



FAUNA *of* AUSTRALIA

58. EQUIDAE

C. P. GROVES

DEFINITION AND GENERAL DESCRIPTION

Members of the family Equidae are distinguished by their monodactyl extremities: there is only a single toe on each foot. Thin ‘splint bones’—remnants of the second and fourth metacarpals—lie alongside the proximal end of the third and only fully developed metacarpal.

HISTORY IN AUSTRALIA

Exactly when the Horse (*Equus caballus*) and the Donkey (*Equus asinus*) began to run wild in Australia is uncertain, but was probably around the very earliest days of European settlement. In the case of Horses, the first substantial influx was the importation, and later release, of the Timor Pony at the Port Essington settlement, Cobourg Peninsula, Northern Territory, in 1838–1849. Donkeys were used regularly in exploration, pastoral and mining enterprises, especially in the Northern Territory and the Kimberleys, and often ran wild.

MORPHOLOGY AND PHYSIOLOGY

Basic anatomical and physiological data are given in sources such as Bourdelle (1955).

External Characteristics

Horses and Donkeys range in build from gracile to fairly stocky. Horses vary more than Donkeys, but feral examples tend to be rather slender and rangy. The typical external features of the family are shown in Fig. 58.1. The mane in Donkeys is short and upright. In Horses it is longer and falls to one side (more markedly in the longer winter coat than in the shorter summer coat), and forwards as a forelock over the forehead. The humerus and femur are enclosed in the body wall. The ‘knee’ (actually the carpus) and ‘hock’ (tarsus) are less than halfway down the leg; the long ‘cannon bones’ are the metapodials. The hoof is broad and undivided, very broad and rounded with Horses and narrower and more solid in Donkeys. The hoof is broad and undivided, very broad and rounded with Horses and narrower and more solid in Donkeys.

Colours vary greatly. Horses may be white to black but are usually some shade of brown, often with darker shanks and lighter (‘mealy’) muzzle. Donkeys may be black or white, but most commonly are a fawn-grey with a black stripe down the spine and a thicker one crossing it at right angles over the withers. This shoulder-cross and a dorsal stripe is seen occasionally on Horses.

Body Wall

Hairs are short, fine (longer in winter), implanted singly and associated with copious sweat glands. Only mane and tail hairs are longer. The eyelashes are long, and bristles are present on the snout. The panniculus carnosus is very well developed.

Skeletal System

The vertebral formula is: seven cervical, 18 or 19 thoracic, 5–6 lumbar, 5–6 sacral and 15–20 caudal vertebrae. There is no clavicle. The skull is elongated preorbitally, but shortened postorbitally (Fig. 58.2). The orbit is ringed by bone and is tubular. The nasal passages are elongated and incompletely separated by the vomer. The turbinal bones—one maxillary and one ethmoid—are simple and

