# Avian Anatomy and Physiology

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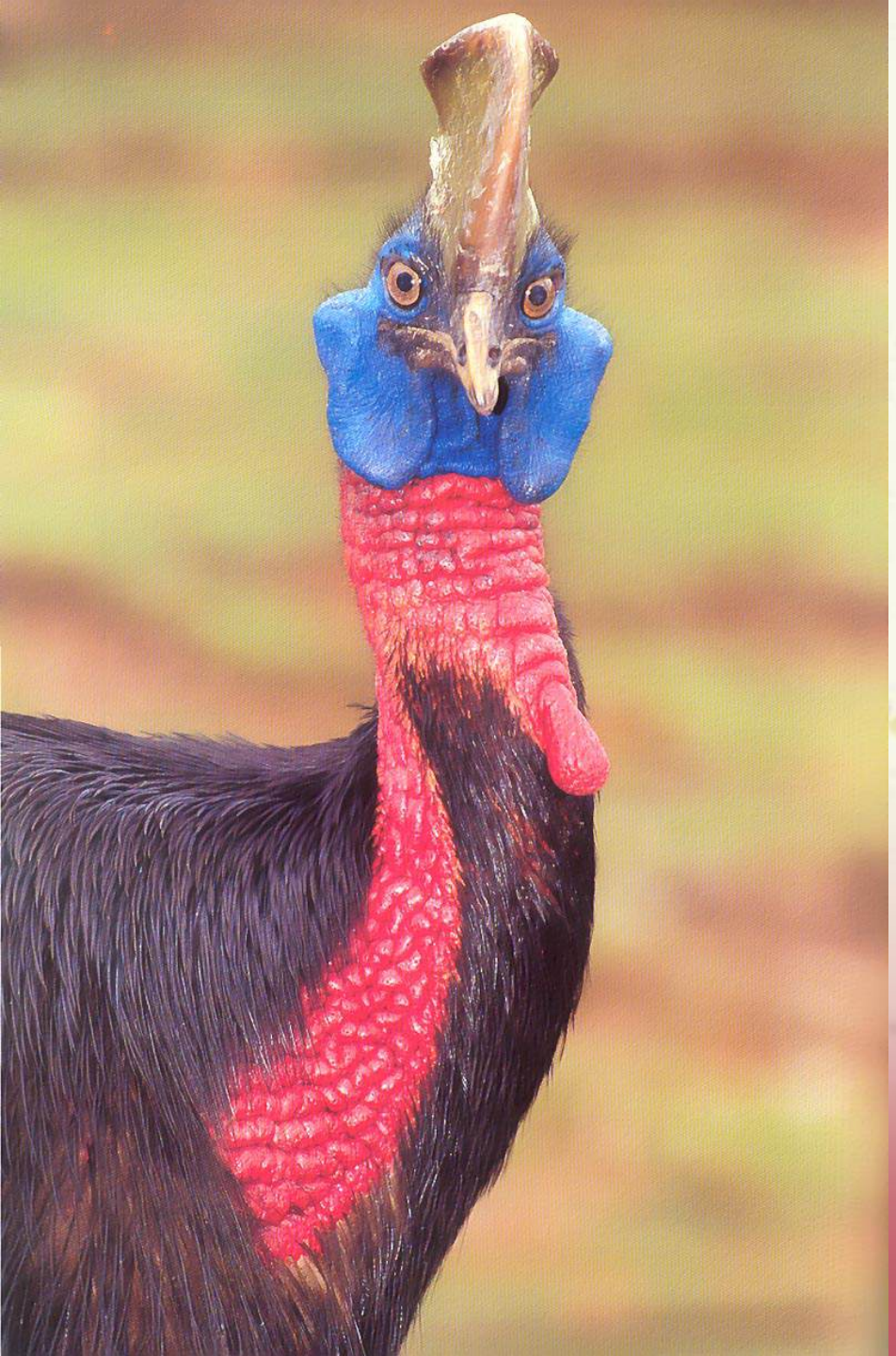
Some slides from Heather Wilson, DVM, Dipl. ABVP Avian



# Integument

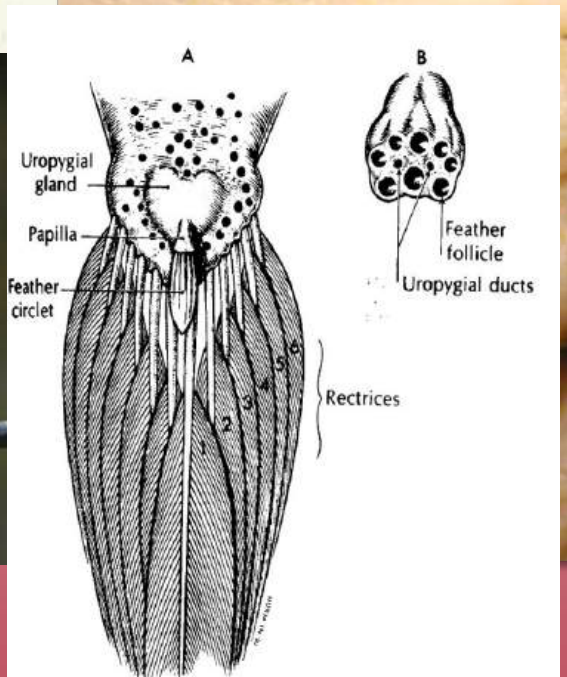
- 2 layers: Dermis and epidermis
- Epidermis thin except for certain areas
- Keratinization produces special structures: beak, nails, scales, feathers
- Lacks glands

# **Feathers-**7 types

- Contour
  - wing & tail (flight)
- Semiplume
- Down
  - fluffy, no barbules
- Bristle
  - “eyelashes”
- Powder down
- Hypopenna
- Filoplume

# Uropygial Gland

- "Preen gland"
- Bilobed holocrine gland
- Conditions feathers
- Not all species have one



# Purpose of Feathers

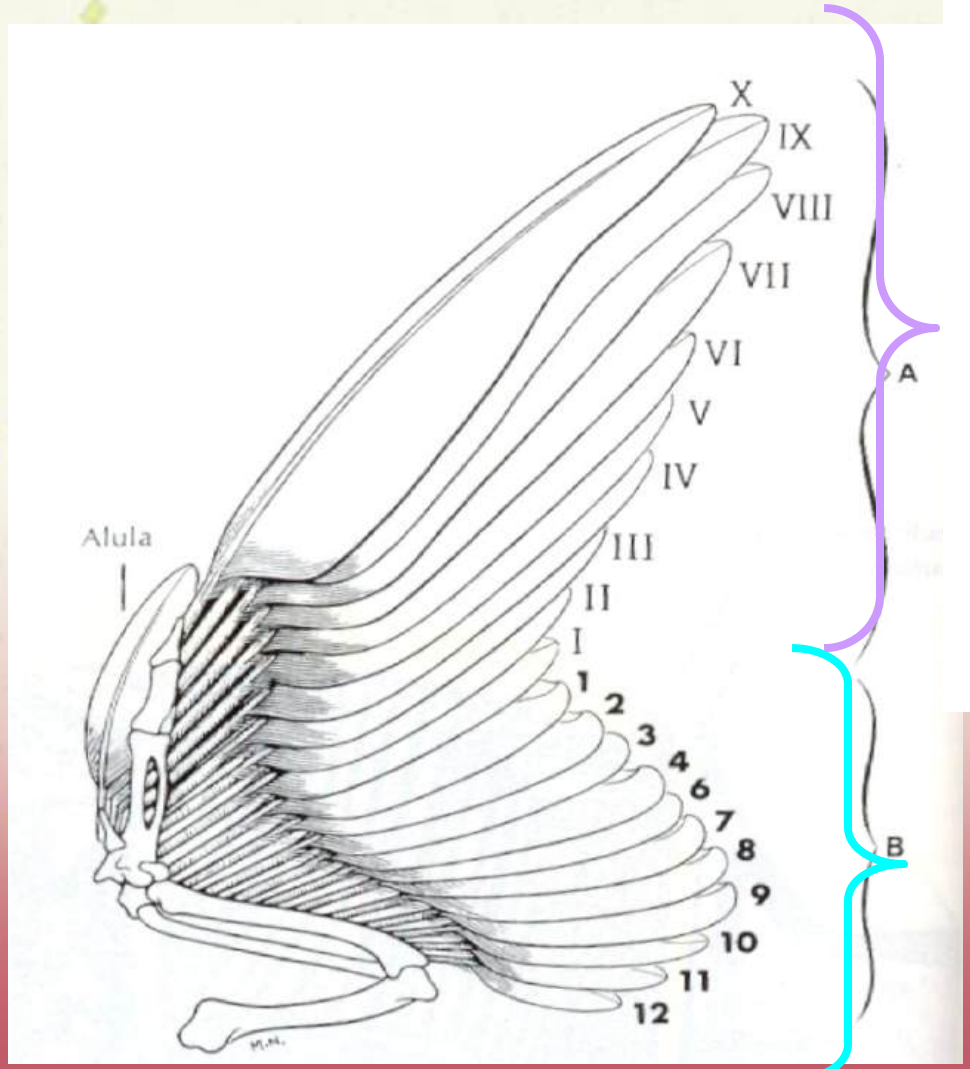
- Flight
- Courtship
- Defense
- Insulation
- Waterproofing

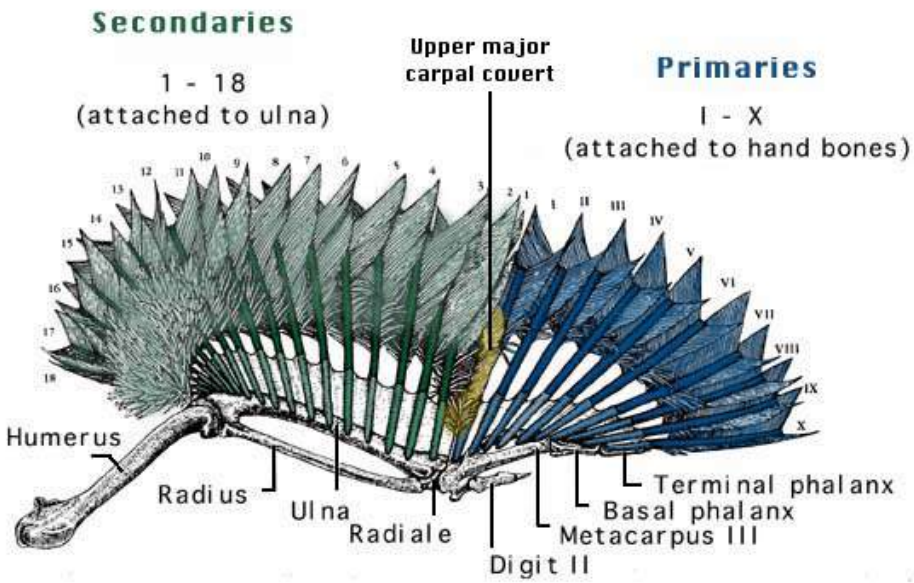
# Contour Feathers

- Rows (pterylae) in most species
- Apteryla=feather-less tracts
- Remiges=Wing flight feathers
- Retrices=Tail flight feathers

# Primaries attach to metacarpals

# Secondaries attach to ulna




# Waterproofing

- Preen gland secretions are not necessary
- Interlocking of feather barbules creates watertight barrier

