

12B • Mammals

Class Mammalia

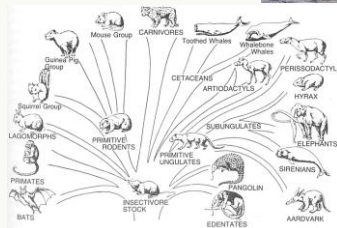


Structure, natural history, and mammal orders

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What makes a mammal a mammal?

1. Hair is present at least during part of the life cycle.
2. Females produce milk from mammary glands.
3. Mammals are endothermic vertebrates.
4. They have a four-chambered heart and
5. Breathe with lungs.
6. Most bear live young; (monotremes lay eggs)



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Natural history: many ways to live

Mammals live on land, underground, in trees, and in water.

Bats use powered flight; some other mammals glide.

Body shape, limbs, senses, and insulation fit different environments.

Daily activity may be nocturnal, diurnal, or crepuscular - concentrated near dawn and dusk.



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Natural history: food and energy

Herbivores eat plant material; carnivores eat animals.

Omnivores use both plant and animal foods.

Small mammals often need frequent meals.

Fur and fat help reduce heat loss.

Some mammals use torpor or hibernation to conserve energy.



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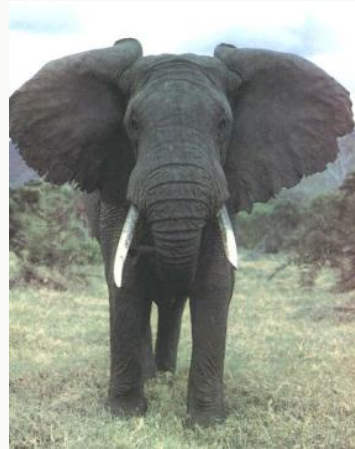
Natural history: behavior and ecosystems

Mammals communicate through scent, sounds, touch, and displays.

Some live mainly alone; others form herds, colonies, or family groups.

Parental care helps young survive and learn.

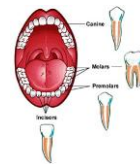
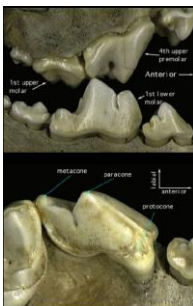
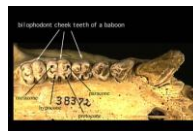
Mammals can be predators, prey, pollinators, seed dispersers, and habitat builders.



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Teeth modified – multi functional

- Incisors – used to slice
- Canine – used to tear
- Premolars & molars used to grind
- Carnivores have a pair of carnassial teeth – used for cutting and breaking



Not all mammals have every tooth type—or any teeth as adults.

Three major reproductive groups & modern taxonomy

Modern taxonomy is driven by molecular phylogenetics (DNA sequence data) and result in some strange genetic “relatives” – ie whales and antelope are in the same order!

Group	Development	Examples
Monotremata	Lay eggs; feed hatchlings milk	Platypus, echidnas
Marsupials (pouched)	Young born very undeveloped; prolonged nursing	Opossums, kangaroos, koalas, bandicoots, Tasmanian devil
Placental mammals	Longer development in uterus with placental support	Rodents, elephants, humans

Modern taxonomists have settled on 29 mammalian orders rooted in phylogenetic systematics and traditional morphological classifications often failed this test because they were based on shared primitive visual traits.

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Egg Laying Mammals

- **Monotremata: Duck-Billed Platypus & Echidna**
- “Monotreme” – means “one opening”
 - Refers to Avian & Reptilian characteristic of the Cloaca – digestive, reproductive & excretory systems all “dump” into the cloaca.
 - Once eggs hatch, young are nursed w/ milk.
 - Living monotremes occur naturally in Australia and New Guinea.



These males have poisonous spur on their ankles



Pouched Mammals

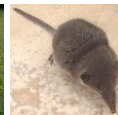
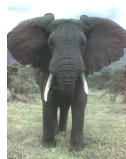
- Kangaroos, Koala, opossums, sugar gliders
- Bear live young – born @ very early stage of development
- Grow & mature for 9 months in mother's pouch (kangaroo)
- New born kangaroo baby (far right) is less than 1" long!!

Young continue early development attached to a teat, often inside a pouch.



