VI. Eutherian Groups. We won’t go through the diversity here in as great detail as we did for Marsupials. We’ll leave a lot of details for the lab.

We’ll recognize 18 orders of placental mammals. For 150 years, the relationships among these are a classic problem in mammalogy. The reason for this is that in the Cretaceous, there was a rapid radiation. That is, the modern Eutherian orders evolved in a burst, which results in a phylogeny that looks more like a bush than a tree, with very short internal branches. Resolving these relationships has been a very active area of research, and a series of papers have been published in the last 15 or so years that have made enormous strides.

We’ll use the phylogeny shown here to structure our treatment of eutherian diversity.

Eutherian Phylogenetic Relationships
(Madsen, 2001; Murphy et al., 2001a, b)

There is support for other resolutions of the deepest nodes (shown below) and controversy around the timing of radiation. Still, we can use this phylogeny as a working hypothesis.
Afrotheria is the name given to the first group. This group is one of the big surprises to emerge from these molecular phylogenies. It contains 6 orders, all but one of which has its first occurrence in Africa.

**O: Proboscidea** - elephants, now known only from Africa and Asia.

Formerly much more diverse and widespread.

**F. Elephantidae** 2 Genera, 3 species.

- Asiatic Elephant – *Elephas* (Small ears)
- African Elephants – *Loxodonta* (Large ears)

*Back-to-front tooth replacement rather than from underneath.

**O: Sirenia** - sea cows, Caribbean and Indian Oceans, also Amazonia. 2 families

These are thought to be the source of the mermaid myths.

Hind limbs are reduced to vestigial organs.
Sister group to elephants, and share back-to-front tooth replacement (more teeth than elephants; 30 vs 6).

F: Trichechidae: Trichechus - manatee

O: Hyracoidea - hyraxes - single family with six species.

F: Procaviidae: Procavia - Feet have unique friction pads. Live in clans (family groups).

Herbivorous, rock hyraxes and tree hyraxes.

O: Macroscelidea - elephant shrews - Central and southern Africa.

F: Macroscelididae - 4 Genera and 13 species.

They’re cursorial, & get their name from large limbs. This has implications for reproductive biology.

Macroscelides

A new species was discovered a few years ago and media attention illustrates one reason I don’t use common names.

O: Tubulidentata - aardvark (monotypic)

F: Orycteropidae - Orycteropus

Myrmecophagous & has the adaptations: long tongue, slender dentary, etc.

Unique tooth pattern: haxagonal prisms.

O: Afrosoricida (a.k.a. Tenrecoidea) – tenrecs and golden moles

These two families were traditionally lumped into the order Insectivora. However, lots of molecular data support their sister group relationship with each other and their inclusion in Afrotheria.

F. Tenrecidae – tenrecs - 10 genera, 24 species

Madagascar and adjacent east-central Africa

The genus Echinops, which we’ll see in lab (hair modified as spines). The genus Tenrec, which doesn’t have hair modified into spines
The next group is a South American group, containing a single order we saw in lab last week.

**O: Xenarthra** (Pilosa plus Cingulata) - sloths, anteaters, and armadillos. 4 families 29 species.

South American - formerly very diverse. One group has invaded N. Am.

Are characterized by an additional articulation between successive vertebrae, formed by the **xenarthrous process**, a structure unique to this order.

It’s possible that these represent the sister-group to the rest of the placental mammals.

**F: Myrmecophagidae** - anteaters 3 Genera and 4 Species all S. American

All are myrmecophagous
- extremely long snout
- thin delicale dentary
- long protrusible tongue (supported by large hyoid)
- sticky copious saliva
- teeth are absent
- forelimbs are modified for digging

*Myrmecophaga* and we saw *Tamandua* in lab.

**F: Bradypodidae** - 3-toed sloths. Single genus, 4 species.

*Bradypus* – three-toed sloth.

These are arboreal foliavores, so they have adaptations for eating low quality food (like *Phascolarctos*).

They also have 8-9 cervical vertebrae.

The next major clade is called **Boreoeutheria**, and it contains groups with apparent origins in the northern hemisphere. Boreoeutheria has two groups of orders:

**Euarchontoglires**

**O: Rodentia.** Rodents are worldwide, 29 families split into 5 suborders. 2030 species - **44% of all mammals**.

All have ever-growing, chisel-like incisors, a large diastema, and grinding cheek teeth.

The suborders are (largely) diagnosable by a combination of jaw morphologies and zygomasseteric conditions.
Sciurognathous vs. Hystricognathus.

