

ANATOMY · RUMINANT · ILLUSTRATED GUIDE

CATTLE (BOVINE) ANATOMY

Cattle (Bovine) Anatomy for Vet Students (PDF)

The whole ox, region by region — skeleton, skull and horns, muscles, the cloven hoof, abdominal topography, the four-compartment stomach, kidneys, the udder and both reproductive tracts — with labelled plates and clinical notes. Companion to the article at vet-ebooks.com.

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IN SHORT

This is a visual, plate-by-plate guide to **bovine anatomy** for veterinary students. Cattle are built around one dominant adaptation — a **four-compartment forestomach** that lets them live on grass — and almost every distinctive feature follows from it. We walk the whole ox: the **skeleton, skull, horns and teeth, the cloven hoof, thorax, abdominal topography, the rumen-reticulum-omasum-abomasum, the intestines, the udder and the reproductive tract**, with labelled plates and the clinical relevance of each.

KEY POINTS

1. The ox is a **ruminant herbivore**: the stomach has four compartments, and the **rumen occupies most of the left abdomen** and is the only viscus touching the left flank — which is why the left paralumbar fossa is the surgical window.
2. There are **no upper incisors**. Cattle tear grass against a **dental pad**, and the incisors erupt in a predictable order used for ageing.
3. The **frontal sinuses extend into the horn cores**, so dehorning an adult opens the sinus — the single most important surgical fact about the bovine skull.
4. Cattle are **cloven-hoofed**, bearing weight on digits **3 and 4**. Most lameness is in the **lateral claw of the hind foot**.
5. The **reticulum** lies against the diaphragm and traps swallowed metal — the anatomical basis of hardware disease.
6. The **udder** has four quarters, each with its own duct system, gland cistern and teat canal — but only the left and right *halves* are truly separated, so infection can still spread between quarters on the same side.

About the images

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01 The bovine body plan

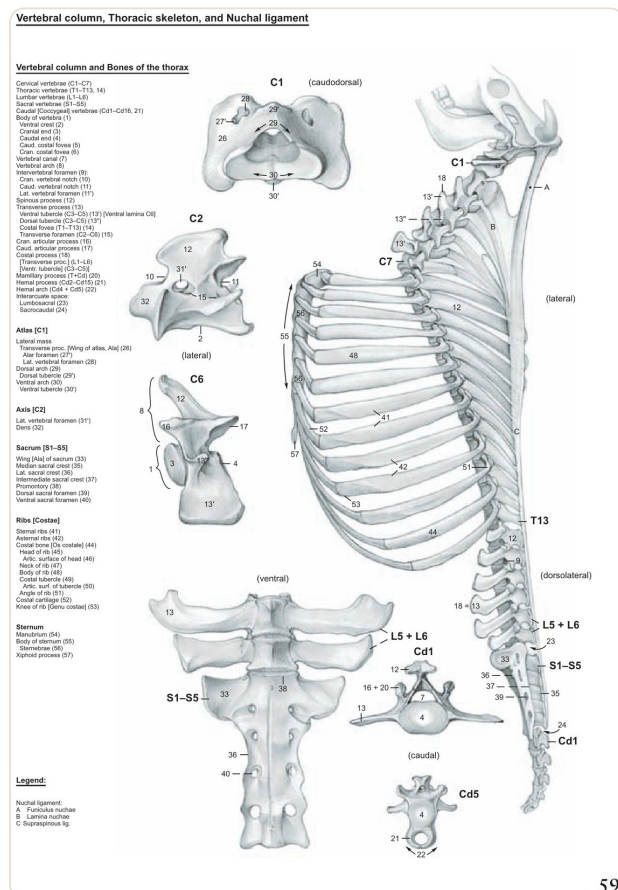
Learning **bovine anatomy** is easier if you start from a single fact: cattle are **ruminants**, and almost everything distinctive about them exists to serve fermentation. A cow cannot digest cellulose herself — her microbes do it — so she carries an enormous fermentation vat, a dentition built for tearing and grinding rather than biting, a jaw that swings sideways, and a body wall arranged so that the vat can be reached surgically from the left. The ox (*Bos taurus*) is a large, cloven-hoofed, horned herbivore whose clinical anatomy is dominated by three structures: the **rumen**, the **udder** and the **foot**. Those three account for the overwhelming majority of what a cattle vet actually treats.

A second organising idea is **sidedness**. In no other domestic species does left versus right matter so much. The rumen occupies the left abdomen; the omasum and abomasum sit to the right; the spiral colon and most of the intestine are right-sided. Learn which organ lies on which side and you can interpret a ping, choose a flank for surgery, and predict where a displaced abomasum has gone.

02 The bovine skeleton & vertebral formula

The bovine vertebral formula is **C7, T13, L6, S5, Cd18–20**. Thirteen pairs of ribs enclose a deep, laterally compressed thorax, and because the caudal ribs arch back over the abdomen, a surprising amount of abdominal viscera lies *under* the rib cage — which is why the reticulum can be percussed over the ribs and why the liver is largely intercostal. The neck carries a strong **ligamentum nuchae** (nuchal ligament) that passively supports the heavy head, sparing muscular effort during long hours of grazing.

REGION	NUMBER	CLINICAL NOTE
Cervical (C)	7	Same in every mammal; the ox has a short, heavy neck with a powerful nuchal ligament
Thoracic (T)	13	13 pairs of ribs; the caudal ribs overlie much of the abdominal viscera
Lumbar (L)	6	The paralumbar fossa here is the surgical window to the left flank
Sacral (S)	5 (fused)	Fused into the sacrum; the sacroiliac joint takes calving strain
Caudal (Cd)	18–20	Tail; Cd 3–5 for coccygeal venipuncture. The caudal epidural goes in further forward — at the sacrococcygeal or first intercoccygeal (Cd1–Cd2) space



03 The skull, teeth & dental formula

The bovine skull is long and heavy, with large paranasal sinuses and a broad grinding dentition. The dental formula of the adult ox is **2x(I 0/3, C 0/1, P 3/3, M 3/3) = 32 teeth** — often written 2x(I 0/4, P 3/3, M 3/3) because the lower canine is incisiform. The striking feature is what is *missing*: there are **no upper incisors and no upper canines**. Instead the upper jaw carries a tough fibrous **dental pad**, and the cow tears grass by trapping it between the lower incisors and that pad, then swinging her head. The lower canine has migrated forward and sits alongside the incisors, so the lower arcade appears to have eight “incisors”.

Because the incisors erupt in a predictable sequence, they are the standard field method for **ageing cattle**: the central pair of permanent incisors appears at roughly **1.5–2 years**, and each successive pair follows at about **9–month** intervals, so the corner incisors erupt at around **3.5–4 years** and are in full wear by about 4.5–5 years. Chewing is a side-to-side grinding action — the cheek teeth are arranged with **anisognathia** (the upper arcade is wider than the lower), so the animal chews on one side at a time, which is why sharp enamel points form on the buccal edge of the upper cheek teeth and the lingual edge of the lower.

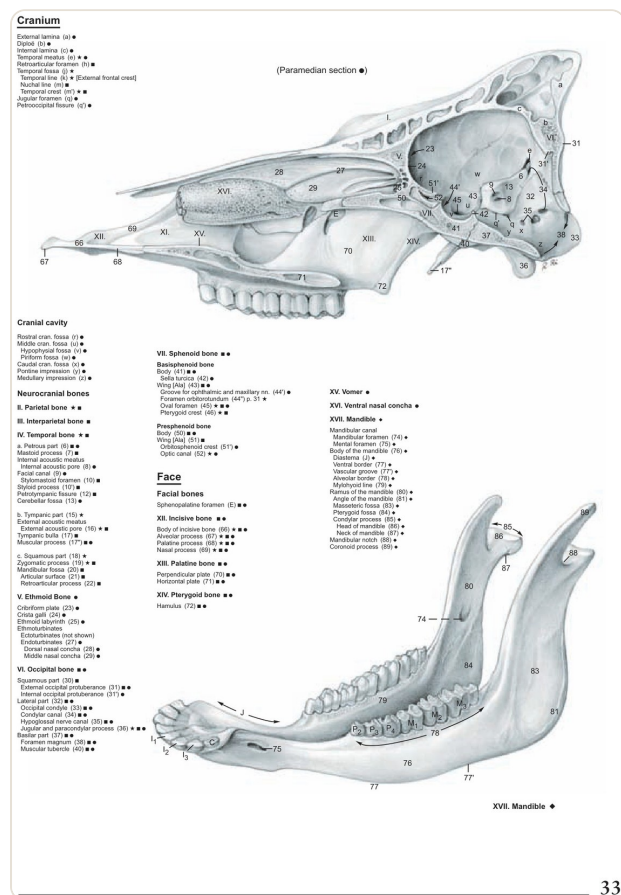


Fig 2 — The cranium and mandible. A paramedian section of the skull with the cranial cavity and nasal conchae, and the mandible carrying the lower incisors and the grinding cheek-tooth arcade.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Cranium and mandible. Reproduced for educational reference.