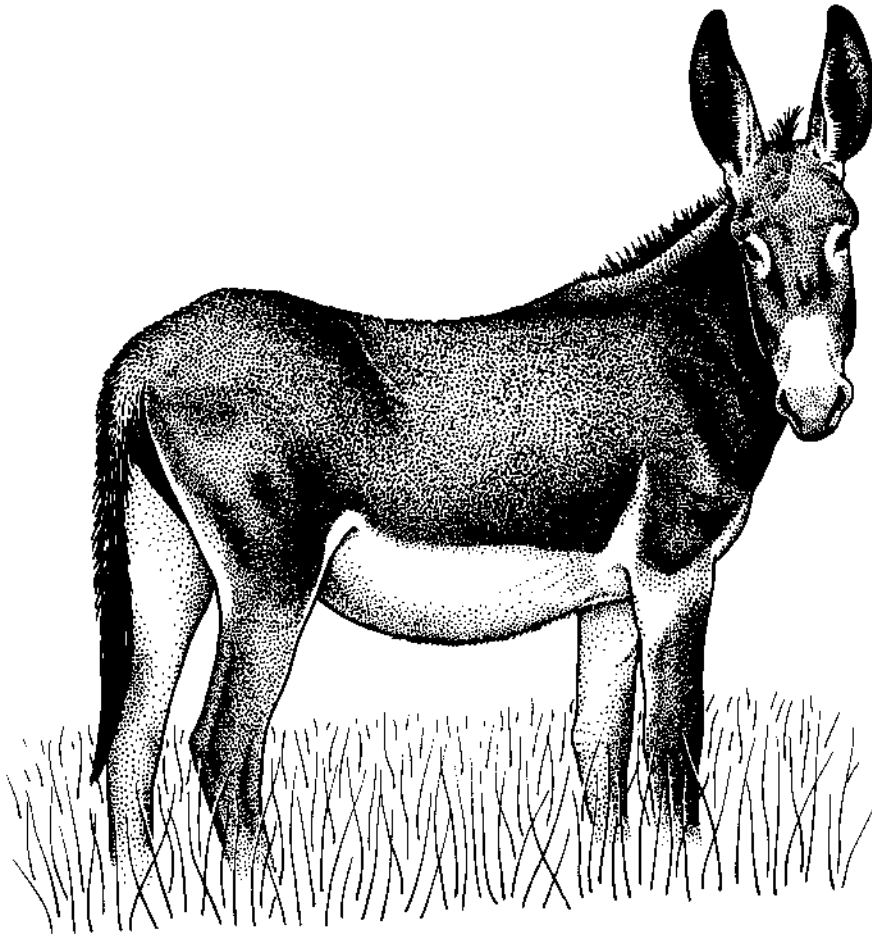


Figure 58.1. External features of the Donkey, a typical equid. The long face bears prominent mobile nostrils and lips. The snout is hairy, without a naked rhinarium. The prominent eyes are well-placed on the side of the head for all-round vision and the ears are conspicuous, mobile and pointed. The mane extends down the dorsal midline from between the ears to the withers. The spine is prominent between withers and sacrum. From the loins to the tail-root, the region called the croup or crupper, the profile slopes down at a 30–45° angle, straight and bony in the Donkey, more rounded (unless malnourished) in the Horse. The body bulges out to the sides below the spine. The tail of the Donkey is tufted; in Horses the tail is enclosed in long hair from the root. (© Environment Australia) [K. McInnes]

large. The nasal bones are long and taper anteriorly and their free ends do not reach as far forward as the incisors. The premaxillae are large, containing the incisors, with a long ascending branch that borders the anterior margin of the maxilla on either side of the nasal aperture and sutures with the nasal bone. The bilateral frontal, superior and inferior maxillary, sphenoidal and ethmoidal sinuses are large. The superior temporal lines are very prominent, but usually do not unite to form a sagittal crest. However, a very prominent nuchal crest is formed.

Locomotion

The whole axis of each limb runs through digit III (Fig. 58.3) – only the proximal ends of digits II and IV remain as splint bones and no trace remains of digits I and V. The femur has a third trochanter. The ulna is fused partially with the radius, the fibula partially fused with the tibia. The hoof is cylindrical, folded inwards behind, obliquely truncated at the base, with a separate keratinised sole

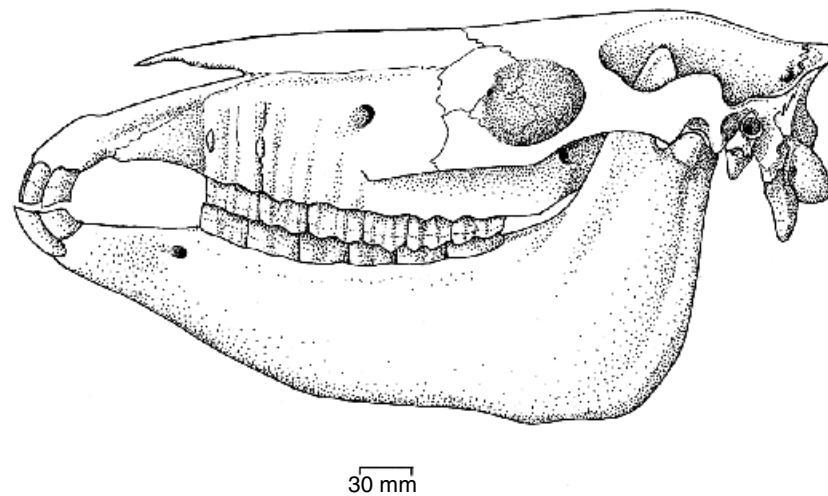


Figure 58.2 Skull of *Equus*. (© ABRS)