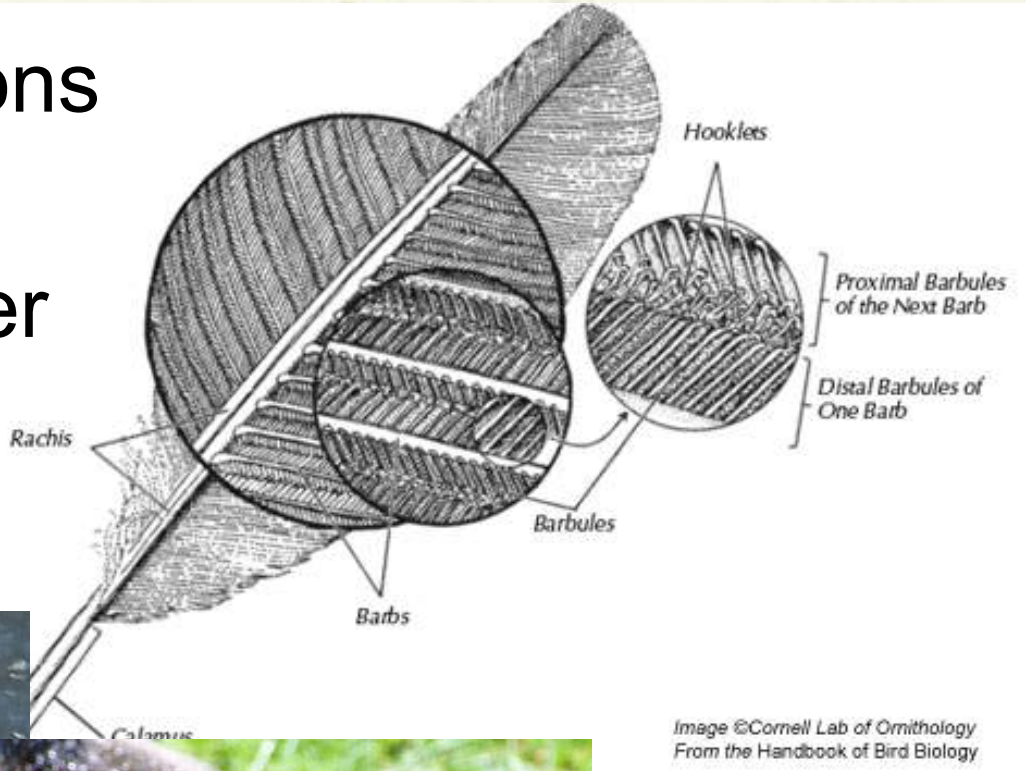
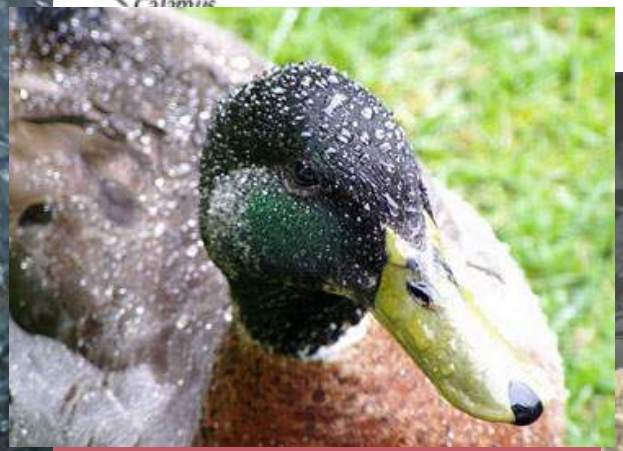
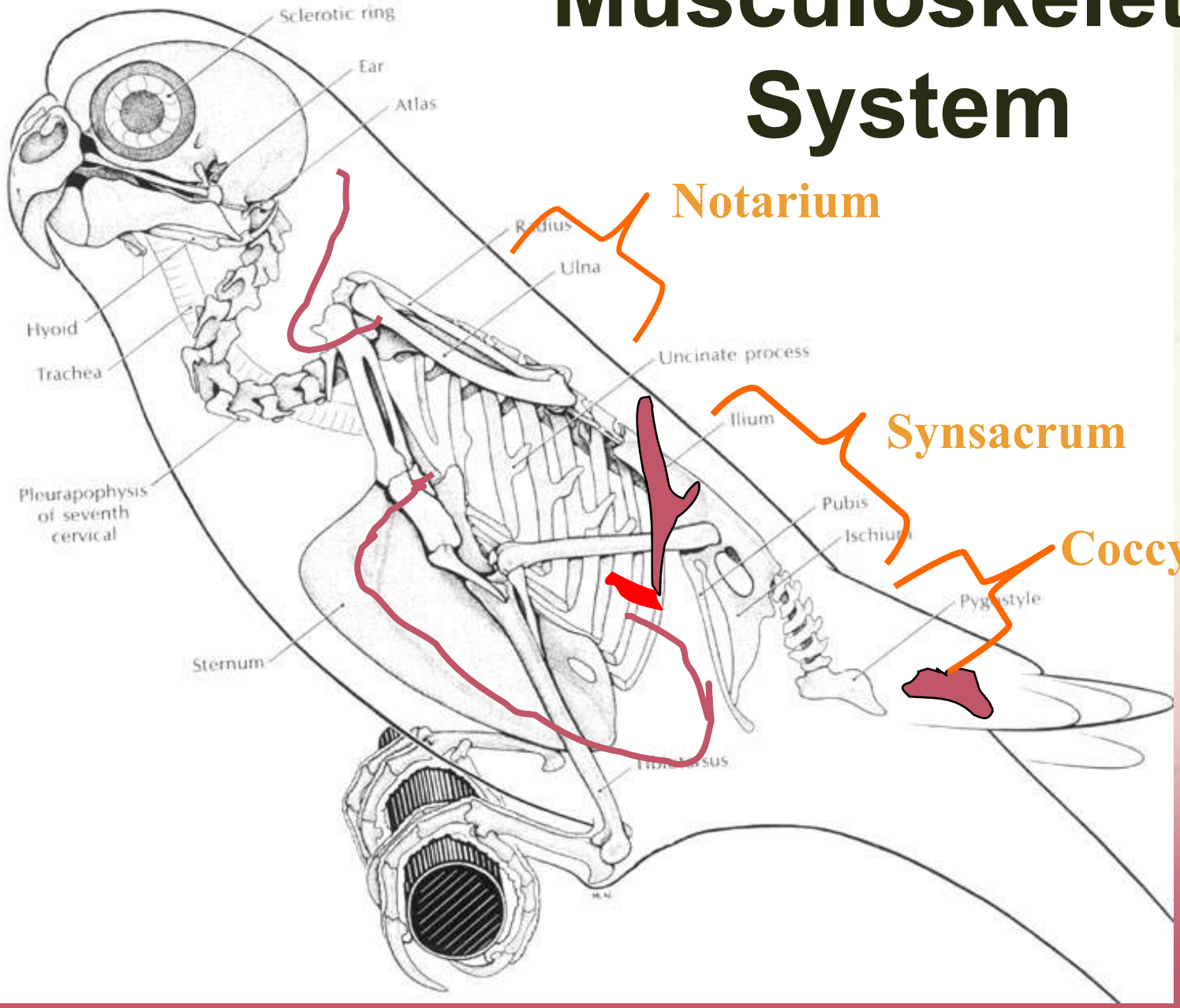



Image ©Cornell Lab of Ornithology
From the Handbook of Bird Biology



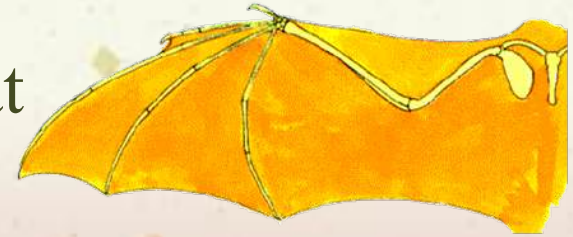
# Musculoskeletal System



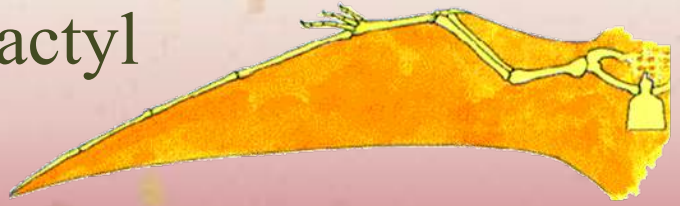
# Avian wings

- Unique structure
- Flight feathers attached to ulna and metacarpals
- Ulna > radius

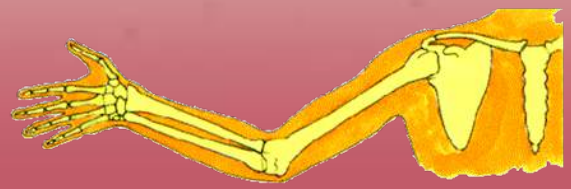
Bat



Pterodactyl



Superman



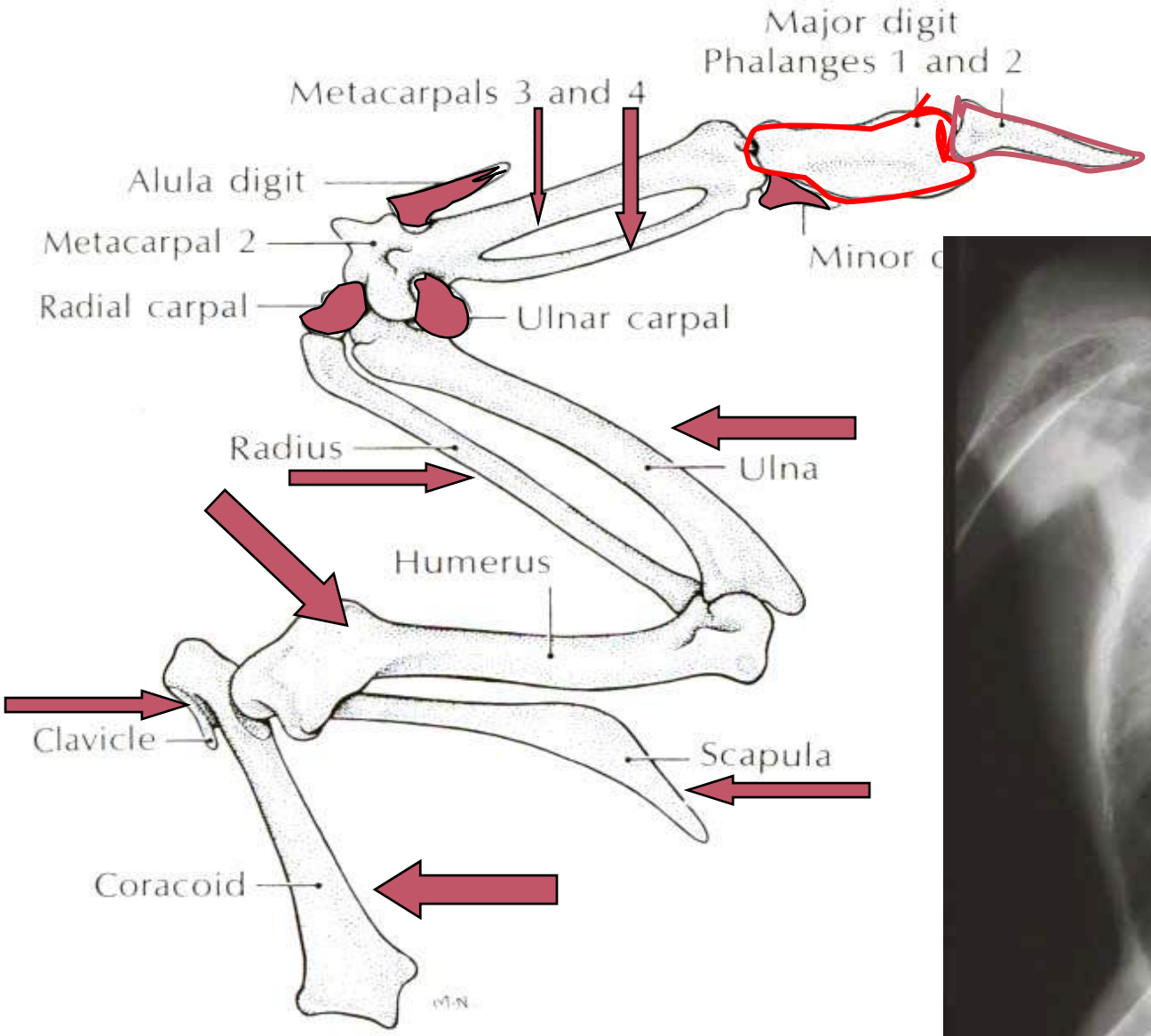
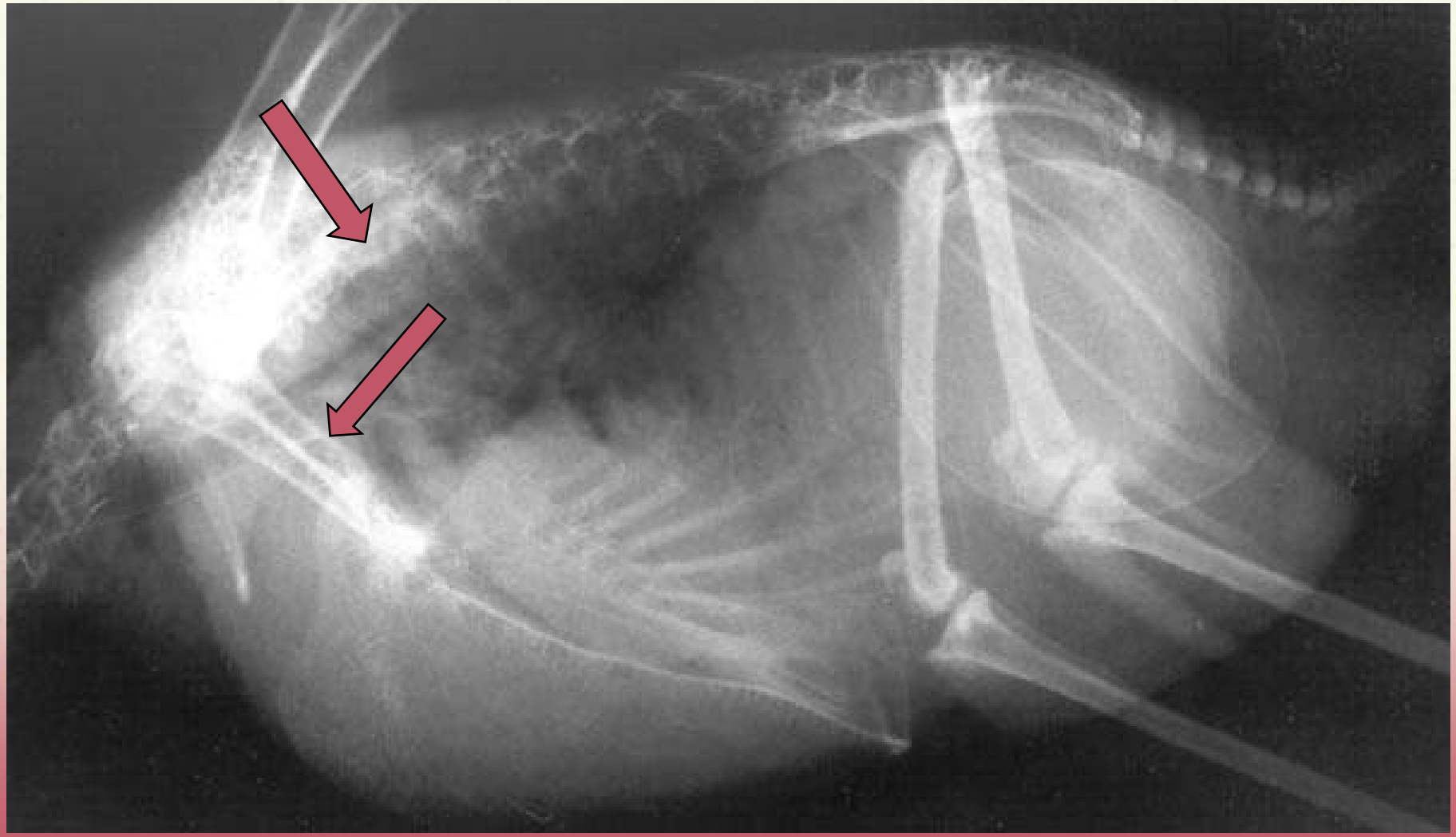