04 The horns & frontal sinuses

This is the plate every student should memorise before their first dehorning. The bovine **frontal sinus is enormous**, and in the adult it extends caudally and laterally *into the base of the horn process*. The horn itself is a keratin sheath over a bony **cornual process** of the frontal bone, and that process is hollow — continuous with the sinus. The practical consequences are immediate: **dehorning a mature animal opens the frontal sinus**, exposing it to contamination, discharge and sinusitis, which is precisely why disbudding calves at a few weeks old (before the horn bud fuses to the skull) is so strongly preferred.

Anaesthesia (anesthesia) follows the anatomy too. The horn is supplied by the **cornual branch of the zygomaticotemporal nerve** — which in the ox is formed by the lacrimal nerve of the **ophthalmic division (V₁)** joined by a communicating branch from the zygomatic nerve of the maxillary division (some texts assign it wholly to V₂), which runs along the temporal line under the ridge between the lateral canthus of the eye and the horn base — the target of the **cornual nerve block**. Goats need a **second** block, because in small ruminants the infratrochlear nerve supplies much of the horn. In cattle too, a failed block often means an unusually large supraorbital or infratrochlear contribution.

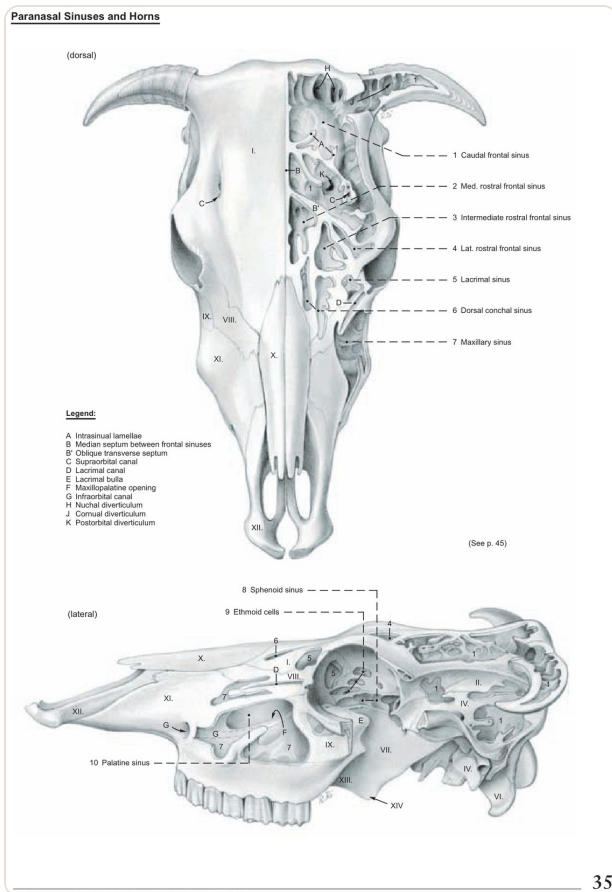


Fig 3 — The paranasal sinuses and horns. Dorsal and lateral views showing how the frontal sinus compartments extend into the cornual process of the horn — the anatomy behind dehorning complications and the cornual nerve block.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Paranasal sinuses and horns. Reproduced for educational reference.

05 The forelimb (thoracic limb)

As in the horse, the bovine forelimb has **no clavicle**: the limb is slung to the trunk by a muscular sling (the *synsarcosis*), which absorbs concussion and lets the shoulder glide. From the scapula the limb runs through the humerus, the fused radius and ulna, the carpus, and then a single large **metacarpal (the cannon, MC 3+4)** — fused along the shaft but still showing longitudinal grooves and **two separate distal condyles**, one for each digit. The forelimbs carry the greater share of body weight, yet — unlike the horse — most clinically significant lameness is in the **hind** foot: the hind claws bear the udder's weight, attach to the trunk through a bony pelvis rather than an elastic sling, and spend more time in slurry.

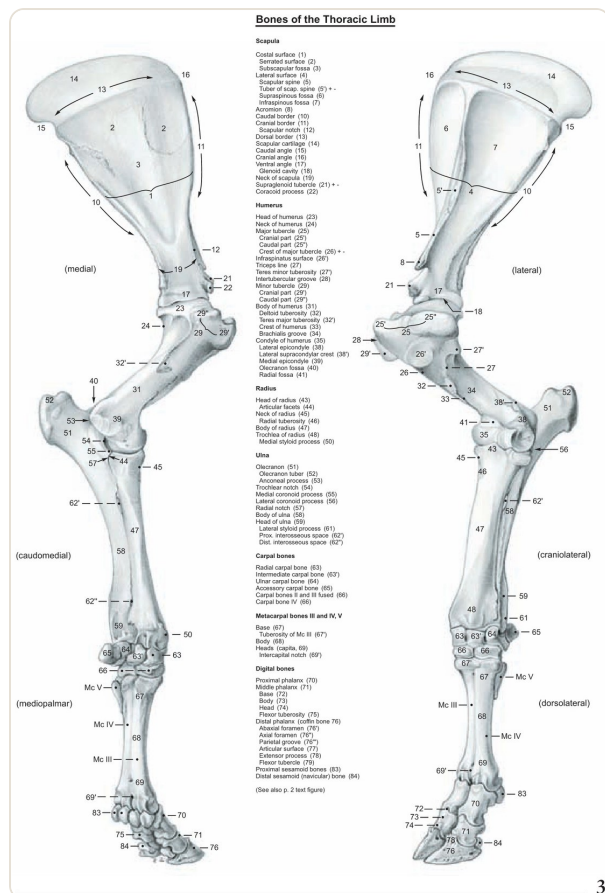


Fig 4 — Bones of the thoracic limb. Scapula, humerus, the fused radius and ulna, the carpus, and the fused metacarpal ending in the two weight-bearing digits — shown in medial, lateral and oblique views.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Bones of the thoracic limb. Reproduced for educational reference.

06 The hindlimb (pelvic limb)

The hindlimb generates propulsion and carries the anatomy behind several everyday procedures. The **tuber coxae** (“hook”) and **tuber ischii** (“pin”) are the palpable landmarks of **body condition scoring** in dairy cattle, alongside the tailhead cavity and the short ribs, and the sacroiliac region takes enormous strain at calving — a difficult calving can leave a cow with obturator or sciatic nerve injury and a “downer cow”. Distally the pattern repeats the forelimb: femur, patella, tibia with reduced fibula, the tarsus (hock), then the fused metatarsal and two digits.

