**Mammalian Species**

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**Giraffa camelopardalis.** By Anne Innis Dagg

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**Giraffa Brünich, 1772**

Giraffa Brünich, 1772-36. Type species Cerus camelopardalis Linnaeus, 1758, by monotypy. Giraffa Brinon, 1762, although frequently cited, is in a work that is not consistently binomial and is therefore unavailable for purposes of nomenclature unless specifically validated by the International Commission on Zoological Nomenclature, a step that has not been taken, although some have advocated it.

Camelopardalis Schreber, 1784: pl. 255. Type species Camelo- pardalis giraffa Schreber, 1784, by monotypy.


Trachelotherium Gist, 1848:81. Proposed as a replacement name for Camelopardalis Schreber, 1784.

**CONTEXT AND CONTENT.** Order Artiodactyla, Suborder Ruminantia, Infracorder Peromys, Family Giraffidæ, Subfamily Giraffinae. There are only two living giraffids, the okapi, Okapia johnstoni, and the giraffe, Giraffa camelopardalis.

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**Giraffa camelopardalis Linnaeus, 1758**

Cerus camelopardalis Linnaeus, 1758:66. Type locality “Sennar and Aethiopia.”

Camelopardalis Giraffa Schreber, 1784: pl. 255 only, rather than Boddart, 1785:133 as usually cited. Type locality of Schreber not given, Boddart gave “Cape of Good Hope,” but no giraffe have been found that far south; here re-stricted to Warmbad (as mapped in fig. 3), where Brink (1761) encountered and described giraffe just north of the Orange River.

Camelopardalis antiquorum Jardine, 1835. Type locality “Senn- nar and Darfour,” restricted to Baggar el Homer, Kordofan, 10°N and 28°E by Harper (1940).

Camelopardalis aethiopica Ogilby, 1837:134. Type locality undesignedated, by inference Ethiopia.

Camelopardalis capensis Lesson, 1842:168. Type locality Cape of Good Hope.

Giraffa senaensis Trouessart, 1898:902. Type locality interpreted to be south of Sennar, Anglo-Egyptian Sudan by Allen (1939:468).

Giraffa tippelskirchi Matschie, 1898:78. Type locality Lake Nyasii, southeast of Victoria Nyanza, Tanganyika Territory (now Tanzania).

Giraffa schillingsi Matschie, 1898:79. Type locality Taveta, Kenya.

Giraffa ingunumata Noack, 1906:356. Type locality Barotse, mid-dle Zambesi region, Northern Rhodesia (now Zambia).

Giraffa hagenbecki Knottnerus-Meyer, 1910:800. Type locality Galland, southern Abyssinia.

**CONTEXT AND CONTENT.** Context noted in generic summary above. Nine subspecies are recognized (Ansell, 1968) as follows:

G. c. camelopardalis (Linnaeus, 1758:66), see above (biturium Duvernoy, aethiopica Ogilby, typica Bryden, and perhaps congoensis Lydekker, are synonyms).

G. c. antiquorum (Jardine), 1835:187, see above (senaensis Trouessart a synonym).

G. c. peralta Thomas, 1898:40. Type locality near Lokoja, at the junction of the Niger and Benue rivers in Nigeria, probably north of the confluence (Happold, 1969).

G. c. reticulata de Winton, 1899:212. Type locality the Loroqui Mts. in Kenya (hagenbecki Knottnerus-Meyer and nigres-cens Lydekker are synonyms). Mertens (1968 a and b) pointed out that reticulata de Winton, 1899, was a junior homonym of reticulata Weinland, 1865, but requested val- idation of de Winton’s name and suppression of Weinland’s by the International Commission on Zoological Nomen- clature under their plenary powers, because Weinland’s type locality was within the range of antiquorum rather than that of reticulata as these names have been used re- cently. The Commission has not yet (May 1970) acted on the request. The name australis Rhdos may also be a synonym.

G. c. rothschildi Lydekker, 1903:122. Type locality, as given originally, Usain Gishu Plateau east of Lake Baringo, Kenya, corrected to west of Lake Baringo (Lydekker, 1908) (cottoni Lydekker a synonym).

