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THE SUBUNGULATES

*Order Proboscidea**Order Hyracoidea**Order Sirenia*

Based upon external appearance, habitat, diet, and nearly every other easily discernible feature, the elephants, hyraxes, and sirenians would have to be regarded as one of the most unlikely assemblages of mammals possible. However, fossil evidence has indicated that these three share a common ancestor in the early Cenozoic of

Africa (Carroll 1988; Romer 1966), and these three, together with two completely extinct orders, have been frequently grouped as the subungulates. The extant species are today mere remnants of what were once very diverse and abundant groups.

ORDER PROBOSCIDEA

The ordinal name, Proboscidea, refers to an elephant's most conspicuous structure—its long prehensile proboscis or trunk. This trunk and other unique external features of elephants are distinctive and well-known (Fig. 25.1).

The two extant species of elephants are the largest living land animals. The African elephant, *Loxodonta africana*, is the larger of the two, with large males measuring up to 4 meters at the shoulder and weighing over 7,000 kg (Grzimek 1975). The Asiatic elephant, *Elephas maximus*, is somewhat smaller, rarely reaching 3 meters at the shoulder and weighing up to 5,000 kg (Altevogt and Kurt 1975). The African elephant has much larger ears, a flatter forehead, and a somewhat concave profile of the back (Fig. 25.1), whereas the Asiatic elephant has smaller ears, a more domed forehead, and a convex dorsal profile.

Elephants are browsing mammals that usually live in herds. The Asiatic elephant has been tamed for centuries and used as a beast of burden throughout its range in Asia. The African elephant has been tamed less frequently but was used by Hannibal from 218 to 202 BC (Douglas-Hamilton and Douglas-Hamilton 1975) and is still used in some parts of Africa (Grzimek 1975). Both species have been extensively hunted and, increasingly, poached for their ivory tusks and as trophies. They are endangered in parts of their range because of hunting,

illegal poaching, or habitat modification due to agriculture or lumbering.

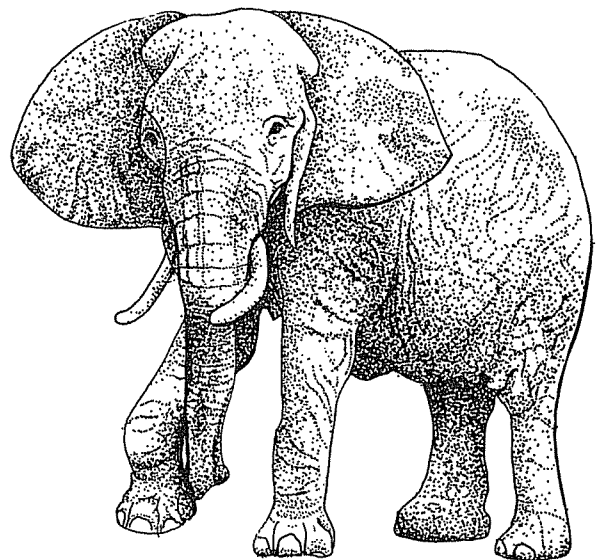
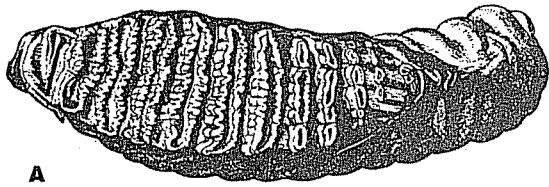
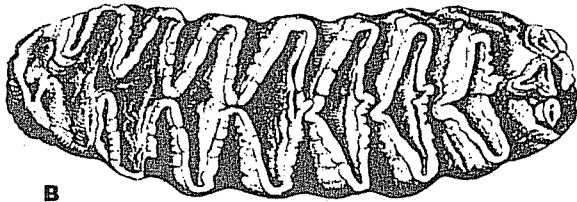


Figure 25.1 An African elephant, *Loxodonta africana*, Elephantidae.

(Michael Gilliland)



A



B

Figure 25.2 Cheek teeth of (A) the Asiatic elephant, *Elephas maximus*; and (B) the African elephant, *Loxodonta africana*, both Elephantidae.

