

Mammalogy Laboratory 7 – Carnivora

General Notes: It may seem like we have several species represented, but there are several families for which we have no representation. Many texts still split the marine carnivores (pinnipeds) from Carnivora as a separate order; others refer to fissipeds (terrestrial carnivores) vs. pinnipeds. It's very strongly supported that pinnipeds evolved from within the order Carnivora (in fact, from within the caniform carnivorans). This order is formally divided into two suborders, Caniformia and Feliformia, with the former containing the marine families (among others).

Order Carnivora (Carnivorans)

Diagnosis: Terrestrial, semi-aquatic or fully aquatic; often three pairs of lower incisors; typically well-developed conical canines in both upper and lower jaw; terrestrial forms with P⁴/M₁ forming carnassial pair (the ancestral condition), no modified carnassials in marine forms; mandibular condyle transverse, sometimes nearly locked into socket; tympanic bulla large and ossified in terrestrial forms; marine forms with cranial part of skull inflated relative to facial portion (also true for mustelids); marine forms with pes and manus fully webbed and a thick subcutaneous layer of fat.

Suborder Feliformia

Family Felidae (cats)

General Notes: There has been a great deal of instability in felid taxonomy, with some authors recognizing as few as two genera and others as many as 19 genera.

Diagnosis: Incisors small, chisel-like, arranged in transverse line; canines elongate, pointed; post canine space common; premolars sharp; carnassials large and well-developed, sectorial; paroccipital process flattened against bulla; bulla inflated and divided; digitigrade; claws retractile; face short and broad.

Habits: Extremely carnivorous; most often solitary; more or less arboreal; senses of smell and hearing acute, but very visually oriented as well, especially cued into motion.

Range: Cosmopolitan

Representative Genera: *Felis*, *Lynx*, *Acinonyx*, *Neofelis*, *Panthera*, *Puma*, *Leopardus*

Material in Lab: *Felis sylvestris* (domestic cat)*
Puma concolor (cougar)
Lynx rufus (bobcat)
L. canadensis (Canada lynx)
Leopardus pardalis (ocelot)*
Leopardus wiedii (margay)*
Panthera onca (jaguar)*
Panthera leo (lion)*

*Not an Idaho species (or introduced)

Family Herpestidae (mongooses)

Diagnosis: Carnassials strongly secondont; M¹ also secondont; long post-orbital region of skull; long tail, often quite thick at base; median lacerate foramen prominent (anterior and slightly medial to auditory bullae); claws non-retractile.

Habits: Very predatory and carnivorous; some are ophiophagous (snake-eating); some highly gregarious, with complex social systems; primarily terrestrial, but may be arboreal.

Range: Africa and Asia, have been introduced widely.

Representative Genera: *Herpestes*, *Urva*, *Mungos*, *Ichnumia*, *Suricata*

Material in Lab: *Urva (Herpestes) javanicus* (Javan mongoose)*

*Not an Idaho species; our specimen is from Hawaii, where Javan mongooses have become invasive.

Suborder Caniformia

Family Canidae (dogs)

Diagnosis: Carnassials well-developed; remaining molars with crushing surface; facial part of skull elongated; paroccipital process long and prominent; legs long and semi-rigid, adapted for cursorial locomotion; digitigrade; claws non-retractile.

Habits: Essentially carnivorous, eat some carrion and plant material; some solitary; some social; rely primarily on hearing smell and less on sight; usually highly vocal.

Range: Cosmopolitan

Representative Genera: *Canis*, *Vulpes*, *Urocyon*, *Nyctereutes*, *Otocyon*, *Chrysocyon*, *Cerdocyon*, *Speothos*.

Material in Lab: *Canis latrans* (coyote)
C. lupus (wolf and dog)
Vulpes vulpes (red fox; note color phases)
V. macrotis (kit fox; subsumed within *V. velox* by some)
V. (Alopex) lagopus (arctic fox)*
Urocyon cinereoargenteus (gray fox)*

*Not an Idaho species

Family Ursidae (bears)

Diagnosis: Canines elongate, conical and slightly hooked; first three premolars rudimentary or lost; molars bunodont; carnassials weakly developed; paroccipital process broad, independent of bulla; claws large, non-retractile.

Habits: Carnivorous, omnivorous, or herbivorous; usually solitary; smell is dominant sense; sight and hearing usually poorly developed; many species climb trees; some hibernate.

Range: North America; Eurasia, including Malay Peninsula; Andes of South America

Genera: *Ailuropoda*, *Helarctos*, *Melursus*, *Tremarctos*, *Ursus*

Material in Lab: *Ursus americanus* (black bear)
 U. arctos (brown bear; grizzly bear is a subspecies: *U. a. horribilis*)
 U. maritimus (polar bear)*

*Not an Idaho species

Family Procyonidae (raccoon and kin)

Diagnosis: Canines elongate and oblong in cross section; premolars pointed and small; carnassials poorly developed; molars broad, somewhat bunodont; paroccipital process prominent; legs rather short; mostly plantigrade; claws non-retractile; long, prehensile tail in *Potos*.