G. c. tippelskirchi Matschie, 1898:78, see above (schillingsi Matschie a synonym).

G. c. thomircohoti Lydekker, 1911:468. Type locality Petauke, Eastern Province, Northern Rhodesia (now Zambia).

G. c. angolensis Lydekker, 1903:121. Type locality by the Cuene River 240 kms. southwest of Humbe, Angola (in- junata Noack a synonym according to Ansell).

G. c. giraffa Schreber, 1784: pl. 255, see above (capensis Les- son, australis Swainson, maculata Weinland, and wardi Lydekker, are synonyms).

**DIAGNOSIS AND GENERAL CHARACTERS.** The genus is monospecific. Height is 5 to 6 m., females smaller than males; legs and neck each over 1.5 m. long. Slope of back makes forlécès appear longer than the hind legs, which are pregnancy, which can be two unbranched permanent horns, in both sexes, are fused to the skull above the fronto-parietal suture and are covered with skin; a median “horn” anterior to this is more developed in males than in females; the facial region of the skull of old males is also covered with other irregular bony growths. Skull is up to 73 cm. long; molars brachydont, upper molars without inner accessory columns; canine teeth bilobed or trilobed. Hole has a buff color base on which are spread darker brown spots varying in shape from irregular jagged blotches to smooth polygons; spots large on body but small on head and upper legs. Tail is long and has long, black, coarse terminal hairs; neck maned with short, brown, stiff hairs.

**DISTRIBUTION.** Giraffes are widespread in Africa where there are scattered trees or bushes. Their range includes semi-arid regions but not deserts, rain forests, or mountain ranges. Within historic times their distribution has been much reduced, because of increasing aridity and increased human population pressures, and their numbers everywhere have de- clined because of hunting, farming and periodic epidemics of rinderpest. None now survive in North Africa but some may have remained in Morocco as late as A.D. 600 (Schomber and Kock, 1961:157). Recently, especially with the advent of drugging techniques, giraffe have been transplanted to areas of Africa (not shown in fig. 3) where they were not previously found, e.g. Orange Free State (Griesel, 1961), Natal, Swaziland.

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**FIGURE 1.** Patterns of trunk spots (all at about the same scale) of giraffe belonging to three adjacent subspecies (from Dagg, 1968): A. G. c. rothschildi; B. G. c. reticulata; C and D. G. c. tippelskirchi.
FIGURE 3. Recent distribution of the giraffe in sub-Saharan Africa, within historic times (outlined with dotted lines, after Krumbiegel, 1939), at present (outlined with solid lines), and at three fossil sites (marked X). Type localities of the nine recognized subspecies are shown by triangles: A, G. c. camelopardalis; B, G. c. antiquorum; C, G. c. peralta; D, G. c. reticulata; E, G. c. rothschildi; F, G. c. appellekirchii; G, G. c. thorncrofti; H, G. c. angolensis; and I, G. c. giraffa.

(Kirk, 1966) and Suanane Island in Lake Victoria (Achard and McCallioch, 1967).

FOSSIL RECORD. The giraffids are believed to have evolved in the early or middle Miocene in central Asia (Chunche, 1970). Specimens thought to belong to Giraffa camelopardalis are known only from Pleistocene deposits of Israel and Africa itself. The Israeli records are for the lower Pleistocene of the central Jordan Valley (Haas, 1966) and for the Villafanchian at Bethlehem (Hooijer, 1938). The African records are for the Villafanchian of Chad (Abadie et al., 1959), for the middle Pleistocene of Olduvai, Tanzania (Hopwood, 1930) and for the lower Pleistocene from Omo, near Lake Rudolph (Arambourg, 1947). However, Leakey (1965) noted that the lower and middle Pleistocene specimens of Giraffa from Africa may not be of the species G. camelopardalis.