(Flower and Lydekker 1891:424)

DISTINGUISHING CHARACTERS

The incisors, numbering 1/0, are long, ever-growing tusks of solid dentine. These tusks are frequently absent in female Indian elephants. Canines are absent. The cheek teeth, consisting of the second, third, and fourth deciduous premolars and the first, second, and third molars, are hypsodont and lophodont (Fig. 25.2). They are replaced from the back of the jaw, and worn teeth are shed from the front of each tooth row (see Fig. 3.2). Only one or parts of two cheek teeth in a jaw quadrant are functional at any one time (Altevogt 1975). The

limbs are graviportal with five digits on each foot. Each digit terminates in a hooflike structure. The upper lip and nose are fused and elongated to form a long, prehensile proboscis with the nostrils at the distal end. The skin is thick and covered with sparse, bristlelike hairs. The caecum is large. Testes are permanently internal, and a baculum is absent.

LIVING FAMILY OF PROBOSCIDEA

There is only a single living family of Proboscidea, **Elephantidae**, which contains two species (Wilson 1993). The African elephant, *Loxodonta africana*, occurs through the Ethiopian Region in sub-Saharan Africa, and in Roman times was found in the Atlas mountains of northern Africa (Grzimek 1975). The Asiatic elephant, *Elephas maximus*, ranged throughout most of the Oriental Region in recent times but is now confined to the continental portion of the Oriental, except for central India, and is found on the islands of Sri Lanka, Sumatra, and Borneo (Altevogt and Kurt 1975). Both species have been eliminated from large areas of their ranges because of human competition for the land and due to hunting and poaching.

COMMENTS AND SUGGESTIONS ON IDENTIFICATION

Both externally and cranially, proboscideans are distinctive and, once seen, are impossible to confuse with any other mammals.

ORDER HYRACOIDEA

The hyraxes are a group of mammals unknown to most people in the areas of the world where they do not exist. Hyraxes (also known as “dassies,” and referred to in the King James Bible as “conies”) are rabbit-sized animals that look rather like rodents (Fig. 25.3). These herbivorous mammals have a unique foot structure (description follows) that provides a firm grip on the rocks and trees in which they live. The terrestrial forms, in the genera *Heterohyrax* and *Procavia*, live in colonies of six to 50 individuals in areas of jumbled boulders and rock outcrops. The arboreal species, in the genus *Dendrohyrax*, have none of the limb modifications usually associated with arboreal mammals (e.g., opposable digits, sharp claws) but have great agility and remarkably adhesive pads on the feet.

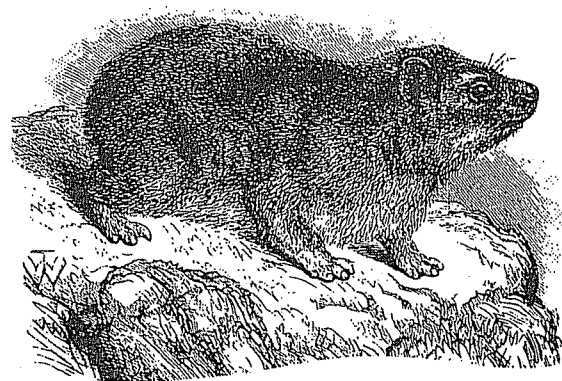


Figure 25.3 A rock hyrax, *Procavia capensis*, Procaviidae.
(Flower and Lydekker 1891)

DISTINGUISHING CHARACTERS

The adult dental formula is $1/2 \ 0/0 \ 4/4 \ 3/3 = 34$. The long, ever-growing, upper incisors are triangular in cross section and have pointed tips (Fig. 25.4), whereas the lower incisors are chisel-shaped and usually tricuspid. The cheek teeth are somewhat lophodont and are separated from the incisors by a wide diastema. The well-developed postorbital processes usually form post-orbital bars. The interparietal is well-developed. The large jugals contribute to the formation of the mandibular fossae.

Limbs are plantigrade. The four manual digits are syndactylous except for their terminal phalanges. The pes has three digits. All digits terminate in short, flat, hooflike nails, except the second pedal digit, which has a long, curved clawlike nail used for grooming (Rahm 1975c). The soles have large, soft, elastic pads that are kept moist by numerous glands. The tail is very short. The testes are internal, and a baculum has not been reported. The uterus is duplex.