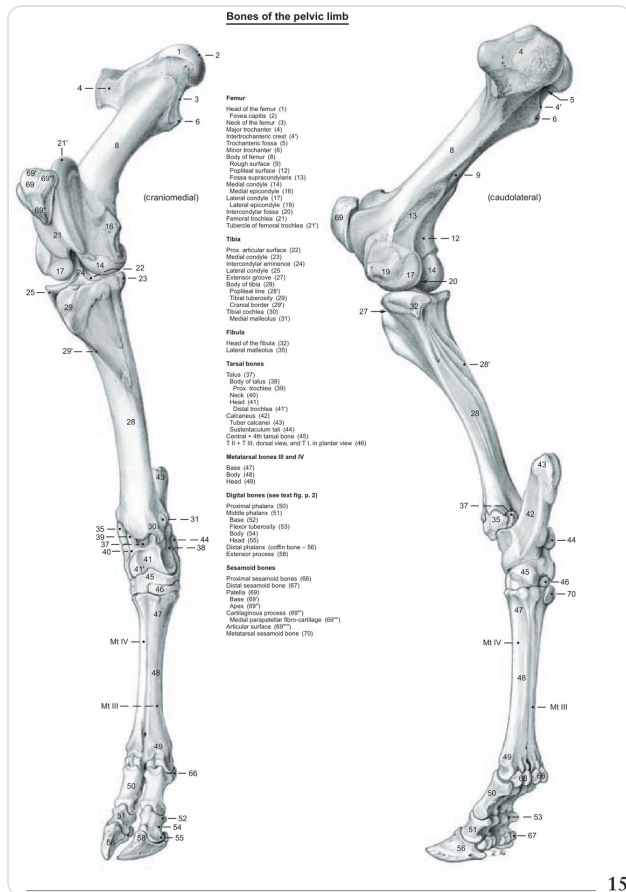


Fig 5 — Bones of the pelvic limb. Femur, patella, tibia and reduced fibula, the tarsus, and the fused metatarsal with the two digits — the propulsive limb and the source of most bovine lameness.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Bones of the pelvic limb. Reproduced for educational reference.

07 The muscles & the jugular groove

Bovine musculature follows the standard mammalian plan, but a few features earn their place in a student's memory. Superficially the neck and shoulder are covered by the **trapezius**, **latissimus dorsi**, the **brachiocephalicus** group (cleidomastoideus, cleido-occipitalis, omotransversarius) and the **sternocephalicus**. Deeper lie the **serratus ventralis** and **rhomboideus** that form the muscular sling suspending the trunk between the forelimbs, and the **pectorals** that bind the limb to the chest. Along the back, the epaxial **longissimus** and **iliocostalis** groups extend and stabilise the spine.

The single most useful piece of neck anatomy is the **jugular groove** — the furrow between the sternocephalicus and brachiocephalicus muscles. It carries the **external jugular vein**, and it is where almost every bovine blood sample and intravenous injection is taken. Deep to it run the **common carotid artery**, the **vagosympathetic trunk**, the **recurrent laryngeal nerve**, the trachea and the oesophagus — which is precisely why a badly placed needle can reach far more than a vein. The oesophagus here is also the site of **choke**, a common emergency when cattle bolt root vegetables.

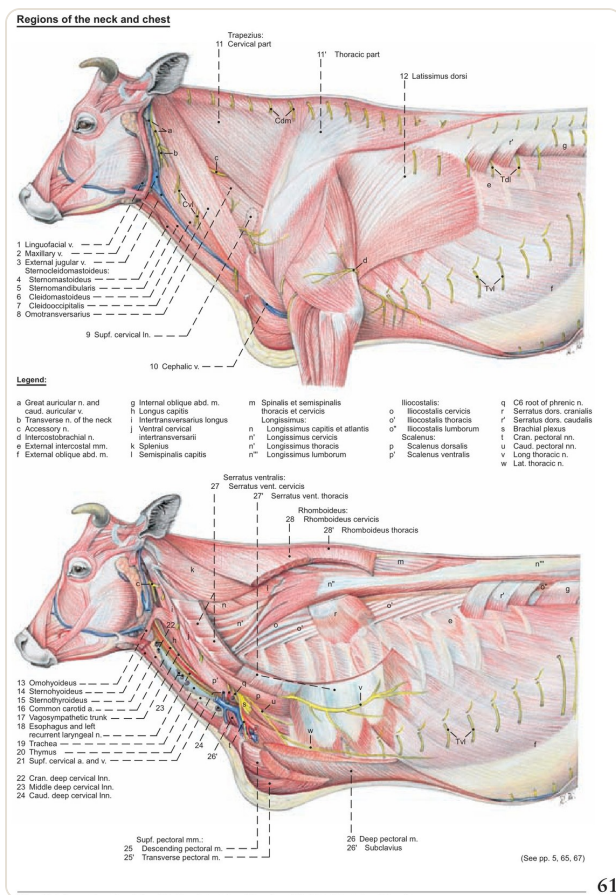


Fig 6 — The muscles of the neck and chest. The superficial layer (trapezius, latissimus dorsi, brachiocephalicus and sternocephalicus) and, beneath it, serratus ventralis, rhomboideus and the pectorals — with the jugular groove and the trachea, carotid and vagosympathetic trunk lying deep to it.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Regions of the neck and chest. Reproduced for educational reference.

08 The cloven hoof

Cattle are **artiodactyls**: they bear weight on two digits, the **third and fourth**, each capped by its own claw, with vestigial dewclaws behind. Each claw is built like a simplified horse hoof — a wall, sole and bulb of horn produced by the underlying dermis (corium), with the **distal phalanx** suspended inside. The junction where wall meets sole is the **white line**, and it is the weakest point of the capsule.

Bovine lameness is overwhelmingly a foot problem, and it is not randomly distributed. The **lateral claw of the hind foot** bears disproportionate load and is the usual site of **sole ulcer** and **white line disease**; the medial claw of the forelimb is the equivalent on the front. Add the infectious conditions — **digital dermatitis** in the skin of the heel bulbs and interdigital cleft, and **interdigital phlegmon (foul-in-the-foot)** — and you have the majority of what a foot-trimmer and a cattle vet see. Understanding that the corium produces horn, and that horn grows down at only about 6 mm a month, explains why an insult to the corium (a bout of acidosis, a calving) shows up as a lesion weeks later.

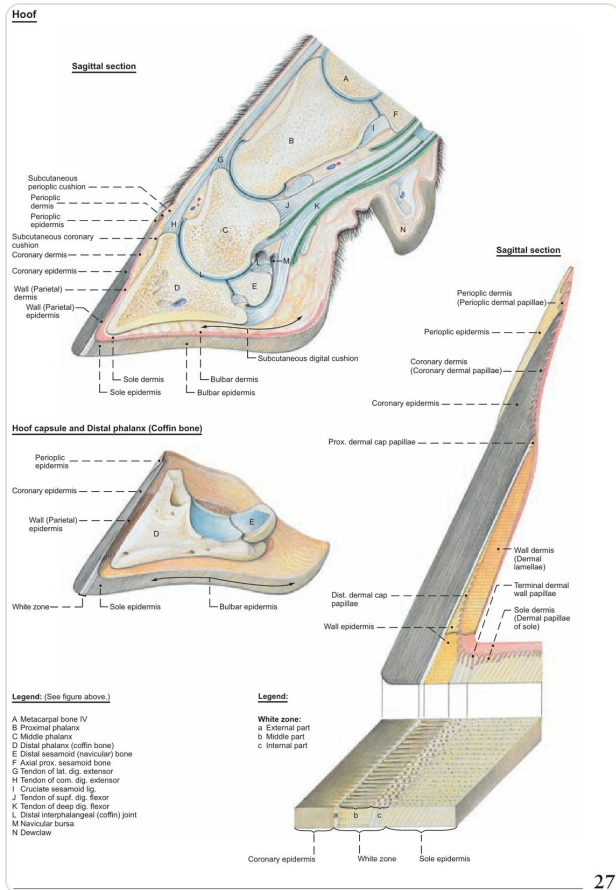


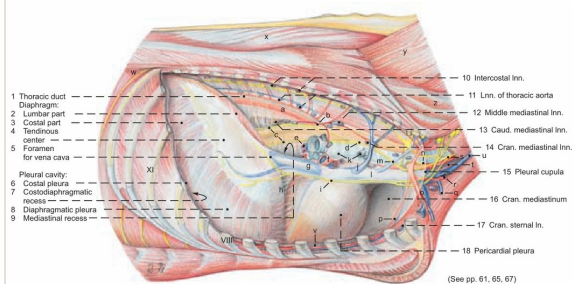
Fig 7 — The hoof. A sagittal section through the claw, the hoof capsule with the distal phalanx (coffin bone), and the horn zones — wall, white line and sole — that determine where lesions appear.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Hoof. Reproduced for educational reference.