**FIGURE 13-22.** Left pectoral girdle and wing skeleton.
elevated to show the ventral surface.

# Pectoral girdle



# Clinical skeletal anatomy

- Spinal fractures at juncture of notarium and synsacrum
- See with birds who flew into a window

# Fractures

- Bones are more brittle compared to mammals
- Bones heal more rapidly
  - 4 weeks
- Fibrocartilagenous healing first
  - may not be visible radiographically

# Pectoral Muscle

- Highly vascularized muscle
- IM injections here are absorbed rapidly
- Nonflighted birds have soft, “flabby” pectoral muscles

# Lower limbs

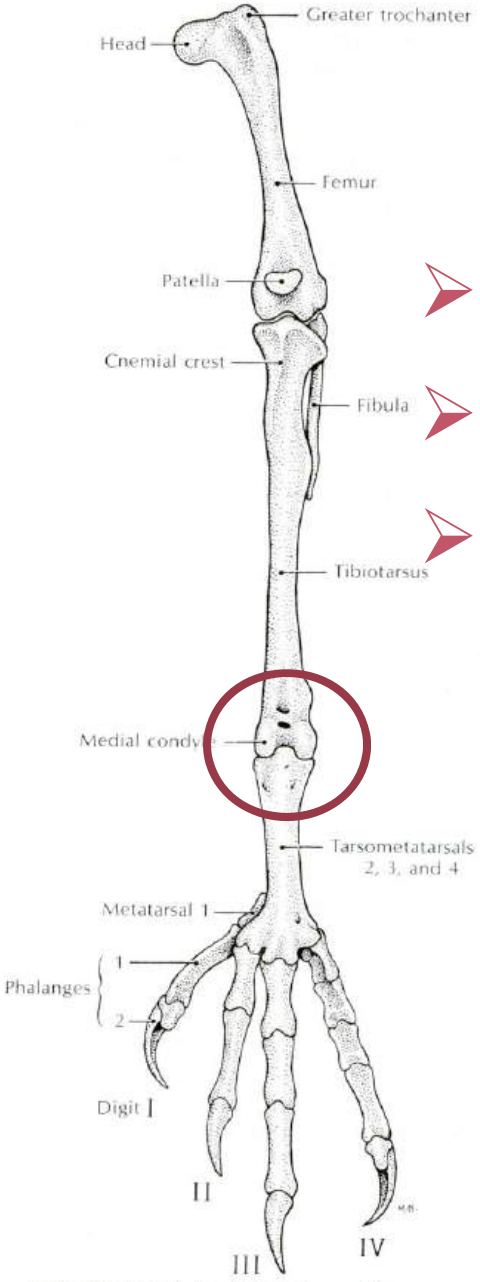


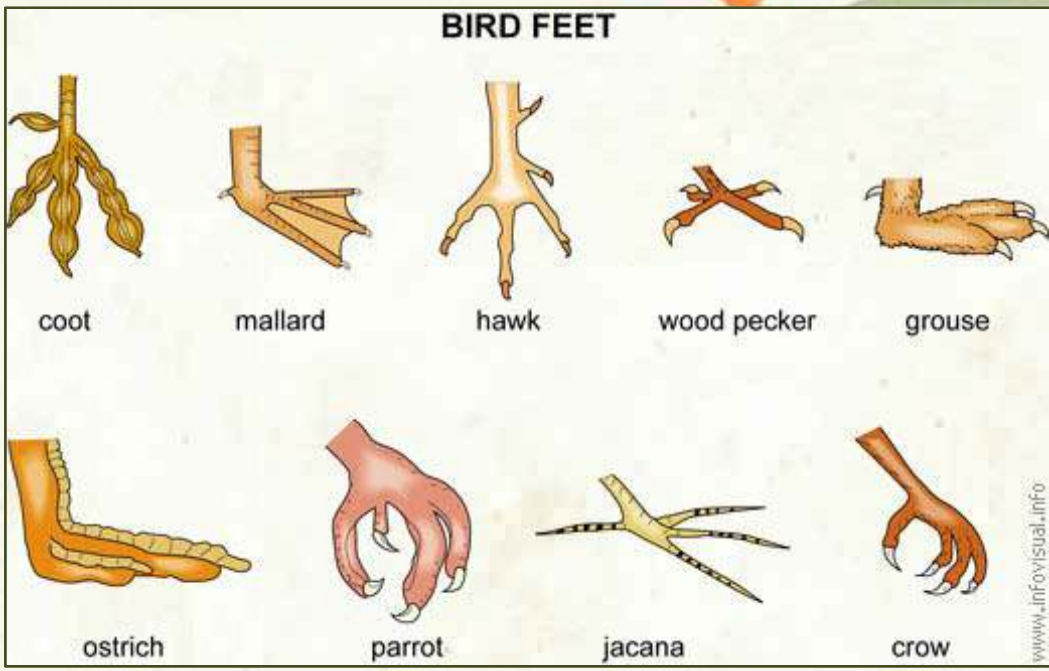
FIGURE 13-24. Left pelvic limb, cranial aspect.

- Femur
- Tibiotarsus
- Tarsometatarsus
  - "Hock" is tibiotarsal-tarsometatarsal joint

# Feet

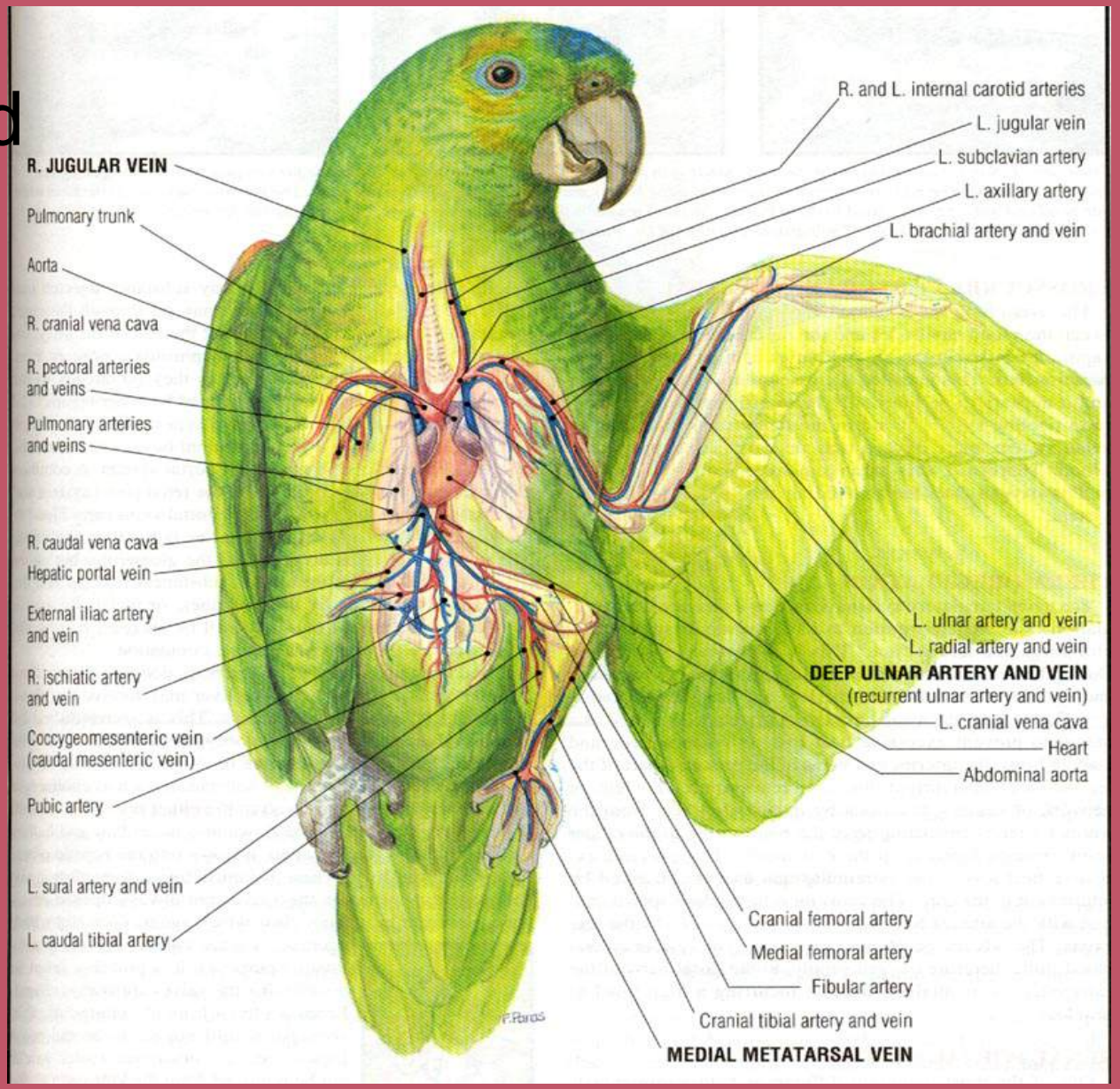
- Each digit has +1 phalanx
  - Digit one has 2 phalanges
  - Digit two has 3, etc
- Parrots are zygodactylus
  - Digits 1 & 4 face back

    Digits 2 & 3 face forward




# Cardiovascular system

- 4 chambered heart
- Encircled by liver
- Right jugular vein larger than left (which may be absent)



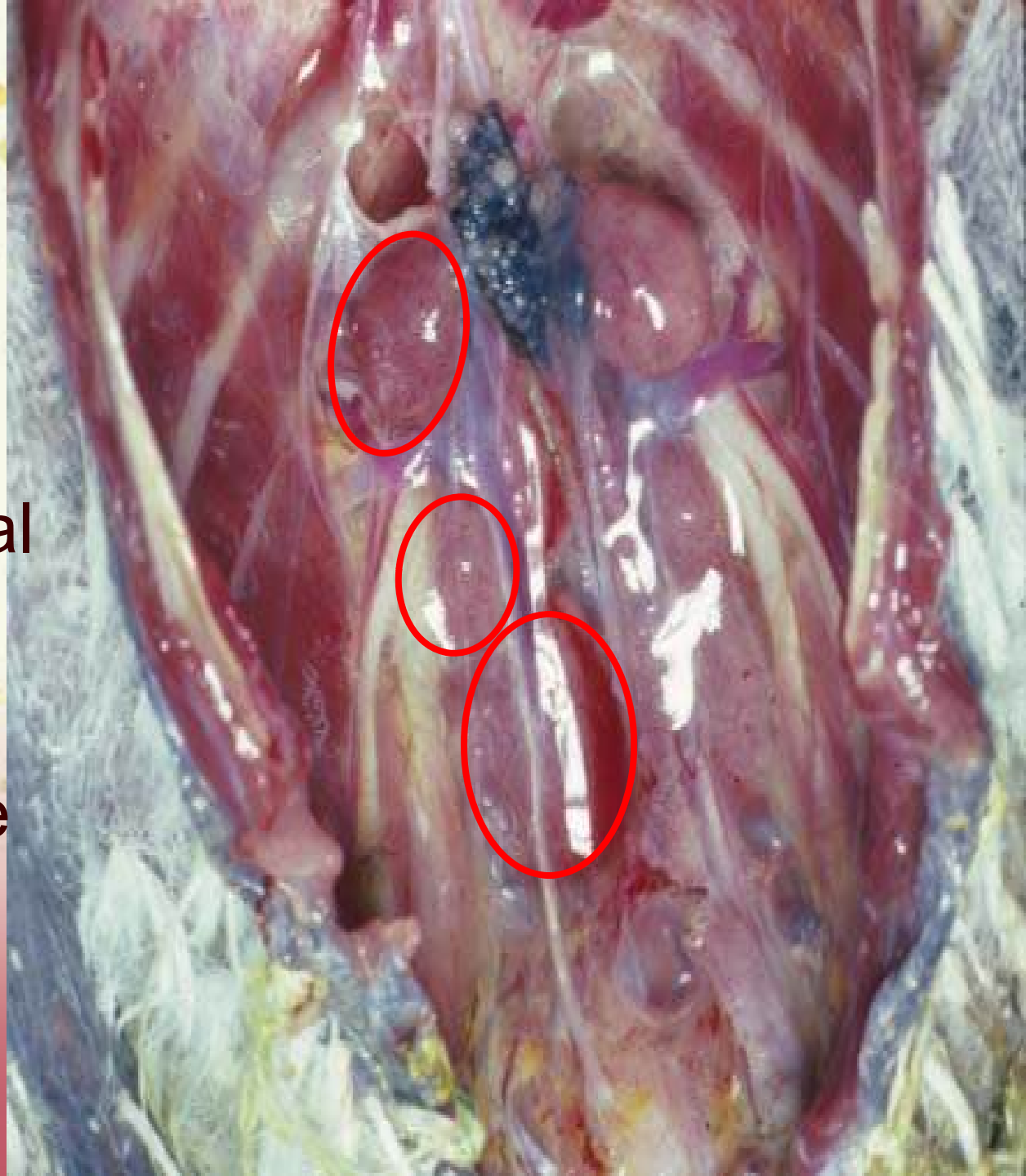
# Lymphatic System

- No lymph nodes
- Lymph vessels follow veins
- Lymph plexuses (rete)
- Bursa of Fabricius
  - B-cells