Protrogomorphous vs. Sciuromorphous vs. Hystricomorphous vs. Myomorphous

**SO: Hystricomorpha** - Primarily South American and African

**F: Erethizontidae** - New World porcupines

*Erethizon* is the only hystricognath that’s native to North America.

*Coendu* - Prehensile-tailed porcupine - primarily eat bark, very arboreal

**F: Hydrochaeridae** - capybaras - Single species

*Hydrochaeris* - Largest rodent - Stands almost 2 feet high

**F: Bathyergidae** - mole rats - 5 G, 8 S All subSaharan Africa

Trend in the family towards increasingly complex social behavior.

*Heterocephalus* - Naked mole rat, the only eusocial mammal.

Only member of the family that’s naked.

**SO: Sciuromorpha** - world wide.

**F: Sciuridae** - squirrels 50 Genera, 276 Species

Worldwide, except Australia

*Urocitellus beldingi* – We’ll talk about the social system in this species.

*Sciurus niger* – Eastern fox squirrel.

**SO: Castorimorpha** – North/Central America and Eurasia.

**F: Heteromyidae** - pocket mice and kangaroo rats and mice - 5 Genera, 59 Species (external, fur-lined cheek couches).

Primarily North American, just get into South America

The family exhibits two trends:
- Progressively desert-adapted forms.
- Progressively saltatorial forms.
Microdipodops - kangaroo mouse

- Enlarged auditory bullae
- Extreme renal physiology
- May never actually have to consume water

**F: Geomyidae** - pocket gophers 5 Genera, 35 Species

- Primarily North American

**Thomomys talpoides** - northern pocket gopher

- Extremely fossorial
- Fusiform body
- Small eyes and pinnae
- Velvety fur
- Short tactorial tail
- Claws modified for digging – front limb later.
- Procumbent incisors - protrude from mouth when it’s closed.

**SO: Myomorpha** – Worldwide

**F: Muridae** - rats and mice, including *Mus* and *Rattus*

**F: Cricetidae** – hamsters, voles, New World rats and mice

- SF: Neotominae - New World rats and mice
  *Reithrodontomys megalotis* - western harvest mouse

- SF: Arvicolinea - voles and lemmings (semi-fossorial, dramatic population fluctuations)
  *Microtus longicaudus* - long-tailed vole

**O: Lagomorpha** – rabbits, hares & pikas - 2 families 80 species

- All have chisel-like upper and lower first incisors, and small peg-like second upper incisors, have a diastema (are herbivorous).

- The sister-group to rodents – Glires (Rodentia + Lagomorpha)

**F: Leporidae** - rabbits and hares - 11 Genera, 54 Species North America and Eurasia

- Highly Cursorial, including fenestrated rostrum

  *Lepus townsendii* - white-tailed jackrabbit.
**O: Primates** - 13 families 233 species. The order is world-wide, & probably evolved from arboreal ancestors.

Two Suborders:

**SO: Strepsirhini** - Often referred to as Prosimians. Diagnosed by dental comb.

**F: Lemuridae** - lemurs - 4 Genera, 5 Species Restricted to Madagascar

Representative form is the genus *Lemur*

**SO: Haplorhini** - Often referred to as Anthropoids.

**F: Callithricidae** - tamarins and marmosets - 4 Genera, 26 Species

Entirely neotropical and omnivorous *Leontopithecus*

**F: Hominidae** - great apes, 4 Genera, 5 Species

Worldwide and omnivorous

*Pongo, Pan, Gorilla, and Homo*

**O: Dermoptera** - gliding lemur or colugo 2 species

**F: Cynocephalidae** - Phillipines and S.E. Asia

Have a gliding membrane that extends between wrist and ankles.

Have comb-like lower incisors use for grooming.

*Cynocephalus*

**O: Scandentia** - tree shrews. Are not shrews, but there’s been a lot of uncertainty regarding relationships.

**F: Tupaidae** – Asian squirrel like organisms 5 genera and 19 species.

*Tupaia* – There seems to be evidence of a mutualism between these and pitcher plants.


https://www.youtube.com/watch?v=TwL7K_loRjM
Laurasiatheria - 6 Orders

O: Insectivora (a.k.a., Eulipotyphla, Soricomorpha) - Worldwide except Australia. Lots of groups used to be lumped in here. Some authors use the name Eulipotyphla to differentiate the new concept of this order.

Almost 400 species – 9% of all mammals


Shrews use echolocation to gain information about surroundings.

Includes a common form *Blarina brevicauda* that has venomous saliva that it uses to kill larger animals; *Microtus* may comprise 90% of its winter diet.

