Esqueleto y vuelo

Esqueleto

Es muy ligero pero fuerte para soportar las tensiones del despegue, el vuelo y el aterrizaje

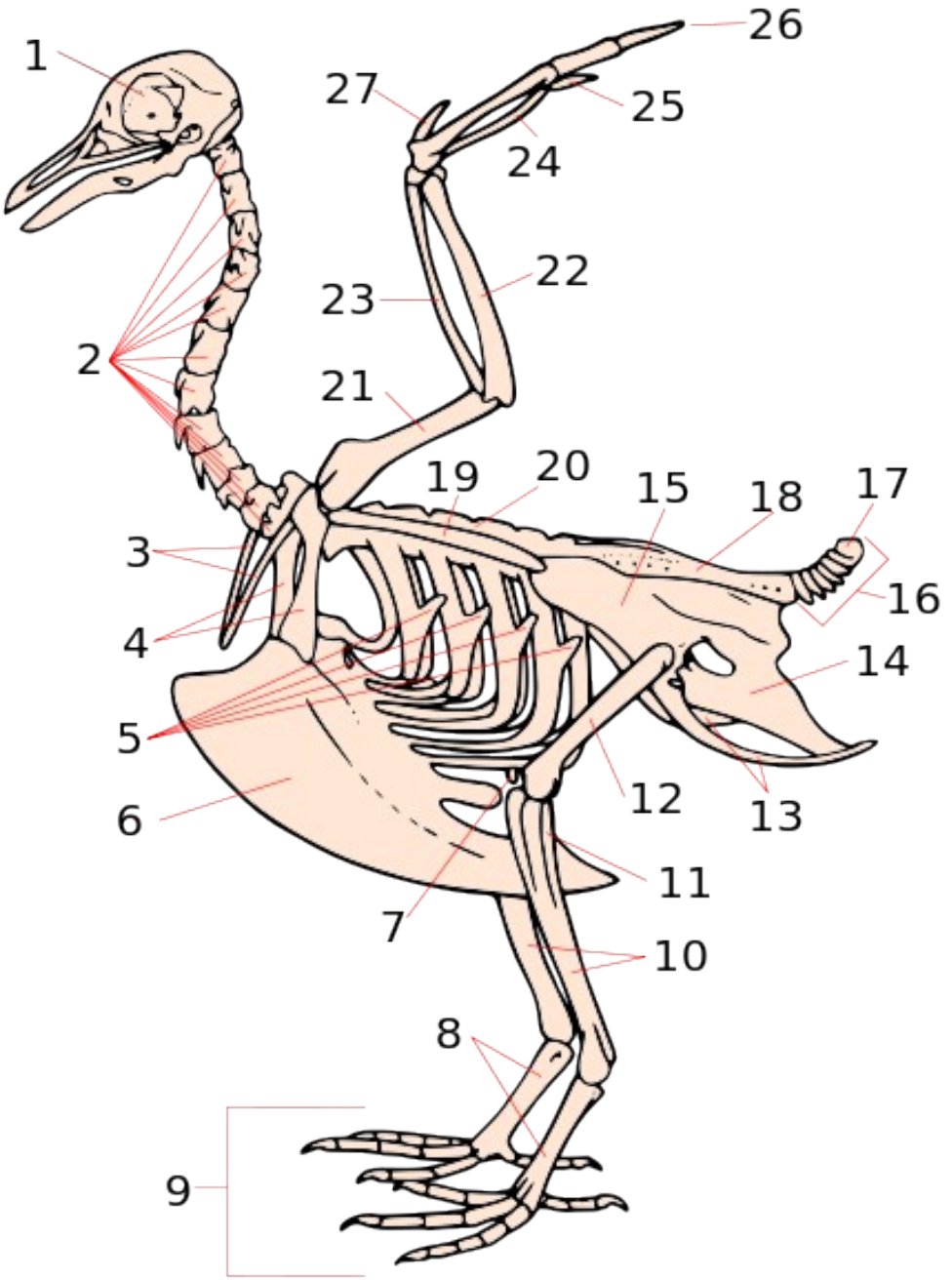
Los huesos tienen cavidades neumáticas llenas de aire que conectan con el sistema respiratorio (sacos aéreos)

Los huesos del cráneo están fusionados y no muestran suturas. Otros huesos también están fusionados (sinsacro, pigóstilo,…)

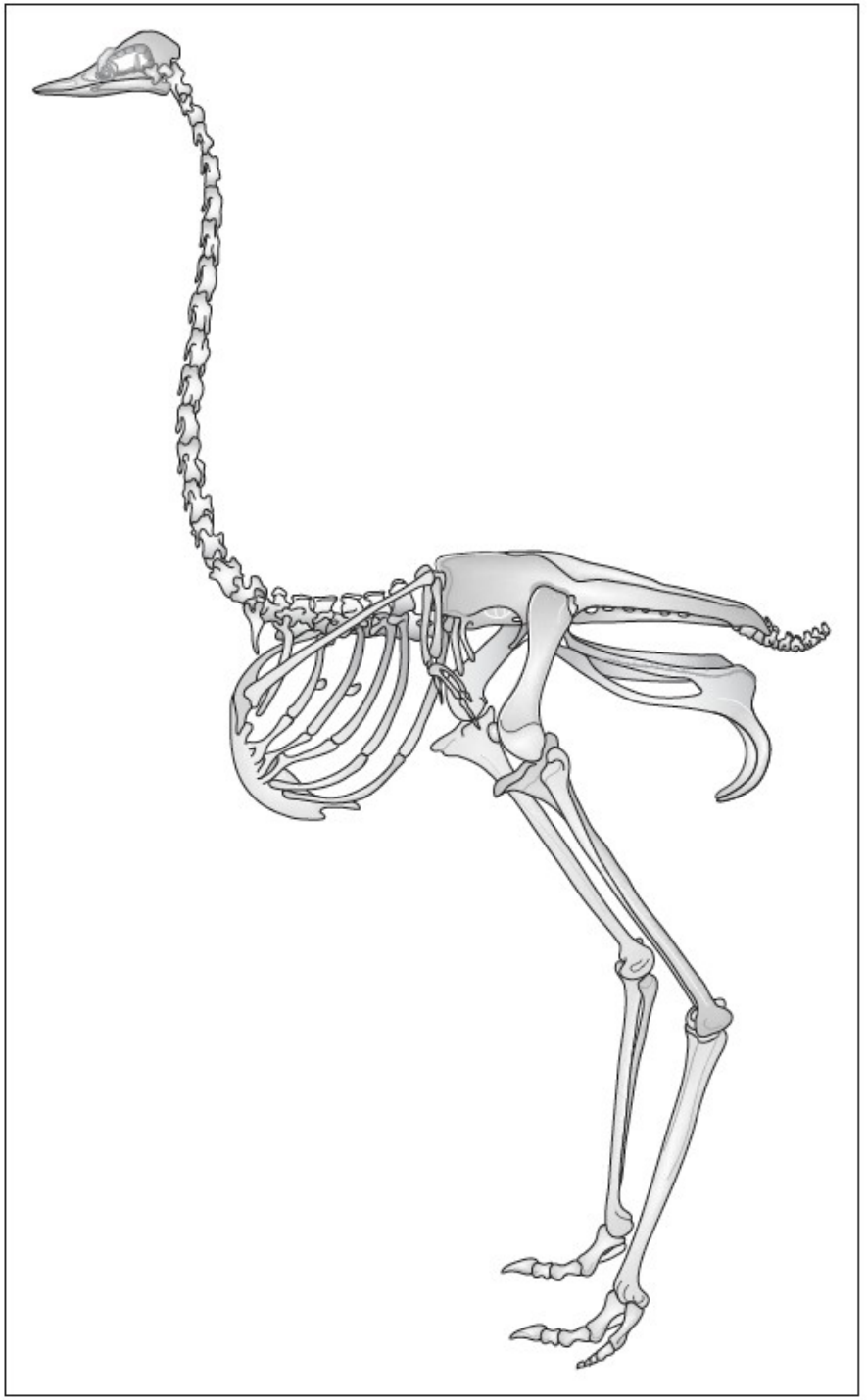
El esternón muestra una pronunciada quilla donde se insertan los músculos del vuelo

Esqueleto de un ave

1. Cráneo,
2. Vértebras cervicales,
3. Fúrcula (clavículas),
4. Coracoides,
5. Procesos uncinados de costillas,
6. Quilla,
7. Rótula,
8. Tarsometatarso,
9. Dedos,
10. Tibia (tibiotarso),
11. Peroné (o fíbula),
12. Fémur,
13. Isquion (hueso innominado),
14. Pubis (hueso innominado),
15. Ilion (hueso innominado),
16. Vértebras caudales,
17. Pigóstilo,
18. Sinsacro,
19. Escápula,
20. Vértebras lumbares,
21. Húmero,
22. Cúbito (o ulna),
23. Radio,
24. Carpo,
25. Metacarpo,
26. Dedos,
27. Álula.



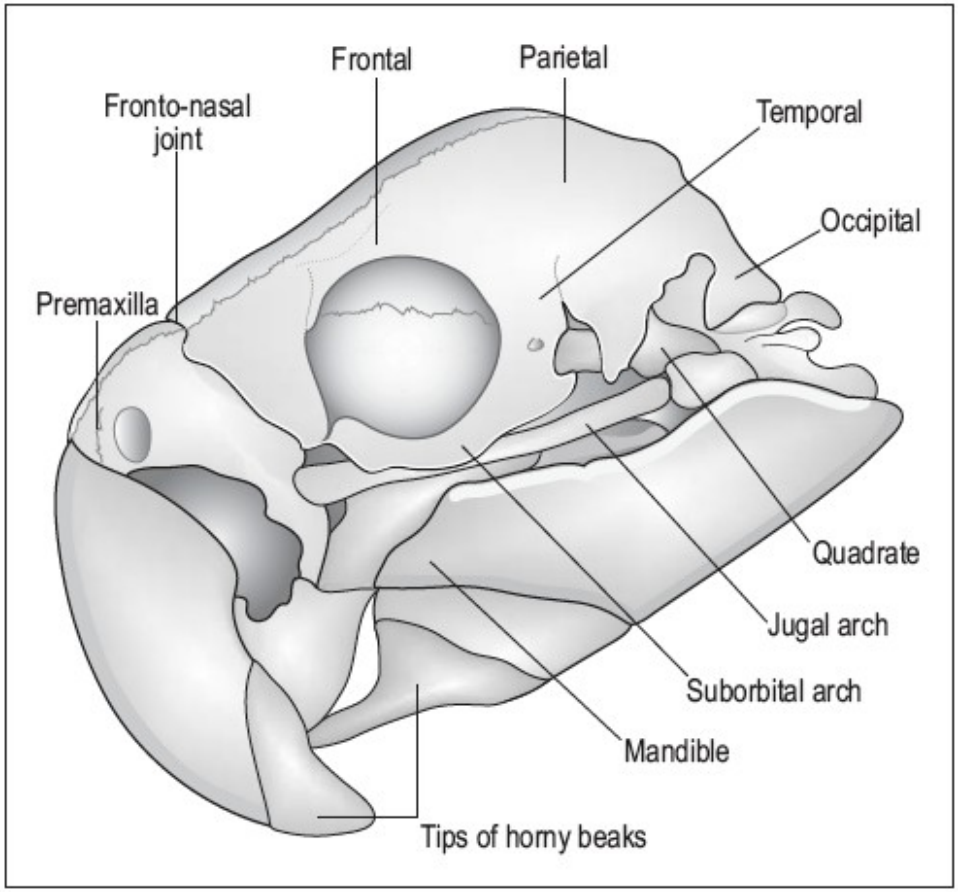
Esqueleto de una ratite no voladora sin quilla y con alas vestigiales



Cráneo de un ave

La caja craneana forma una sola pieza producto de la fusión del frontal, parietal, temporal y occipital

Las órbitas son muy grandes y ocupan buena parte del cráneo. Están rodeadas de un anillo esclerótico formado por pequeños huesos



Cráneo de un ave

Lc, lacrimal;

V, vómer;

M, maxilar;

Pmx, premaxilar;

D, dentario;

Y, yugal;

Pal, palatino;

Pt, pterigoides;

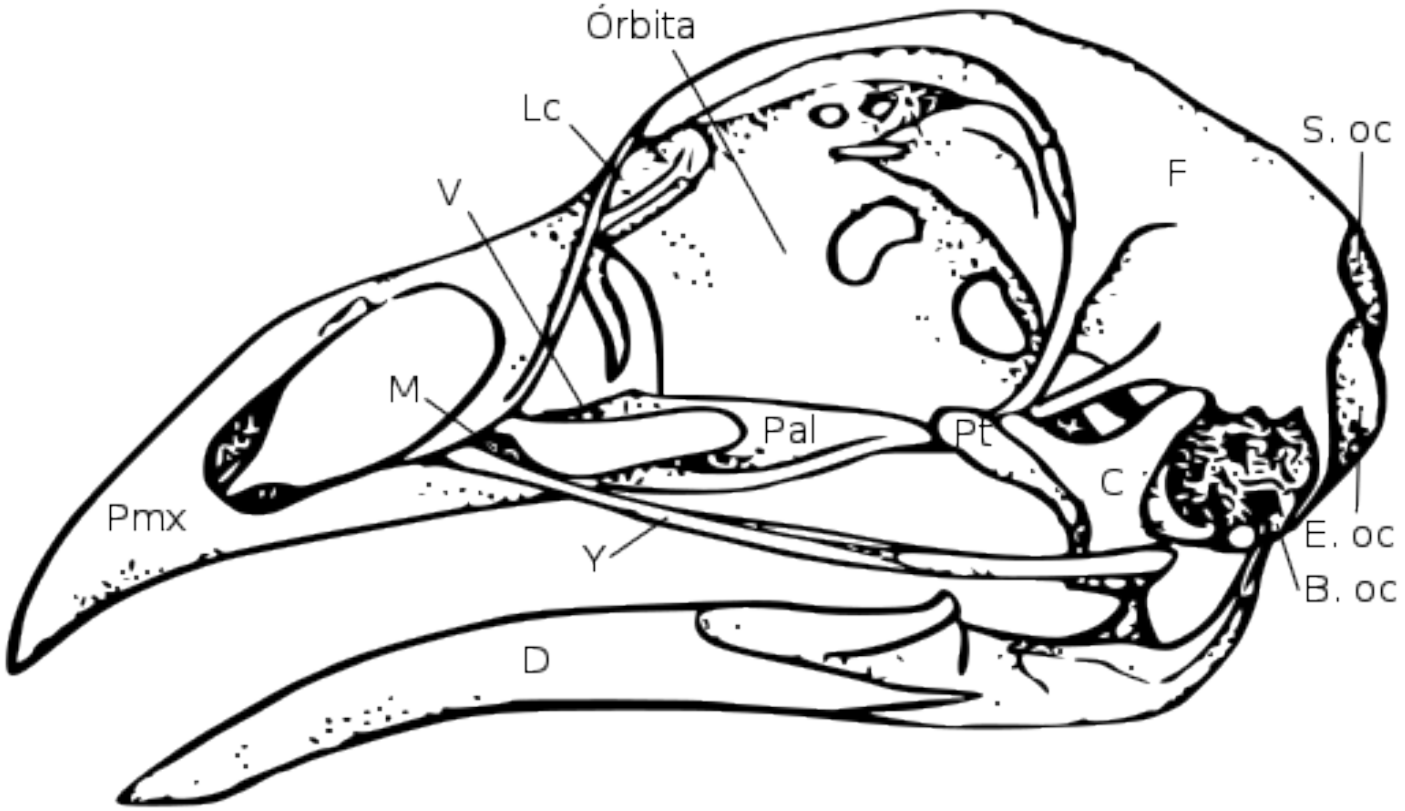
C, cuadrado;

