NREM/ZOOL 4464 – Ornithology
Dr. Tim O'Connell

Avian morphology: Part 1 - integument
Laboratory information for week of Feb. 22–23, 2017

In lab this week, we will be introducing general avian morphology and comparative morphology, focusing on integument (skin and associated features) and skeletal structure. In addition to your text, background information for this material has been gleaned from the following sources:

Elphick, C., J. B. Dunning, Jr., and D. A. Sibley. 2001. The Sibley guide to bird life and behavior. Alfred A. Knopf, Inc., New York.

Hildebrand, M. 1982. Analysis of vertebrate structure. 2nd Ed. John Wiley & Sons, New York.

Podulka, S., R. W. Rohrbaugh, Jr., and R. Bonney. (Eds). 2004. Handbook of bird biology. 2nd Ed. Cornell Lab of Ornithology, Ithaca, NY.

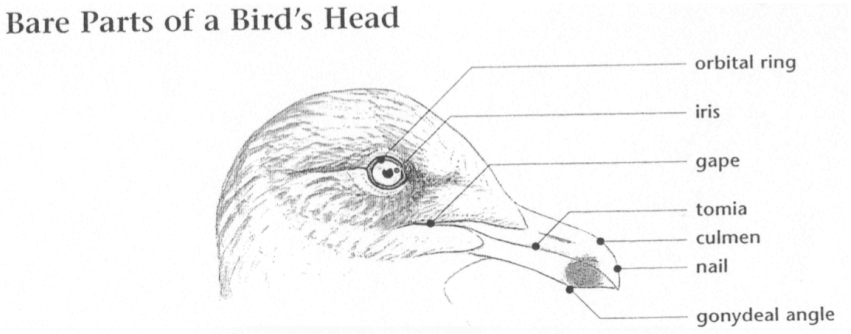
Pyle, P. 1997. Identification guide to North American Birds Part I: Columbidae to Ploceidae. Slate Creek Press, Bolina, CA.

Rising, J. D. 1996. A guide to the identification and natural history of the sparrows of the United States and Canada. Academic Press, Harcourt Brace & Company, San Diego.

For this lab, we will use preserved specimens from the OSU Collection of Vertebrates as well as salvaged birds (window-killed or road-killed).

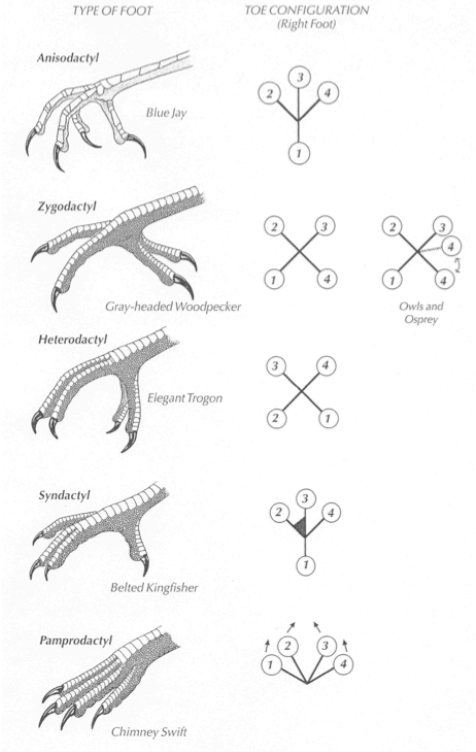
To begin, let's look at skin and other bare parts.

Bill
- ramphotheca
- maxilla (upper mandible)
- mandible (lower mandible)
- culmen
- gonydeal angle
- tomia
- gape