*Sorex palustris* - water shrew.

O: Chiroptera. Bats are worldwide, 17 families, also split in to two suborders. 925 species. 20% of mammals

All have powered flight. And the flight membrane is supported by the hand (hence name). This character evolved only a single time.

Bats have a keeled sternum like birds, but it’s not nearly as extensive as birds.

Megachiropterans are large bats that evolved from within the microbats.

F: Pteropodidae - Flying foxes - primarily frugivorous.

They rely on vision; only one genus echolocates. We’ll see a skeleton in lab.

*Rousettus* (the echo-locating form).

Microchiropterans - Echo-locating or microbats are not monophyletic. These are worldwide, and there are 16 families. We’ll mention two.

F: Phyllostomidae – New World leaf-nosed bats 49 Genera, 143 Species

Neotropics

Spectacular diversity in feeding habits
- sanguinivorous forms *Desmodus rotundus*
- Nectarivorous forms *Choeronycteris*
- frugivorous forms *Artebias jamaicensis* & *Centrurio*
- Piscivorous, and frog-eating (*Trachops*;
F: Vespertilionidae - Vespertilionids - 42 Genera, 318 Species worldwide

All are primarily insectivorous. All our local bats are vespertilionids.

*Euderma maculatum* - spotted bat. Solitary, cliff-roosting bat, Idaho species, not represented in our collection.

O: Carnivora - Majority are meat eaters, although there are herbivorous forms

There are 11 families, including the familiar canids and felids, but the order also includes the old order Pinnepedia - seals, walrus and sea lions.

F: Phocidae - seals - 10 Genera, 19 species - Aquatic –

Here represented by elephant seal *Mirounga*. We’ll talk about at the end of the semester.

Terrestrial forms are characterized by carnassial teeth that are adapted for shearing meat. 4th upper premolar - 1st lower molar.

F: Procyonidae - racoons and their kin. 6 G & 10 S All in the New World.

- ringtail – *Bassariscus*
- racoon - *Procyon*


F: Manidae - *Manis*

These are likely the sister group to Carnivora.

Scales - These are composed of keratin. If you look at them, you can see the individual fibers that comprise the scales.

Young cling to base of mother’s tail.

Myrmecophagous - have the adaptations that typically associate with that.

O: Cetartiodactyla - even-toed ungulates & whales. 20 families 298 species.
Characteristics of 11 terrestrial families:
- 3rd & 4th digits are modified. Metapodials are elongate and fused into a cannon bone
- The ungula (nail homologue) is modified into hoof.
- Primarily herbivorous, but there are omnivorous forms.
- In many families, the stomach is multi-chambered

**F: Suidae** - hogs - 5 Genera, 16 species - Native distribution is Eurasia and Africa

Omnivorous and include the domestic hog *Sus*, with only slightly modified stomachs (2-chambers).

warthog *Phacochoerus*

Tusks are modified canines – used in male-male combat.

**F: Giraffidae** - 2 Genera and 2-6 species *Giraffa*

Ruminants, with 4-chambered stomachs.
unique horns - parietal bones

A paper published last summer recommends recognition of 4 species of *Giraffa* (Fennessy et al. 2016. Curr. Biol.) as if it's a new idea, but an older paper (Brown et al. 2007. BMC Biol.) had already suggest this.

Characteristics of fully marine forms
- Fusiform bodies
- Forelimb modified into fins
- Hind limbs lost (pelvic girdle vestige remains)

Whales actually appear to be sister group to Hippopotamidae.

There are phenomenal fossil intermediates from the terrestrial ancestors of whales; we’ll address these during locomotion lectures.

Mysticete (baleen) whales - Named for baleen, keratinized plates used in filter feeding

**F: Balaenopteridae** – rorquals. 2 Genera and 6 Species *Megaptera*

Odontocete (toothed) whales - toothed whales - may be paraphyletic

**F: Delphinidae** - dolphins. 17 Genera and 32 species. *Orcinus*
O: Perissodactyla - odd-toed ungulates: 3 families 18 species

Formerly more diverse and wide spread.
3rd digit is expanded and typically have a single hoof - Lateral digits reduced
Herbivorous - have diastema.

F: Rhinocerotidae - 4 Genera, 5 Species - Keratinized horn

*Ceratotherium* - white rhino

F: Equidae - 1 Genus 9 Species - Natural distribution includes only East Africa and Asia, although much equid evolution occurred in North America.

*Equus grevyi* - Grevy’s zebra - Narrow stripes that extend to hooves.