FORM. Leche (1952) described five different types of hair found on giraffe. Brem (1938a) explored one of these types, from the mane, in detail. The mane, which is about 12 cm. long in the adult, can be identified microscopically in a fetus only 28 cm. long. The arrangement of hair produces areas of hair whorls, feathering, and crests which seem to be correlated with positions or areas in which movement occurs in any particular region of the body (Kidw, 1900, 1903; Lankester, 1907; Rothschild and Nevile, 1911), although there is also much individual variation. The female has 4 mammae, Shorridge's (1935) widely quoted count of 2 mammae being an error. The milk of giraffe has been analyzed by Stephan (1923), Greed (1960), Ben Shaul (1962) and Aschaffenburg et al. (1962). The teeth and bones of the giraffe are especially large but not otherwise greatly different from those of other pectoral species. The dental formula is 0/3, 0/1, 3/3, 3/3 = 32. The molars are brachydont and rugose. The row of front teeth is wide, in part because of the broad lobed canines, which makes the combing action used while browsing on leaves particularly effective. The skull has extensive air spaces, but, even with these spaces, its weight may reach 13 kg. in old males (Dagg, 1965). Dorsal neck muscles and ligaments attach to two enlarged bony areas at the back of the adult skull which are sometimes referred to as occipital, posterior, or mizzen horns (Thomas, 1901). The occipital condyles allow the head to be raised through an angle of more than 90°; this allows free movement for browsing or fighting. The various sutures in the skull close at different times so that a skull of a newborn up to at least six years of age can be aged fairly accurately (Singer and Bone, 1960). They also found that giraffe could be aged by sequences of ephippia and wear of teeth. The giraffe has only 7 cervical vertebrae, each very elongate, but the first of the 14 (rarely 13) thoracic vertebrae is modified to resemble a cervical vertebra too (Lankester, 1908). The dorsal spines of the anterior thoracics are long, forming the prominent hump on the upper back. They serve for the attachments of the large muscles and the nuchal ligament which supports the neck and head. The thoracics are followed by 5 lumbar, 5 to 6 fused sacral and 16 to 20 caudal vertebrae. The pelvis is shorter than in most ruminants, and the upper ends of the ilia are more expanded (Flower, 1970). The legs are highly specialized; the first, second and fifth metapodials are usually absent. The joints and ligaments of the hind leg at least are very similar to those of antelope (Heinze, 1965). The hooves are low posteriorly so that the fetlock nearly touches the ground; this may increase the foot's ability to support a large weight. The footprint is about 31 by 23 cm. in an adult male and slightly less in a female. There are no interdigital glands or lateral hooves. The musculature of the giraffe has been largely described by Owen (1841), Jolly and Lavocat (1843) and Murie (1872). More recently, smaller muscle groups have been studied in depth: the neck and shoulder muscles by Chaine (1929), Rothschild and Nevile (1911), Zuckerman and Kiss (1932), Wilmont (1958) and Angermeyer (1966); the foreleg muscles by Bego (1960); and the hind leg muscles by Heinze (1964, 1965). The circulatory system is specialized to cope with the high blood pressure necessary in the giraffe to pump blood to the brain. The arteries of the neck have thick walls composed largely of elastic tissue al-
though in the carotids the muscle fibres increase in prominence towards the base where they are densely packed (Goetz and Keen, 1957). The blood pressure at the brain is regulated by a reti mirabile into which the external carotids divide (Lawrence and Rewell, 1948). The blood pressure in the carotid may reach 300 (systolic) to 30 (diastolic) mm. (infracture). In a number of animals the blood pressure is measured by a sphygmomanometer, and the vessel from the brachial to the carotid artery is ligatured. The blood pressure was recorded in animals weighing up to 10 kg. (Goetz and Keen, 1957; Goetz et al., 1960). Some large veins are extensively varicose, to help counteract the effects of gravity (Amoroso et al., 1947). The veins of the legs are very thick and muscled, the varicosities being lumina. In gen-

OTONOEY AND REPRODUCTION. Following copulation the fertilized egg implants without delay. The gestation period averages 15 months (the mean of 35 pregnancies in captive females, Backhaus, 1961), but in the wild it may extend from 394 days for a small animal that died shortly after birth (Lang, 1955) to 488 days (Robinson et al., 1965). A male fetus, 18 cm. in body length and about 3 months of age, was collected by Mrs. C. A. B. in the wild. The horns of the male were indicated by two mounds above the skull 8 mm., in diameter and 5 mm. high, and the testes had already descended into the scrotal sacs. In a female fetus, 60 cm. long and about 4 months of age, the testes were not as large as those of the male, but were visible on various parts of the head, especially on both lips and on the upper eyelid, and on the tip of the tail. The main horn anlagen were 2 cm. in diameter and 5 mm. high, while the anterior horn was represented as a minute lobe. The incisors and canines were visible through the gums. The 4 teeth were papillate 3 4 mm. high and 1.5 mm. thick. Beddard (1906) noted in an 8-months-old female lemur the hair were all whitish so that there were no spots. The horn cartilages could be felt through the skin above the skull. The hooves were soft and quite pointed. Many parturitions have been observed in captivity. The first young born was born about 8 months after the rupture of the fetal membranes. The young is slowly pushed outward as the mother strains while standing with her hind legs spread apart. The umbilical cord breaks about 30 minutes after birth. The young are reared on the mother's back. Female lemurs generally have their young born during the early part of the year. The young are quite large, especially the adenohipophysis (Hansström, 1953; Kludtzycky, 1954). Frank (1960) discussed the parathyroid and thyroid glands of the infant.