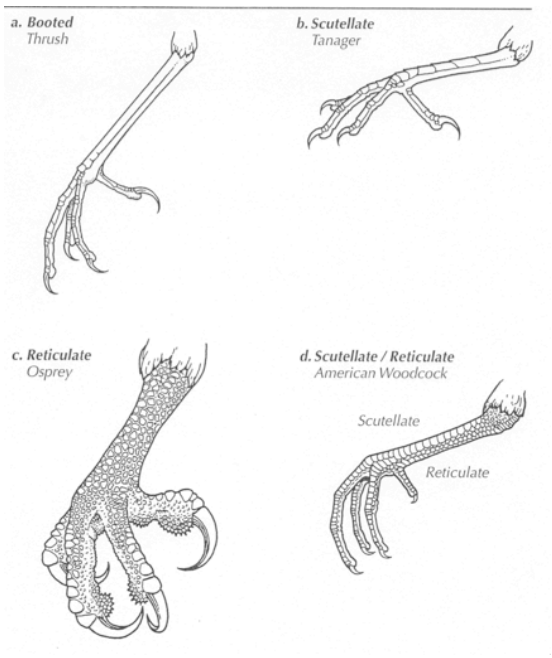


Specific beak adaptations
- lamellae for straining (e.g., ducks)
- serrations (e.g., mergansers)
- tomial tooth (e.g., falcons)
- display/thermoregulation (e.g., toucans)
- cranial kinesis (e.g., American Woodcock)

Toe arrangements
- anisodactyl
- zygodactyl
- heterodactyl
- syndactyl
- pamprodactyl

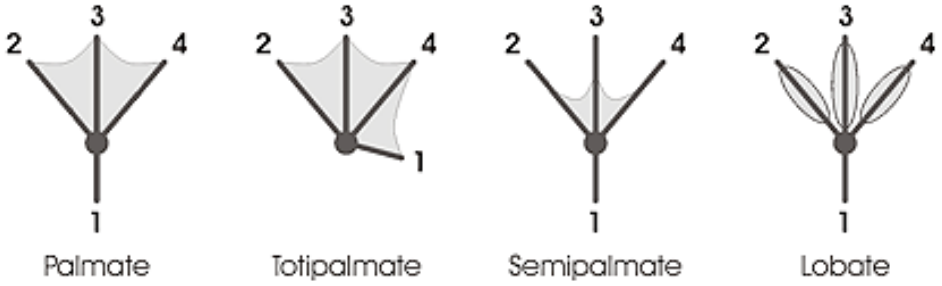


Scaling patterns of podotheca
- booted
- scutellate
- reticulate
- scutellate/reticulate



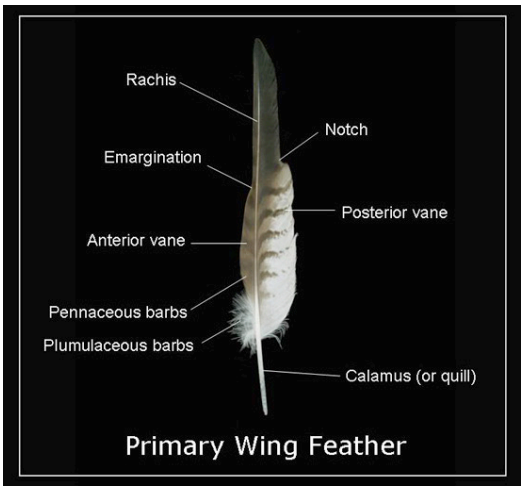
Specific foot adaptations
- webbing – totipalmate (all four toes joined, e.g., pelicans), palmate (hallux unwebbed, e.g., ducks, semipalmate (reduced webbing, e.g., Semipalmated Sandpiper)
- lobing – grebes, coots, finfoots
- reduction in toes for running (e.g., plovers, ostriches)

Webbing patterns for aquatic birds



<u>Feathers</u>

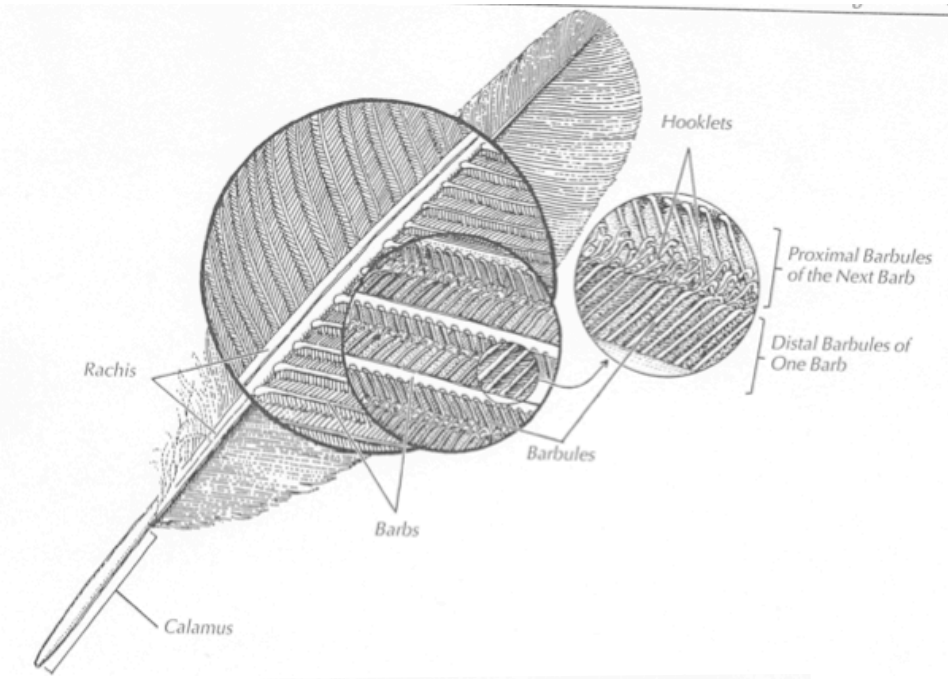
Comprised of the protein keratin – same as hair, nails, rhino horn, and the outer sheath of cattle horns