F, frontal;

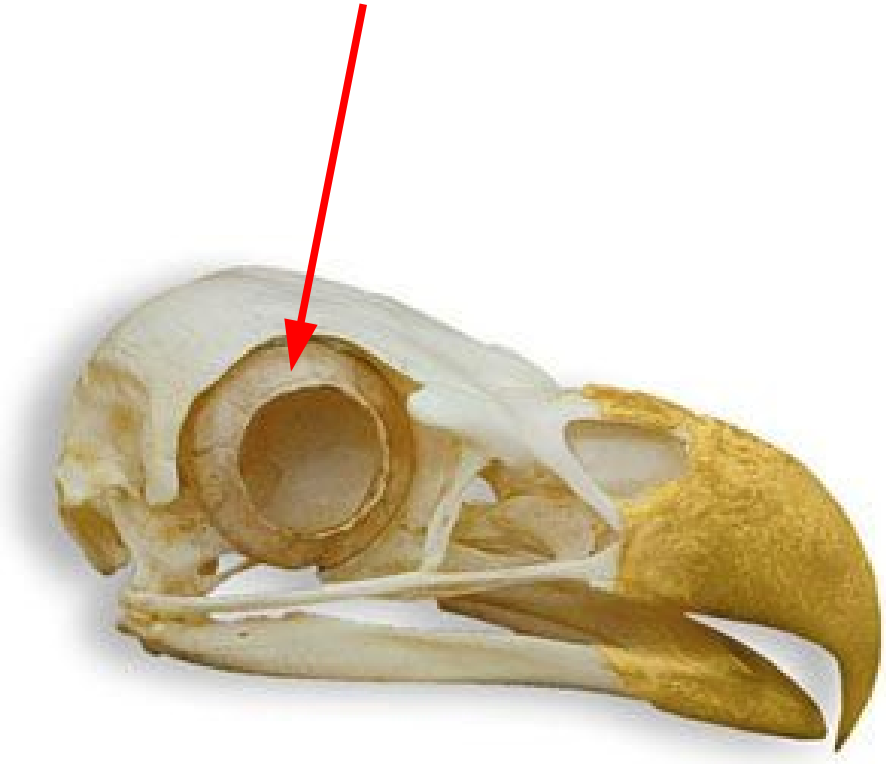
S. oc, supraoccipital;

E. oc, exoccipital;

B. oc, basioccipital.



anillo esclerótico



Cinesis craneal

El cráneo de las aves es muy movible

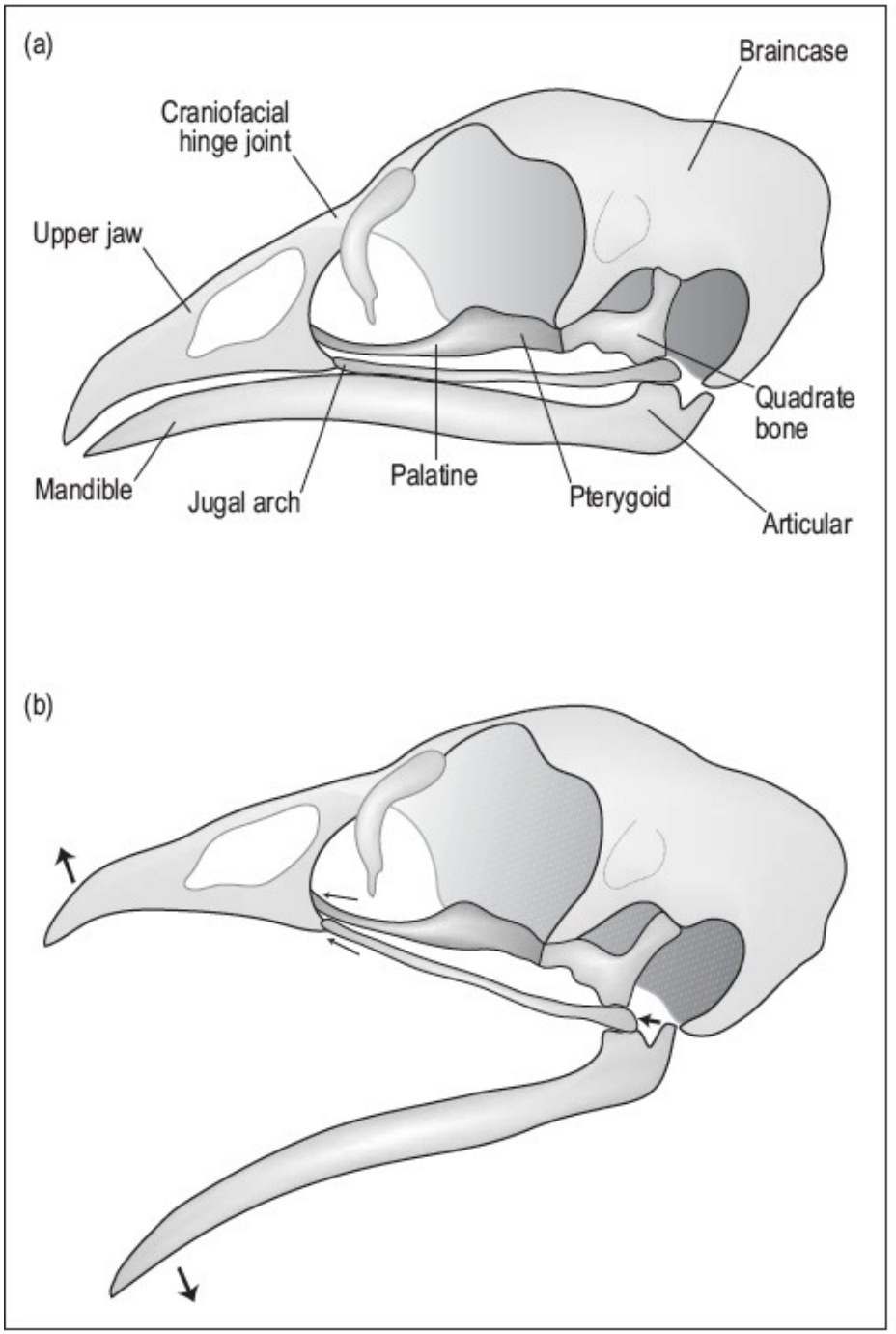
El hueso cuadrado permite una gran abertura de la boca

Hay un sólo cóndilo occipital que permite una rotación de 180º

Birds, especially psittacines, have a highly mobile kinetic skull. This means that, unlike mammals that can only move their bottom jaw, they are also able to move their maxillary jaw (upper beak). This wide gape is achieved by an elastic hinge at the rostral skull that allows the bones to bend without disturbing the cranium (Fig. 6.7). In psittacines, this elastic hinge is replaced by an articular craniofacial joint, allowing parrots even more flexibility of movement (

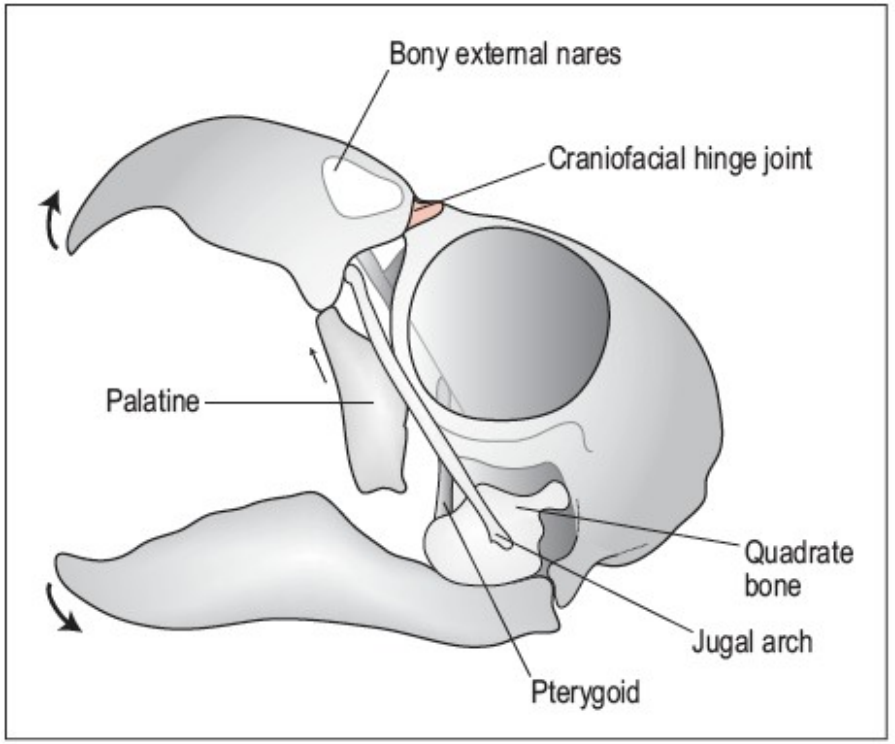
- Avian skull is highly kinetic
- Movable quadrate bone allows wide gape
- Single occipital condyle so can rotate head 180 degrees
- Well-developed sinuses
- Psittacines have synovial joint at craniofacial maxillary hinge for greater gape