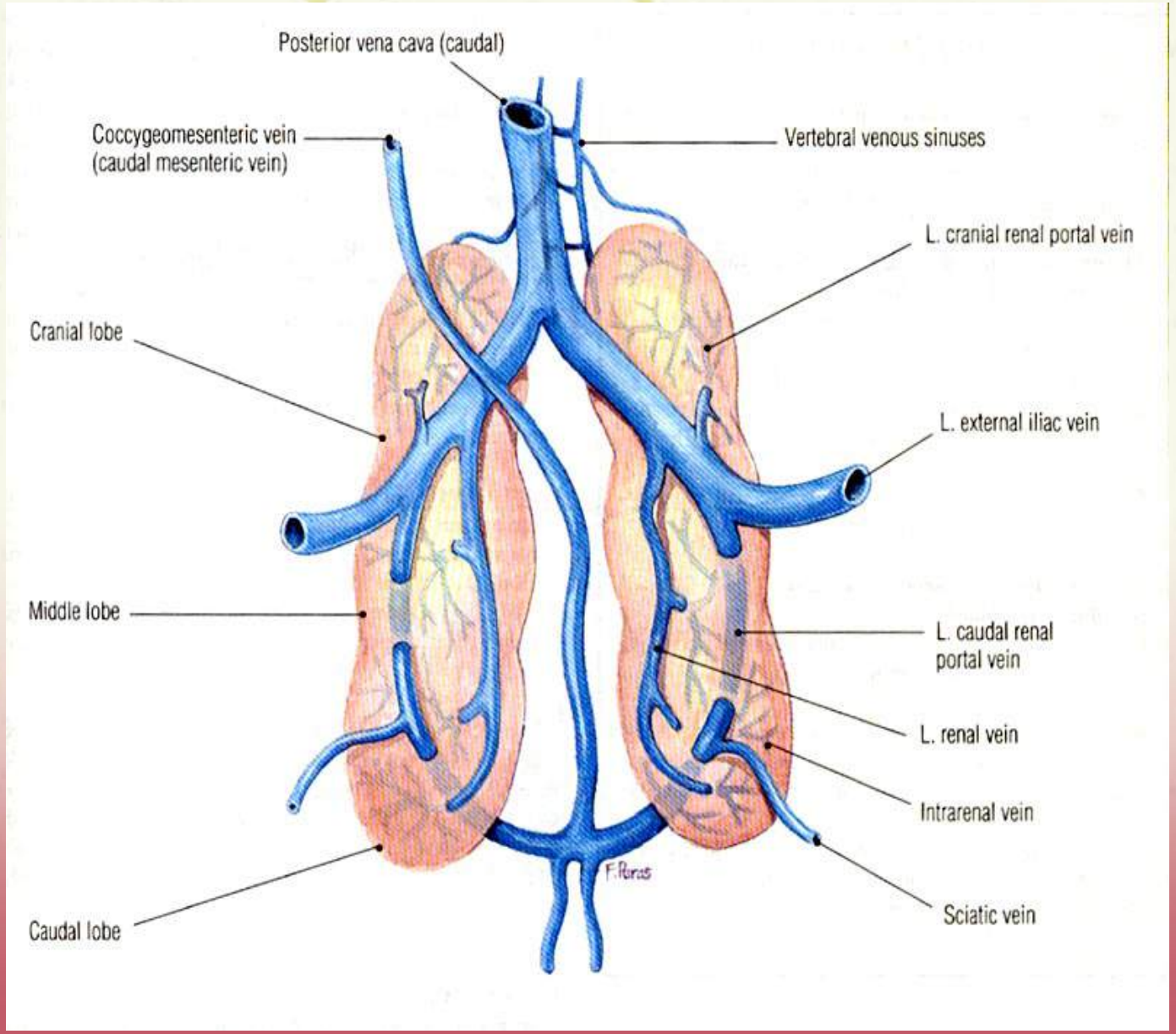
付図 8. 鶏のファブリシウス嚢

# Kidneys

- Adhered to dorsal body wall
- Retroperitoneal
- 3 lobes
- Excrete uric acid and some urine

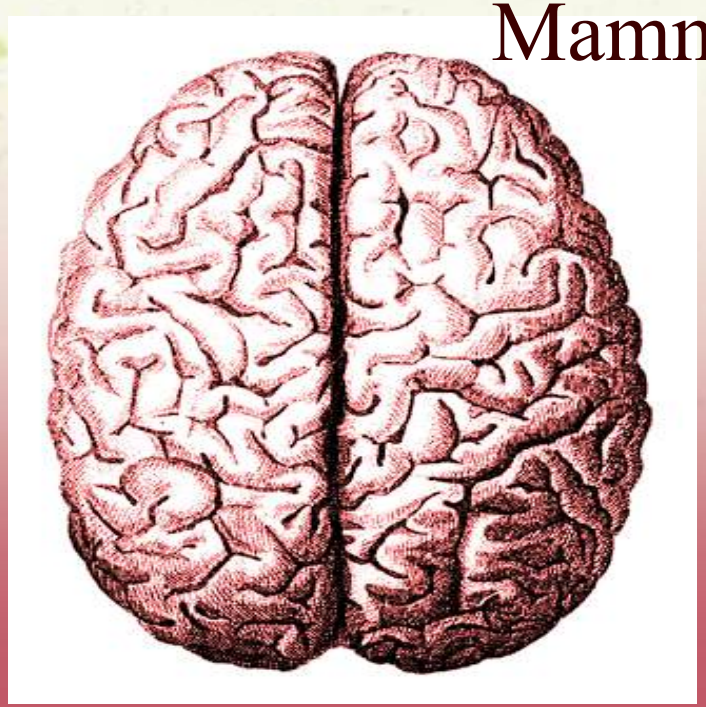


# Renal Portal System



# Nervous System

- Brain: 3 meniges & 12 CN as in mammals
- In contrast, birds have no neocortex
- Surface of cerebrum almost smooth
- Olfactory bulb relatively small

# Bird Brain

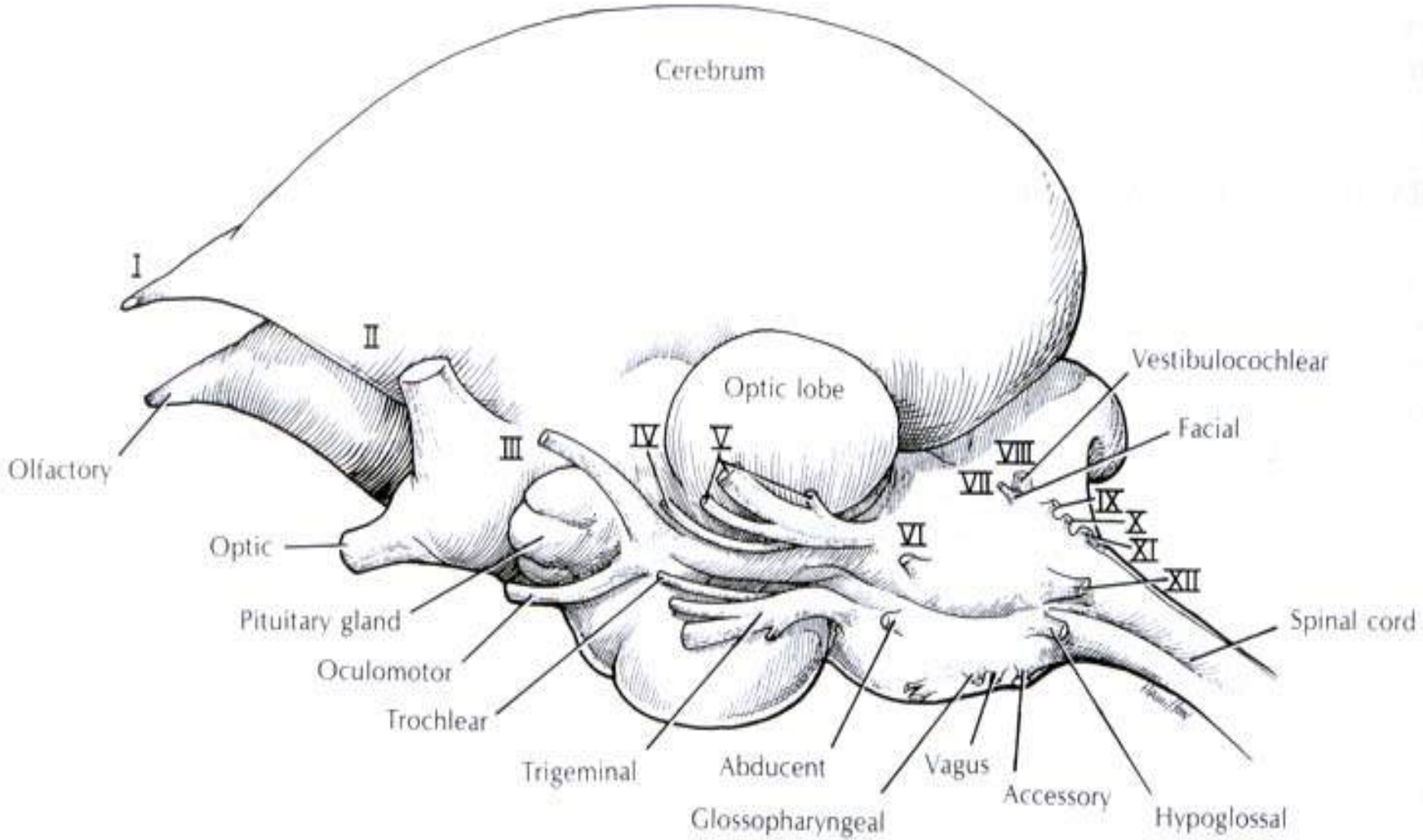
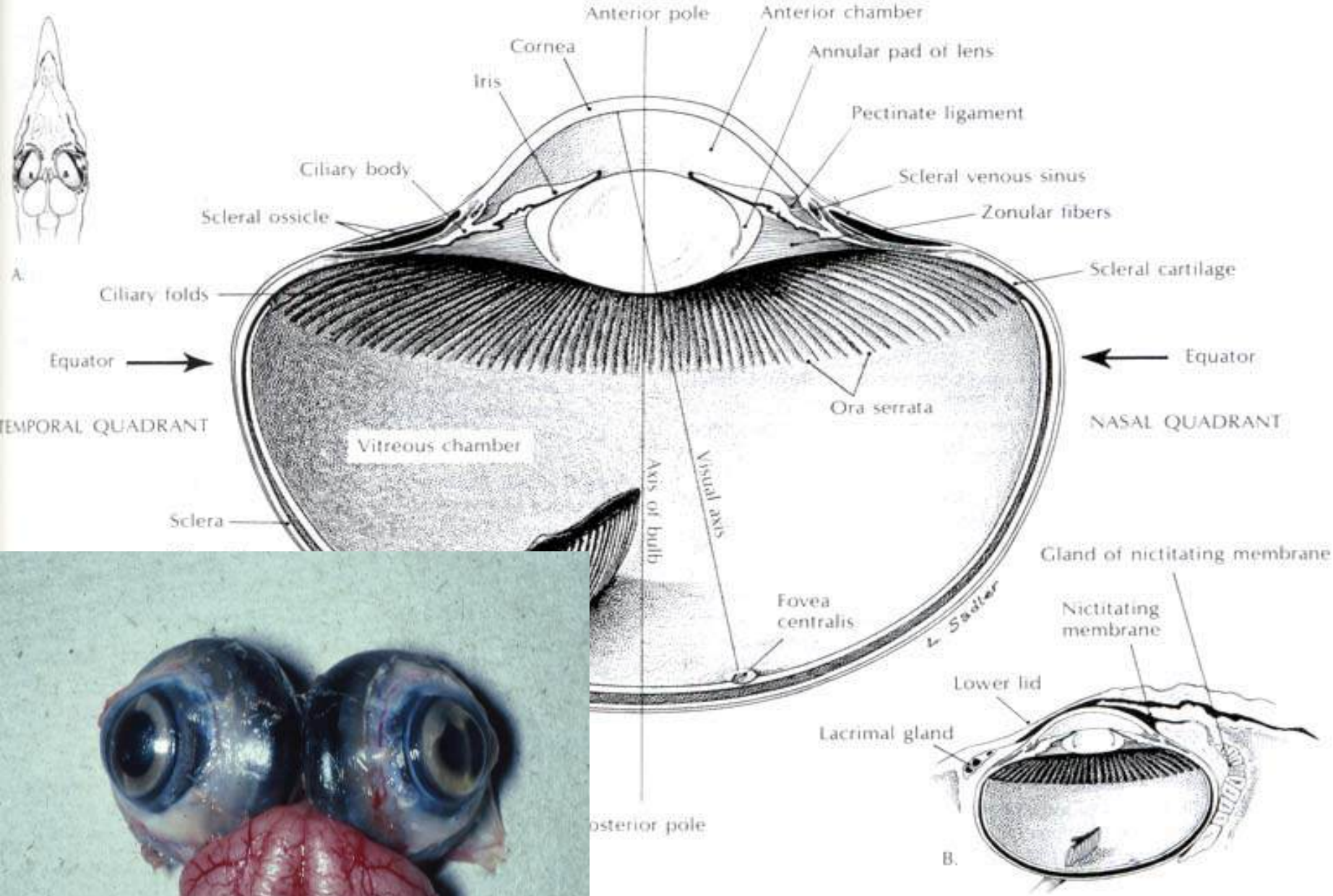



**FIGURE 13-48.** Brain and cranial nerves of the budgerigar.

# Eyes

- Most birds have excellent vision
- More cones than rods (in general)
- No blind spot (no optic disk)
  - Pecten, unique to birds, provides nutrients
- Iris contains striated muscle--can't use atropine to dilate
  - Need curariform drugs