Functions of feathers
- insulation
- camouflage
- uv protection
- flight
- display
- sound production

Types of feathers

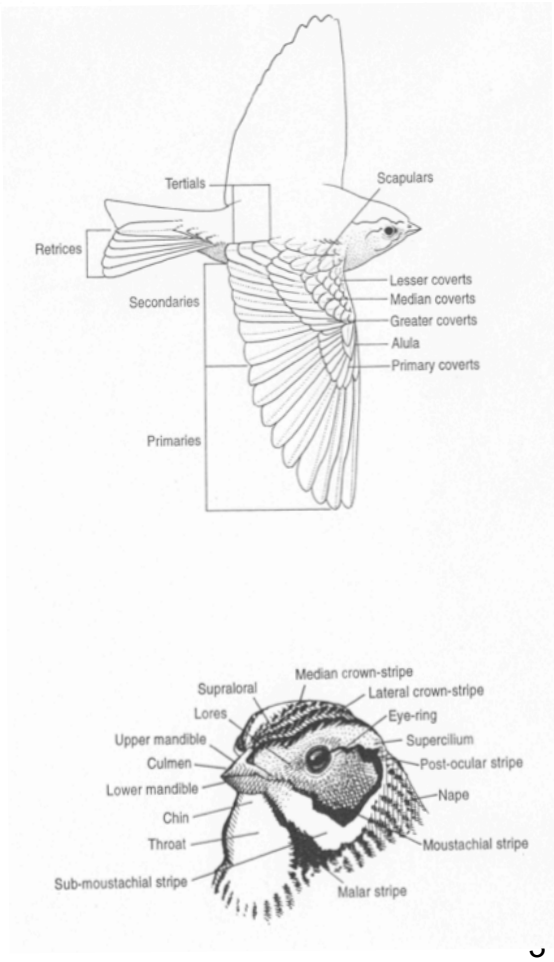
- down
- contour
- semiplumes
- filoplumes
- bristle
- powder down
- rectrix (rectrices) – tail feathers
- remige (remiges) – wing feathers



Feather structure (generalized remige)

- calamus
- rachis
- vane
- barbs
- barbules
- hooklets

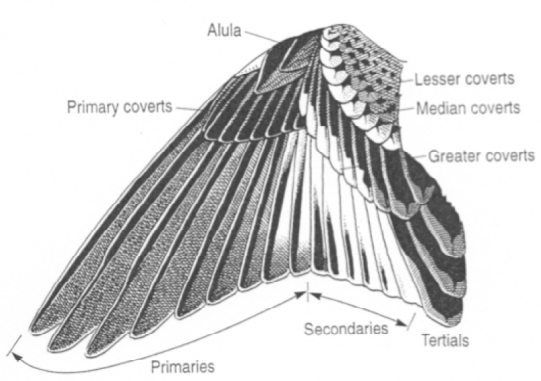
In down feathers, the barbs lack barbules and hooklets so there is no vane to "zip together." In addition, the barbs are longer than the rachis, making the feather round in shape.

