

Mammalogy Lecture 4A – Metatherian Diversity

I. Therians. Remember that metatherians and eutherians (i.e., marsupial and placental mammals) form a clade.

II. Metatherians – Marsupials are a monophyletic group.

Older classifications treat Metatherians as a single order (Marsupiala); most folks now recognize 7 orders. The common name is derived from the well-known pouch, or **marsupium**, but only about half the species have one.

Skeletal features that we'll see today in lab include:

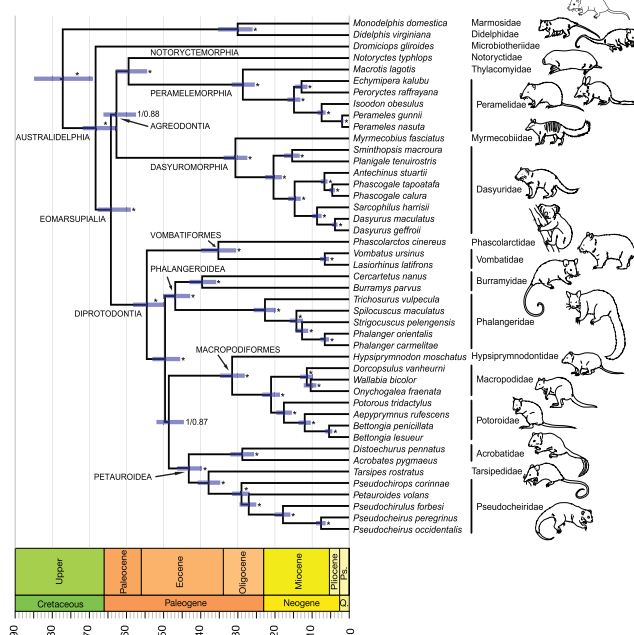
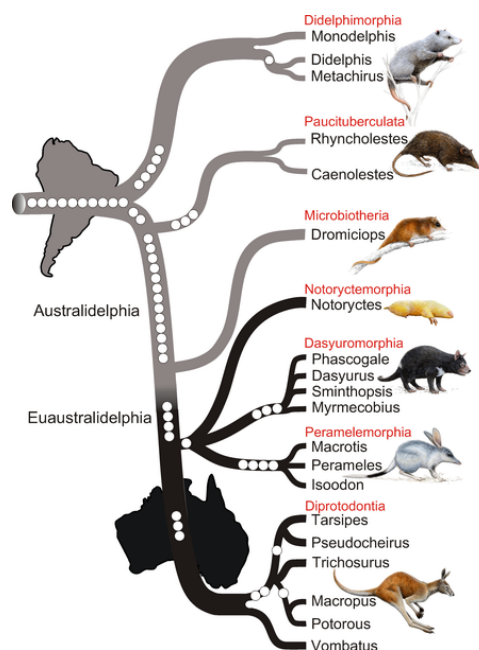
The angular process of the mandible is medially in marsupials.

The zygomatic process of the jugal extends posteriorly to the mandibular fossa.

Marsupials probably evolved in eastern Asia early in the Cretaceous (~125 MYA), spread to N. America, dispersed to S. America where they diversified, across Antarctica, and into Australia, and went extinct in N. America, and later (3 MYA) reinvaded N. America.

This classic hypothesis is supported by phylogenies of extant taxa (below) but has been challenged by phylogenies with fossil taxa included (e.g., Beck 2012. *Naturwissenschaften* 99:715–729). They differ primarily in the placement of *Dromiciops*.

The issue is whether there was a single dispersal into Australia, which implies monophyly of the Australian groups.



Emerging molecular phylogenies support classic hypothesis rather strongly (for extant forms).

We'll use the recent phylogeny of Nilsson et al. (2010; on the left above) to structure our discussion

<http://www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.1000436>.

It's also congruent with a more recent genome-wide phylogeny (Duchene et al. 2018; on the right above).

Currently, we recognize three extant South American groups, and four Australian groups.

A. South American Groups: Three orders that *are not a clade*.

1. O: Didelphimorphia - New World Opossums. Primarily South American – a few genera have reinvaded North America (including Mexico).

These are the sister group to all other living marsupials.

Single Family F: Didelphidae 19 G, ~100 S

Tribosphenic molars → Omnivorous

Hallux, or big toe is opposable

5 upper incisors, 4 lower incisors.

Didelphis - American opossum. There is a record from Idaho, but IF&G does not consider this to be an Idaho mammal.

Marmosa - mouse opossum.

Northern Mexico through southern S. America.

These have a prehensile tail.

They lack a marsupium, but young attach securely to nipples.

Monodelphis is the short-tailed opossum; there's a fragmented skull in lab.

2. O: Paucituberculata - shrew opossums

F: Caenolestidae, with 3 G and 6 S.

Have a very enlarged medial pair of lower incisors and several smaller pairs

Caenolestes - occur in high elevation Andean forests near tree line.

3. O: Microbiotheria - Single family, genus, and three species (two were discovered in 2016).

F: Microbiotheriidae – *Dromiciops*. Common name is Montio del Monte.

Nocturnal, arboreal, and omnivorous, and occupy mid-elevation southern beech forests.

The phylogenetic position of this species has seen lots of interest because their placement bears on the biogeography we discussed. It's becoming well-established that they are the sister group to the living Australian forms.