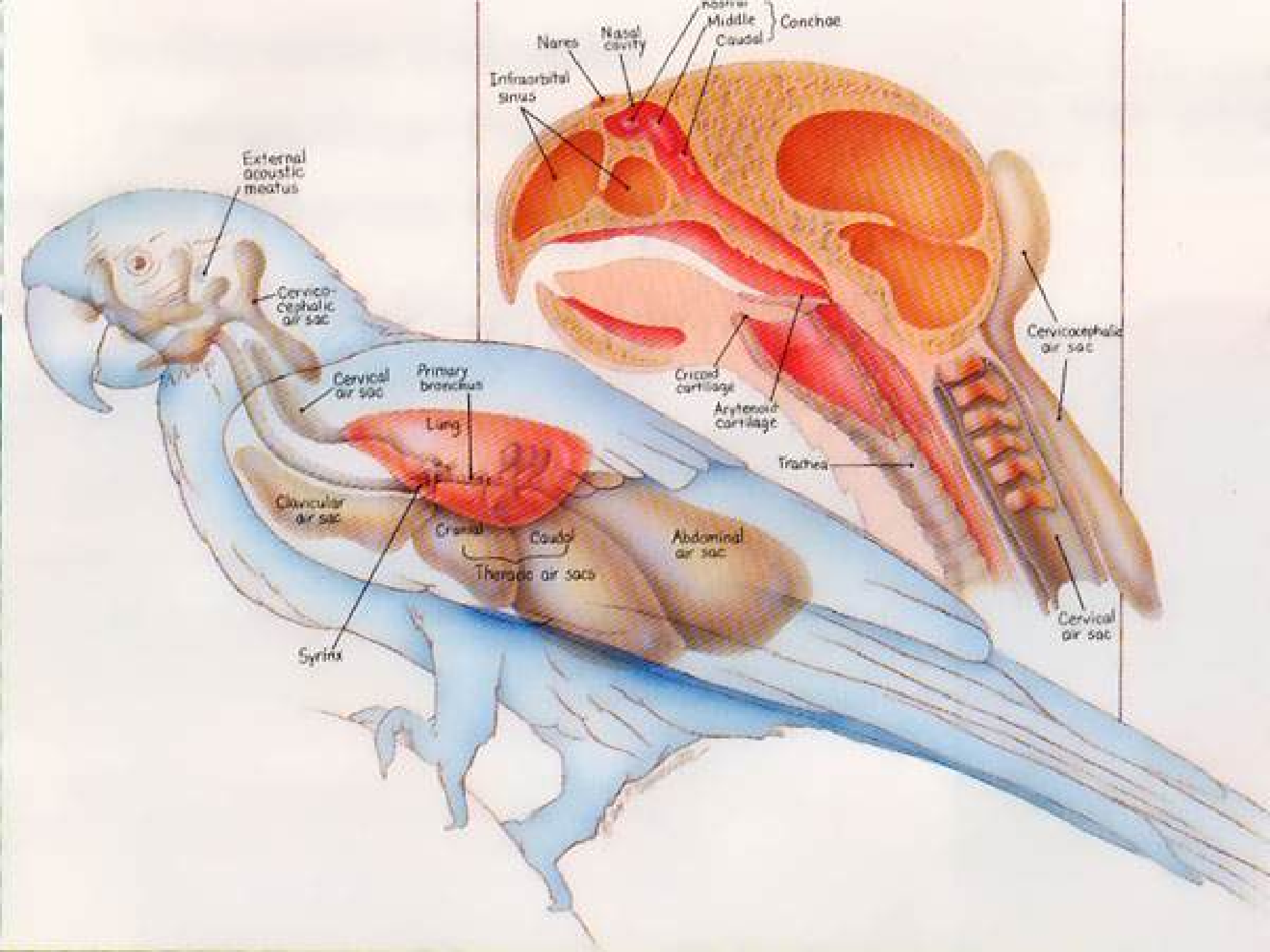

zontal section of the head. Note the position of the pecten in the fundus. B. ection of the eyeball.

# Coelomic Cavities

- 16 separate cavities within body
- 8 air sacs
- 5 peritoneal
- 2 pleural
- 1 pericardial

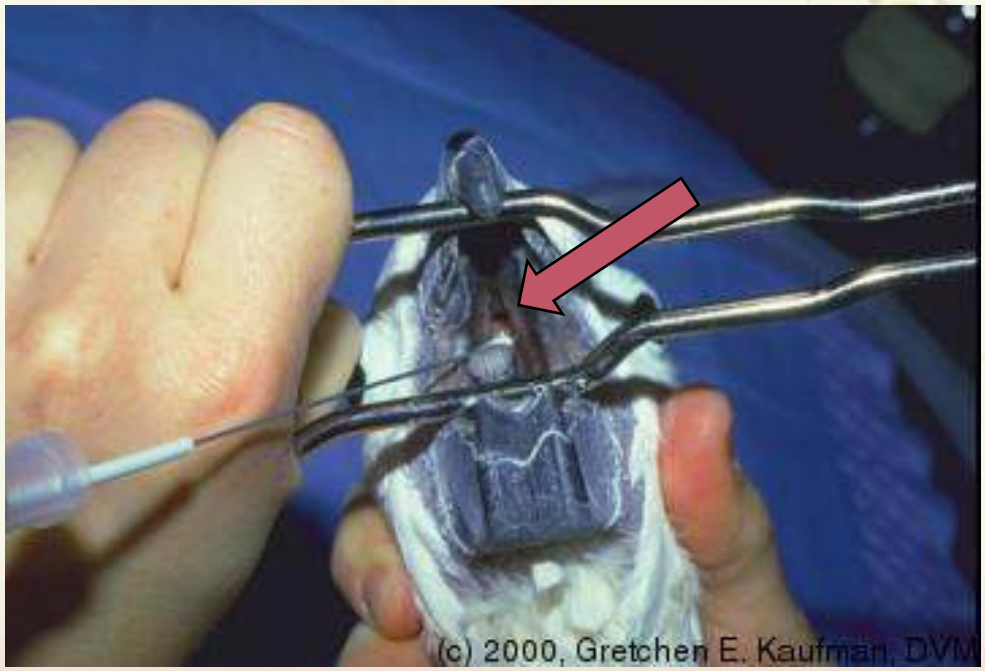
# Upper Respiratory Tract

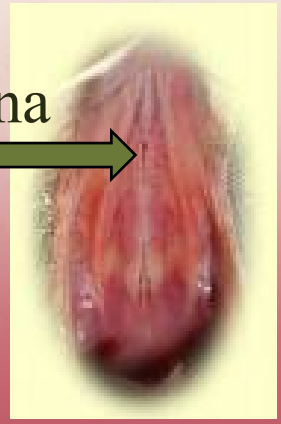
- Nares
  - Cere
- Operculum
- Sinuses
- Conchae
- Choana
- Oropharynx


Middle
Caudal
Conchae
Nares
Nasal cavity
Infraorbital sinus
External acoustic meatus
Cervico-cephalic air sac
Cervical air sac
Primary bronchus
Lung
Clavicular air sac
Cranial
Caudal
Thoracic air sacs
Abdominal air sac
Syrinx
Cricoid cartilage
Arytenoid cartilage
Trachea
Cervicocephalic air sac
Cervical air sac

# Upper respiratory tract

- Nasal cavity
  - Communicates with oral cavity
- Choana
  - exceptions
- No soft palate



# Respiratory anatomy

- Trachea
  - Relatively large
  - Glottis at base of tongue
  - Complete rings
- No diaphragm
- Syrinx (no larynx)

# Clinical anatomy

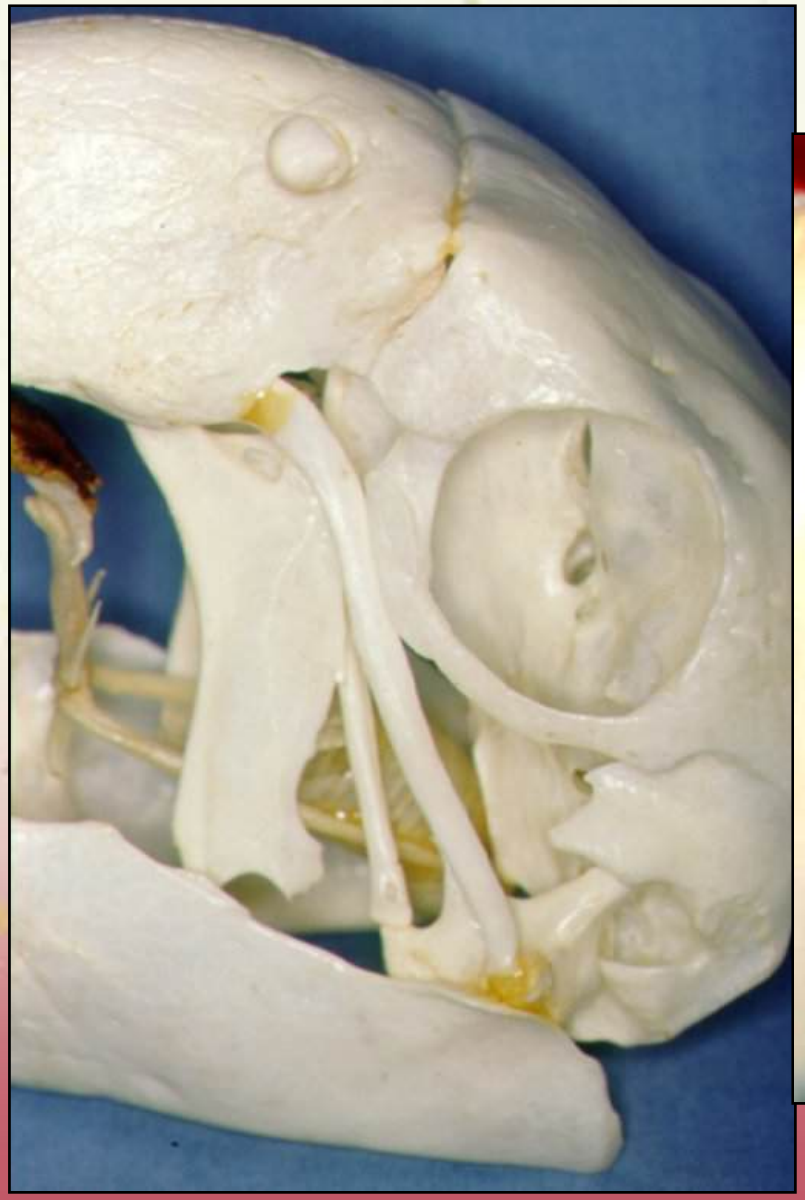
- Choanal swabs
  - *Chlamydiophila* testing
  - Bacterial culture
- Sinusitis

- Complete tracheal rings
  - Use extreme care with intubated birds

# Infraorbital sinus

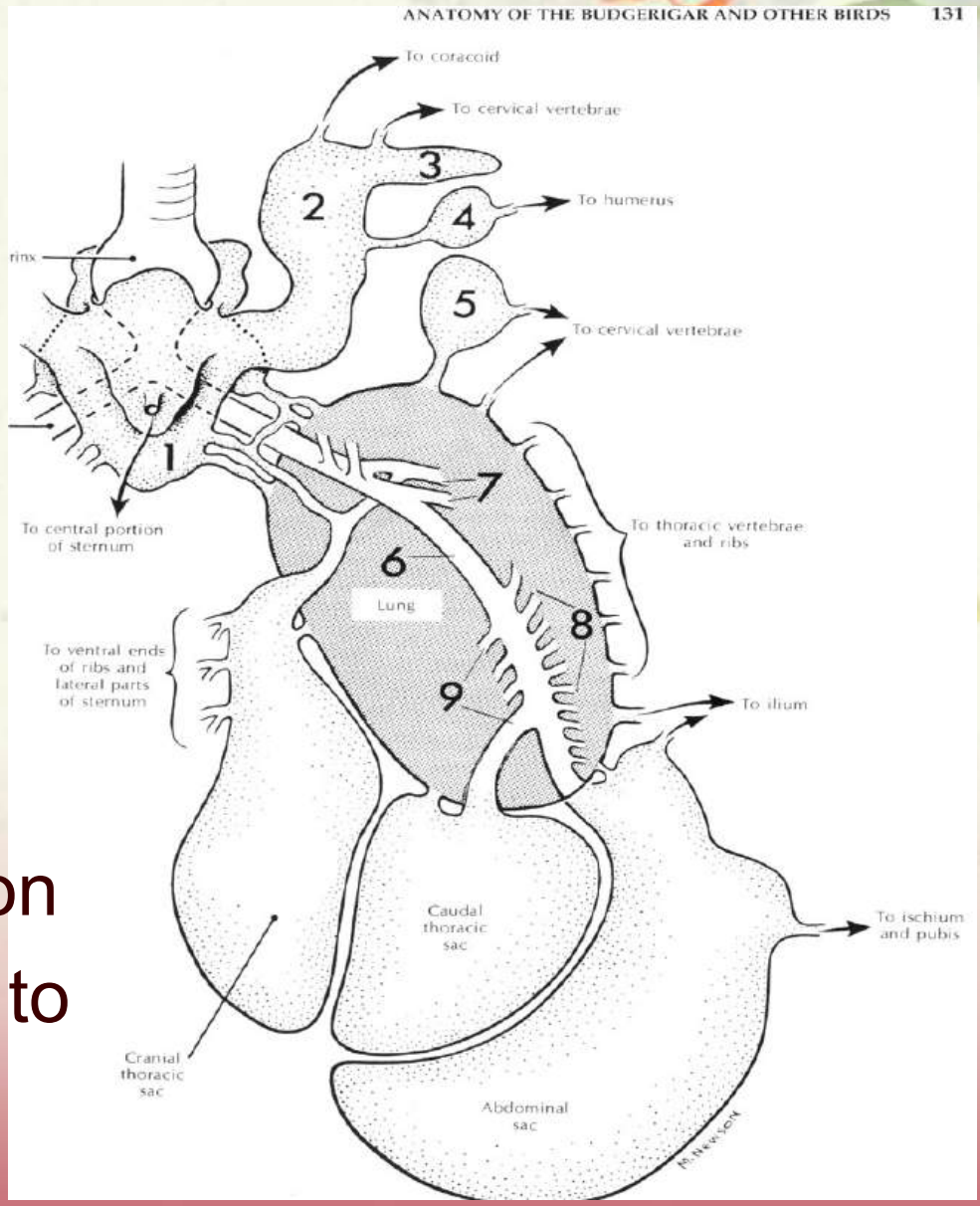
- Access: between medial canthus and oral commissure
  - Diagnositc samples
  - Therapeutic flushing
- Easier than trephining a horse!