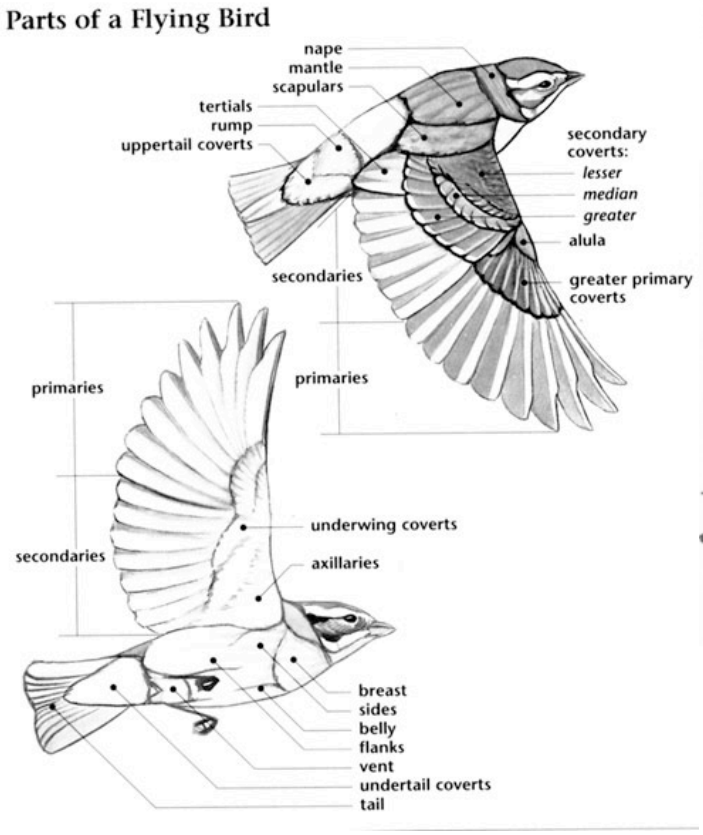


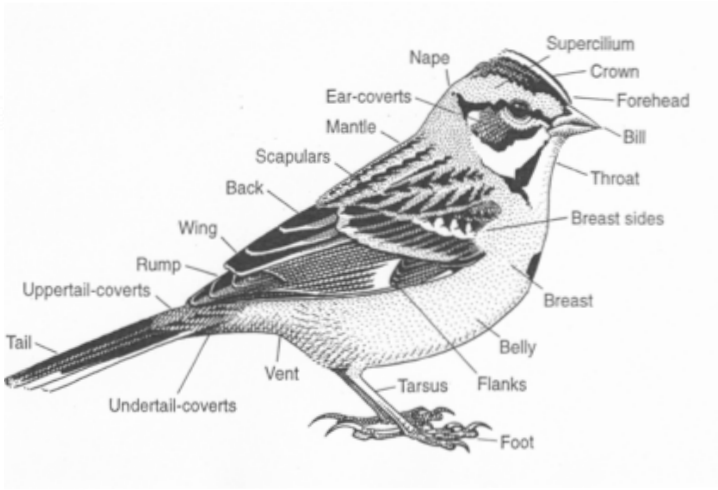
Feather tracts

- tail/rectrices
- uppertail coverts
- undertail coverts
- belly/vent
- flanks
- breast
- throat
- chin
- auriculars
- lores
- orbital ring
- supercilium
- crown
- nape
- scapulars
- mantle/back
- axillaries
- primaries

- secondaries
- tertials
- alula
- primary coverts
- greater coverts
- median coverts
- lesser coverts







Skeleton

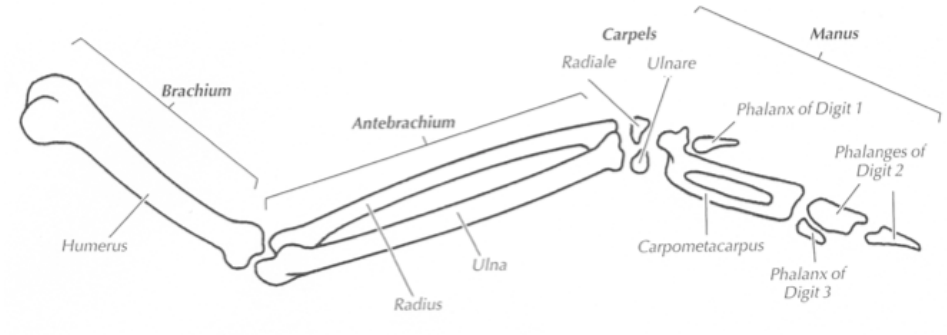
Bird skeletons are characterized by reduction of bones (to reduce weight), fusion of bones (to provide rigid structures for shock absorption), and pneumatization of long bones especially (to provide strength and reduce weight).