[S. Weidland]

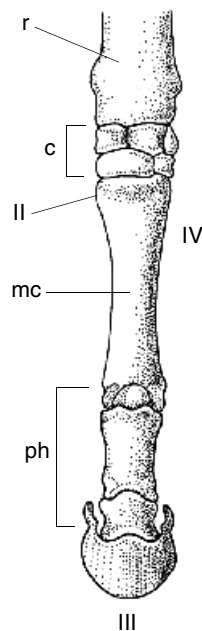


Figure 58.3 The bones of the left forefoot of *Equus*: c = carpus; mc = metacarpus; ph = phalanges; r = radius; II, III, IV represent the toes numbered in the normal series of I to V. (© ABRS)

[S. Weidland]

and ‘frog’ – the V-shaped, grooved structure fitting into a notch at the back of the sole. The hoof is attached to the underlying skeletal element—the broadly expanded terminal phalanx, or ‘coffin-bone’—by a keratogenic membrane. On the inner surface of the carpus (external ‘knee’ of the foreleg) are naked, keratinised areas called chestnuts, oval in shape. In the Horse, these also occur on the tarsus (hock). Similar, but more rudimentary, callouses called ergots are at the back of the metapodial-phalangeal joints (fetlocks). The scapula is prolonged dorsally by a cartilaginous plate to which the rhomboid and serratus magnus muscles are attached. This tension-resisting structure, aided by the absence of a clavicle, assists free movement of the scapula in locomotion and so increases speed.

Feeding and Digestive System

The formula for permanent dentition is I 3/3 C 0–1/0–1 PM 3–4/3 M 3/3 (permanent); the deciduous dentition lacks the molars. Each incisor is strongly curved, its open roots are implanted nearly horizontally in the jaws and its crown curve round to meet its opposing tooth edge-on. When erupted, each consists of a ring of enamel surrounding a hollow, the infundibulum or 'cup'. This is transversely oval in freshly erupted incisors, but with wear becomes smaller and more rounded, while wear of the enamel reveals dentine underneath. The occlusal surface of an incisor in mid-wear, therefore, has an enamel outer ring, a thick dentine ring, an inner enamel ring and the central infundibulum. At about 10 years of age the infundibulum disappears. In the lateral (third) incisors, the enamel generally is not closed behind the infundibulum.

Canines are present and triangular in shape in males, but are rudimentary or absent in females. Cheekteeth are hypsodont, selenodont and open-rooted for most of the animal's life. Their occlusal surfaces are complicated by enamel loops, forming a fossette in the middle of each of the selenes as well as a cusp (the protocone) on the lingual side of the tooth. Premolars and molars are similar, except for the anterior premolar ('wolf tooth'), which is small, peg-like or plate-like and may not occur at all.

The mandibular condyles are transversely elongated, the lips are mobile and prehensile, and the salivary glands are very large. All four types of papillae are present on the tongue.

The stomach is simple, but the mucosa is well differentiated into a small cardiac and large fundic and pyloric parts. A large area of oesophageal epithelium is also present in the stomach. The small intestine is very long: 22–23 m long in the Horse, 12 m in the Donkey. The large intestine is long and voluminous, the folded colon is 5.5 m long in Horses and 5 m long in Donkeys. The caecum is large (1 m long with a volume of 35 litres in the Horse, slightly bigger for the Donkey) with absorptive villi. The large intestine contains bacteria and ciliates and ferments cellulose. Unlike the Bovidae and Cervidae, the Horse is a hindgut fermenter, rather than a foregut fermenter. The stomach takes 24 hours to empty and has a capacity of 7–14 litres. The liver is large and many-lobed and there is no gall-bladder.