Cinesis craneal

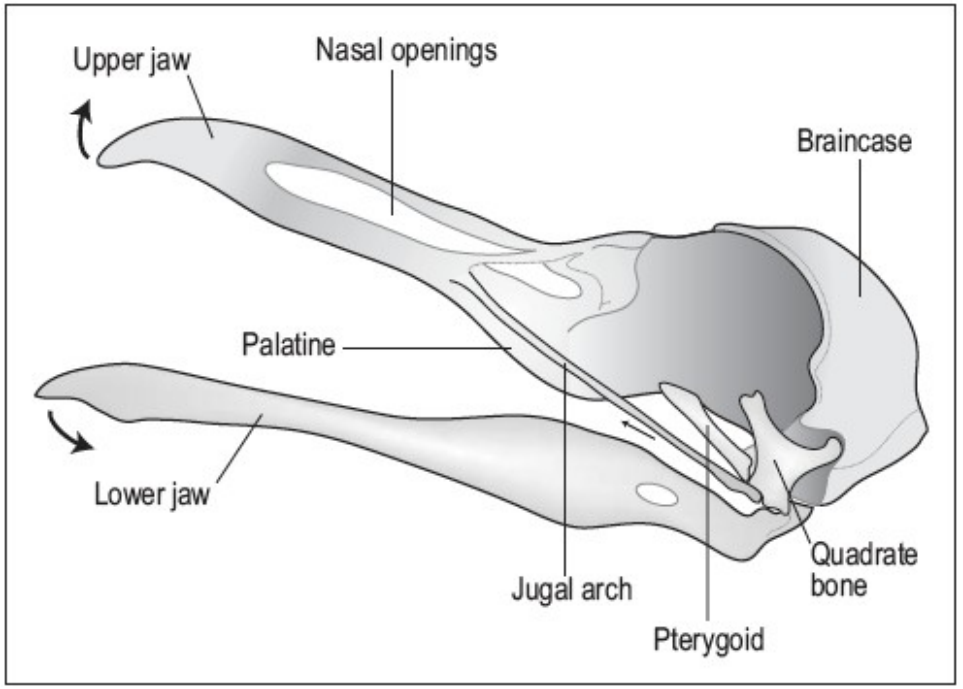


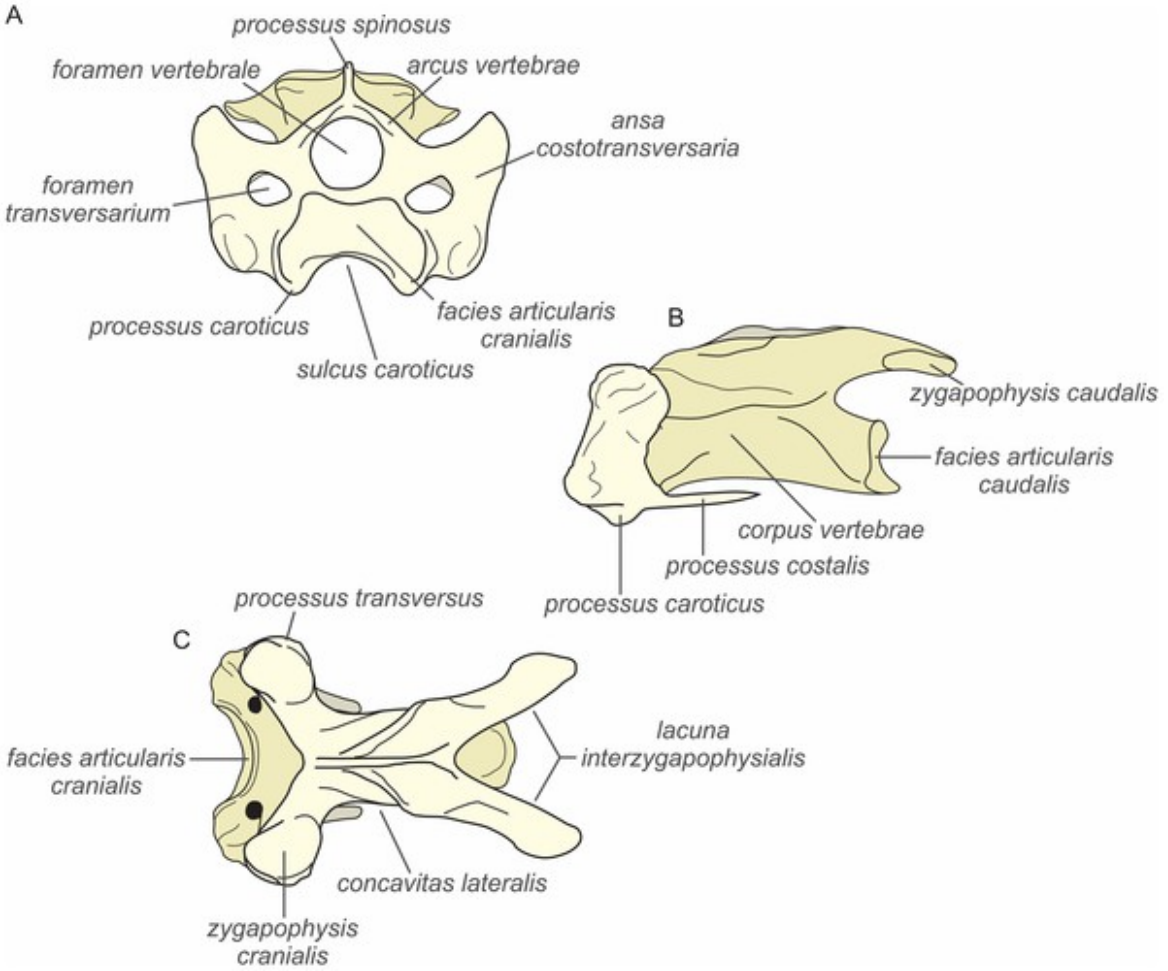
Cinesis craneal

proquinético

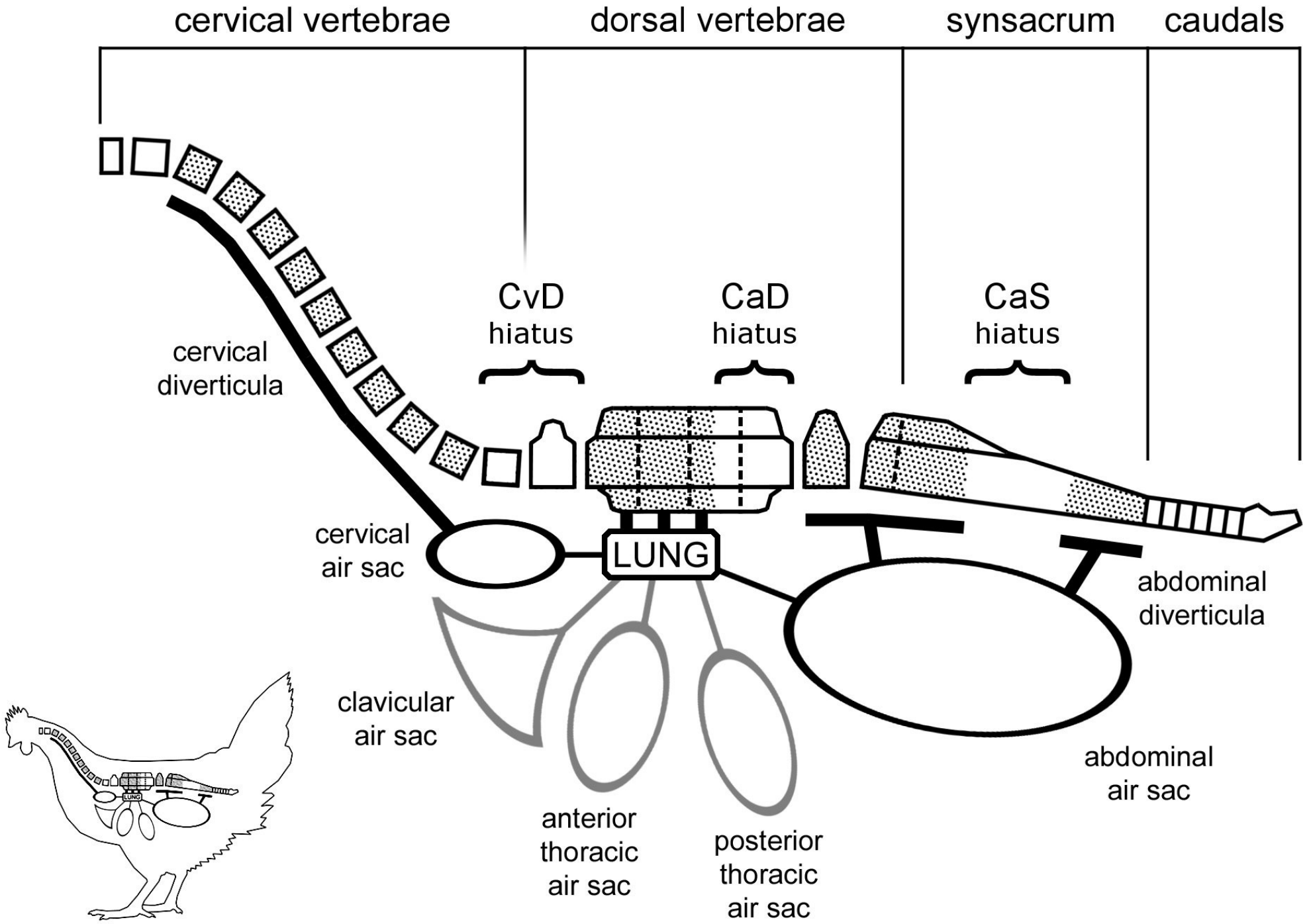


rincoquinético





The 5th cervical vertebra of a gull
(Larus spp.)


cervical vertebrae
dorsal vertebrae
synsacrum
caudals
CvD hiatus
CaD hiatus
CaS hiatus
cervical diverticula
cervical air sac
LUNG
abdominal diverticula
clavicular air sac
anterior thoracic air sac
posterior thoracic air sac
abdominal air sac
LUNG