**FUNCTION.** Few physiological experiments have been carried out on giraffe except on the circulatory system. To study the circulation giraffe have been drugged so that apparatus could be fastened to individuals. The maximum blood pressure in the carotid artery at the base of the brain in a female surrounded by scaffolding was 200 mm. Hg when she was standing but only 175 mm. Hg when she lowered her head (Goetz and Keen, 1957). The mechanism that controlled the blood pressure so effectively was not related to a high viscosity or high protein content of the blood, as these values in the female giraffe were normal for an animal of this size. Recently information was obtained via radiotelemetry in free-ranging giraffe (Van Citters et al., 1966). An animal while resting had a low blood pressure reading from the carotid artery of 150 (systolic) to 105 (diastolic) mm. Hg. Immediately after galloping, these values increased to 230/125 mm. Hg. The pulse rates ranged from 60 to 170 beats per minute. The blood flow in the carotid artery ranged between 50 cm.3/sec. in a prone giraffe and 35 cm.3/sec. in a walking giraffe. The flow during diastole the velocity fell to nearly 40 cm.3/sec. (Van Citters et al., 1968). Radiotelemetric thermometry has been used to determine the deep body temperature of a giraffe (Bligh and Hartlaub, 1965). At low ambient temperatures the deep body temperature in the lower neck of a 400 kg. female was remarkably thermoregulated at between 37.5° C and 39.1° C. This thermoregulation may be related to high ambient temperatures, as in eel Taururus oxyr (Taylor and Lyman, 1967), and this would help the giraffe keep cool while conserving water. Backhaus (1959) studied color vision in a captive giraffe. He offered food in variously colored containers and judged that the animal could distinguish between red, orange, yellow, yellow-green and violet.
is short and slightly woody. The horn cartilages lie flat at first and grow during the winter, but become upright between two horns (Benchley, 1946) and four weeks (Sigel, 1886) after birth and fuse to the skull during ossification. Their position is indicated by two prominent tufts of black hair. In the Nairobi National Park, the male-to-female ratio of calves was 1:1 (Foster, pers. comm.) but Bourlière (1961) found that of 117 captive neonates 65.5% were males. Calves can stand and suck at 10 minutes after birth, and walk and run soon afterwards (Gigon, 1963). The female thereafter comes into heat about every 14 days (Lang, 1955) and can conceive while she is lactating. She can breed until she is at least 20 years old (Ried, 1958). A captive male that had survived for 16 years was 24 years old (Dagg, 1970). In captivity the oldest giraffe attained 28 years of age (King, 1947) but giraffe in the wild do not commonly live at least up to 22 years of age, pers. comm. The mortality of the young giraffe is not great in the wild, but in their first year of life as many as 68% of those born may die (Foster, pers. comm.).

**ECOLOGY.** Lions are by far the most important predators of giraffe (Wright, 1960; Brynard and Pienaar, 1960; Pienaar, 1963; Kruuk and Turner, 1967) although on rare occasions a lion itself may be killed by a giraffe (R. Douglas of Turangi, pers. comm.). Cranes, pelicans, and crocodiles kill giraffe very rarely—0.28% each of 675 giraffe kills in the Kruger National Park over a 25 year period (Pienaar, 1969). The only other killers were lions. Various tickbirds live commensally with giraffe—the buff-tailed bever Texor niger (FitzSimons, 1920) and the red-billed and yellow-billed oxpeckers Buphagus erythrorynchus and B. africanaus (Attwell, 1966). These birds call out at the approach of a man and probably of other predators too (Attwell, 1966). They also serve a giraffe by searching through its hair for ticks, which they eat. They sometimes peck at wounds, so aggravating the injury, and perhaps they compensate for this by devouring the maggots in the area.