09 The thorax & lungs

The bovine lung is unusual and clinically important. The **right lung is much larger than the left** and — unlike the horse, dog and cat — cattle (in common with pigs and the small ruminants) have a **tracheal (accessory) bronchus** arising from the trachea itself to ventilate the right cranial lobe. It is worth remembering when placing a cuffed endotracheal tube, which can occlude it. Bovine lungs are also heavily **lobulated** by thick connective-tissue septa, with poor collateral ventilation between lobules. The septa help localise infection, and the bovine lung has a comparatively **small alveolar surface area and little functional reserve** — between them these explain why cattle are so prone to **bronchopneumonia** beginning in the cranioventral lung fields, and why interstitial emphysema spreads so dramatically along the septa. The cranioventral distribution is exactly where you should place the stethoscope first in a coughing calf.

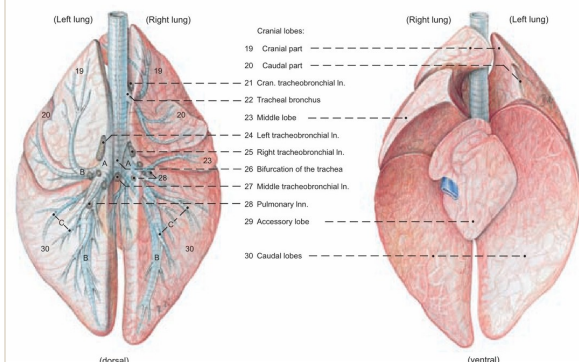
Right thoracic cavity and Lungs



Legend:

- | | | | | |
|--------------------------------|---------------------|---------------------------------|---|---|
| A Main bronchus | d Right vagus n. | j Right azygos v. | p Internal thoracic a. and v. | v Transverse thoracic m. |
| B Lobar bronchus | e Pulmonary vv. | k Trachea and tracheal bronchus | q Cephalic v. | w Retractor costae |
| C Segmental bronchus | f Pulmonary a. | l Cran. vena cava | r Supr. cervical a. and v. | x Spinall et semispinalis cervicis et capitis |
| a Thoracic aorta | g Caud. vena cava | m Cistocervical v. | s Vagosympathetic trunk | y Semispinalis capitis |
| b Bronchopharyngeal a. | h Plica venae cavae | n Right recurrent laryngeal n. | i Common carotid a. and internal jugular v. | z Longissimus cervicis |
| c Dors. and vent. vagal trunks | i Phrenic n. | o Right subclavian a. and v. | u External jugular v. | |

Lungs and Bronchial Inn.



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Fig 8 — The right thoracic cavity and lungs. The lungs in situ and the bronchial tree — note the tracheal (accessory) bronchus to the right cranial lobe and the marked lobulation that shapes bovine pneumonia.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Right thoracic cavity and lungs. Reproduced for educational reference.

10 The heart

The bovine heart sits in the **middle mediastinum**, reached clinically through the cardiac notch between about the third and sixth ribs, and is markedly asymmetrical — **60% or more of it lies left of the midline**. Two features matter clinically. First, cattle have **ossa cordis** — two small bones in the fibrous skeleton of the heart, related to the aortic valve. They are not unique to cattle, as is often taught, but they do develop unusually early in this species. Second, and far more importantly, the **reticulum lies immediately caudal to the heart**, separated from it only by the diaphragm. A swallowed wire that penetrates the reticulum can therefore travel forward into the pericardium, producing **traumatic pericarditis** with classically **muffled** heart sounds with splashing or tinkling overtones, jugular distension and brisket oedema.

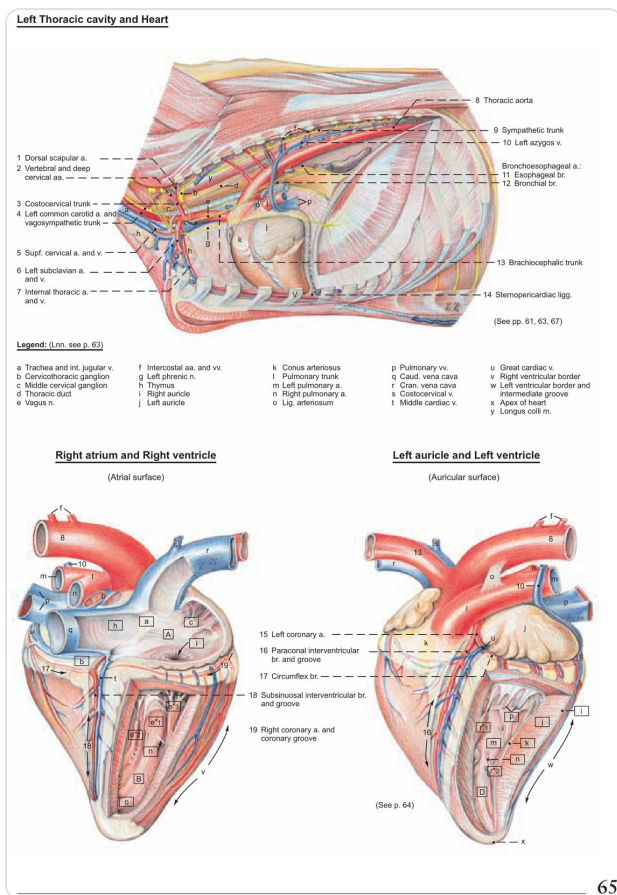


Fig 9 — The left thoracic cavity and heart. The heart in situ with the great vessels, and the atria and ventricles opened — lying just across the diaphragm from the reticulum, the route taken in traumatic pericarditis.

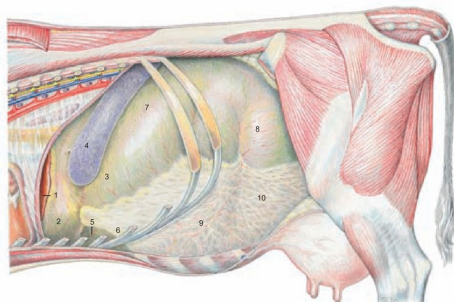
Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Left thoracic cavity and heart. Reproduced for educational reference.

11 Cow internal organs: which side is which

If you learn one thing about the bovine abdomen, learn the **sides**. On the **left**, the rumen dominates from the diaphragm to the pelvic inlet, with the spleen applied flat to its dorsolateral surface. On the **right** lie the omasum, the abomasum (ventrally), the liver, the duodenum, and the great mass of intestine including the **spiral colon**. The **left paralumbar fossa** — bounded by the last rib, the lumbar transverse processes and the tuber coxae — is the standard standing-surgery window, used for rumenotomy, left-displaced abomasum correction and caesarean section.

This topography is also what makes **percussion and auscultation** diagnostic in cattle. A gas-filled viscus under the body wall produces a high-pitched resonant “**ping**”: high on the *left* suggests a **left-displaced abomasum**; on the *right*, a right displacement or abomasal volvulus. Free gas trapped dorsally in the rumen gives ruminal tympany (bloat). None of this can be interpreted without the map on this plate.