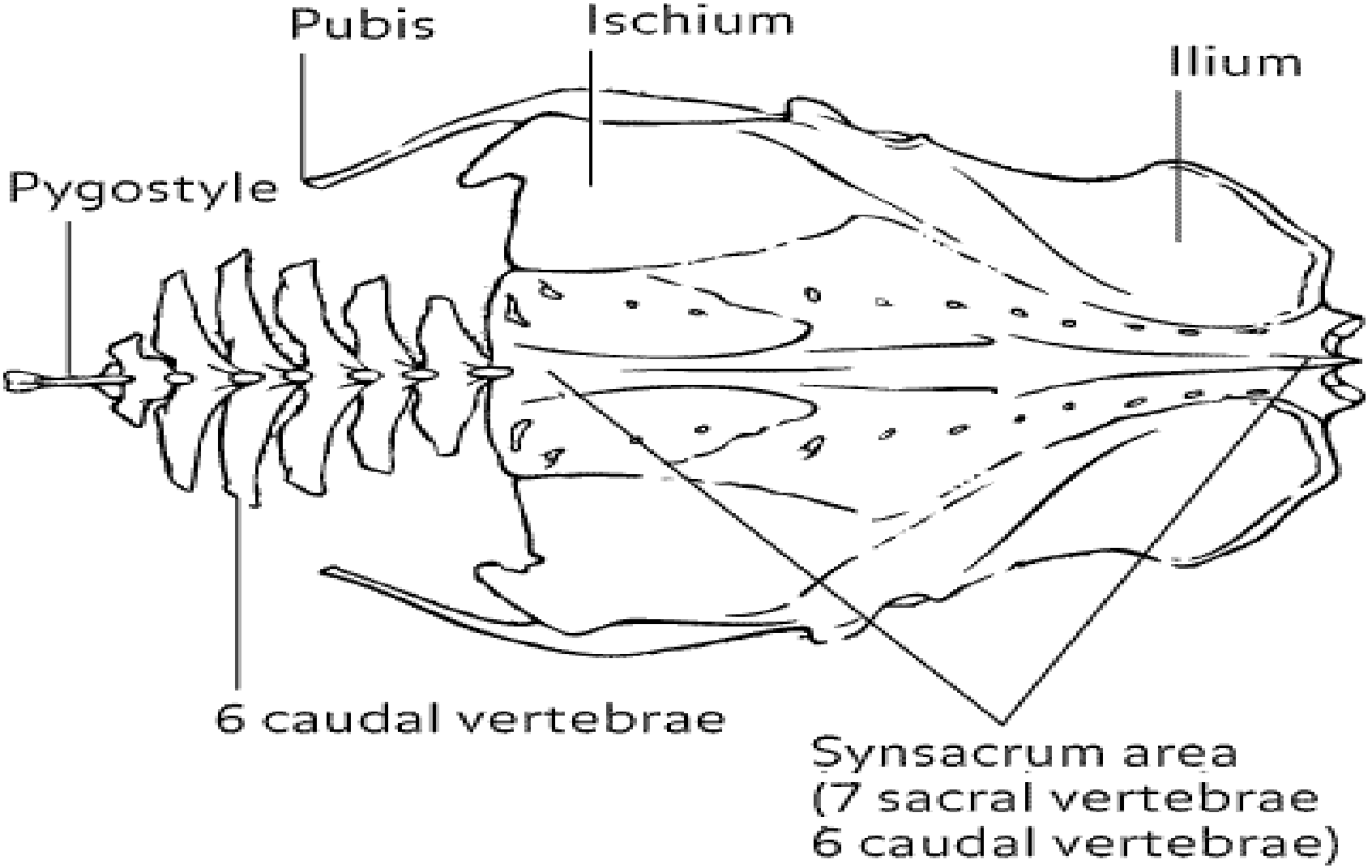
caudales sinsacro cervicales

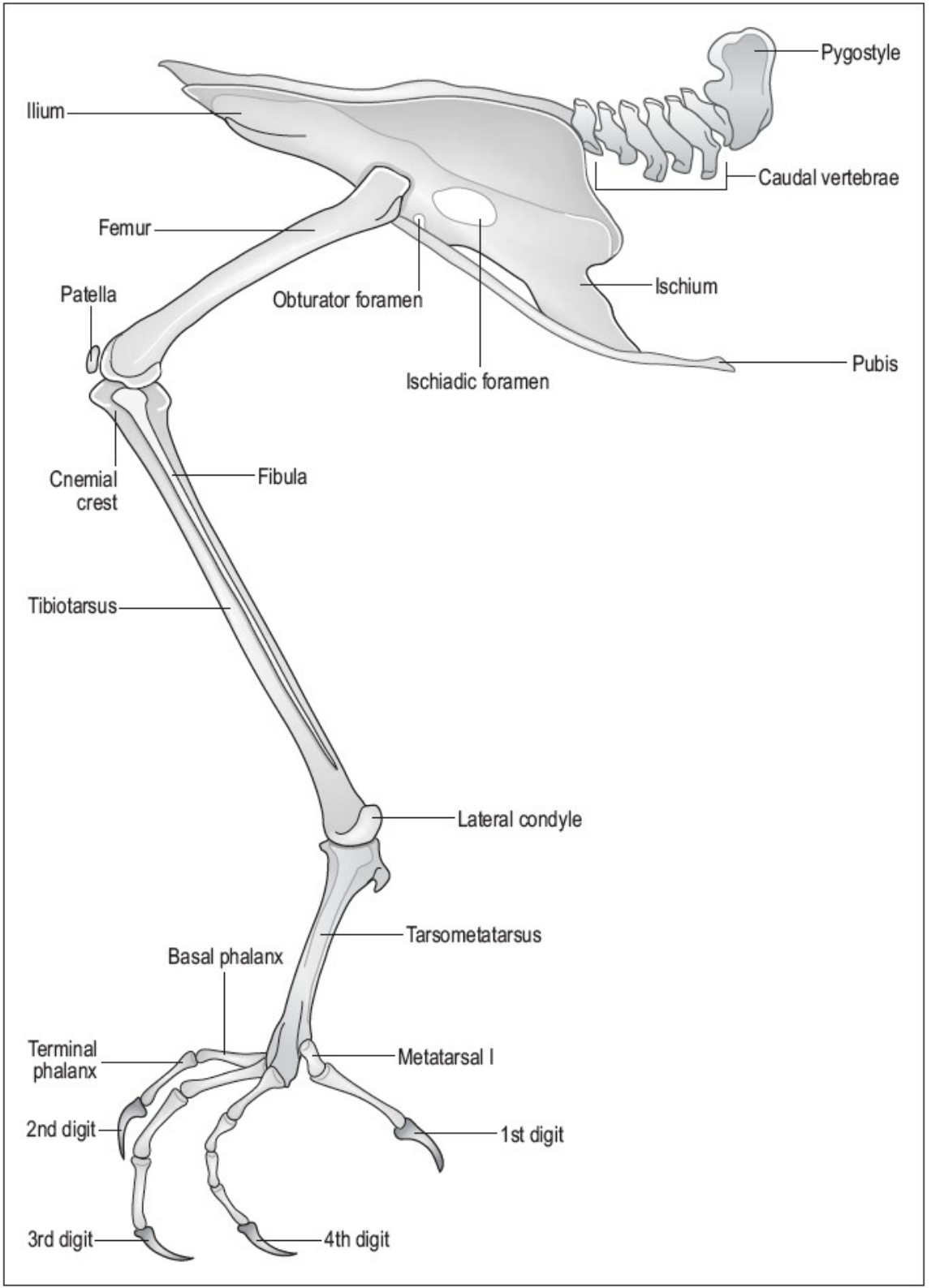
torácicas

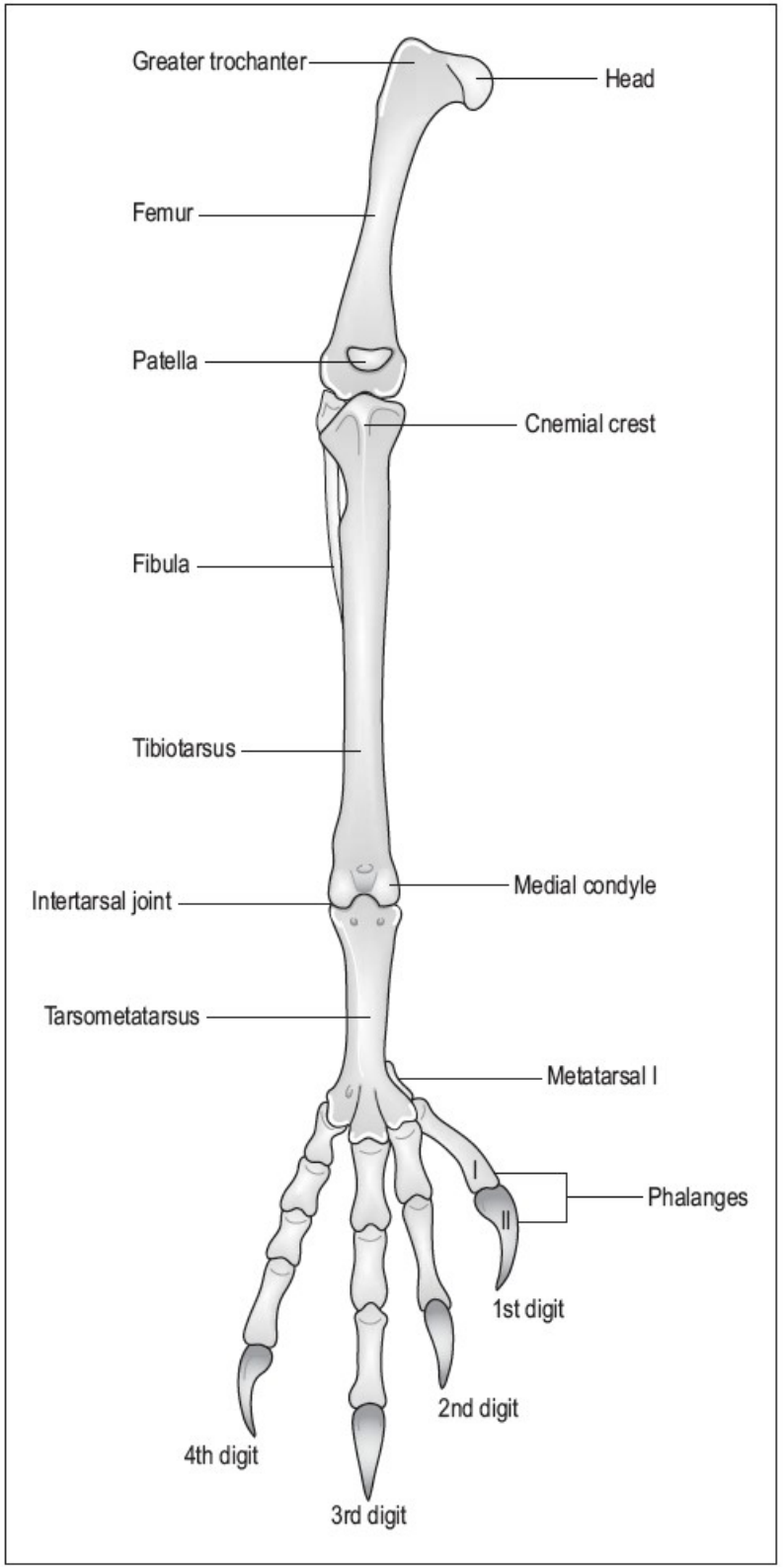
pigóstilo

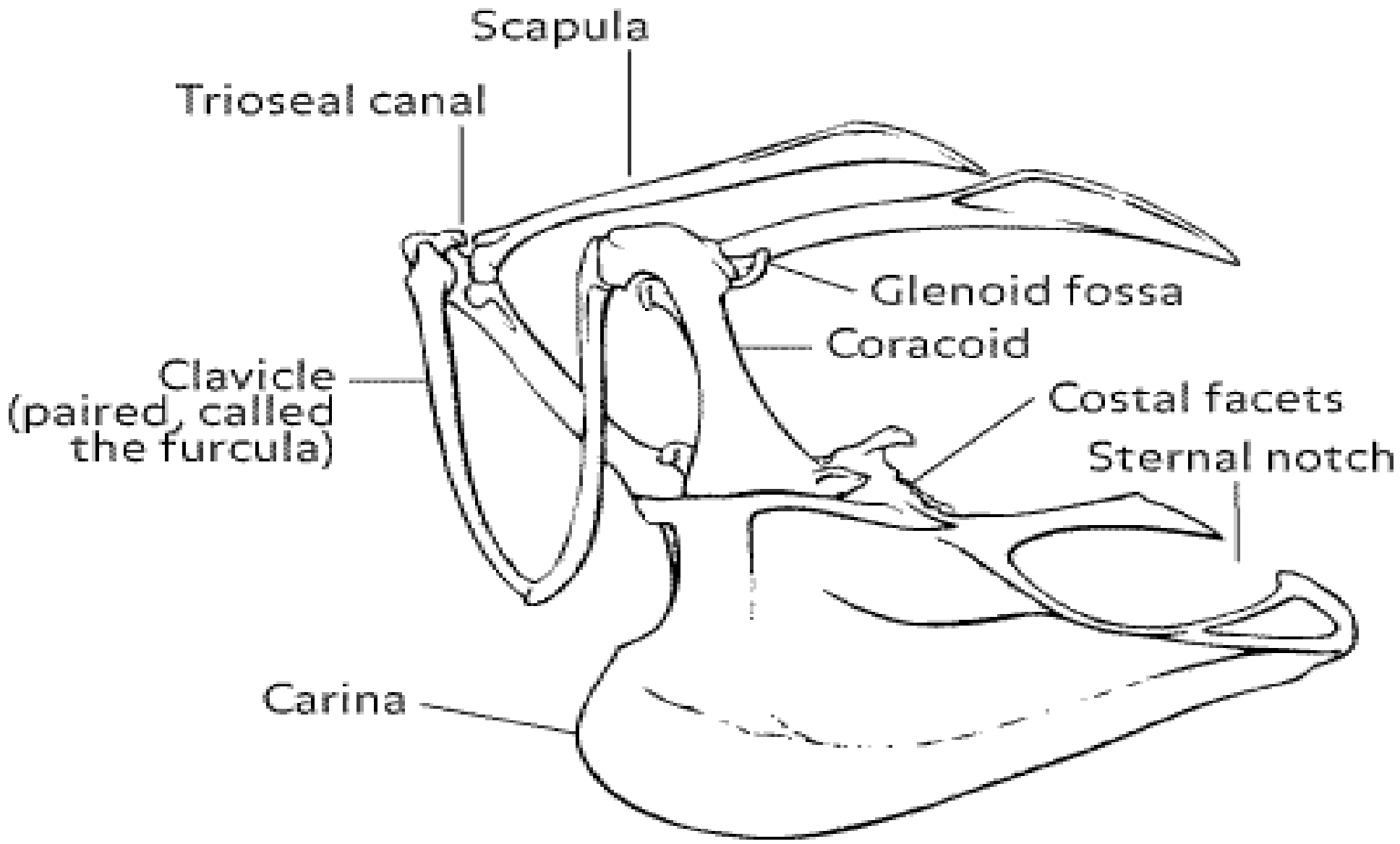
Número de vértebras en algunas aves

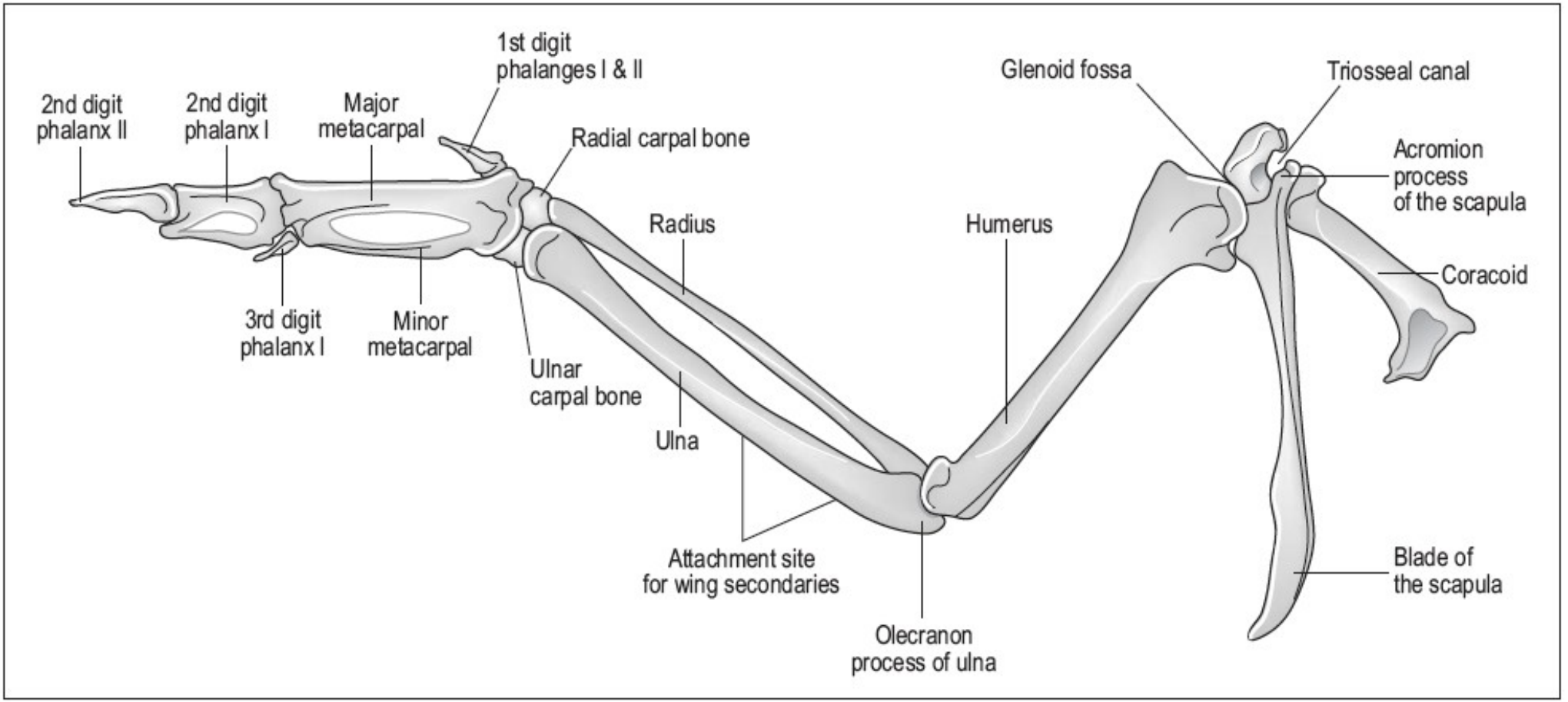
	Cervical	Torácicas	Sinsacro	Caudales
paloma	12	7 (Notarium)	fusionado	8
gallina	14–17	7 (Notarium)	fusionado (15–16)	5–6
oca	17–18	9	fusionado	8
pato	14–15	9	fusionado	8
periquito	12	8	fusionado	8

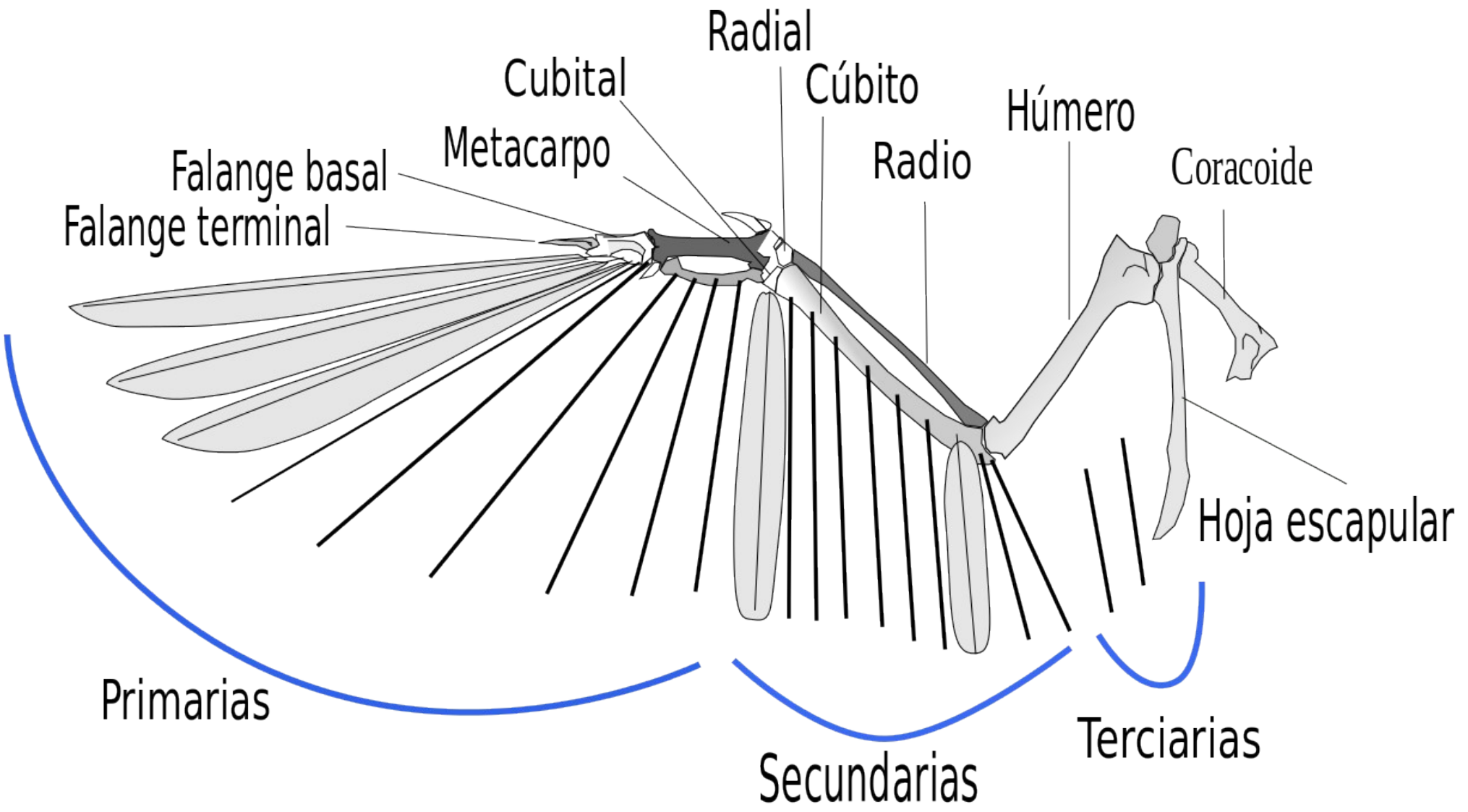

Pubis
Ischium
Ilium
Pygostyle
6 caudal vertebrae
Synsacrum area
(7 sacral vertebrae
6 caudal vertebrae)