Habits: Omnivorous; may travel alone, in family groups or in bands; semi-arboreal; generally non-vocal.

Range: New World

Genera: *Procyon*, *Bassariscus*, *Bassaricyon*, *Nasua*, *Nasuella*, *Potos*

Material in Lab: *Procyon lotor* (raccoon)
 **Bassariscus astutus* (ringtail)

*Species of special concern in Idaho

Family Mustelidae (weasels, badgers, otters, wolverine)

General Note: There are a number of subfamilies in this family. Molecular studies suggest one of these, the Mephitinae (skunks), should be removed and elevated to its own family, **Mephitidae**.

Diagnosis: Canines elongate and sharp; premolars small; carnassials usually well-developed; molars reduced in number; facial region of skull very short; paroccipital process short;

postglenoid process curved over mandibular fossa, locking mandible in place; legs usually short in relation to body; plantigrade to digitigrade; claws never fully retractile; tail usually long.

Habits: Primarily carnivorous; fierce and very quick; most solitary; some good swimmers; most forms have delayed implantation.

Range: Cosmopolitan, except Madagascar, Australia, and most oceanic islands

Representative Genera: Mustelinae: *Mustela*, *Martes*, *Vormela*, *Eira*, *Ictonix*; Gulinae: *Gulo*; Mellivorinae: *Mellivora*; Melinae: *Meles*; Lutrinae: *Lutra*, *Lontra*, *Aonyx*, *Enhydra*

Material in Lab: *Mustela frenata*¹ (long-tailed weasel)
 M. erminea (ermine)
 M. vison (American mink; called *Neovison vison* by some, *Vison vison* by others, *Neogale vison* by still others; however, removing it from *Mustela* solves no phylogenetic issues)
 ²*Martes caurina* (Pacific marten)
 Pekania (formerly *Martes*) *pennanti* (fisher)
 Gulo gulo (wolverine)
 Lontra canadensis (river otter)
 **Enhydra lutris* (Sea otter)
 Taxidae taxus (American badger)

*Not an Idaho species

¹Some (Patterson et al. 2021. J. Animal Diversity) have proposed *Neogale* as the genus for *frenata* and *vison*; this solves no phylogenetic problem, and I view it as unjustified.

²*Martes americana*, the American marten, occurs in Idaho north of the Clark Fork River and low levels of hybridization with *Martes caurina* have been detected (Lucid et al. 2020. Front. Gen.).

Family Mephitidae (skunks)

General Note: There are several molecular phylogenetic papers that suggest skunks are sister to the procyonids. This has led to their elevation as a distinct family.

Diagnosis: Cheek teeth tuberculo-sectorial (partially modified for omnivorous diet). Scent glands prominent; legs usually short in relation to body; plantigrade.

Habits: Rather omnivorous; mostly solitary; delayed implantation.

Representative Genera: *Conepatus*, *Mephitis*, *Spilogale*

Material in Lab: *Mephitis mephitis* (striped skunk)
 Spilogale gracilis (western spotted skunk)

Family Otariidae (sea lions, eared seals, fur seals)

Diagnosis: Aquatic; fusiform; teeth nearly homodont; hind limbs capable of being placed under body for support and movement on land; small ears; post-orbital process present; four lower incisors; usually 20-24 postcanine teeth.

Habits: assemble in large herds in during breeding season, when males guard harems; mostly pelagic; migrate seasonally; forelimbs used in swimming.

Range: Coastlines of Pacific, South Atlantic, and Indian Oceans

Representative Genera: *Phocarctos*, *Otaria*, *Zalophus*, *Callorhinus*

Material in Lab: ***Zalophus*** (sea lion)*

*Not an Idaho species

Family Phocidae (Seals)

Diagnosis: Aquatic; fusiform; teeth nearly homodont; hind limbs extend straight back, cannot be rotated forward under body; external ears absent; post-orbital process rudimentary or absent; usually 16 -20 post-canine teeth in all.

Habits: Vary from solitary to highly gregarious; mostly monogamous; mainly use hind limbs and dorso-ventral flexion for swimming; primarily piscivorous; some are migratory.

Range: Along most coastlines north of 30° north and south of 50° south.

Representative Genera: *Monachus*, *Mirounga*, *Phoca*, *Halichoerus*, *Lobodon*.

Material in Lab: ***Phoca vitulina*** (harbor seal)*

*Not an Idaho species

Family Odobenidae (Walrus)

Diagnosis: Aquatic; fusiform; upper canines form long tusks; lower canines absent; cheek teeth simple and peg like.

Habits: Inhabit shallow waters, rocky shores and ice floes; feed on mollusks and other invertebrates, probably using tusks to dislodge prey; polygynous.

Range; Arctic regions of Atlantic and Pacific Oceans.

Single species: ***Odobenus rosmarus*** (walrus)*

*Not and Idaho species.