Placental Mammals

- All other orders of mammals includes:
 - Rodents, shrews, elephants, dogs, cats & whales
 - Placenta – reproductive organ connects embryos w/ mother's uterus.
 - Allows exchange of O_2 , CO_2 , nutrients and wastes between mother & offspring
 - Allows for longer protected embryonic development – up to two years for elephants!



Placental Mammals

The placenta exchanges nutrients, gases, and wastes between mother and fetus.

- Longer gestation periods allow for better success at birth
 - Precocial – mature well developed young at birth – ready to run shortly after birth – wildebeest
 - Altricial – young unable to care or feed themselves at birth, undeveloped, eyes closed etc. – puppy dogs



Precocial young



Moments after birth



Altricial young



Small mammals: three distinct orders

Order	Examples	Useful recognition clues
Eulipotyphla	Moles, shrews, hedgehogs	Many eat invertebrates
Rodentia	Rats, beavers, porcupines, squirrels	One upper pair of gnawing incisors
Lagomorpha	Rabbits, hares	Two upper pairs of incisors

Chiroptera • bats

Bats have skin membranes stretched over elongated fingers.

They are the only mammals with sustained powered flight.

Many use echolocation to navigate and find food.

Depending on species, bats eat insects, fruit, nectar, or other foods.



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The former “Edentata” group

Modern order	Examples	Natural history clues
Pilosa	Anteaters and sloths	Anteaters eat social insects; sloths eat plants
Cingulata	Armadillos	Bony armor; many dig for food

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Elephants and hoofed mammals

Order	Examples	Useful recognition clues
Proboscidea	African and Asian elephants	Muscular trunk; enlarged incisors form tusks
Perissodactyla	Horses, tapirs, rhinoceroses	Weight centered on the third toe
Artiodactyla	Pigs, deer, cattle, sheep, camels	Land forms bear weight mainly on two central toes

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Whales belong within Artiodactyla

Cetacea remains a useful name for whales, dolphins, and porpoises.

These mammals breathe air through lungs and nurse their young.

Forelimbs form flippers; tail flukes drive swimming.

Baleen whales filter food; toothed whales capture prey.



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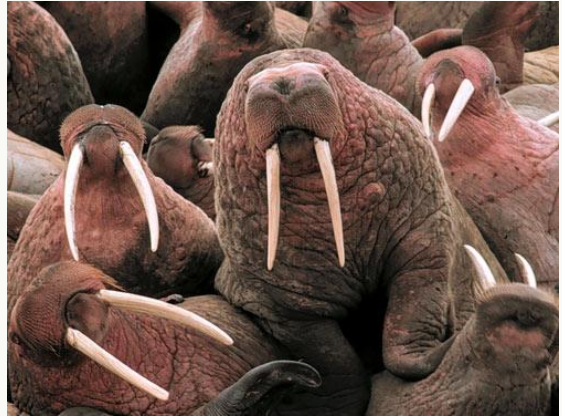
Carnivora includes the pinnipeds

Land examples: bears, dogs, cats, and skunks.

Pinnipeds: seals, sea lions, and walrus.

Pinnipeds feed at sea but return to land or ice for important life activities.

Carnivora is an order name; some members eat many plant foods.



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Sirenia • aquatic plant eaters

Examples: manatees and dugongs.

They graze on aquatic vegetation.

Paddle-like forelimbs help steer; the tail supplies thrust.

They surface to breathe air.

Their resemblance to whales reflects an aquatic way of life.



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Primates • grasping and learning

Examples: humans, apes, monkeys, and marmosets.

Most have grasping hands and forward-facing eyes.

Many use flexible limbs to move through trees.

Learning and social behavior are important in many species.

Marmosets are monkeys; humans are apes.



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12B review: classify and explain

Which mammal traits are shared by a bat and a whale?

How do monotreme, marsupial, and placental development differ?

Why is a rabbit not a rodent?

Where do pinnipeds and cetaceans fit in this classification?

Choose an order and explain one adaptation of an animal in it.

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Sources and teaching materials

Original lesson: life_pps_26(2).pps and life_ws_26.pdf.

Order selection: “Mammalian Orders Need to Know” in life_insect_mammal.pdf.

Modern classification: ASM Mammal Diversity Database.

Mammal development and monotremes: Australian Museum and OpenStax Biology 2e.

Specific references and teaching notes appear in slide notes.