Pygostyle
Ilium
Caudal vertebrae
Femur
Patella
Obturator foramen
Ischium
Pubis
Ischiadic foramen
Cnemial crest
Fibula
Tibiotarsus
Lateral condyle
Tarsometatarsus
Basal phalanx
Terminal phalanx
Metatarsal I
2nd digit
1st digit
3rd digit
4th digit

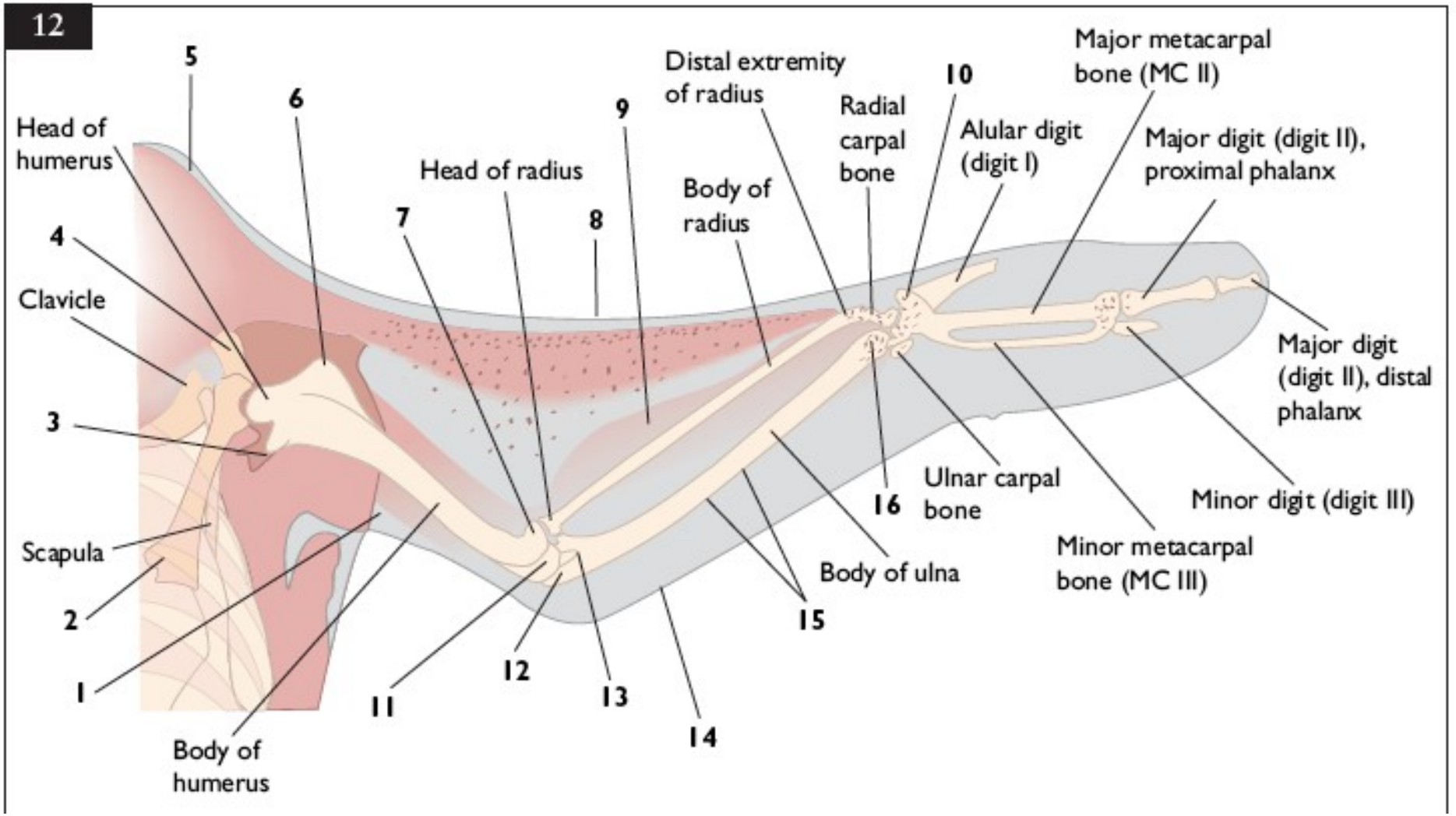

Greater trochanter
Head
Femur
Patella
Cnemial crest
Fibula
Tibiotarsus
Intertarsal joint
Medial condyle
Tarsometatarsus
Metatarsal I
I
II
Phalanges
1st digit
2nd digit
3rd digit
4th digit


Scapula
Trioseal canal
Glenoid fossa
Coracoid
Clavicle
(paired, called
the furcula)
Costal facets
Sternal notch
Carina

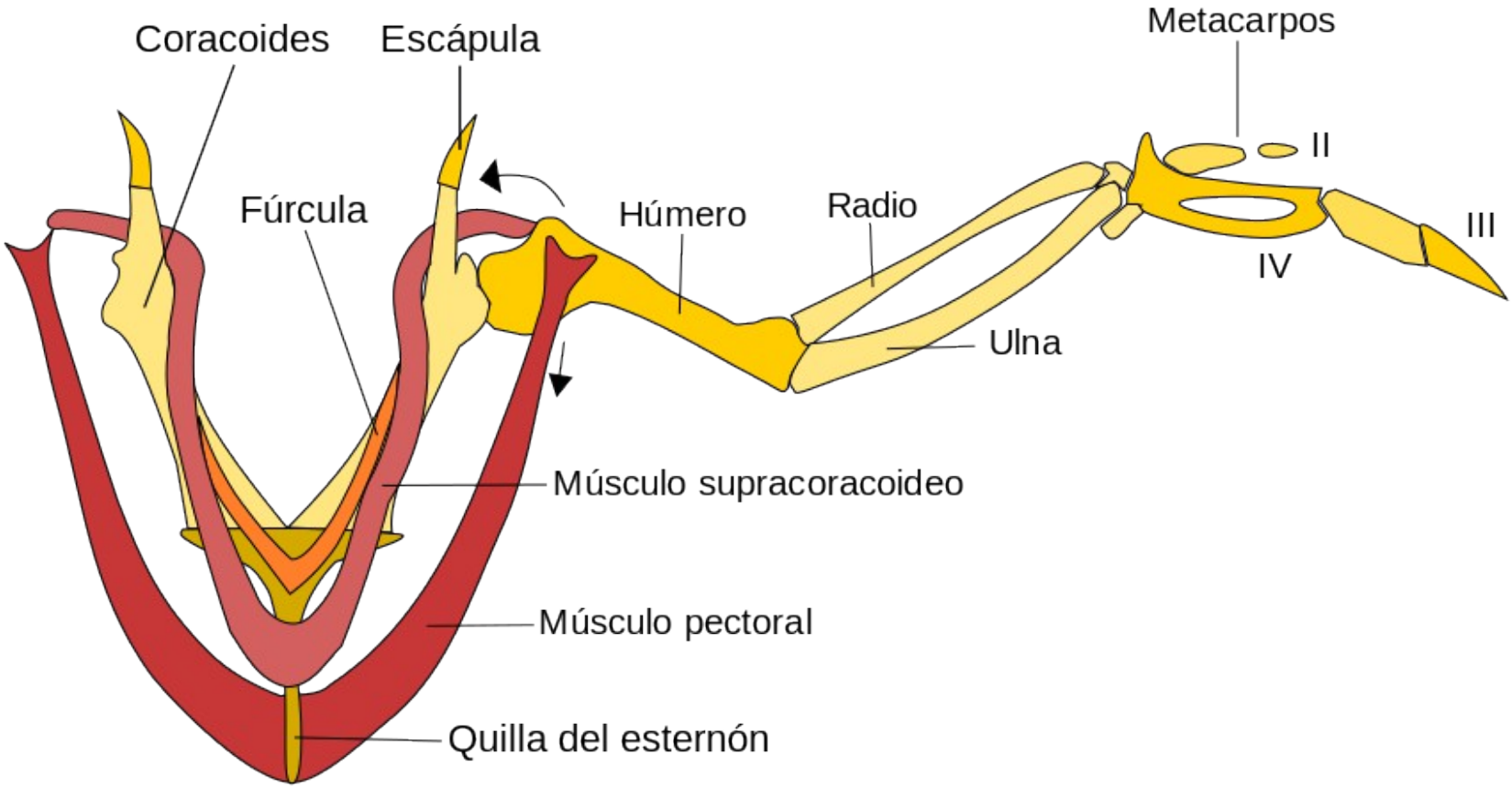

2nd digit phalanx II
2nd digit phalanx I
Major metacarpal
1st digit phalanges I & II
Radial carpal bone
Radius
Humerus
Glenoid fossa
Triosseal canal
Acromion process of the scapula
Coracoid
3rd digit phalanx I
Minor metacarpal
Ulnar carpal bone
Ulna
Attachment site for wing secondaries
Olecranon process of ulna
Blade of the scapula


Radial
Cubital
Cúbito
Húmero
Metacarpo
Radio
Coracoide
Falange basal
Falange terminal
Hoja escapular
Primarias
Secundarias
Terciarias

12



1. Extensor muscles of elbow 9. Extensor muscles of carpus and digits
2. Sternal extremity of coracoid bone 10. Extensor process of alular metacarpal bone (MC I)
3. Ventral (or major) tubercle of humerus 11. Ventral condyle of humerus
4. Shoulder extremity of coracoid bone 12. Olecranon
5. Cervical patagium 13. Proximal condyles of ulna
6. Dorsal (or minor) tubercle of humerus 14. Postpatagium
7. Dorsal condyle of humerus 15. Attachment of secondary flight feathers to ulna
8. Propatagium 16. Distal condyles of ulna


Coracoides
Escápula
Metacarpos
II
Fúrcula
Húmero
Radio
III
IV
Ulna
Músculo supracoracoideo
Músculo pectoral
Quilla del esternón