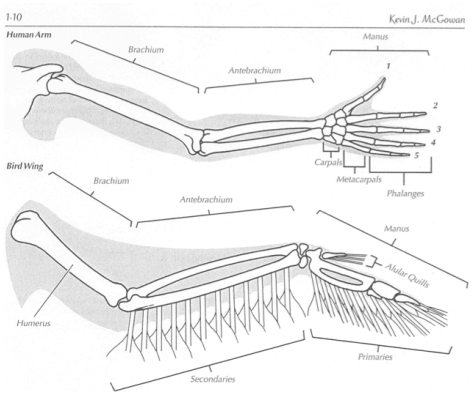
Bones to know

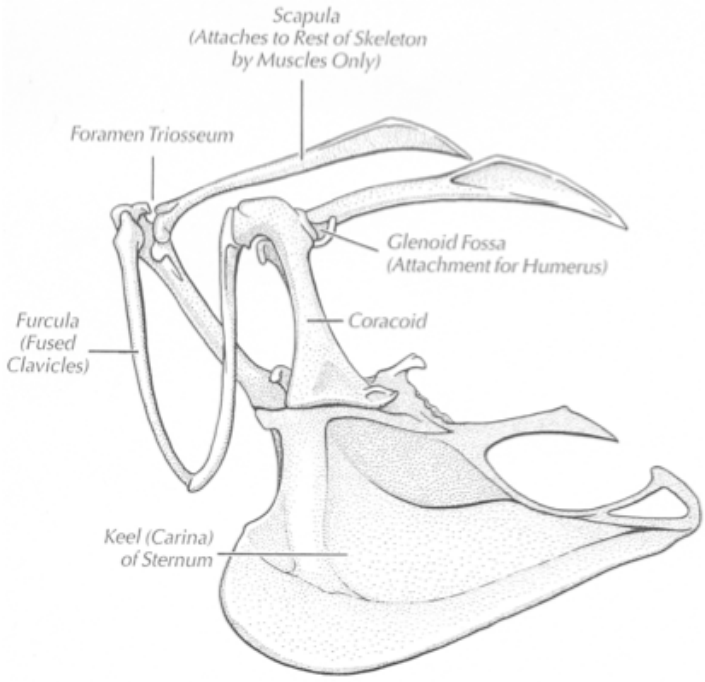
- cranium (single occipital condyle; double in mammals)
- craniofacial hinge
- secondary bony palate
- premaxilla
- dentary

- cervical vertebrae (7 in mammals; avg. 14-15 in birds)
- wing: brachium [humerus], antebrachium [radius and ulna], manus [carpals, metacarpals, and phalanges]
- coracoid
- clavicle (fused to form furculum)
- sternum (with or without keel, a.k.a. carina)
- scapula
- uncinate process on ribs
- synsacrum (fused lumbar vertebrae, ilium, ischium, and pubis)
- leg: thigh [femur], tibiotarsus [tibia and fibula], tarsometatarsus [fused tarsals and metatarsals], toes [phalanges]