# Infraorbital sinus



# Air sacs

- No gas exchange
- 9 air sacs in parrots
- Can ventilate via air sac cannula
- Poorly vascularized
  - Bad place for infection
  - Air sacculitis difficult to treat

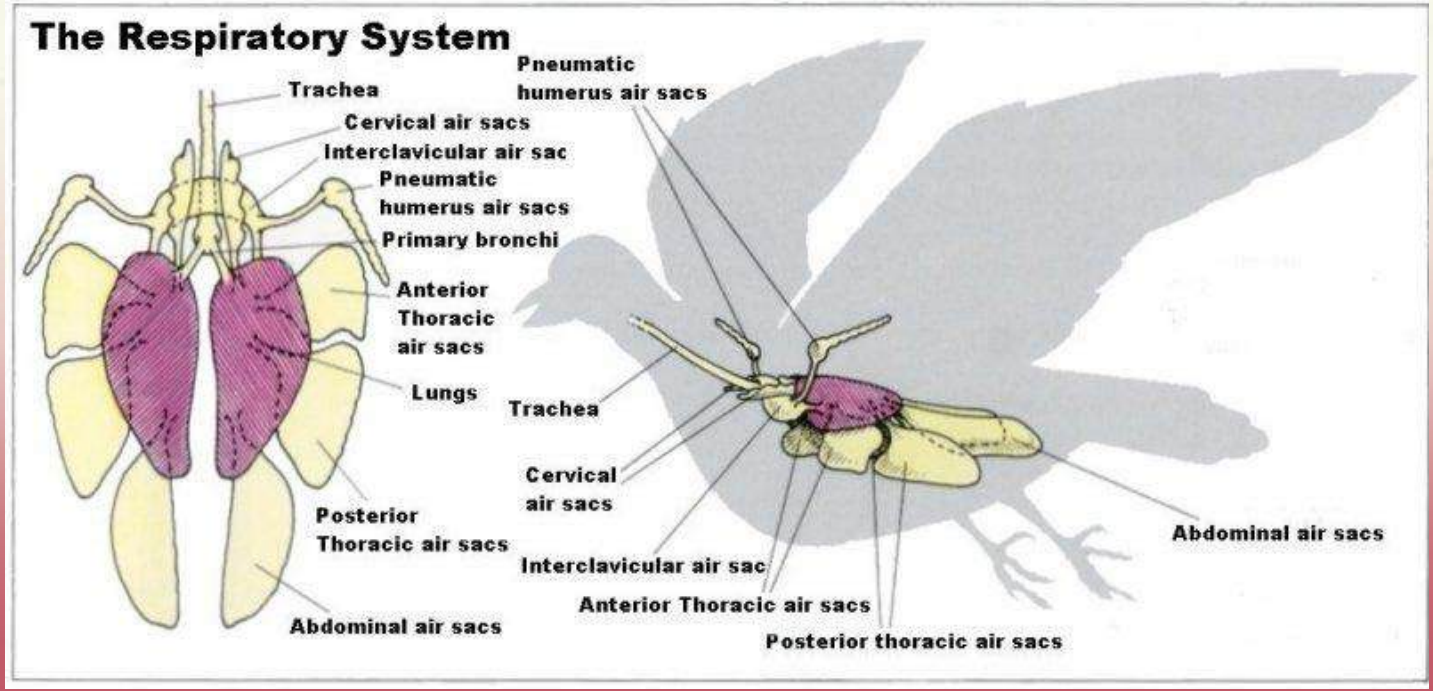


# Air sacs

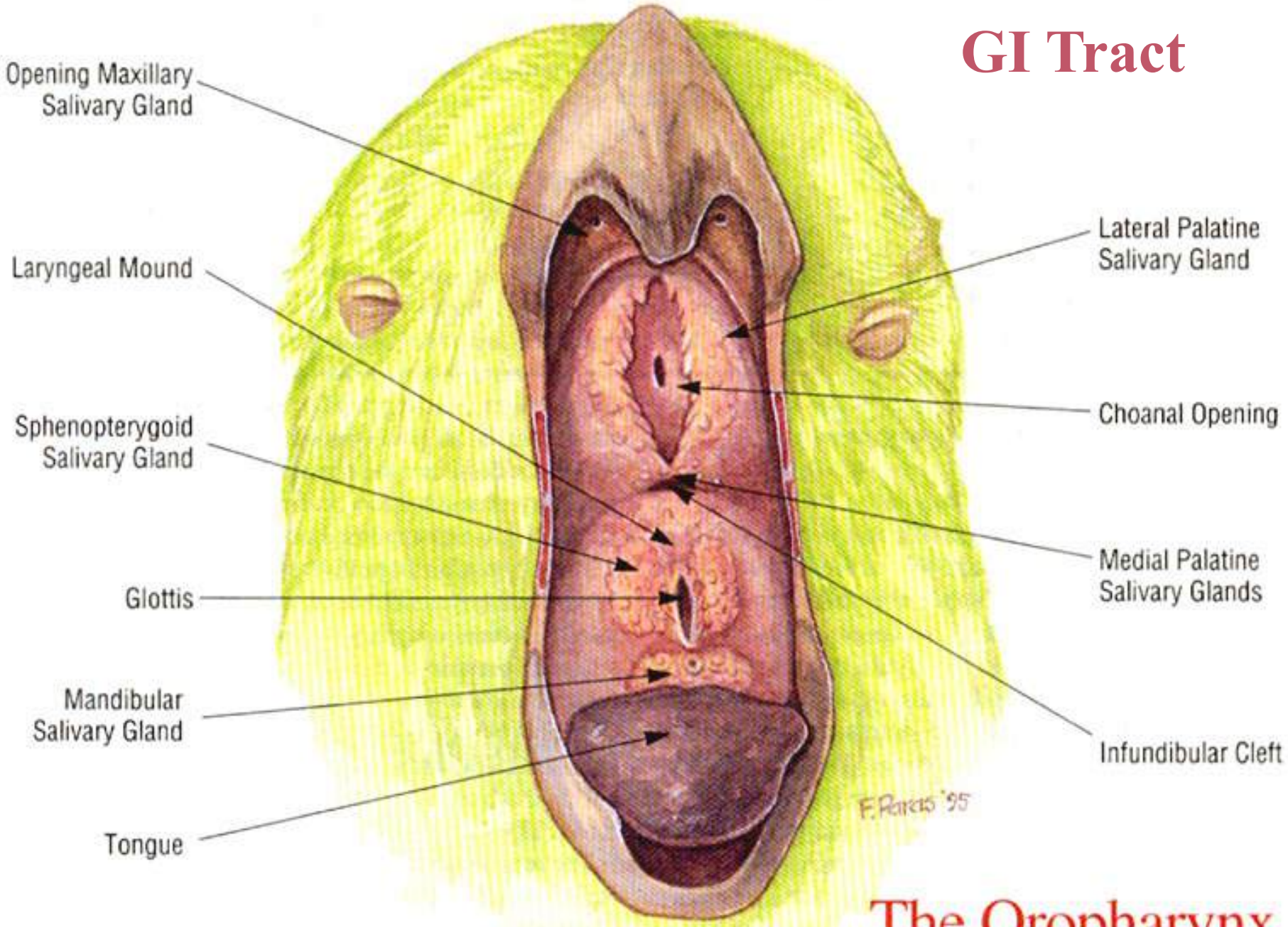
- Pneumatic bones
  - humerus, femur
  - Don’t put intraosseous catheters here
- Must move sternum to breathe
  - Don’t smush little birds during restraint
  - Don’t lean on chests of anesthetized birds

# Avian lungs

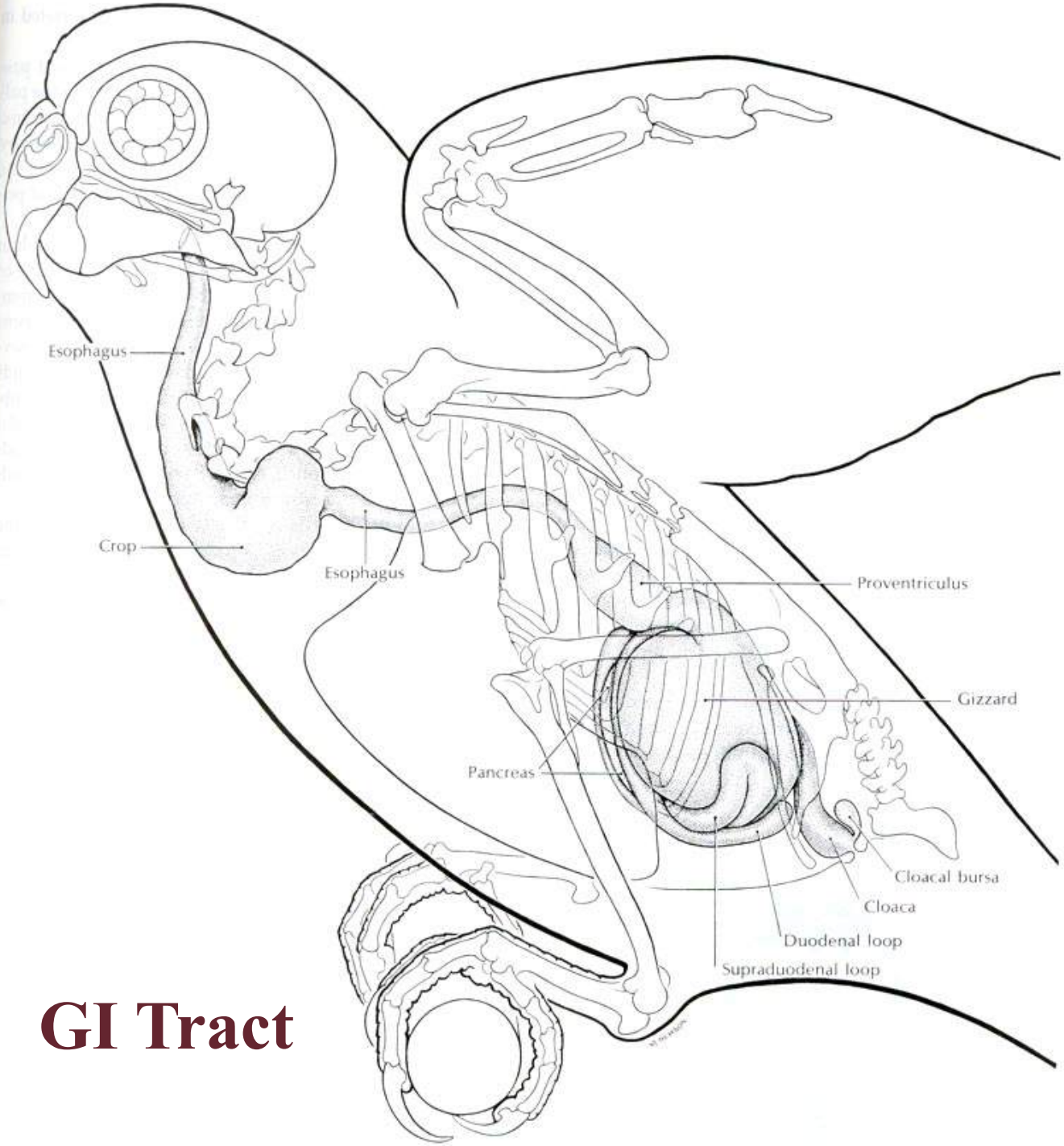
- Unidirectional air flow
  - Extremely efficient compared to mammals
- Gas exchange occurs in air capillaries of parabronchi
- Rigid lung