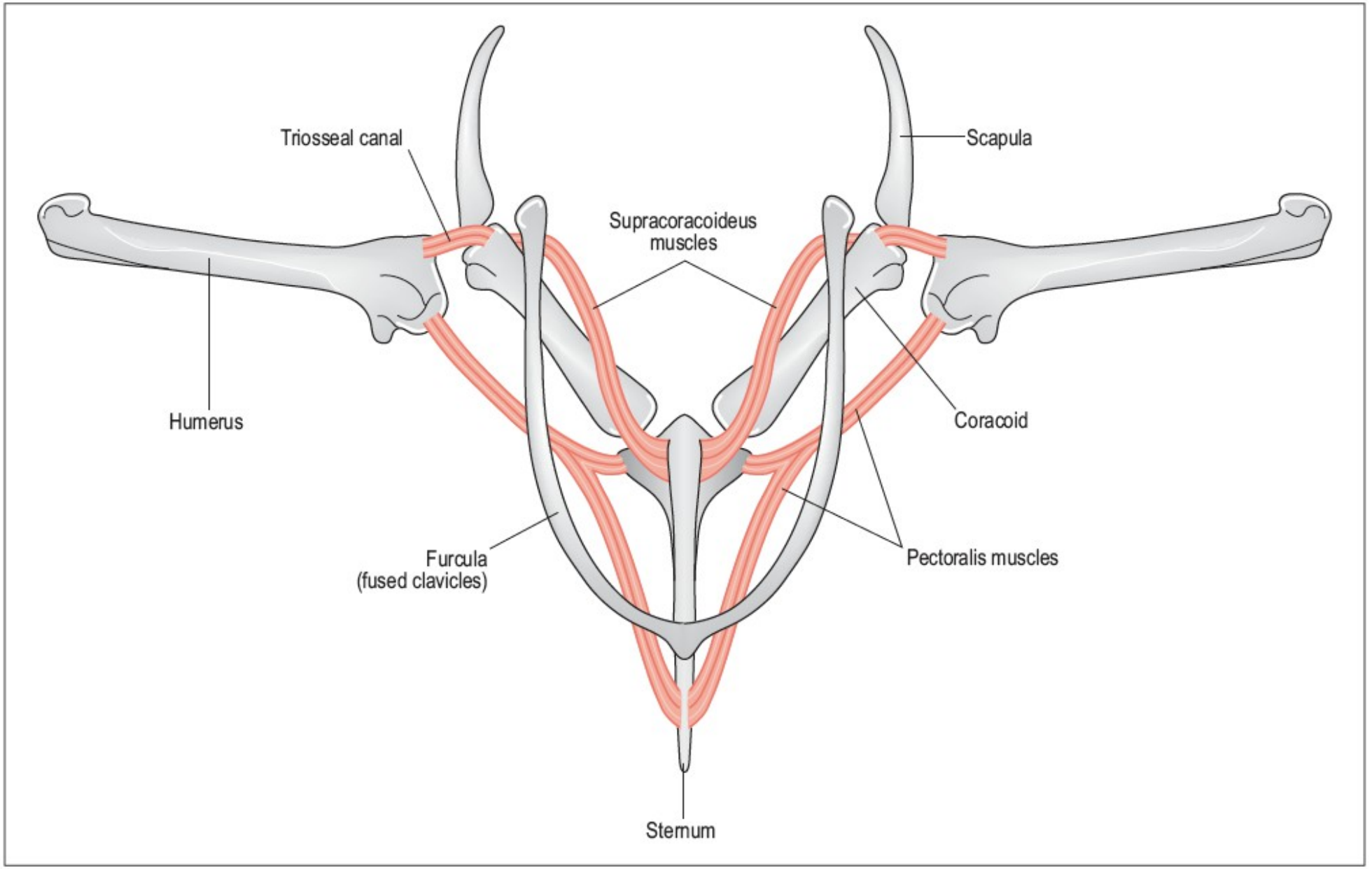
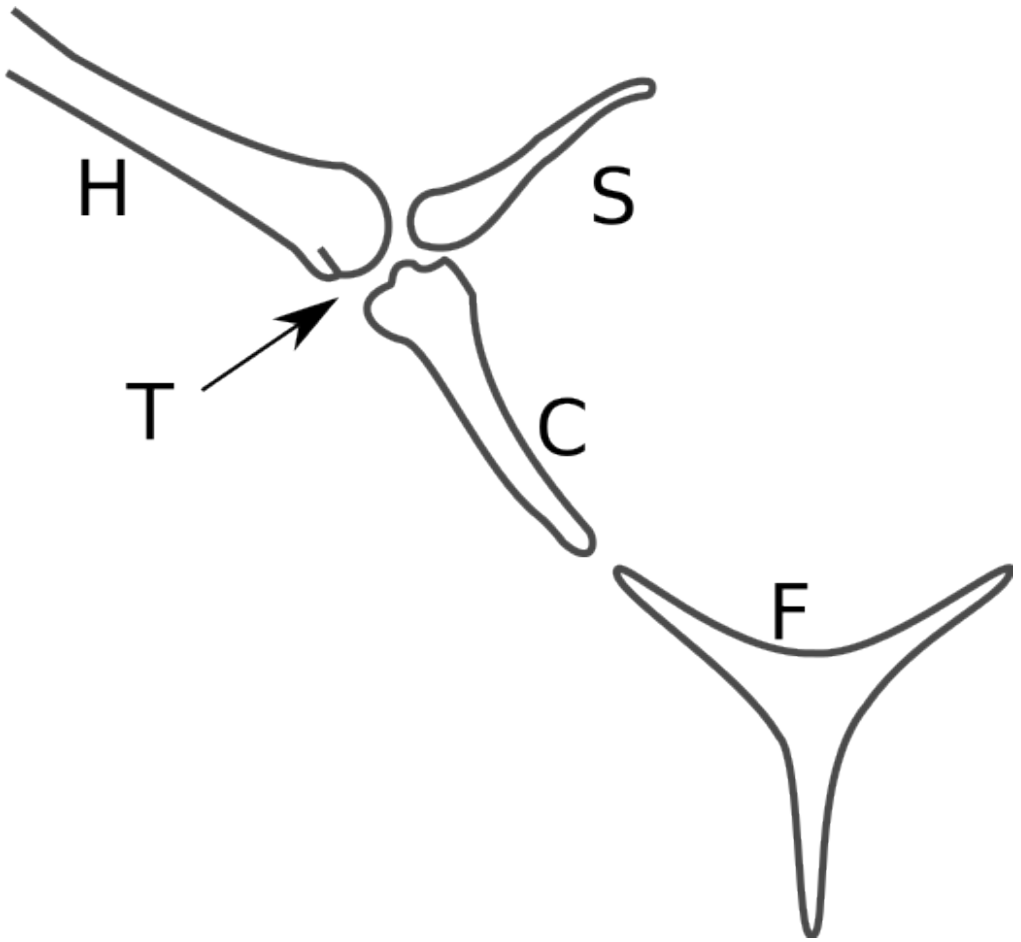
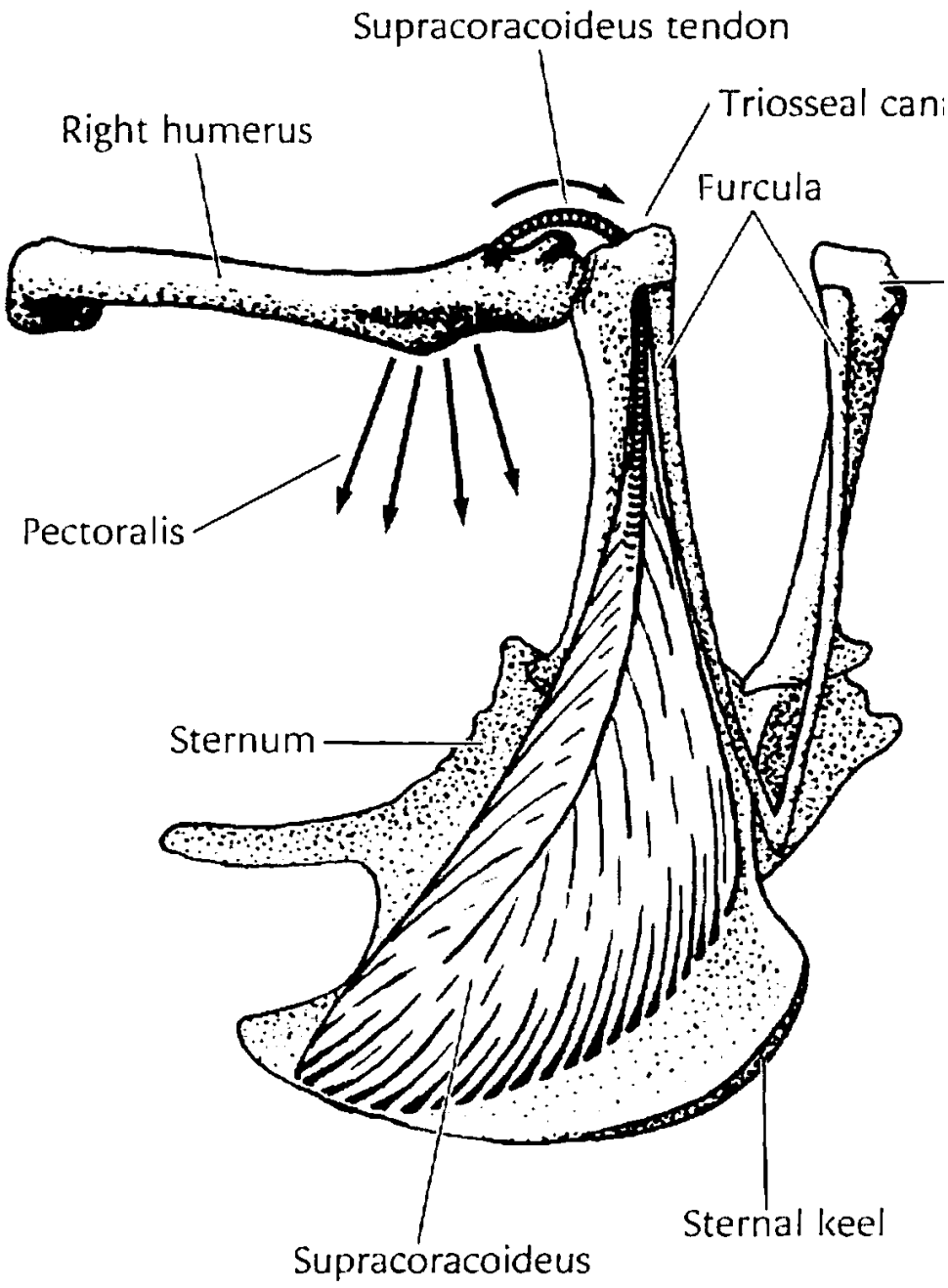
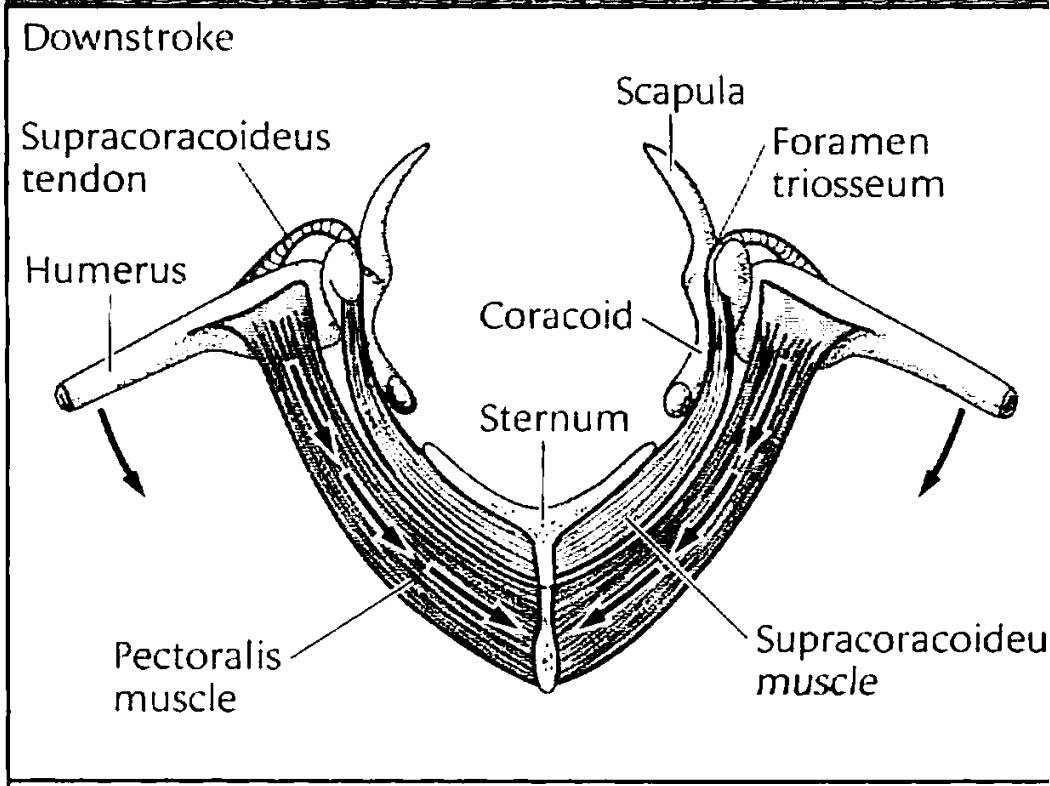


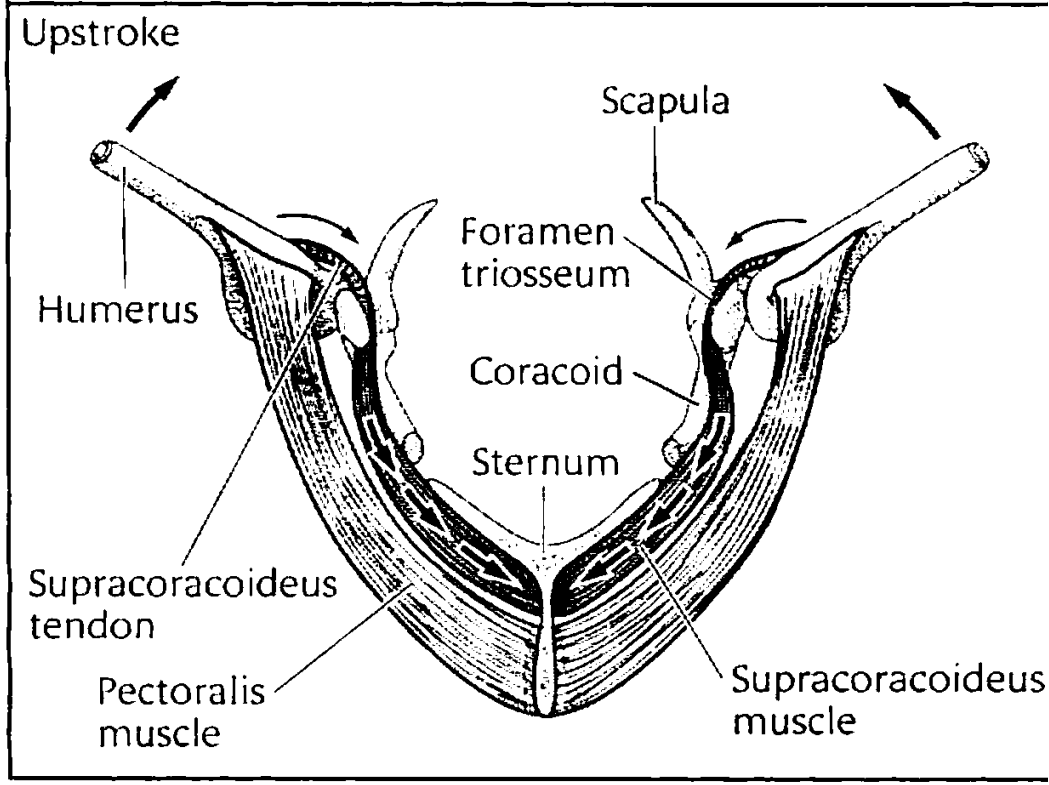
Figure 6.22 • Diagram of pectoral muscles demonstrating how both the supracoracoideus, which elevates the wing, and the pectoralis, which depresses the wing, have ventral origins. This keeps the heavy musculature close to the bird's center of gravity.