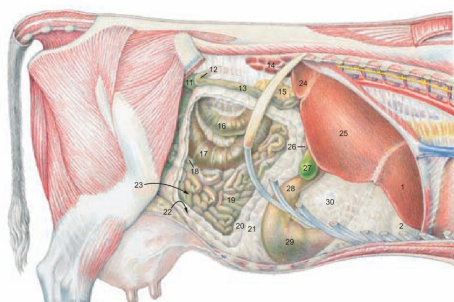
(Left side)



Legend:

- | | | | |
|----------------------|---|--|-------------------------------------|
| 1 Left lobe of liver | 5 Fundus of abomasum | 8 Caudodorsal blind sac of rumen | 11 Sigmoid part of descending colon |
| 2 Reticulum | 6 Recess of ventral sac of rumen covered by omentum | 9 Ventral sac of rumen covered by omentum | 12 Caudal flexure of duodenum |
| 3 Atrium of rumen | 7 Dorsal sac of rumen | 10 Caudodorsal blind sac of rumen covered by omentum | 13 Descending duodenum |
| 4 Spleen | | | 14 Right kidney |
| | | | 15 Right lobe of pancreas |

(Right side)



Legend:

- | | | | |
|----------------------------------|------------------|-----------------------------|-------------------------------------|
| 16 Prox. loop of ascending colon | Greater omentum: | 23 Supracloacal recess | 27 Gall bladder |
| 17 Cecum | 20 Deep wall | 24 Caudate process of liver | 28 Pyloric part of abomasum |
| 18 Ileum | 21 Spl. wall | 25 Right lobe of liver | 29 Body of abomasum |
| 19 Jejunum | 22 Caudal recess | 26 Cranial part of duodenum | 30 Omasum covered by lesser omentum |

(See pp. 17, 63, 65, 67)

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Fig 10 — Abdominal topography, left and right. The left side dominated by the rumen with the spleen on its surface; the right side showing the omasum, abomasum, liver and intestinal mass — the map behind every ping and flank approach.

Image — Budras et al., Bovine Anatomy, 2nd ext. ed. — plate: Abdominal cavity and digestive system. Reproduced for educational reference.

12 The four-compartment stomach: rumen, reticulum, omasum & abomasum

This is the defining structure of bovine anatomy. The ruminant stomach is a single organ in four parts — three non-glandular **forestomachs** (rumen, reticulum, omasum) lined by stratified squamous epithelium, and one true glandular stomach (**abomasum**). Food is swallowed, fermented by microbes, regurgitated and re-chewed as **cud**, then progressively dehydrated and finally digested by acid and enzymes. The **reticular groove** is worth noting separately: in the suckling calf a reflex closes it into a tube that carries milk from the oesophagus on through the omasal groove into the abomasum, bypassing the undeveloped rumen and reticulum — which is why a calf is functionally a monogastric for its first weeks, and why drenching an adult does *not* reliably bypass the rumen.

COMPARTMENT	POSITION	FUNCTION	CLINICAL RELEVANCE
Rumen	~80% of total stomach volume; occupies most of the left abdomen and is the only viscus in contact with the left flank	Fermentation vat — microbial digestion of cellulose; papillae absorb VFAs	Left-flank laparotomy, rumenotomy, bloat trocarisation
Reticulum	Most cranial , sits on the xiphoid, level with ribs 6–8	Honeycomb lining; sorts particles and returns them for re-chewing	Traps swallowed wire → traumatic reticuloperitonitis (hardware disease)
Omasum	Right side, ribs 7–11	Muscular laminae (“many plies”) absorb water and pass fine particles on	Impaction; imaged sonographically by its laminae from the right 7th–9th intercostal spaces
Abomasum	On the abdominal floor. The pyloric part curves right, but the fundus and much of the body lie LEFT of midline , between the reticulum and the ventral sac of the rumen — exactly where an LDA begins	The true glandular stomach — HCl and pepsin, as in monogastrics	LDA / RDA / abomasal volvulus — the classic dairy-cow surgery

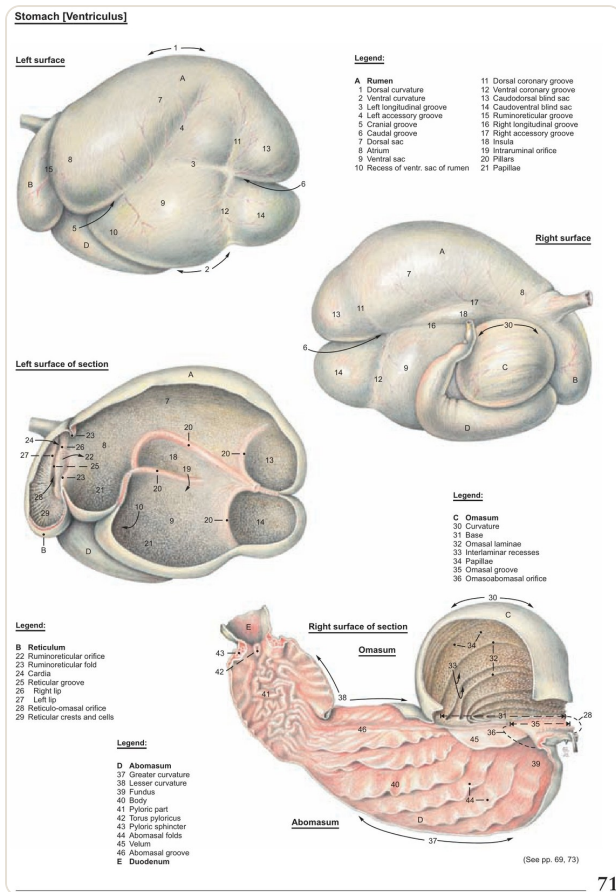


Fig 11 — The stomach: rumen, reticulum, omasum and abomasum.
Left and right surfaces of the intact stomach, and sections revealing the ruminal pillars and papillae, the honeycomb reticulum, the omasal laminae and the glandular abomasal folds.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Stomach (Ventriculus).
Reproduced for educational reference.

13 The intestines

The bovine intestine is long — up to about **50 metres** — roughly twenty times body length — and is packed almost entirely into the **right** half of the abdomen, suspended in a common mesentery. Its signature feature is the **spiral colon (ansa spiralis)**, a flat disc of centripetal and centrifugal coils that is unmistakable at laparotomy and post-mortem. The caecum (cecum) is a simple blind tube whose apex points caudally and which can dilate and twist (**caecal dilatation/torsion**). Because the whole mass is right-sided and mobile, intestinal accidents in cattle — volvulus, intussusception, and the compression that follows a right abomasal displacement — are diagnosed and approached from the right flank.

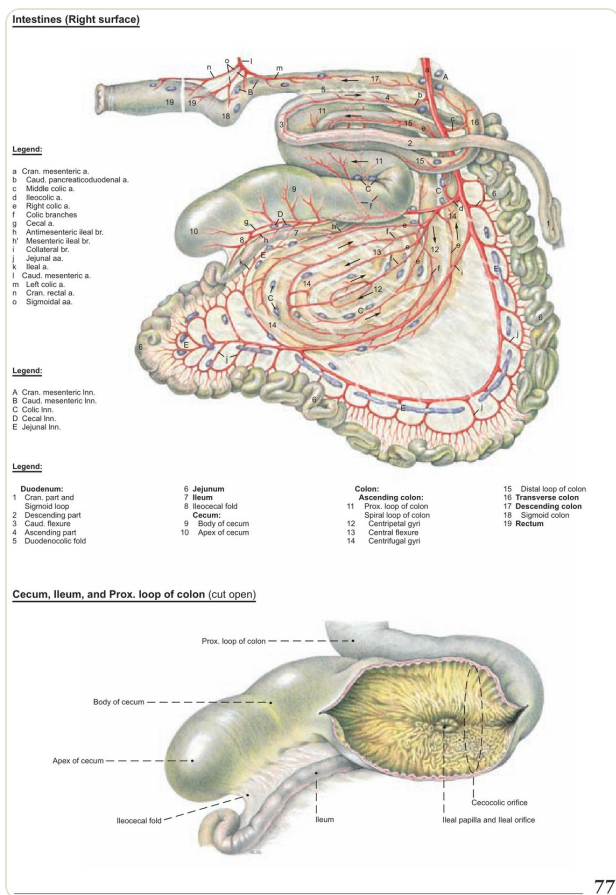


Fig 12 — The intestines. The right-sided intestinal mass with the distinctive spiral colon and its centripetal and centrifugal coils, plus the caecum and ileum opened to show the ileal papilla.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Intestines.
Reproduced for educational reference.

14 Liver, spleen & pancreas

Rumen development pushes the other abdominal organs to the right, so the bovine **liver lies almost entirely on the right side**, largely hidden under the ribs, with its long axis running obliquely. Unlike the horse, cattle **have a gall bladder**. The liver is a major site of production-disease pathology: **fatty liver** and **ketosis** in the fresh cow, and **liver abscesses** seeded from a rumenitis caused by grain overload — the “rumenitis-liver abscess complex”. The **spleen** is quite different from the horse’s: it is flat, sits high on the left against the dorsolateral rumen wall, and is firmly attached, so it is not a blood reservoir and rarely torses. Its position, plastered to the rumen, is why splenic abscessation can follow reticular perforation.