B. Australian Groups - Four Orders, and these are supported as a clade in recent phylogenies.

1. O: Notoryctemorphia - marsupial moles

F: Notoryctidae - *Notoryctes*. 2 Species - rare animals that occur in deserts of NW and SC

Australia. One species is only known from ~20 specimens.

Eutherian moles (talpids, cover in Lab 2) don't occur in deserts.

Nose has a cornified shield.

Our first example of a **fossorial** mammal - adapted for burrowing

Small eyes (vestigial in *Notoryctes*, and lacking optic nerve) and small pinnae

Fur is velvety – doesn't lie in one direction

Fusiform body with a short tail, which is often tactile

Forelimbs modified for digging

Claws on 3rd & 4th digit are enlarged and the others are reduced.

While they are fossorial, the burrows are not deep, only a few cm below sand, the burrows are ephemeral (not long lasting), and the animals move over surface frequently.

2. O: Dasyuromorphia - Three recent families 17 Genera, 63 species

F: Dasyuridae - marsupial mice, rats, and cats. 15 Genera, 61 species

4/3 incisors

triboshenic molars

Sarcophilus - Tasmanian devil --- Nocturnal scavengers now present only in Tasmania.

Antechinus – 15 species that share a pretty unique (among mammals) mating system.

F: Thylacinidae - Tasmanian wolf - monotypic

Thylacinus cynocephalus - extinct

Last specimen was taken in 1930 - last known was a zoo animal that died in 1933. In 1960 there was a track reported in western Tasmania. There continue to be unverified sightings, but in all likelihood, these are extinct.

There are attempts to de-extinct it using gene-editing approaches.

F: Myrmecobiidae – Numbat or Banded-anteater - Monotypic

Myrmecobius - Diurnal, and **myrmecophagous** (eats ants)

- Marsupium is absent
- Found in eucalyptus woodlands in SW Australia.

Myrmecophagous adaptations

- long rostrum
- delicate dentary
- reduced or absent teeth
- tongue is long and extendible
- saliva glands produce viscous, sticky saliva
- front limbs modified for digging

3. O: Peramelemorphia - bandicoots – one or two families, depending on classification.

Tribosphenic molars, forelimb is shorter than hind limb.

F: Peramelidae - widespread in Australia. 4 or 5 Genera and 21 species.

- 2nd & 3rd digits are syndactylous. That is, they have a single sheath of skin.
- Have a eutheria-like placenta - independently evolved.
- *Macrotis* - Rabbit-eared bandicoot, or bilby.

4. O: Diprotodontia - Diprotodont marsupials - Two front teeth

10 Families in the order, we'll mention a few of these families.

There is a single pair of lower incisors; the medial pair of upper incisors is enlarged and when 2nd or 3rd pair is present, they are usually reduced.

All forms have some type of syndactyly - the bones of two or more digits enclosed in a single sheath of skin.

F: Phalangeridae - Phalangiers -- 6 Genera, 18 species.

Found in forests of Australia and New Guinea.

Adapted for arboreal life, with a prehensile tail that has a naked ventral surface.

Well-developed marsupium, and some serve as an important food source for indigenous people of Australia.

Trichosurus – brush-tailed possum

F: Petauridae -- Gliders 3 Genera, 10 species

Found in Northern Australia and New Guinea.

Petaurus breviceps - Sugar glider.

Many ways these are convergent with flying squirrels; They have rectangular gliding membrane between ankles and wrists and can glide up to 50 M.

However, they are nectarivores and important pollinators.

Feet have an opposable hallux.

F: Phascolarctidae - Koala -- monotypic

Phascolarctus - restricted to eucalyptus, feed on only 12 species.
Typically have a strong eucalyptus order

- Endangered and fully protected
- 1st and 2nd digits are opposable in the hand
- foot, 2nd and 3rd digits are syndactylous
- Our first example of an **arboreal foliivore**
 - low quality food
 - eat almost constantly while awake
 - sleep to digest
 - low metabolism
 - heterothermic
 - dense fur to retain body heat

F: Vombatidae – wombats - 2 Genera, 3 species

These are herbivorous, with chisel-like incisors and a diastema.

They construct burrows, which are clustered into colonies that can be seen from satellites.

Though colonial, they are solitary, in that each individual has its own burrow and they don't interact much except during mating season.

Lasiorhinus - Hairy-nosed wombat

F: Macropodidae - Kangaroos and Wallabies - 11 Genera/53 species

Widespread in Australia, New Guinea and Indonesian Islands.

All grazers and/or browsers

Multi-chambered stomachs that function in a somewhat manner similar to those of deer and cattle, as fermentation chambers.

All are saltatorial, that is, adapted for bipedal hopping.

Syndactylous, with 2nd & 3rd digits reduced and sheathed together.

4th digit is very enlarged and strong.

Tail is very thick at the base and used for balance.

There are typical plains grazers *Macropus rufus* Red kangaroo.

these get up to 90 kg

very gregarious - mobs of 200 common, may reach 1500

There are arboreal forms -- *Dendrolagus* -- tree kangaroos - NE Australia, New Guinea, and Indonesia.

incredibly agile

leap from ground up into trees

leap down from as high as 18M

tail is not prehensile but is used extensively as a brace.

There are rock dwelling forms in the genus *Petrogale* --- Three rock wallabies were brought to a private zoo in 1916. The breeding pair escaped and established a population that still persists and includes around 50-100 individuals.