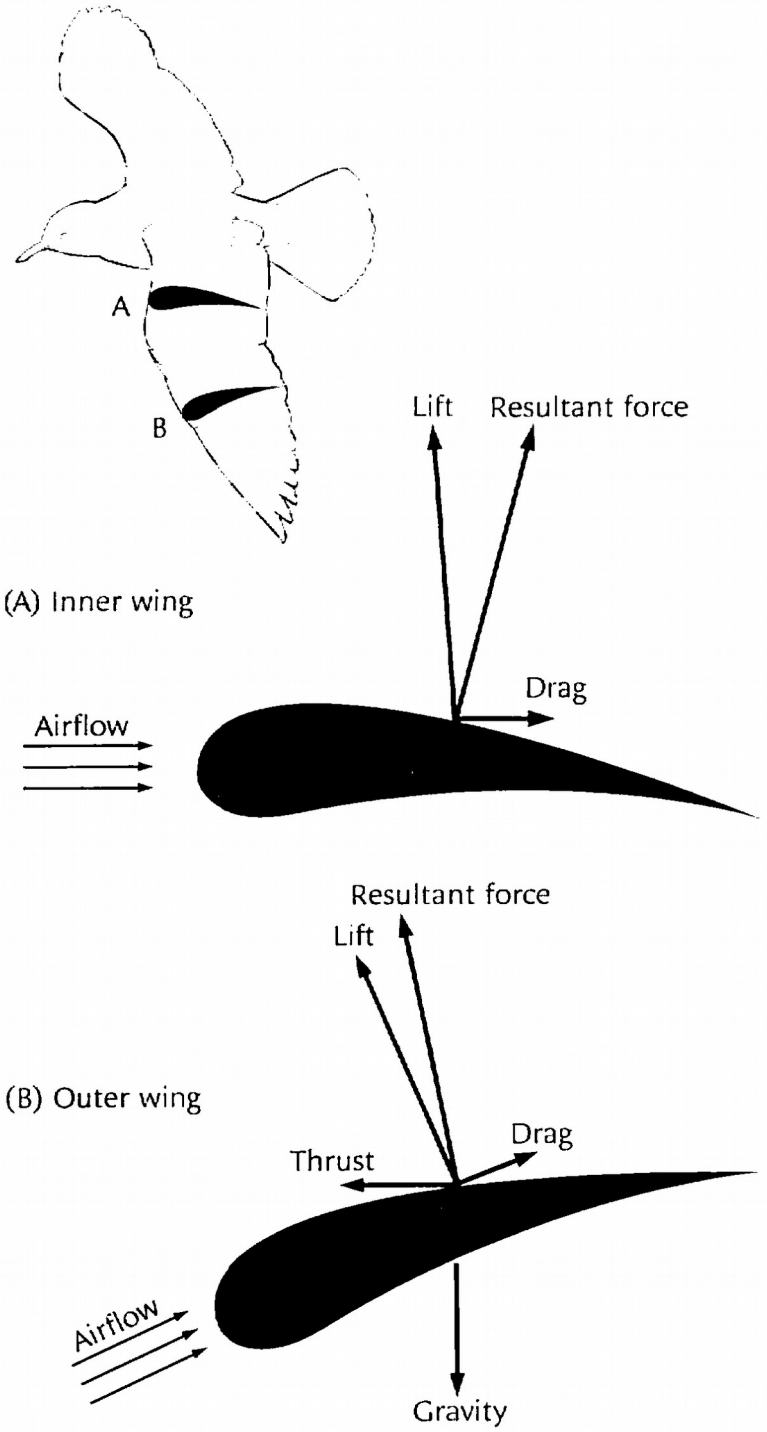

H
S
T
C
F


Supracoracoideus tendon
Triosseal can
Right humerus
Furcula
Pectoralis
Sternum
Sternal keel
Supracoracoideus

CLOSER LOOK


Downstroke
Scapula
Supracoracoideus tendon
Foramen triosseum
Humerus
Coracoid
Sternum
Pectoralis muscle
Supracoracoideu muscle


Upstroke
Scapula
Foramen triosseum
Humerus
Coracoid
Sternum
Supracoracoideus tendon
Pectoralis muscle
Supracoracoideus muscle


A
B
Lift
Resultant force
(A) Inner wing
Drag
Airflow
Resultant force
Lift
(B) Outer wing
Drag
Thrust
Airflow
Gravity

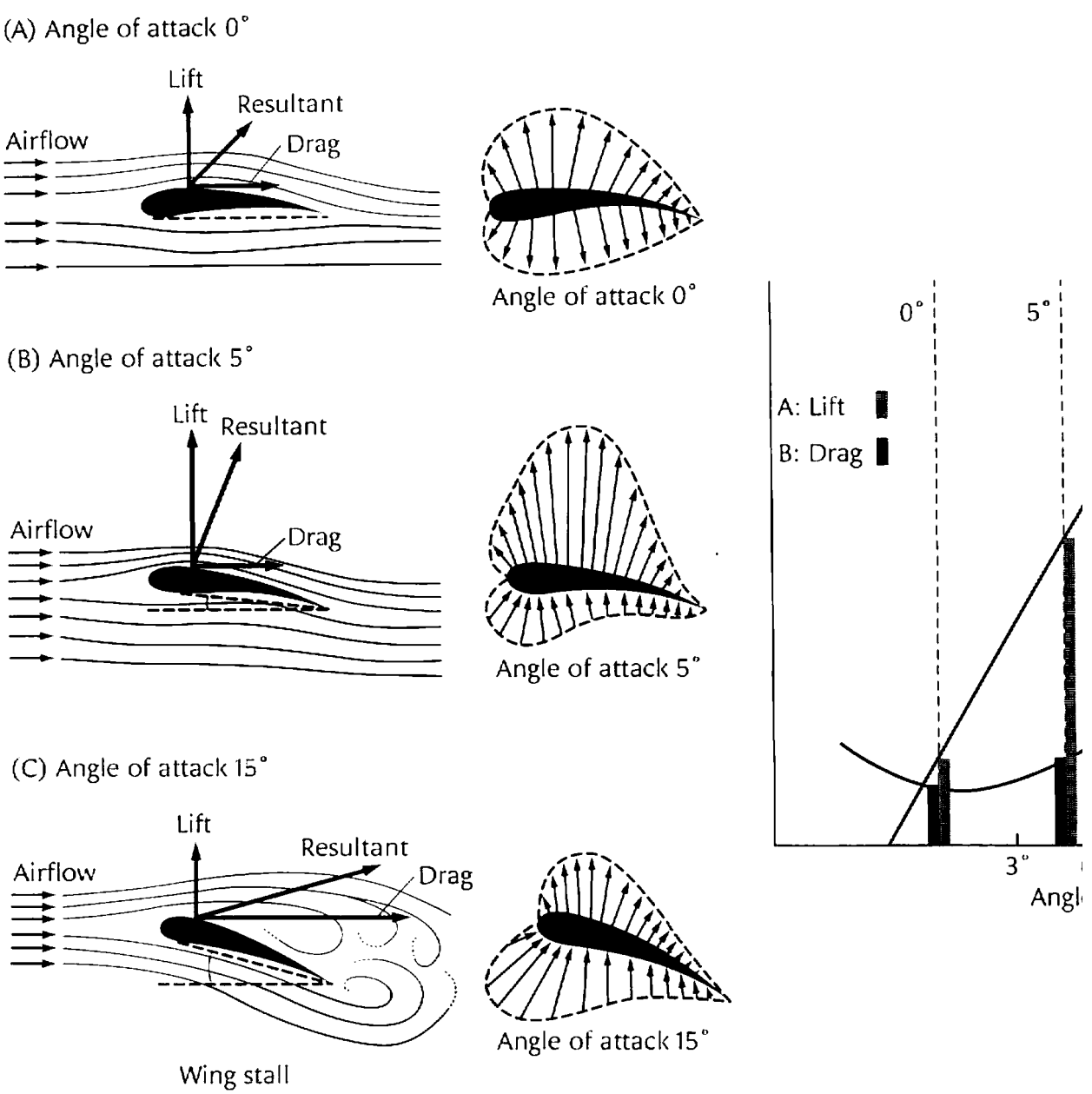
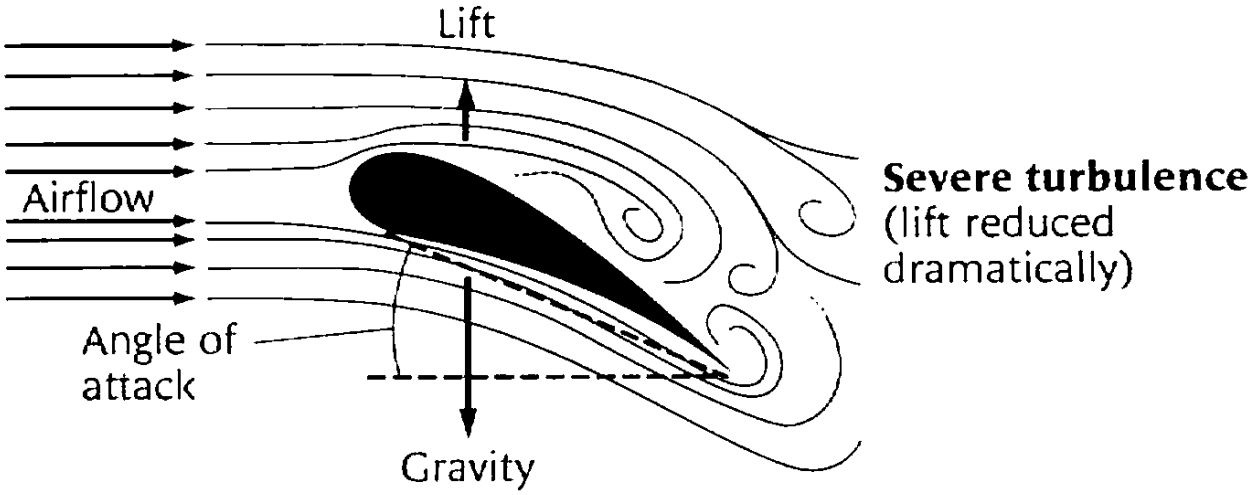
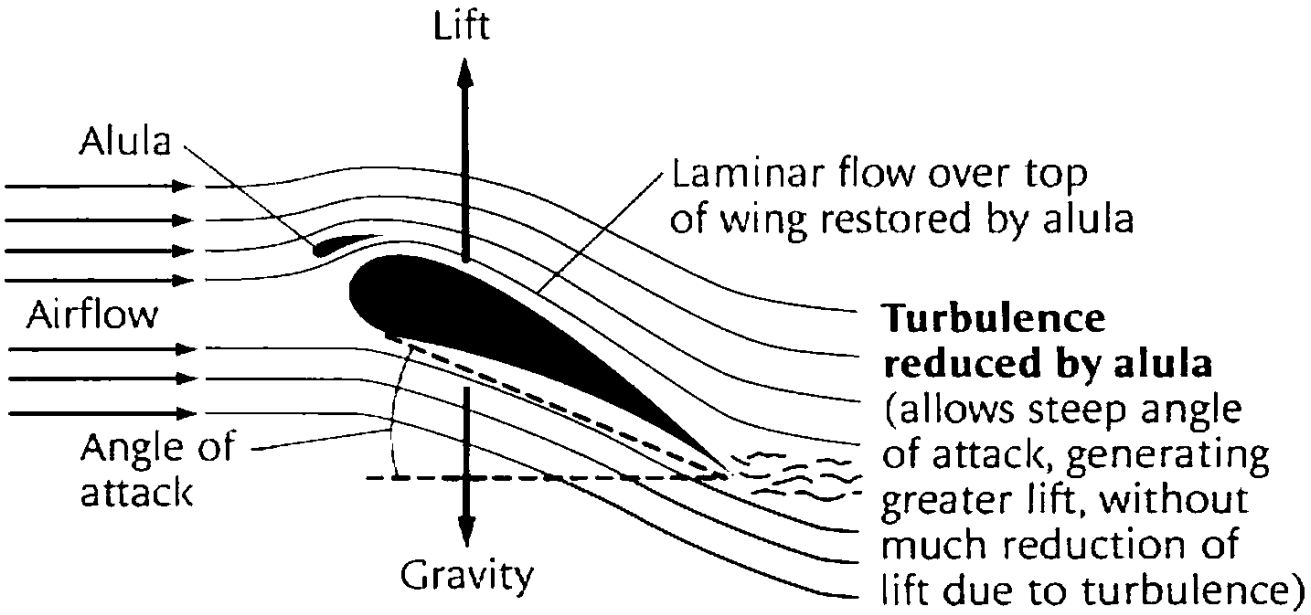