LIVING FAMILY OF HYRACOIDEA

There is a single living family of Hyracoidea, **Procaviidae**, the hyraxes. This family includes three extant genera and six species (Schlitter 1993). Most species are confined to the Ethiopian Region in sub-

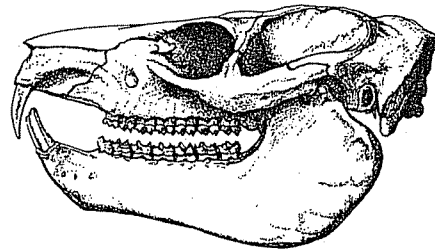


Figure 25.4 Skull of a tree hyrax, *Dendrohyrax dorsalis*, Procaviidae.
(Flower and Lydekker 1891)

Saharan Africa; however, *Procavia* extends into the Palearctic, up the Nile valley from the Ethiopian and into Arabia and the Levant.

COMMENTS AND SUGGESTIONS ON IDENTIFICATION

Hyraxes superficially resemble rodents or large pikas but are quickly identified by their unique foot structure. The skulls may also, at first glance, look like those of rodents. However, the triangular (in cross section) upper incisors and the presence of two lower incisors per side are diagnostic.

ORDER SIRENIA

Sirenians are fully aquatic mammals that lack external hindlimbs and have forelimbs modified to form flippers (Fig. 25.5). Unlike most cetaceans (the only other fully aquatic mammals), sirenians have a short but flexible neck. (The beluga, Cetacea, Monodontidae, has a similarly flexible neck.) The mammae are pectoral, and the female has been said (apparently incorrectly) to float on her back as she clasps her young to her breast to suckle. Some have speculated that the supposedly humanoid appearance of these ungainly animals as they supposedly floated and nursed their young caused sailors, who must have been long at sea, to originate the legends of mermaids. The ordinal name refers to the sirens, sea nymphs who, in Greek mythology, lured mariners to destruction. Columbus recorded seeing three "sirens" (manatees) in an inlet on the island of Hispaniola, and he noted that they were not nearly as beautiful as those described by Horace (Kurt and Wendt 1975).

Sirenians feed on aquatic vegetation, and, in some parts of their range, play an important role in keeping navigation channels free of excess vegetation (Kurt and

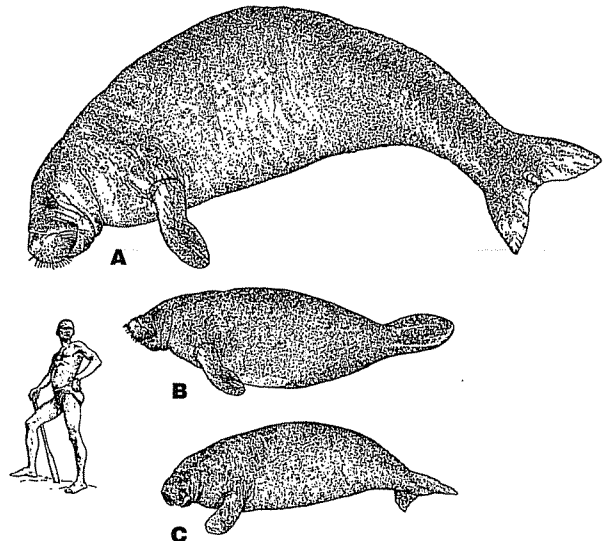


Figure 25.5 Representative sirenians: (A) the recently extinct Steller's sea cow, *Hydrodamalis gigas*, Dugongidae; (B) a manatee, *Trichechus* sp., Trichechidae, and (C) a dugong, *Dugong dugon*, Dugongidae. These are drawn to scale with each other and with the 6' tall person illustrated. (Feldhamer et al. 1999)

Wendt 1975). They are hunted for meat, hides, and oil in various parts of their range.

Living sirenians are tropical or subtropical, but one species, the large Steller's sea cow, *Hydrodamalis gigas* (Fig. 25.5A), lived in far northern waters. It was discovered around Bering Island and an adjacent island in the Bering Sea in 1742. For 27 years, this species served as a source of food, oil, and boat-building materials to mariners sailing or marooned in the area, but by 1766, the last of the original population of 1,500 to 2,000 was exterminated (Kurt and Wendt 1975). Steller's sea cow was a member of the family Dugongidae. It differed from living representatives of this family in completely lacking teeth and phalanges and in its much larger size (up to 8 meters long and 4,000 kg in weight) (Kurt and Wendt 1975). This extinct form is not included in the following description or key.