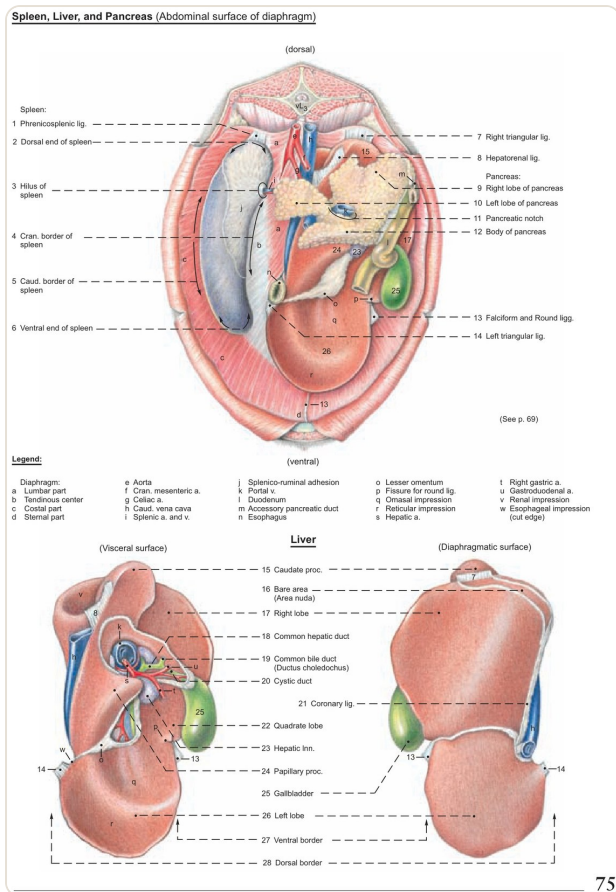


Fig 13 — Spleen, liver and pancreas. The abdominal surface of the diaphragm with the right-sided liver and the flat spleen applied to the rumen, plus the visceral and diaphragmatic surfaces of the liver with its gall bladder.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Spleen, liver and pancreas. Reproduced for educational reference.

15 The kidneys & urinary tract

The bovine kidney is a classic exam contrast, because it is unlike the smooth kidney of the horse, dog or cat. It is **multilobar** — the fetal lobulation persists into adult life, so the surface stays visibly divided into **renal lobes**. More importantly, **the ox has no renal pelvis**. Each renal pyramid projects its papilla into a **renal calyx**, and the calices drain into two collecting ducts that unite to form the ureter — an arrangement no other domestic species shares.

The two kidneys are not symmetrical. The **right kidney** is a flat, elongated oval lying retroperitoneally from about the 12th intercostal space back to the second or third lumbar vertebra; it is fixed in place. The **left kidney** is almost completely wrapped in peritoneum and therefore **pendulous**: displaced across the midline by the sheer bulk of the rumen, it hangs ventral to lumbar vertebrae 2–5, caudal to its fellow, and is rotated about 90° on its long axis so that its hilus faces dorsally. Students meet it as the “wandering kidney”. Both are landmarks on **rectal examination**, and the renal lymph nodes lying between the renal vessels are routinely examined at meat inspection.

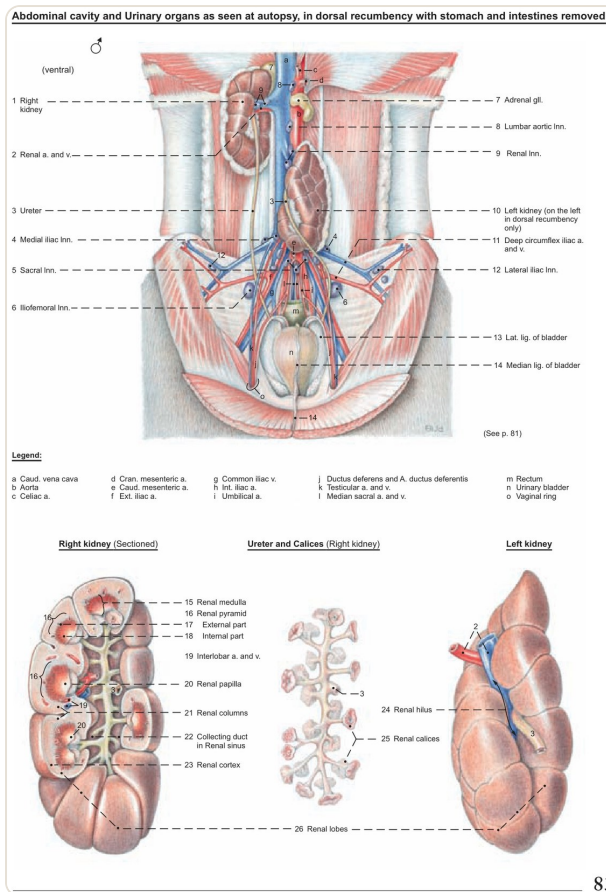


Fig 14 — The urinary organs and the bovine kidney. The kidneys, ureters and bladder seen at autopsy, with the right kidney sectioned to show the renal lobes, pyramids and papillae draining into *calices* — the ox has no renal pelvis.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Abdominal cavity and urinary organs. Reproduced for educational reference.

16 The udder

The bovine udder is four separate mammary glands fused into one mass. Crucially, each quarter has its **own independent duct system**: its own secretory tissue, **gland cistern**, **teat cistern** and single **teat canal (streak canal)**, so milk never passes from one quarter to another. That is why milk is sampled and treated quarter by quarter. Be precise about the anatomy, though: only the **left and right halves** are truly separated, by the medial laminae — which is why a whole half-udder can be amputated. Fore- and hindquarters of the *same* side share connective tissue and no distinct septum, so **infection can spread between them**.

The whole structure is slung by a **suspensory apparatus**: the paired **medial laminae** in the midline — largely **elastic** tissue, and together the median suspensory ligament — plus the mainly **collagenous lateral laminae**. In a heavy, high-yielding cow, breakdown of the elastic medial laminae lets the udder drop and the teats splay outward, predisposing to injury and mastitis. The teat canal is the udder's only defence gate: it is sealed between milkings by a **plug of desquamated, fatty keratinised cells** and surrounded by the teat sphincter, and above it lies **Fürstenberg's rosette** (in practice rarely as distinct as textbooks suggest). Anything that damages that canal — over-milking, poor liner vacuum, teat-end lesions — opens the direct route for environmental mastitis pathogens.

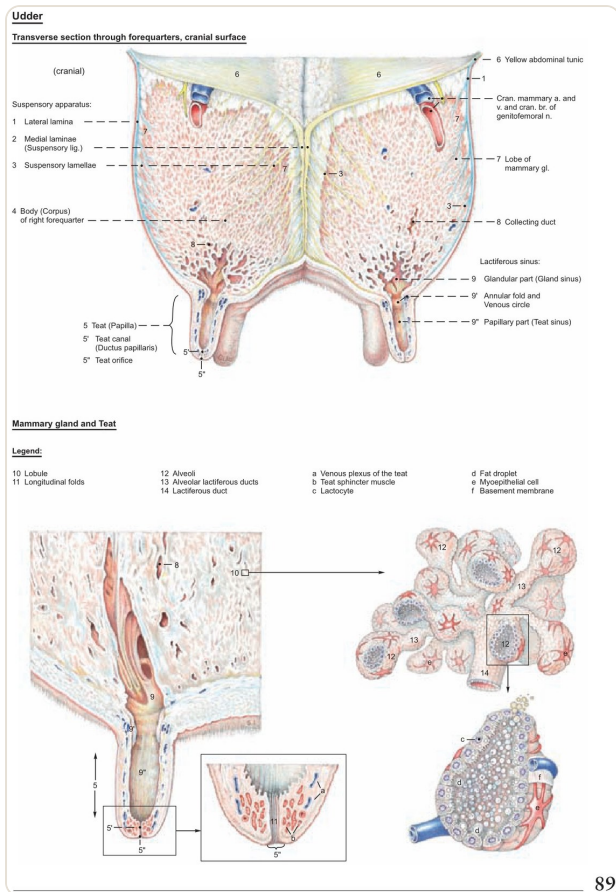


Fig 15 — The udder. A transverse section through the forequarters showing the median and lateral suspensory apparatus, the lobes and collecting ducts, the lactiferous sinus and the teat with its canal — plus the microscopic alveoli where milk is made.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Udder. Reproduced for educational reference.