# GI Tract



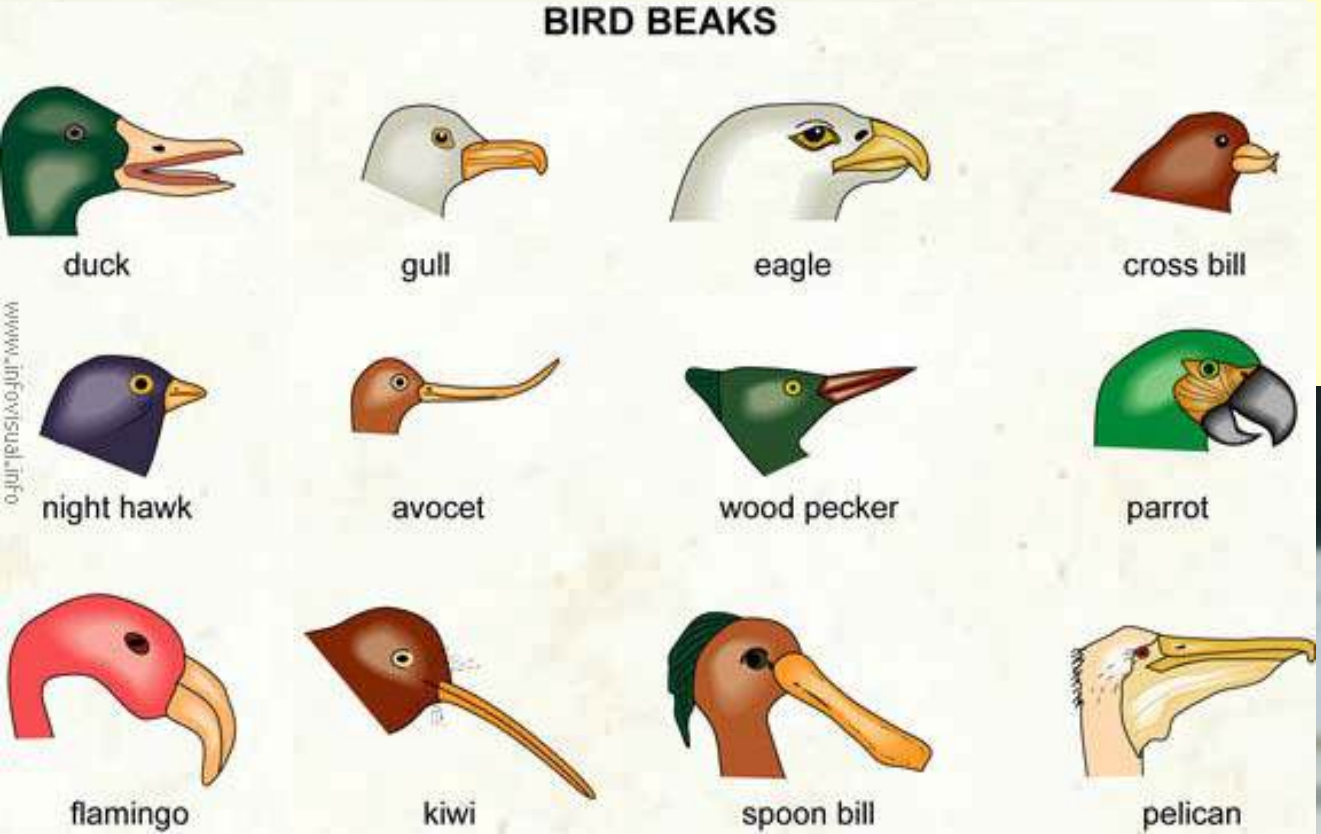

The Oropharynx

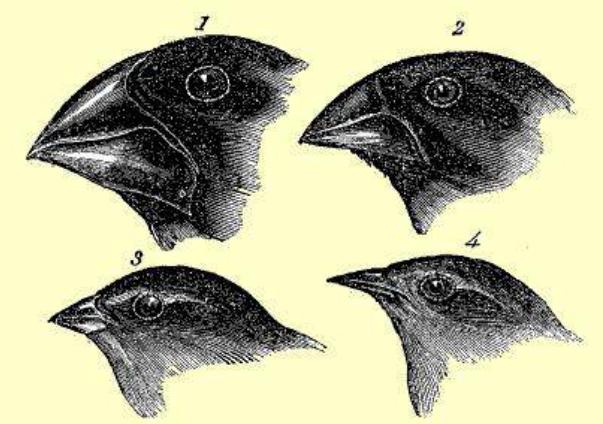

Esophagus
Crop
Esophagus
Proventriculus
Gizzard
Pancreas
Cloacal bursa
Cloaca
Duodenal loop
Supraduodenal loop

# GI Tract

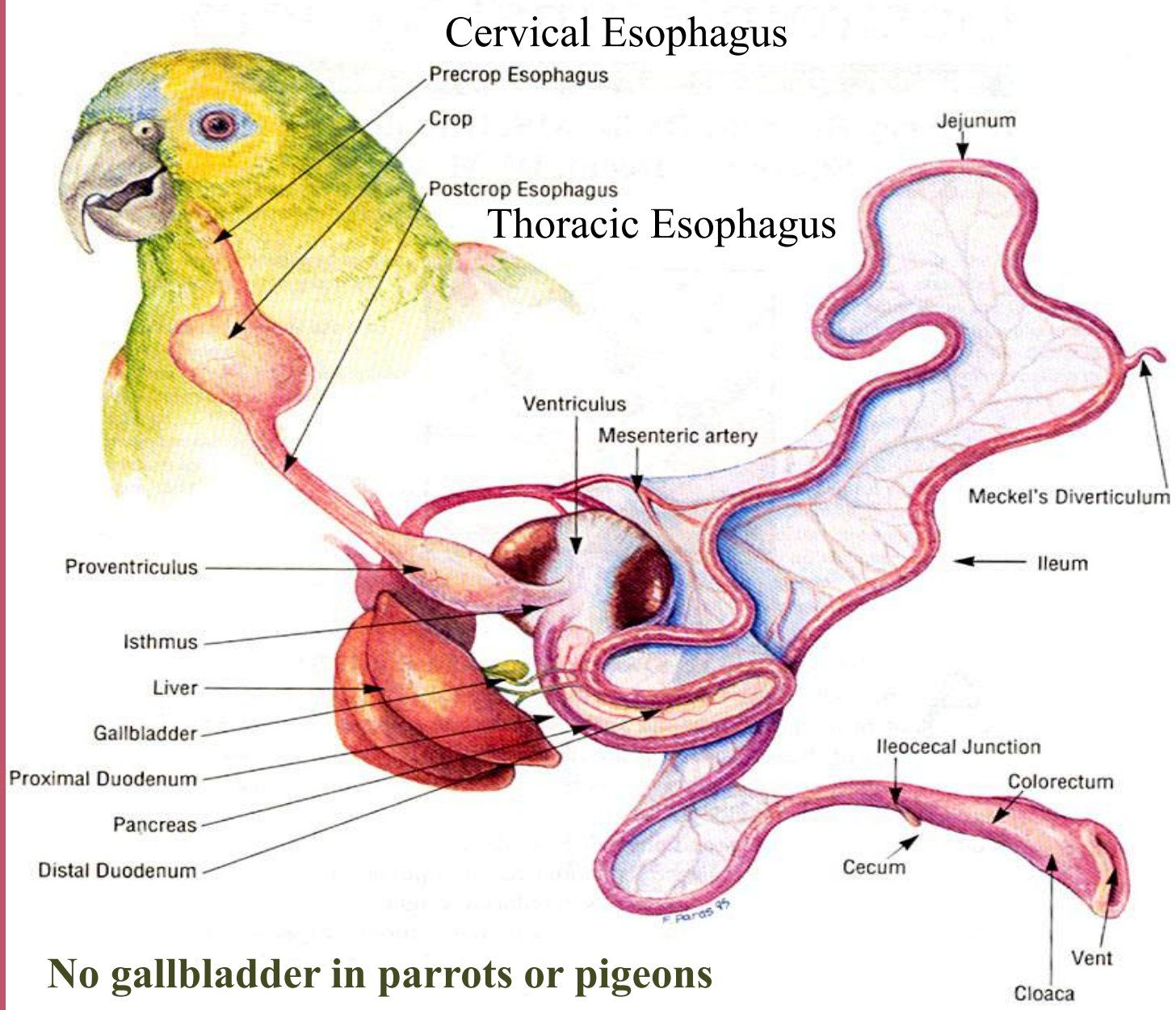
# Oral cavity

- Ramphotheca-upper sheath
- Gnathotheca-lower sheath




# The Gastrointestinal Tract



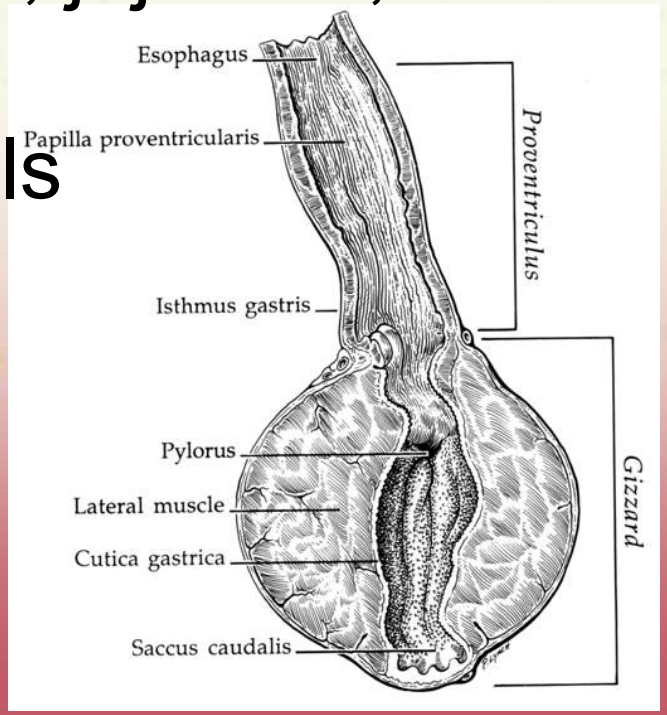

**No gallbladder in parrots or pigeons**

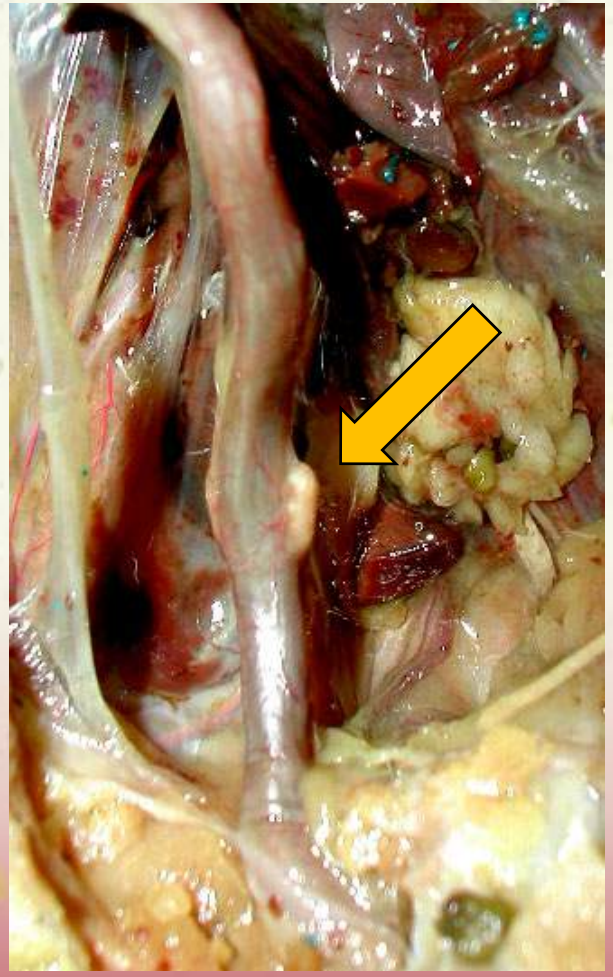
# Upper GI Tract

- Crop not present in all species
- Proventriculus is glandular stomach
- Ventriculus (gizzard) is muscular
  - Lined with koilin

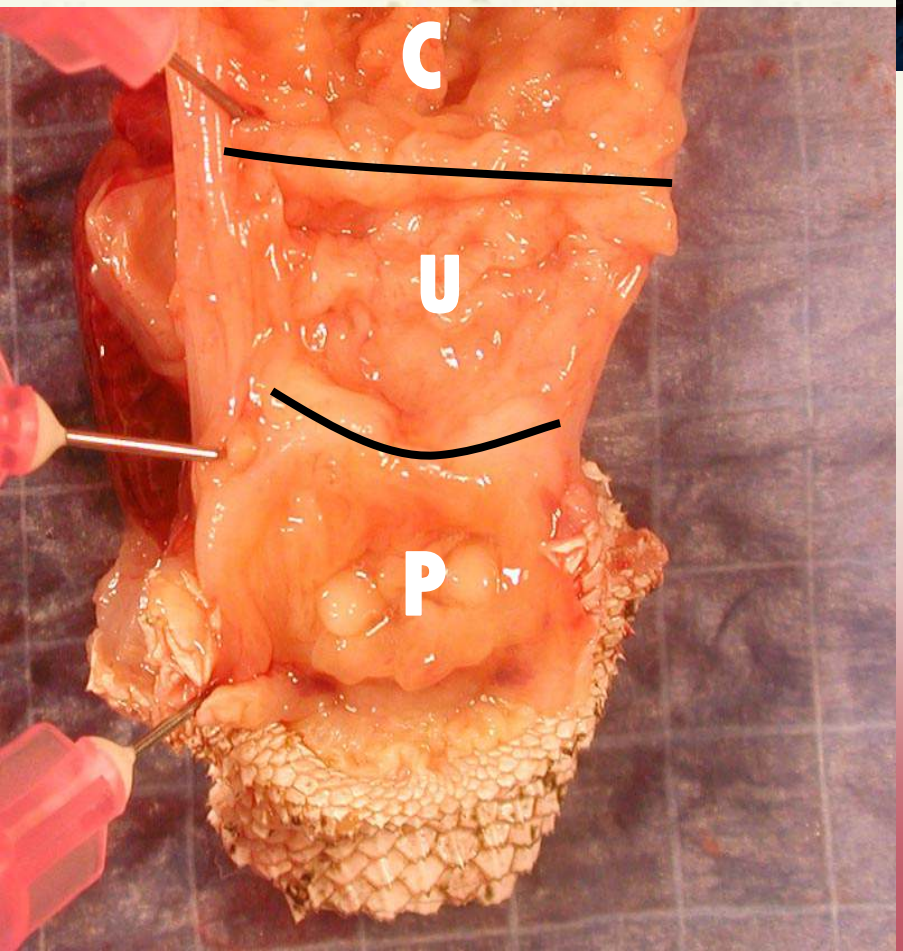
# Intestines

- Paired cecae mark the junction between small and large intestine
- Duodenum, jejunum, ileum as in mammals