DISTINGUISHING CHARACTERS

The external nares are situated high on the skull posterior to the anterior margins of the orbits. The nasal bones are rudimentary or absent. Incisors are absent except in the dugong, which has I 1/0 (Fig. 25.6). Canines are absent. Cheek teeth in the Trichechidae are lost from the front and replaced from the rear as in Proboscidea. In the dugong, most cheek teeth are quickly worn away and may be replaced by horny plates in adults (Kurt and Wendt 1975).

The vestigial pelvic limbs are not visible externally. The pectoral limbs are paddlelike, with their five digits indistinguishable externally. The tail bears a horizontally flattened "fin" that may (Dugongidae, see Fig. 25.5A and C) or may not (Trichechidae, see Fig. 25.5B) be cleft. The dugong has the normal mammalian component of seven cervical vertebrae, but the species of Trichechidae have only six. (Deviation from the basic number of seven cervical vertebrae occurs among living mammals only in Trichechidae and in the two families of sloths in the order Xenarthra.) The ribs are extremely massive and serve as "ballast." Horizontal stability is

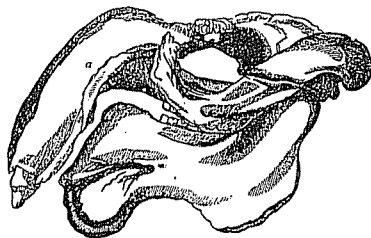


Figure 25.6 Skull of a dugong, *Dugong dugon*, Dugongidae. (Giebel 1859)

enhanced by elongated lungs and a horizontal diaphragm.

The nostrils are on the upper surface of the snout. Eyes are small, and pinnae are absent. The lips are large and highly mobile. Numerous stiff vibrissae are present on the upper lip, but the body is otherwise nearly naked. The uterus is bicornuate. Testes are permanently internal, and a baculum has not been reported.

LIVING FAMILIES OF SIRENIA

There are two living families. **Trichechidae**, the manatees, contains one genus and three species (Wilson 1993). They occur in the Western Hemisphere along the Atlantic coast from North Carolina to southern Brazil and throughout the West Indies. They are found in rivers in Florida and in the Amazon and Orinoco drainages of South America. In the Eastern Hemisphere, they range along the Atlantic coast of Africa from 10° N to 10° S, in Lake Tchad, and throughout the drainages of the Congo, Niger, and several other western and central African rivers (Jones and Johnson 1967; Kurt and Wendt 1975).

The **Dugongidae**, with one living species, *Dugong dugon*, occurs in the Red Sea and ranges throughout coastal waters of the Indian Ocean from Mozambique and Madagascar to northern Australia. It inhabits the Indonesian Region and extends east through the Solomons, north through the Philippines, and along the Chinese coast almost to Japan (Jones and Johnson 1967).

The second species of Dugongidae, *Hydrodamalis gigas*, which became extinct in recent times, was discussed in detail earlier.

The ranges given earlier are being greatly fragmented, and the various sirenian species now are found only in scattered portions of their former ranges.

KEY TO LIVING FAMILIES OF SIRENIA

- 1 Upper incisors present as short tusks in males (Fig. 25.6), unerupted in females; cheek teeth, if present, simple; tail cleft (Fig. 25.5C); upper lip only partly cleft **Dugongidae**
dugong, *Dugong dugon*
- 1' Incisors absent in adults (Fig. 25.7); cheek teeth with two cuspidate, transverse crests; tail spatulate (Fig. 25.5B); upper lip deeply cleft (Fig. 25.8) **Trichechidae**
manatees

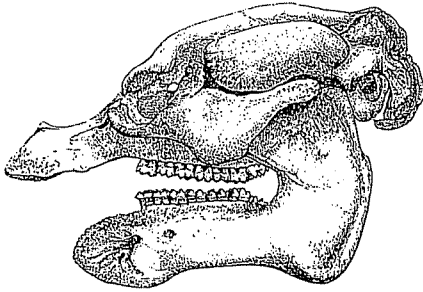


Figure 25.7 Skull of a West African manatee, *Trichechus senegalensis*, Trichechidae.

(Flower and Lydekker 1891)



Figure 25.8 Anterior view of a manatee, *Trichechus manatus*, Trichechidae, showing bilobed upper lip.

(Flower and Lydekker 1891)

COMMENTS AND SUGGESTIONS ON IDENTIFICATION

Both the external appearances and the skulls of sirenians are distinctive and not easily confused with those of any other mammals. Dental characters and the shapes of the skulls and tails serve to differentiate the two families.