# TAXONOMIC HIERARCHY

Taxonomy - science of classification and naming of organisms

<table>
<thead>
<tr>
<th>Taxonomic Level</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingdom</td>
<td>Animalae</td>
</tr>
<tr>
<td>Phylum</td>
<td>Chordata</td>
</tr>
<tr>
<td>subphylum</td>
<td>Vertebrata</td>
</tr>
<tr>
<td>Class</td>
<td>Aves</td>
</tr>
<tr>
<td>subclass</td>
<td>Neornithes</td>
</tr>
<tr>
<td>superorder</td>
<td>Neognatha</td>
</tr>
<tr>
<td>Order</td>
<td>Gaviiformes</td>
</tr>
<tr>
<td>Family</td>
<td>Gaviidae</td>
</tr>
<tr>
<td>Genus</td>
<td>Gavia</td>
</tr>
<tr>
<td>Species</td>
<td>immer</td>
</tr>
</tbody>
</table>

1. Latin Name = **Gavia immer**  (Common Loon)
2. Each taxonomic level can be given a “sub” or “super” level of taxonomy
3. All orders end in “formes”  
   All families end in “idae”  
   All subfamilies end in “inae”
CLASSIFICATION OF BIRDS

Kingdom Animalae
Phylum Chordata
  Subphylum Vertebrata
Class Aves
  Subclass Archaeornithes - Archaeopteryx
  Subclass Neornithes
    Superorder Ichthyornithes - Ichthyornis
    Superorder Odontognathae - Hesperornis
    Superorder Impennes - Penguins
    Superorder Neognathae - Modern birds
      (no teeth)
CLASSIFICATION OF BIRDS

A. SUBCLASS ARCHAEORNITHES

1. ARCHAEOPTERYX LITHOGRAPHICA
2. JURASSIC AGE (150mya)
3. CROW SIZE; 22 gams
4. HEAD & UPPER NECK UNFEATHERED
5. 1 PAIR OF FEATHERS PER TAIL VERTEBRA (20)
6. RIBS LACKED UNCINATE PROCESSES
7. TEETH PRESENT - Homodont

B. SUBCLASS NEORNITHES (New Birds)

SUPERORDER ICHTHYORNITHES
1. REPRESENTED BY Ichthyornis sp.
2. CRETACEOUS PERIOD (120 mybp)
3. TOOTHED
4. DEEPLY KEELED STERNUM
5. MODERN BIRD-LIKE WINGS
6. LOST THE ARCHAEOPTERYX TAIL
7. BICONCAVE VERTEBRA - Reptilian feature
8. GULL-LIKE IN APPEARANCE
9. 9 SPECIES KNOWN

SUPERORDER ODONTOGNATHAE
1. REPRESENTED BY Hesperornis sp.
2. CRETACEOUS AGE
3. 2 meters LONG
4. VESTIGIAL WINGS - swimmer
5. STUBBY TAIL
6. POWERFUL SHORT LEGS
7. CONICAL TEETH (Homodont)
8. LOON LIKE
9. 9 SPECIES KNOWN

“A birdwatcher 65 million years ago could have seen relatives of today’s loons, geese, ducks, albatrosses, petrels, gulls, and shorebirds”
“Modern birds continued to diversify through the Cenozoic so much that by 35mya most bird orders had appeared”

SUPERORDER IMPENNES (PENGUIN)
1. WEB FOOTED
2. WING MODIFIED INTO PADDLE - FLY UNDERWATER
3. LARGE KEELED STERNUM
4. SCALE-LIKE FEATHERS
5. TYPICALLY COLD WATER HABITAT
6. NO TEETH

SUPERORDER NEOGNATHAE
1. WARM BLOODED
2. NO TEETH
3. TYPICAL “AVIAN FEATURES”

2 early Cenozoic birds to watch-out for:

Phororhachids:
Flightless, fast-running, 3 meter tall, predator armed with enormous beak & claws (dominated South & part of North America)

Diatrymidae:
Eocene bird that resembles phororhachids (dominated Europe & North America)

CLASS AVES
Features on Modern Birds:
A. Features derived from Reptilian Ancestry:

1. Oviparous - lays external eggs
2. Amniotic egg - contains amnion, chorion, allantois membranes
3. Telolecithal egg - yolk concentrated at one end (polar)
4. Single occipital condyle
5. Sclerotic rings - bony rings around eye orbit
6. Nucleated red blood cells
7. No pinna - external ear tissue absent
8. Simple middle ear (1 ear bone - stapes)
9. Lower jaw (fusion of 5-6 bones)
10. Ankle bones between tarsal bones
11. Some ___ are XY
12. Scales similar

B. Features developed by dinosaurian ancestors:
1. Three forward toes, one backward  
2. Four-chambered heart  
3. Endothermic - generates own heat  
4. Homeothermy - maintains constant Temp  
5. Migration behavior  
6. Colonial nesting behavior  

C. Features developed by birds  

1. Possess feathers  
2. Toothless - modern birds only  
3. Horny bill - extension of mandible & rostrum  
4. Long bones hollow with strut support  
5. Fusion of bones ie: pelvic girdle, metacarpels, vertebra (thoracic & some lumbar)  
6. Keeled sternum  
7. Ribs laterally compressed with uncinate process (interlock)  
8. Female retains left ovary  
9. Pectoralis major (major flight muscle)  
10. No diaphragm (weight reduction)  
11. Syrinx present (sound production)  
12. No urinary bladder  
13. Crop present
14. Unique Aortic Arch (arches over right)
15. Large optic lobes
16. Air sacs supplement the lungs
17. Navigation abilities unsurpassed
18. Skin glands reduced to absent
19. Large cerebellum (motor control)

Adaptations for Flight:

1. **LOW-BODY WEIGHT**
   - pneumatic bones & reduction
   - feathers
   - reduction in organs & glands
   - egg laying

2. **HIGH POWER PRODUCTION**
   - 4-chambered heart
   - high Metabolic Rate & Body Temp (10°C)
   - efficient digestive, respiratory system
   - eat high energy food
THEORIES IN BIRD EVOLUTION

1. **PSEUDOSUCHIAN THEORY**
   - early Triassic
   - arboreal crocodilian-like ancestor (Thecodont)
   - long narrow scales with lateral striations
   - 14 skeletal features in common
     (similar ear and skull structures)
     - ?Protoavis?
     - ?Confusciusornis?
   
   Problem: long time period gap (90-100mya)
   No intermediate fossils

2. **DINOSAUR THEORY**
   - Jurassic
   - cursorial coelurosaurs
   - short arms, long tails, long hind leg
   - bone structure evidence
   - 23 skeletal features in common

   Problem: long time gap (65-75mya)
   No intermediate fossils
   Enantiornithes - hatchling (130mya)