Circulatory System

The conical heart weighs 3–5 kg (0.6–0.7% of the body weight). An os cordis is absent. In the arterial system, anastomoses between different vessels are very numerous. The lymphatic system is well developed. Mules and hinnies (hybrids between Horse and Donkey) have lower arterial elasticity than Horses or Donkeys.

Respiration

Large membranous sacs, the Guttural Pouches, arise from the eustachian tubes – their function is unknown. There is a large nasal diverticulum, which is bigger and more complicated in the Donkey than the Horse as well as a subepiglottal sinus – also larger in the Donkey. The opening of the lateral laryngeal ventricle is larger in the Horse. The lungs are almost undivided, except for an azygous lobe on the right, separated from the rest of the right lung by the channel for the posterior vena cava; the right lung is very much larger than the left.

Excretion

The kidneys are simple, with unbranched pelvises. The right kidney weighs more than the left— which is bean-shaped—and resembles a ‘clubs’ playing-card motif. Although a Donkey can tolerate a 25% water loss in an experimental situation, it must water at least every 2 days, requiring only 2 minutes to fully rehydrate itself.

Sense Organs and Nervous System

Despite the thickness of the skin, tactile sensitivity is well developed. The eyes, particularly those of the Donkey, are very large, with horizontally oblong pupils for all-round vision. The brain is well developed with many complex fissures and weighs 400–430 g (up to 650 g) in the Horse, 250–300 g in the Donkey (equivalent to about 100–150 g / 100 kg of body weight). The cerebellum is not covered by the cerebrum. The Organ of Jacobson (vomeronasal organ) does not communicate with the buccal cavity.

Numerous vibrissae are present on the lips, tip of snout, eyelids and base of hoofs. The ears are large and mobile (especially in Donkeys), with a cartilaginous tube lining the passage to the middle ear. There is little mastoid inflation. Cones are present in the eye, but they are not numerous. The tapetum lucidum, which is very bright, is usually blue or blue-green in colour. The eye has a total visual arc of 215°, with 60–70° of binocular vision.

Endocrine and Exocrine Systems

The thyroid glands have accessory glandular annexes that are variable in number. The main thyroid glands of the Horse are separate, but those of the Donkey are united by an isthmus below the trachea. Parathyroids are present, a thymus is found only in the young, suprarenals have accessories and there are carotid glands and coccygeal glands. Horses sweat profusely due to numerous eccrine glands in the skin.

Reproduction

The testes descend in a semipendulous scrotum and are much bigger in the Donkey than the Horse. The penis has a high proportion of cavernous to connective tissue, enabling enormous enlargement on engorgement. It is 350–500 mm long when engorged, lacks a baculum and emerges from a prepuce which is positioned not far in front of the scrotum. There are small prostate and Cowper's glands. Stallions (male equids, especially male Horses) yield from 50–200 ml of semen per ejaculation.

The uterus is bicornuate. The cervix is smooth and projects some distance into the vagina. A single pair of mammae are positioned just in front of the groin.

Equid females (mares) are seasonally polyoestrus. Oestrus begins in spring and can continue into late summer if mares are not fertilised. The cycle is 21 days in Horses and generally longer (up to 28 days) for Donkeys. Oestrus lasts 5–8 days (usually 4–6 in the Horse and anything from 2–7 days in the Donkey). In oestrus, the vulva, vaginal and uterine mucosa swell and the vulva of the Donkey secretes a mucus mixed with blood. Follicles migrate to an ovulatory fossa where they come to maturity. At each oestrus, eight to nine follicles begin to enlarge, but only one is shed—the rest undergo atresia. The corpus luteum begins to degenerate after 35 days of gestation and new ones that last until about the 150th day of gestation are formed from the degenerated follicles.

Gestation lasts 329–345 days in the Horse; those ending in winter are 20 days shorter than those ending in spring. The gestation of the Donkey lasts 365 days. Hybrids are carried about 10 days longer than purebreds of the maternal species.

Embryology and Development

The placenta is diffuse and epitheliochorial. Implantation takes 55 days to occur. Twins are rare in the Equidae. Foals have a birth weight of 25–30 kg, doubling over 4 weeks.