Appendicular skeleton – limbs and associated attachments

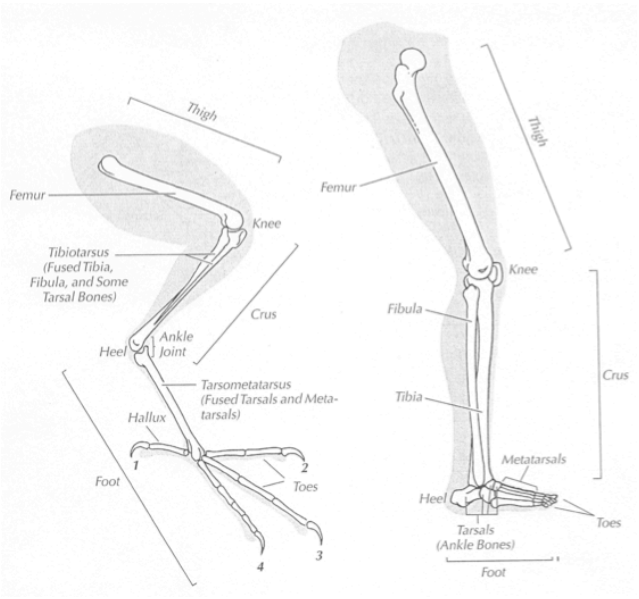




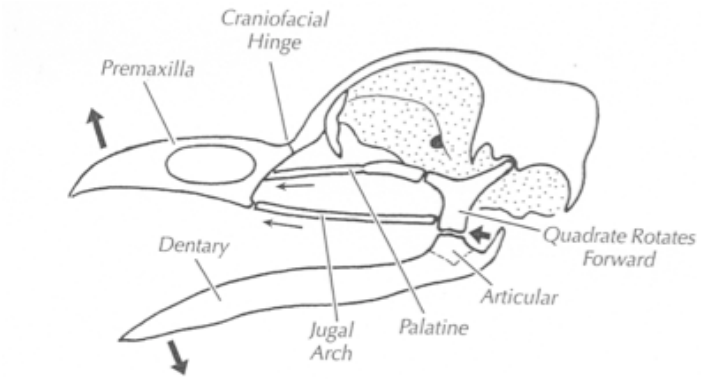


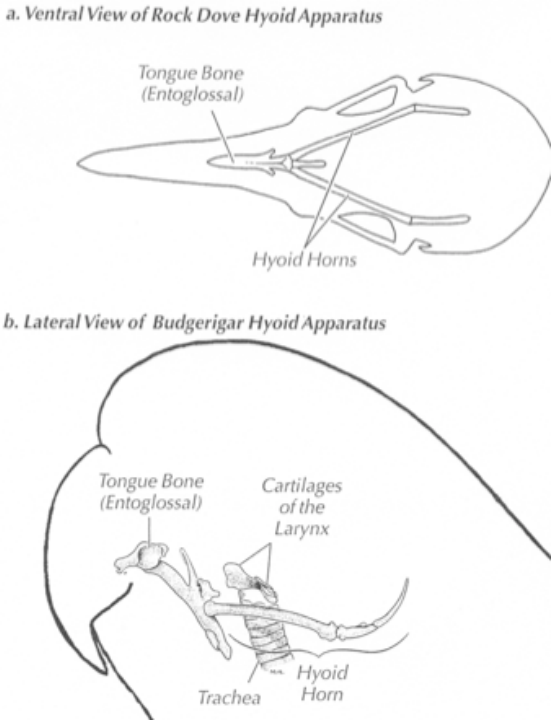
Feet and legs

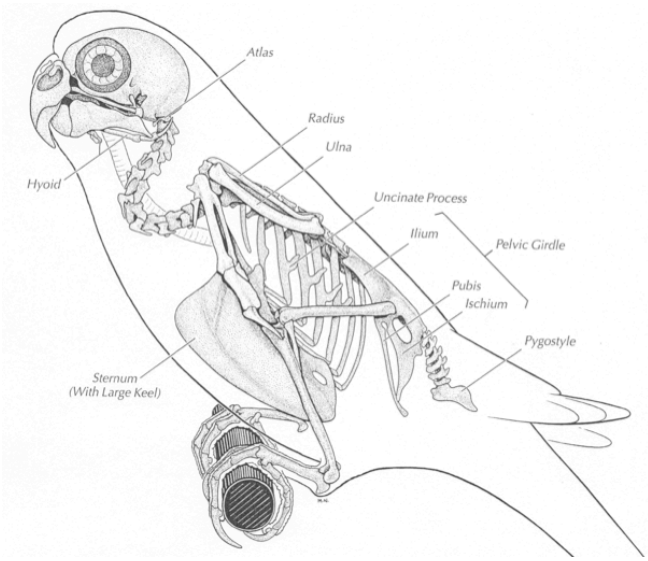
- thigh
- tibiotarsus
- tarsometatarsus (tarsus)
- toes 2–4. (#1 is the hallux, others just referred to as “phalanges #_”)
- talons
- spurs