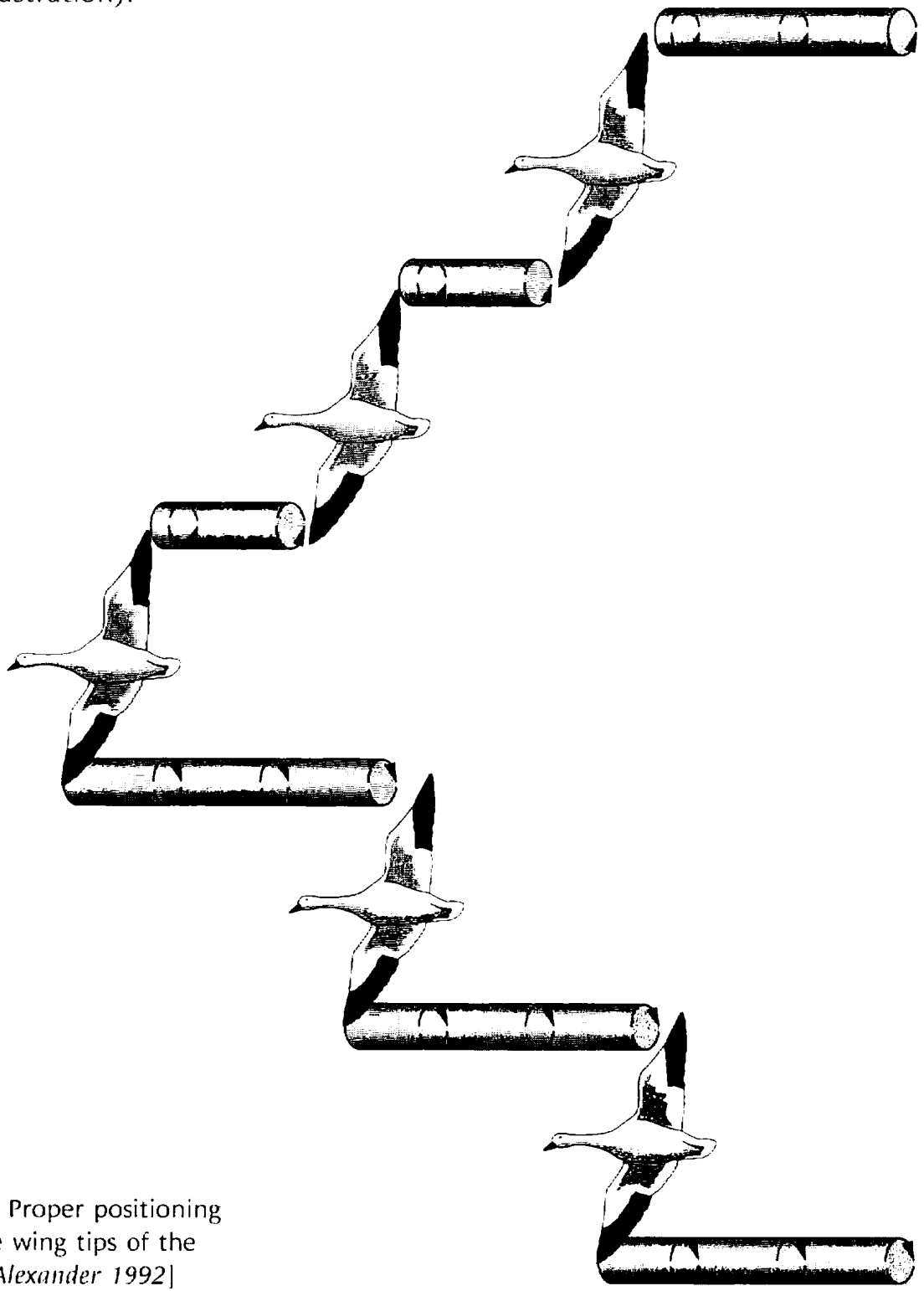
FIGURE 5–3 The angle of attack affects the balance of aerodynamic forces on the wing. The angles of attack illustrated are (A) 0, (B) 5, and (C) 15 degrees. Increasing the angle of attack by 5 degrees from a horizontal position increases lift, but increasing the angle by only 15 degrees causes the airstream to separate from the upper surface of the airfoil, which increases turbulent airflow, or drag, and severely reduces lift. Higher angles of attack will cause a loss of lift and the bird or airplane to stall. [*After Burton 1990*]



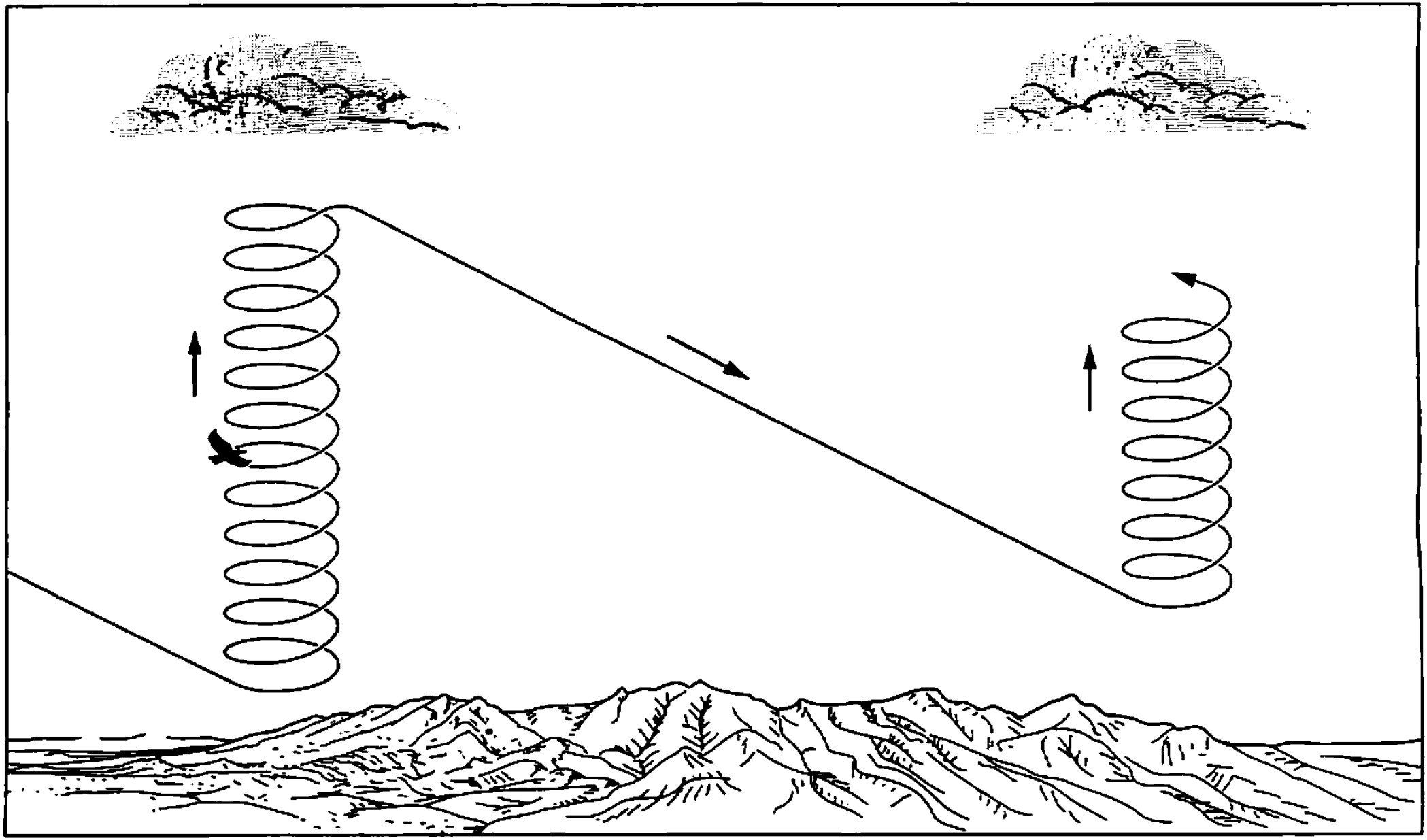
Steep angle of attack with alula present



ee illustration).



eese. Proper positioning
n the wing tips of the
fter Alexander 1992]



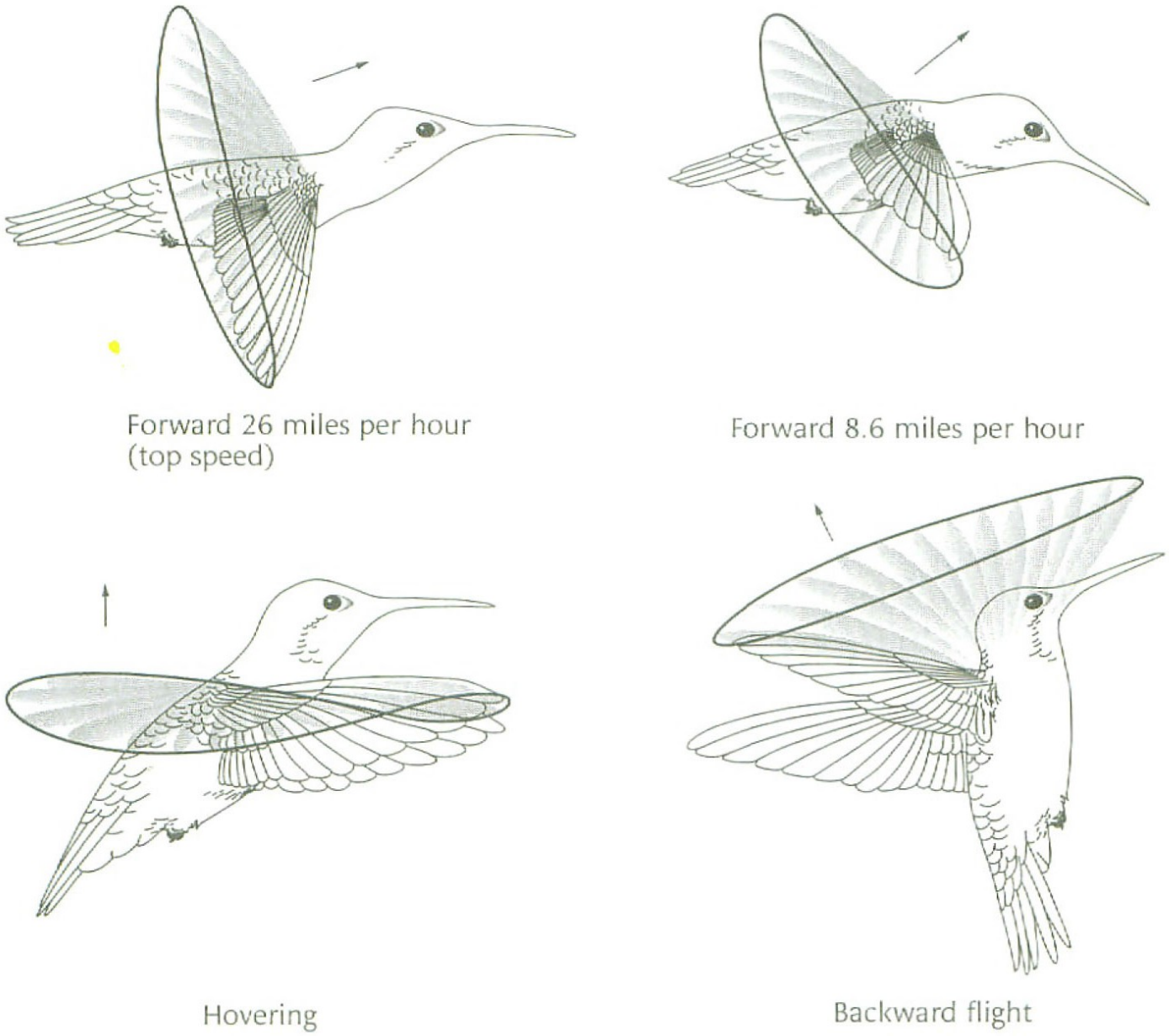


FIGURE 5–9 Hummingbird wing motions. In forward flight, the wings beat vertically to generate forward thrust. In hovering flight, the wings beat horizontally in the pattern of a flattened figure eight. To fly backward, the hummingbird tilts the angle of wing action to create rear-directed thrust. [*After Greenewalt 1960a*]

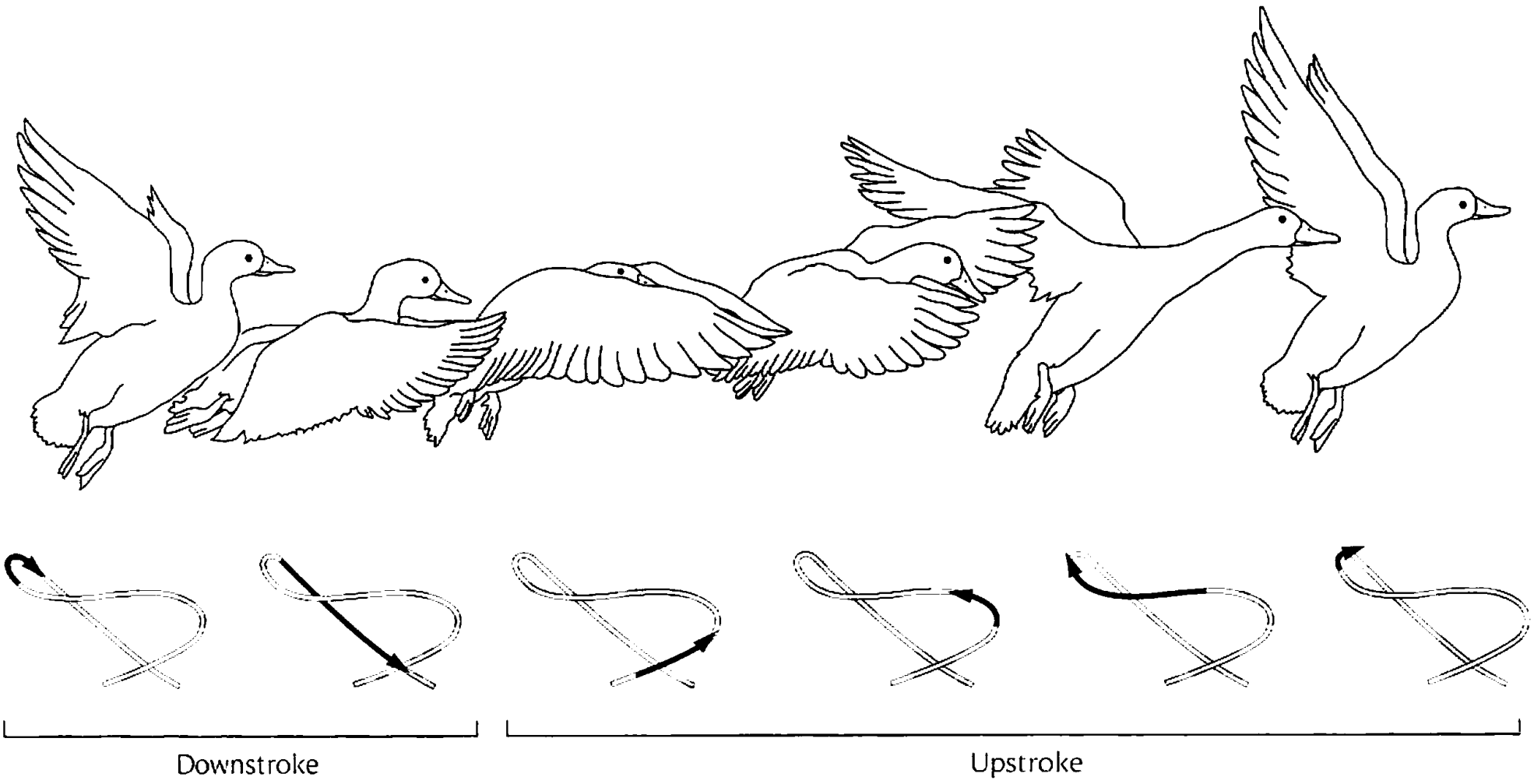


FIGURE 5–10 Complete wing stroke of the duck. Black arrow sections trace the movement of the wing tip through the wing stroke. [*After Burton 1990*]