17 The cow: female reproductive tract

The bovine female tract is the one every student must be able to identify *by feel*, because rectal palpation and transrectal ultrasound are routine. The uterus is **bicornuate** with a prominent **intercornual ligament** — the handle you hook a finger under to retract the tract during palpation. The cervix is long, thick and firm with **three to four interlocking annular rings**, which makes it the landmark you find first and the obstacle that must be negotiated for artificial insemination.

The defining feature is the placenta: cattle have a **cotyledonary** placenta, in which foetal cotyledons interdigitate with maternal **caruncles** to form **placentomes** — around 100 caruncles in total. Because attachment is at these discrete buttons, failure of the placentomes to release gives the very common postpartum problem of **retained foetal membranes**. The ovaries carry palpable structures — follicles and a **corpus luteum** — whose identification underpins all fertility work and oestrus synchronisation.

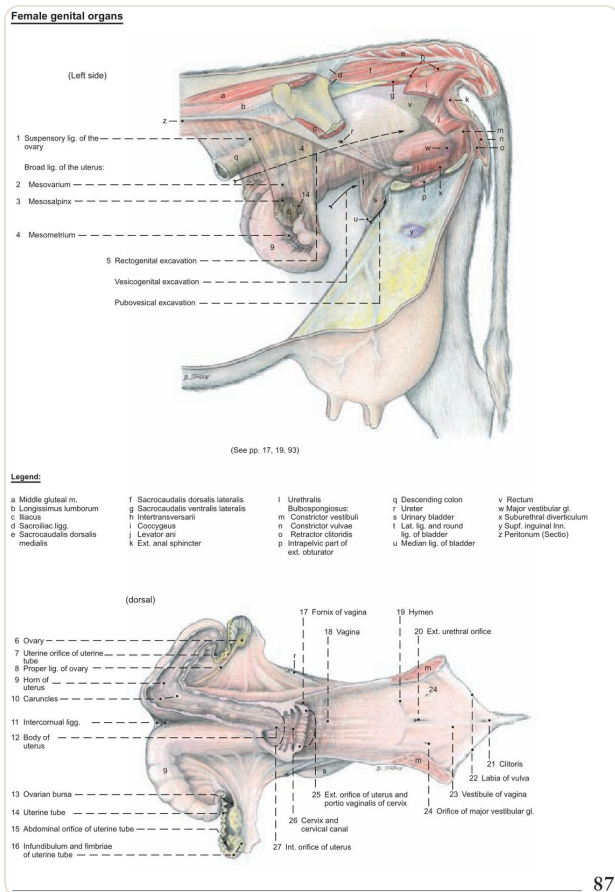


Fig 16 — The female genital organs. The tract in situ within the pelvis, and opened to show the ovaries, uterine tubes, the bicornuate uterus with its caruncles, and the long ringed cervix.

Image — Budras et al., Bovine Anatomy, 2nd ext. ed. — plate: Female genital organs. Reproduced for educational reference.

18 The bull: male reproductive tract

The bull's tract is built for a rapid, brief service, and its anatomy reflects that. The **testes** are large ovals — roughly 300 g each — hanging **vertically** in a pendulous, bottle-shaped **scrotum** in the cranial pubic region, with the epididymal border facing medially. Scrotal circumference is the single most-used measurement in a **breeding soundness examination**, because it tracks sperm-producing capacity.

The defining feature is the **sigmoid flexure** — an S-shaped bend in the fibroelastic penis, held folded by the paired **retractor penis muscles**. Erection in the bull is achieved mainly by *straightening* that flexure rather than by large-volume engorgement, which is why service is so brief. It also explains two classic bull problems: **penile haematoma** ("broken penis" — rupture of the tunica albuginea at the flexure during a mistimed thrust) and **persistent frenulum**. The accessory glands — paired **vesicular glands**, the **prostate** and the **bulbourethral glands** — are assessed per rectum, and the vesicular glands are the usual site of **seminal vesiculitis** in young bulls. The **ductus deferens** runs in the mesoductus deferens on the cranial surface of the mesorchium — the detail that matters for vasectomy.

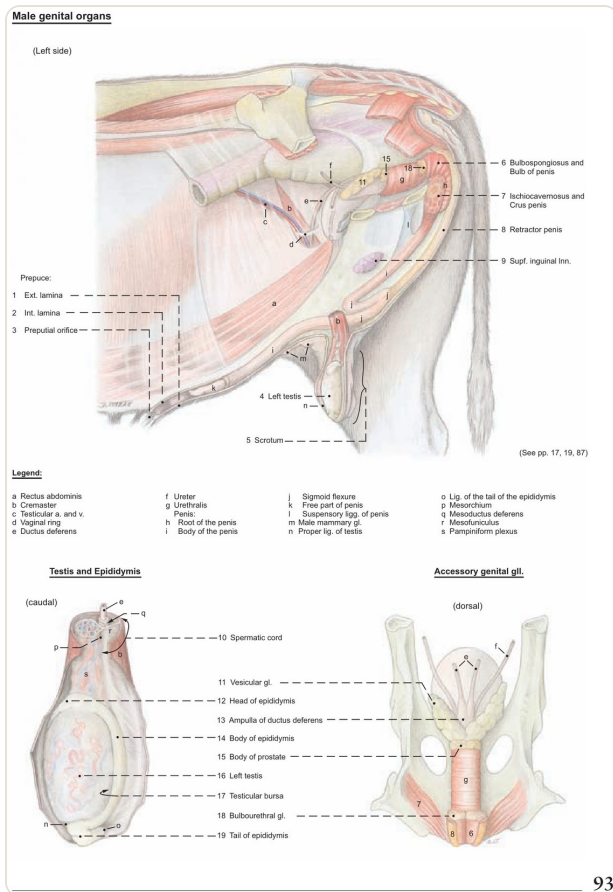


Fig 17 — The male genital organs. The bull's tract in situ with the sigmoid flexure and retractor penis muscles, plus the testis and epididymis and the accessory genital glands — vesicular, prostate and bulbourethral.

Image — Budras et al., *Bovine Anatomy*, 2nd ext. ed. — plate: Male genital organs. Reproduced for educational reference.

19 Cattle vs sheep, goat & horse: what changes

Students are examined on *differences* far more often than on cattle in isolation. The ruminant plan is shared across cattle, sheep and goats; the horse is the standard non-ruminant contrast.

FEATURE	CATTLE (OX)	SHEEP & GOAT	HORSE
Stomach	4 compartments; rumen fills the left abdomen	Same 4-compartment plan, proportionally smaller	Simple stomach; hindgut fermenter (large colon & caecum)
Upper incisors	Absent — dental pad	Absent — dental pad	Present (full incisor arcade)
Adult teeth	32	32	36–44 (canines, wolf teeth)
Digits	Cloven — two (digits 3 & 4)	Cloven — two	Single (digit 3) in one hoof
Horns	Frontal sinus extends into the horn core	Goats need two nerves blocked (cornual + infratrochlear)	None
Kidney	Multilobar , no renal pelvis, drains via calices	Smooth, unilobar, has a renal pelvis	Smooth, unilobar, has a renal pelvis
Placenta	Cotyledonary, ~100 placentomes	Cotyledonary, fewer and cup-shaped	Diffuse microcotyledonary
Gall bladder	Present	Present	Absent
Udder	4 quarters, 4 teats	2 halves, 2 teats	2 halves, 2 teats (mare)

20 Test yourself: 12 bovine anatomy questions

Cover the answers and work down the list — these are the points that come up most often in ruminant anatomy vivas and spot tests.

