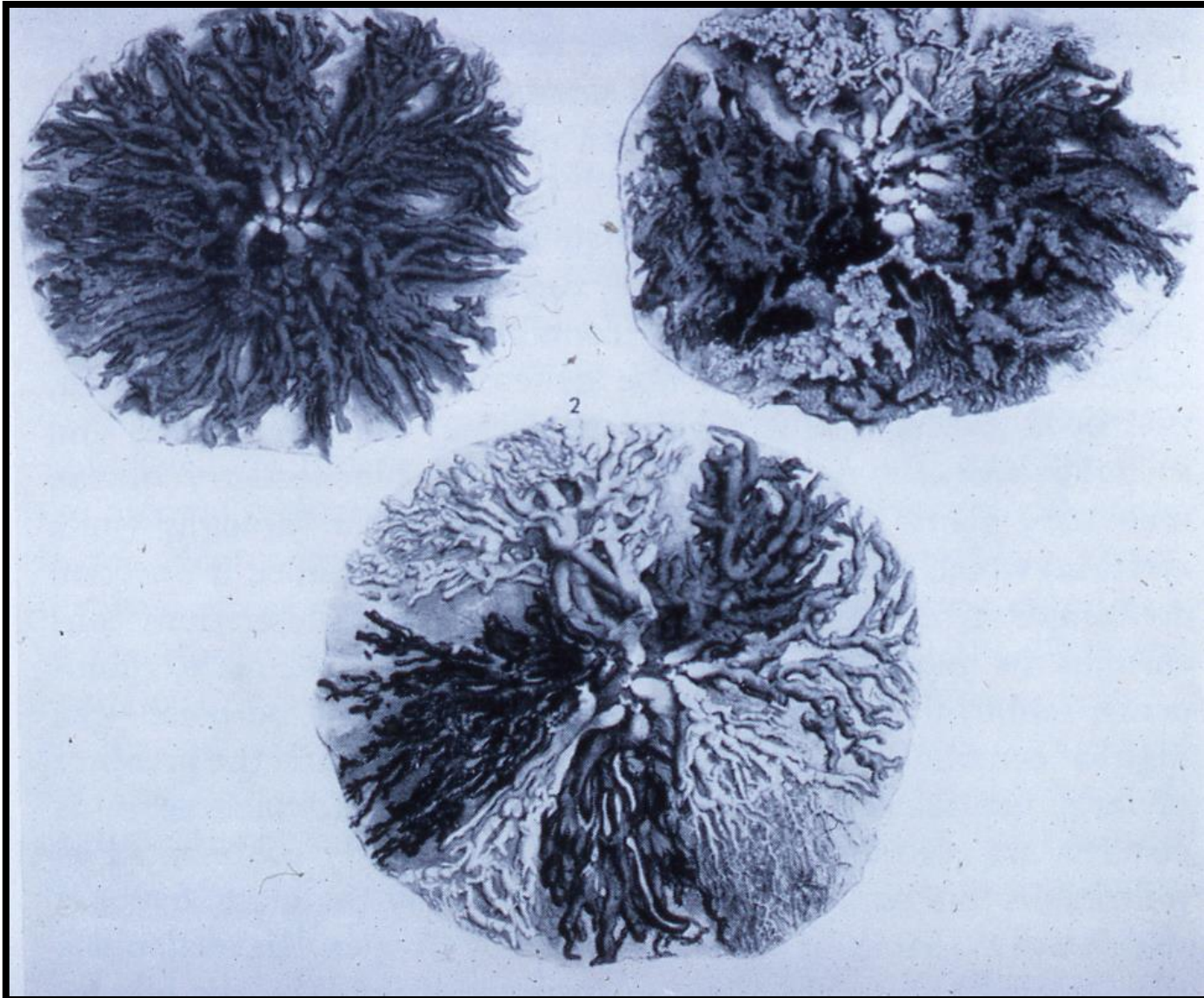
Mouse



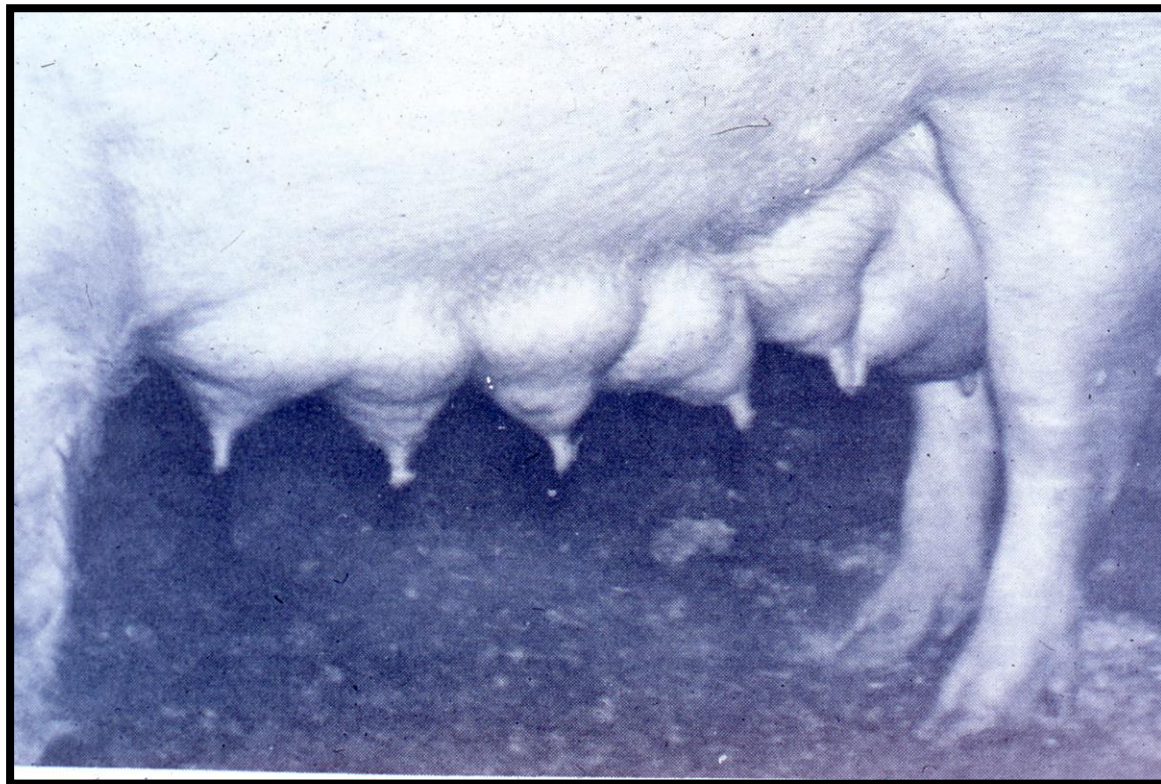
Guinea pig



Human



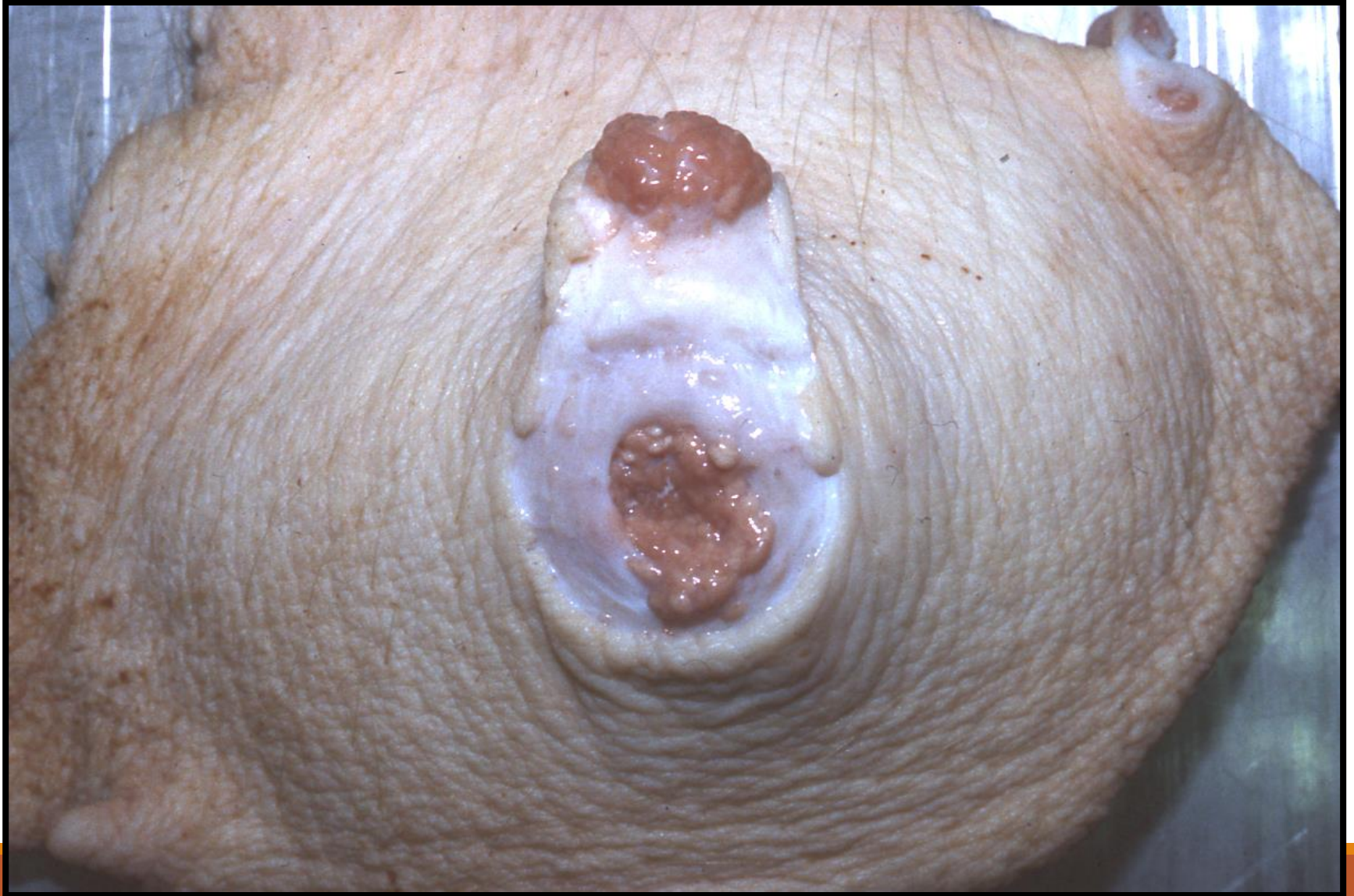
Sow



Sow



Sow



Horse



Horse



Horse



Dolphin Mammary Slit



Dolphin Mammary Slit



Goat suckling



Mothering instinct



Mothering instinct



Mothering instinct