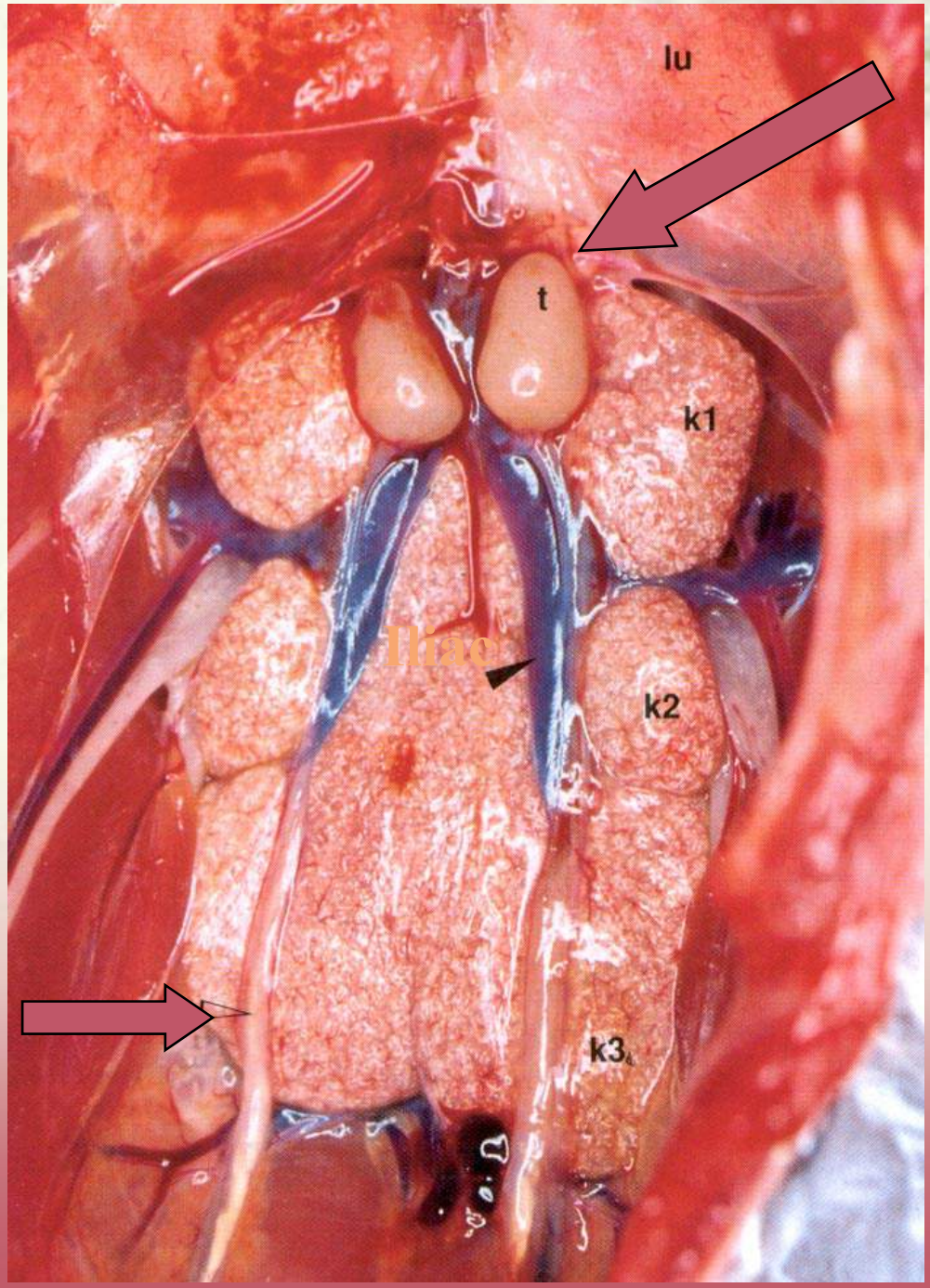
# Cloaca and Vent




- GI and Urogenital tracts end in cloaca
- Coprodeum
- Urodeum
- Proctodeum
- Vent is opening into cloaca

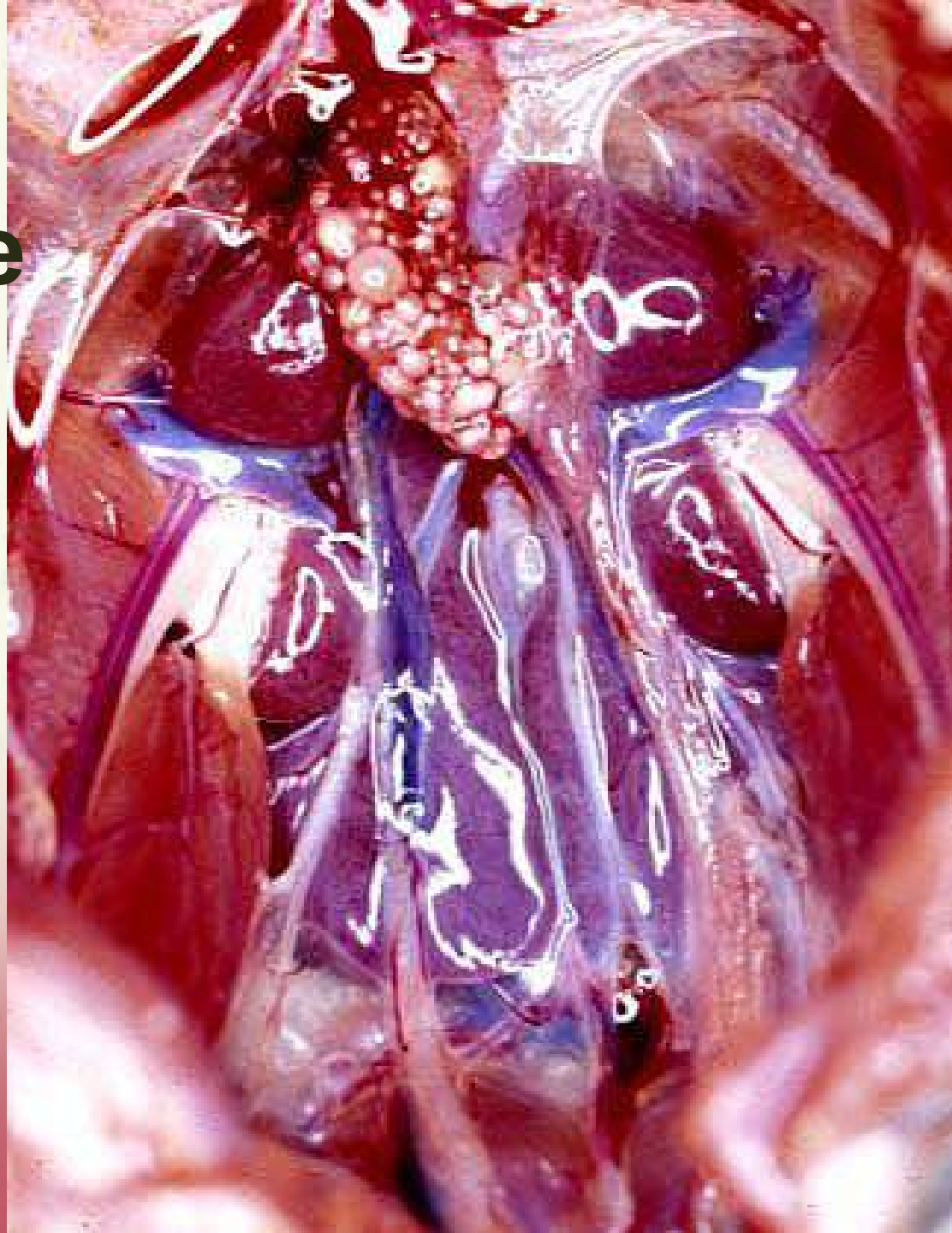
# Male Reproductive Tract

- 2 testis
- Rudimentary phallus (may or may not be intromittant)
- Parrots non-intromittant



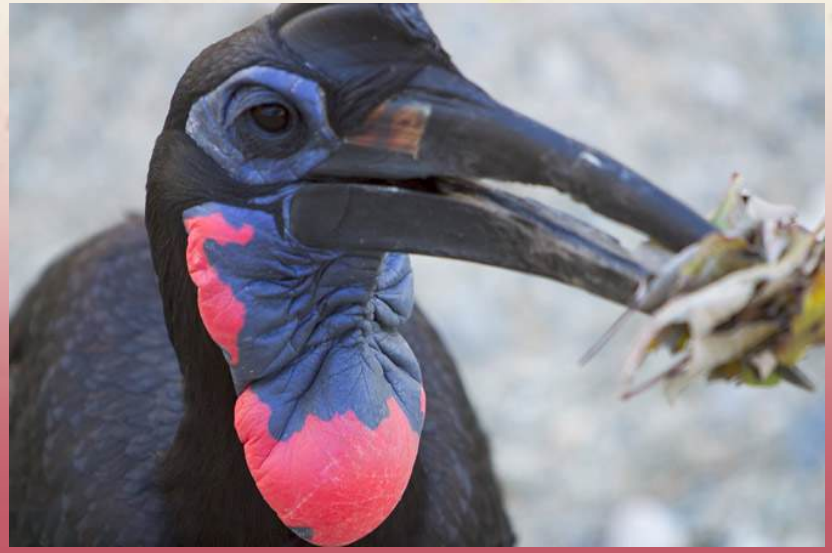
# Female Reproductive Tract

- Left ovary
- Infundibulum
- Magnum
- Isthmus
- Uterus (shell gland or oviduct)



# Adrenal Glands

- Paired
- Medial and cranial to kidneys and gonads
- Function similar to mammalian adrenals



# Thyroid, Parathyroid & Thymus

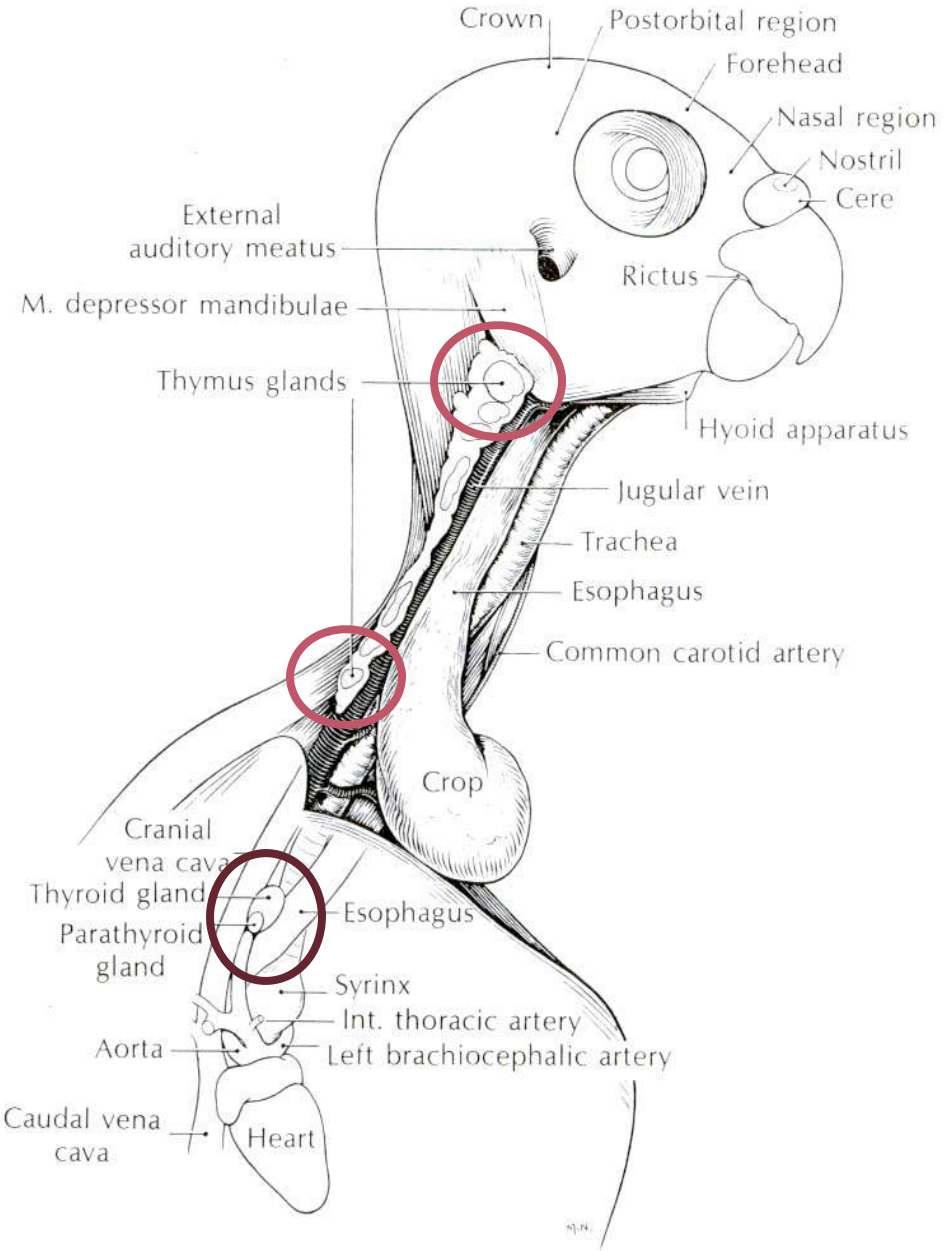



**FIGURE 13-39.** Structures of the head, neck, and thoracic inlet.