Equid milk contains 1.6–1.8% fat, 2.0–2.4% protein and 5.5–6.1% lactose.

The deciduous dentition, except for the second and third incisors, is erupted by the time of birth or, at the latest, 2 weeks after birth. Second (deciduous) incisors erupt at age 4–6 weeks, and third incisors at 6–9 months. The permanent dentition begins to emerge with the eruption of the first molars at 9–12 months. Second molars erupt at 2 years, first incisors and second premolars at 2.5 years and so on until the eruption of third incisors and canines at 4–5 years.

Sexual maturity in females occurs at around 18 months (range 10–24 months), but they do not physically mature until about 4 years (in wild Horses).

NATURAL HISTORY

Life History

Foals are dropped in a quiet place and not brought into their social group until some 9 days old. A post-partum oestrus occurs in the female, which is therefore, generally pregnant and lactating at the same time. Foals suckle for brief periods, up to a minute at a time. They are weaned gradually, sometimes not being fully dependent on solids until 2 years old, although this is unusual. Foals play together and try to play with adult mares. Sex ratio is about even at birth, but male mortality is greater at all ages and adult sex ratio may be expected to be about 1:2 or more.

The first oestrus in mares is often infertile, but pregnancy rates thereafter are over 90%. In Horses, mares have been known to keep breeding until some 20 years of age. Stallions, which are capable of breeding from about 3 years of age, generally do not do so until they have achieved dominance at 5 years or more. They continue siring foals until their 20s (the record is 31 years for a Horse).

Life expectancy is variable, but most Horses that survive to adulthood can expect to die in their 20s. Donkeys live a little longer, often 30 years or more. The maximum age recorded (for a domestic Horse) was 61 years.

Ecology

Equids live predominantly in open country, where their alertness and speed protects them against most enemies. Donkeys prefer drier country than Horses and can survive in the absence of surface water, getting adequate moisture from their food. Overwhelmingly, they are grazers, though Horses in lightly wooded country do browse.

Equids in the wild are more diurnal than many other large mammals and are crepuscular (most active around dawn and dusk). Horses seek shade in the middle of the day; so do Donkeys if shade is available, but where the environment is particularly harsh and open they are capable of tolerating exposure to the blazing midday sun. Horses prefer flat or lightly sloping country. Their narrow hooves, however, give Donkeys great sure-footedness and their preferred terrain is one of desert hills and ravines. In hot weather, Horses wallow in liquid mud, probably to escape biting insects and to aid heat loss by evaporation.

Behaviour

The social organisation of Horses and Donkeys is quite different. Only one brief report is available on these species in Australia (Hoffmann 1983). Klingel (1975) has described the typical social organisations of all equid species.

Horses live in harem groups that may consist of some three to six mares and a single stallion, with their maturing offspring. Bonds among the mares are close. Mutual grooming is common – two mares will stand flank-to-flank, facing in opposite directions, nipping each other with their incisors. This is at once a social activity and a hygienic one. The stallion is somewhat peripheral to the mare group and participates infrequently in grooming interactions, instead acting as the group's buffer from the outside world. He is more alert than the mares, gets less sleep and is more nervous and restless even when grazing. He defends the herd against attack, generally fleeing last and nipping the rumps of lagging foals to make them keep up. He also defends the harem against other males. When the females have returned to the herd after dropping their foal, the stallion is especially active, driving them and attempting to mate when they come into oestrus. Other stallions are fiercely fought; the hind feet are used to lash out backwards, the incisors to slash, and they rear to strike with the forefeet.

The females in a Horse herd are not necessarily related. When a maturing female comes into oestrus for the first time, she will often leave her natal herd and join another. She is likely to stay in the herd in which she first becomes pregnant. This may be her natal herd that she never left, or to which she has returned, thus resulting in a fair degree of inbreeding in Horse herds. Stallions do however, leave their natal herds permanently and live solitary lives until they manage to take over a herd and become breeders. The full life history of a wild Horse remains obscure. The degree of inbreeding and the fate of ousted stallions are two phenomena not fully investigated. Calaby & Keith (1974) saw wild Horses on the Cobourg Peninsula in harem herds. In the Macdonell Ranges, the social organisation of feral Horses appeared to be more flexible. Some groups consisted only of females and foals, with no permanently associated males (Hoffmann 1983).