SELF-TEST 1. Which side of the abdomen does the rumen occupy, and which fossa gives surgical access? **Answer:** The **left**. The left paralumbar fossa is the standing-surgery window. 2. Name the four stomach compartments in the order ingesta passes through them. **Answer:** Rumen → reticulum → omasum → abomasum. Only the abomasum is glandular. 3. Why does dehorning an adult cow risk sinusitis? **Answer:** The frontal sinus extends into the cornual process, so removing the horn opens the sinus. 4. Which nerve is blocked before dehorning, and where? **Answer:** The cornual branch of the zygomaticotemporal nerve, along the temporal line between the lateral canthus and the horn base. 5. Give the bovine vertebral formula. **Answer:** C7, T13, L6, S5, Cd 18–20. 6. Which claw is the usual site of sole ulcer, and in which limb? **Answer:** The **lateral** claw of the **hind** foot. 7. What is the dental formula of the adult ox? **Answer:** $2 \times (I\ 0/3, C\ 0/1, P\ 3/3, M\ 3/3) = 32$ — often written $I\ 0/4$ as the lower canine is incisiform; no upper incisors, a dental pad instead. 8. How does the bovine kidney differ from the horse's? **Answer:** It is multilobar and has **no renal pelvis** — papillae drain into calices. 9. Why can mastitis affect one quarter and spare its neighbour? **Answer:** Each quarter has its own duct system, cistern and teat canal, so milk cannot pass between them — though infection can still spread between quarters of the same side. 10. What is a placentome, and why does it matter postpartum? **Answer:** A foetal cotyledon interlocked with a maternal caruncle. Failure to release gives retained foetal membranes. 11. Which structure lies immediately caudal to the diaphragm and traps swallowed metal? **Answer:** The reticulum — a wire can travel forward through the diaphragm into the pericardium, giving traumatic reticuloperitonitis and pericarditis. 12. What is the sigmoid flexure and which two conditions relate to it? **Answer:** The S-bend of the bull's fibroelastic penis; penile haematoma (hematoma) and persistent frenulum.

21 Cow & bovine anatomy — frequently asked questions

How many stomachs does a cow have?

One stomach with **four compartments** — rumen, reticulum, omasum and abomasum. The first three are non-glandular forestomachs where microbes ferment plant fibre (fiber); only the **abomasum** is the “true” glandular stomach that secretes acid and enzymes, equivalent to the stomach of a dog or human.

Why do cattle have no upper front teeth?

Cattle have no upper incisors or canines. In their place is a firm fibrous **dental pad**. The cow grips grass between her lower incisors and that pad and tears it by swinging her head — an arrangement suited to cropping forage rather than biting.

How many teeth does a cow have?

32 permanent teeth: $2 \times (I\ 0/3, C\ 0/1, P\ 3/3, M\ 3/3)$, often written $2 \times (I\ 0/4, P\ 3/3, M\ 3/3)$ because the lower canine is incisiform. Because the permanent incisors erupt in a predictable order — the central pair at about 1.5–2 years, then a further pair roughly every 9 months, with the corners in at about 3.5–4 years — they are the standard way to estimate a cow's age in the field.

Why is dehorning an adult cow a problem?

Because the **frontal sinus extends into the horn core**. Removing the horn of a mature animal opens the sinus, allowing contamination and sinusitis. Disbudding calves before the horn bud attaches to the skull avoids this entirely, and the horn is desensitised by blocking the **cornual nerve**.

Which side of a cow is the rumen on?

The **left**. The rumen occupies most of the left half of the abdomen and is the only viscus in contact with the left flank, which is why the left paralumbar fossa is used for rumenotomy and left-flank surgery, and why a high-pitched ping on the left suggests a left-displaced abomasum.

Why is bovine lameness usually in the hind foot?

Cattle bear weight on two digits, and in the hind limb the **lateral claw** takes disproportionate load. That claw is the classic site of sole ulcer and white line disease, alongside infectious causes such as digital dermatitis and interdigital phlegmon.

What is the dental formula of cattle?

The adult ox has **32 permanent teeth**: $2 \times (I\ 0/3, C\ 0/1, P\ 3/3, M\ 3/3)$, commonly written $2 \times (I\ 0/4, P\ 3/3, M\ 3/3)$ because the lower canine sits with the incisors. There are no upper incisors or canines — the upper jaw carries a dental pad instead — and the lower canine sits alongside the incisors, so the lower arcade looks like eight incisors.

How do you age a cow by its teeth?

By counting the erupted **permanent incisor pairs**. The central pair appears at about 1.5–2 years, then a further pair roughly every 9 months, so the corner incisors erupt at around 3.5–4 years and are in full wear by about 4.5–5. After that, ageing relies on wear rather than eruption and becomes far less precise.

What is the difference between the rumen and the reticulum?

The **rumen** is the huge fermentation vat filling the left abdomen, lined with absorptive papillae. The **reticulum** is smaller, lies most cranially against the diaphragm, and has a honeycomb lining that sorts particles. The two communicate freely (they are often called the reticulorumen), but only the reticulum traps swallowed wire — which is why **hardware disease** is a reticular problem.

How many teats does a cow have?

Four — one per quarter. Each quarter is a separate gland with its own cistern and single teat canal, so milk cannot pass between them. Supernumerary (extra) teats are common and are usually removed in heifer calves.

Where is the paralumbar fossa and why operate from the left?

The **paralumbar fossa** is the hollow bounded by the last rib, the lumbar transverse processes and the tuber coxae. The **left** fossa opens directly onto the rumen, which makes it the standing-surgery window for rumenotomy, left-displaced abomasum and caesarean section.

Does a cow have a gall bladder?

Yes. Unlike the horse, cattle **do** have a gall bladder, on the visceral surface of the right-sided liver.

What is the milk vein, and can you use it for injections?

The "milk vein" is the **subcutaneous abdominal vein**, which runs forward along the ventral abdominal wall from the udder and dives into the thorax through an opening in the body wall traditionally called the *milk well*. It drains the udder, so it becomes strikingly large and tortuous in a high-yielding dairy cow — a useful clue to production at a glance. It can be used for venipuncture and is occasionally used in emergencies, but it is a poor routine choice: it is thin-walled, sits in loose subcutaneous tissue with nothing to compress against, and bleeds and thromboses readily. The **jugular** in the jugular groove, or the **coccygeal** vein under the tail for small samples, are the sensible sites.

How is pregnancy diagnosed in cattle by rectal palpation?

By feeling the reproductive tract through the rectal wall, which is possible because the bovine uterus lies within reach of an arm and the rectum sits directly above it. An experienced operator can detect pregnancy from about **35 days**, and it is reliable from **45–60 days**. The findings in sequence are asymmetry and fluid in one uterine horn, **slipping of the fetal membranes** between finger and thumb, the amniotic vesicle, then the **placentomes** and fetal parts as the pregnancy advances, and **fremitus** — a distinctive thrill in the enlarged middle uterine artery — from around 90–120 days. Transrectal **ultrasound** pushes reliable diagnosis back to roughly 28–30 days and adds fetal viability and sexing.

Is cattle anatomy the same as sheep and goat anatomy?

The ruminant plan is shared — four-compartment stomach, dental pad, cloven hoof, cotyledonary placenta — but there are differences in size, horn anatomy, and detail. For the other species we have covered, see our Horse Anatomy, Dog Anatomy and Cat Anatomy visual guides.

When to refer

- **The cow with a left-sided ping** — left-displaced abomasum, read directly off the abdominal topography.
- **The sudden-onset anorexic cow with an arched back** — traumatic reticuloperitonitis; the reticulum lies against the diaphragm, with the heart just beyond it.
- **The lame dairy cow** — check the lateral claw of the hind foot first: sole ulcer and white line disease.
- **The mastitic quarter** — quarters are anatomically independent, so treat and sample quarter by quarter.
- **The cow that hasn't cleansed** — retained foetal membranes, a direct consequence of the cotyledonary placenta.

Sources

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