Axial skeleton – cranium and vertebral column







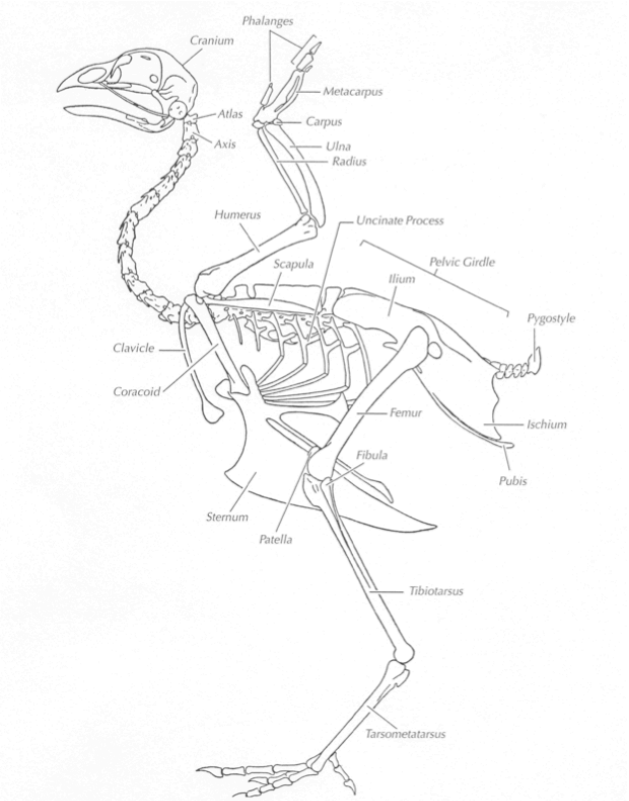
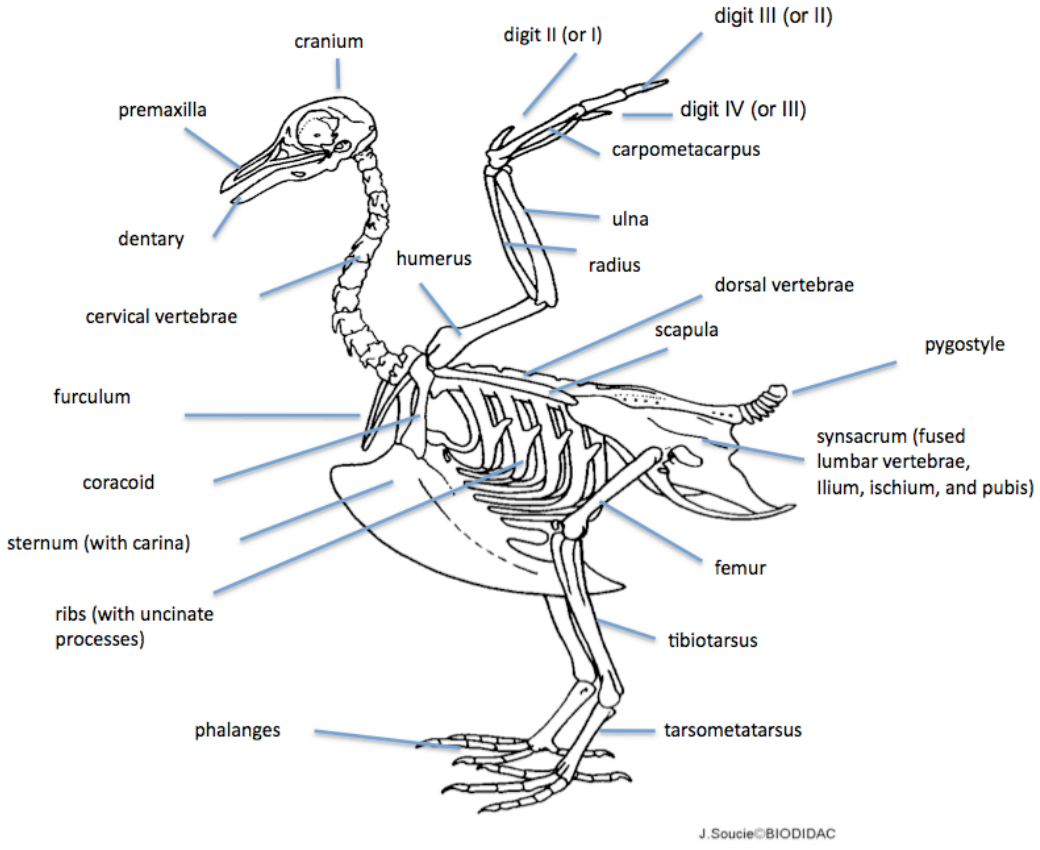


Figure 4–4. Skeleton of the Chicken: *Viewed from the left side, the chicken skeleton is shown with the left wing raised over body. Compare with Figures 4–5 and 4–6, in which different bird species in different positions provide additional perspect*



Without its feathers, the skeleton of *Archaeopteryx* was very similar to that of maniraptor dinosaurs like *Velociraptor*. As a student of Ornithology, it is important to understand the modifications of that basic theropod body design in modern birds, with an emphasis on the changes that are associated with the demands of flight.