Donkeys, on the other hand, form no stable social groups, except for mother-foal bonds. In Somali wild asses (which are truly wild), according to Klingel (1975), the males are territorial and mate with females which enter their territories. However, with feral Donkeys this system seems to break down to some extent. In North American feral Donkeys, Woodward (1979) recorded only one territorial male, but noted that elsewhere territoriality was more widespread. Only males more than 6 years old become territorial. Where the system is widespread, territorial males do most of the breeding, but this was not the case in California, where the males formed highly unstable groups, as did the females, and would fight each other to mate with a female in oestrus. Older males were in any case, more likely to be solitary. Both sexes normally occupied very large, but overlapping, home ranges (20–70 km²). In central Australia, Hoffmann (1983) found the same loose social organisation, but there was no apparent territoriality.

In the wild, Donkeys and, to a lesser extent, Horses, raise dung-piles, usually where trails converge, and every individual will add to these piles. Donkeys vocalise with the typical bray as a territorial marker or for social contact.

Economic Significance

Feral Horses have from time to time been captured and either slaughtered for petfood or, if of good quality, broken and trained. During the Second World War, central Australia provided Horses for the Indian Army (Letts 1964). Feral Horses often have a high parasite load and constitute a potential threat to

domestic Horses, are said to upset cattle, compete with them for grass and to foul sources of water. These claims have rarely been investigated properly. In some areas, they seem to do little damage and have been present for many years (nearly 150 years in the Northern Territory) without noticeable detriment to the environment.

Feral Donkeys, living as they do in more arid country, could be much more environmentally damaging. Where there is permanent or sporadic running water, Donkeys certainly trample the banks of these waterways and heavily graze the local vegetation, thus accentuating erosion. They, too, are full of parasites such as strongyloid worms. They are a source of petfood, though there is little other economic use. A bounty was placed on feral Donkeys in 1961.

BIOGEOGRAPHY AND PHYLOGENY

Distribution

The original range of the Horse in the wild seems to have been, in broad terms, northern Eurasia and North America. In Europe they survived until modern times and in Central Asia perhaps persist till the present day. Wild asses live in North Africa and the Sahara, and formerly lived in the Middle East.

In Australia, wild Horses are widespread, from the Brindabella Range near Canberra to the Cobourgh Peninsula, Northern Territory. They are to be found wherever there is suitable habitat (open or lightly timbered plains with a flat to rolling topography), not too moist nor totally arid. Feral Donkeys are spread over much of the arid centre, as far north as the Victoria River district.

Affinities with other Groups

The Order Perissodactyla also includes tapirs (Family Tapiridae) and rhinoceroses (Family Rhinocerotidae). The defining feature of the order is that the axis of weight-bearing of each leg passes through a single central digit of each foot (compare with Artiodactyla, in which the axis passes through two evenly developed toes, the cloven-hoofed state). In this respect, therefore, the Equidae is the most highly derived perissodactyl group, with the number of toes reduced to one on each foot. Traditionally, the Equidae is separated into a suborder of its own, Hippomorpha, and the more plesiomorphic tapirs and rhinoceroses are placed in a second suborder, Ceratomorpha, an arrangement that cladistically does not seem to be very securely based.

Affinities within the Equidae

All living equids—zebras and onagers as well as Horses and asses—are placed in a single genus, *Equus*, by most authors. The number of subgenera, even the exact number of species, is disputed, but asses and Horses universally are allocated to separate subgenera: *Asinus* for the asses, *Equus* for the Horse. Whether wild asses should be allocated to a separate species, *Equus (Asinus) africanus*, as distinct from domestic Donkeys, *E. (A.) asinus*, and wild Horses to the species *Equus (Equus) ferus*, apart from domestic ones, *E. (E.) caballus*, is, of course, a non-question. Domestic forms are not species in the biological sense, being artificially kept apart from their wild representatives and much too variable even to define.

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