Ticks usually infest giraffe, particularly on the relatively thin-skinned area of the genitalia. The common species include the Amblyomma hebraeum, the Amblyomma decoloratum, brown tick Rhipicephalus appendiculatus (Innis, 1958), Rhipicephalus camelopardalis (Walker and Wiley, 1959), and Hyalomma anatolicum (Linné, 1752). On giraffe imported into New York the following ticks were found: Amblyomma gemma, Boophilus decoloratus, Hyalomma alibarnum and Rhipicephalus palpebrosa (Becklund, 1968). Internal parasites are more numerous. Species that have been identified are Cooperia pecinata, C. pacifica, Haemonchus contortus, H. meitkeli, Trichuris globulosa (Ortlepp, S. Afr. govt., pers. comm.), Trichuris giraffae, Parabronema skrjabini, Monodora tala giraffae (Leiper, 1938), Trichophorus gracilis (Cobbold, 1860), Uncinaria smithi (Weidman, 1910), Haemonchus sp., Tachistophorus sp. (Sloan, 1965), Fasciola gigantica (Cobb, 1855), Taenia saginata = Cysticercus bovis of Schwartz, 1932, and Taenia solium = Cysticercus bovis of Schwartz, 1932. They have a number of forms which are common in cattle and other food animals and thehost of the best of these are know to have been collected by Foster (1966 and pers. comm.) from the approximately 90 giraffe of the Nairobi National Park. Apparently the population increases by nearly 25% each year but of these yearlings only 15% live in their first year. The young giraffe wander away from their mothers at an early age but these young do not have a greater mortality than the young that remain near their mothers. In 1967 the resident giraffe population of the Nairobi National Park was estimated at 136, 25% adult male, 12% in their fourth and fifth years, 8% in their third year, 10% in their second year and 14% in their first year. These percentages have been quite stable for the average life span of a giraffe in the park was 10 years, but some live more than 25 years. In Wankie and Garamba National Parks, Dasmann (pers. comm.) and Backhaus (1961) respectively estimated about 30% of the giraffe to be immature and 70% to be adult females. Inns found only 12% of the giraffe were immature and half of these were calves. The proportion of females was low in some regions of the park. Giraffe are sometimes found on forested areas, always near trees or bushes. They are often sedentary animals, seldom moving great distances except when forced to by fire or drought (Inns, 1958). In Nairobi National Park, Foster (pers. comm.) found that the bulls were much less restless than the cows, often walking from herd to herd presumably to find a female in heat. One male was spotted 50 km. from the Park. The giraffe in the Park are not all permanently established, because although there are about 90 giraffe there at one time, these may be as many as 241 individuals. Giraffe do not show territorial behavior. In the Nairobi National Park, Foster (pers. comm.) calculated the average home ranges for the 10 most commonly seen males and females at 62 and 85 sq. km. respectively.

Various diseases have been reported in wild giraffe, the most virulent of which is an enteritis known as African horse sickness. It is widespread through Africa in the 1980s, killing hundreds of giraffe and other ruminants (Grzymek, 1956a). There have been scattered outbreaks in Africa since then, including a severe epidemic which was reported to be about 400 cases in the southern in 1962 (Simon, 1962). Earlier in this same area an epidemic of gastroenteritis killed some giraffe (Perceval, 1924) and others died during a brief outbreak of anthrax in southern Africa (Pienaar, 1961). This disease was suppressed by distilling the water sources responsible for the spread of the infection (Payne, 1961). Giraffe eat from a variety of species of plants, many of which are acaulis. Lists of specific eaten are given by Inns (1958), crochet and crew (1953), and Foster (1966). Giraffe eat the leaves, but sometimes also the pods, fruit and twigs of these trees and bushes. They are not deterred by the absence of long thorns or spines on their food plants but they may be by ants (Brown, 1960). Throughout most of Africa at present, the giraffe is a protected species although a few may be shot on special licenses for museums or sport. Undoubtedly a number are also poached each year. Giraffe are found in zoos throughout the world, where they breed readily. Some captive mothers refuse to suckle their young, but these calves can be raised by bottle milk (Zell, 1960; Savoy, 1960). African has always used parts of giraffe—the flesh for meat; the skin for sandals and drums; the tendons for stringed musical instruments and thread; and the tail hairs for bracelets, flyswatters and thread. In the wild man may kill and eat the giraffe, and killed and the species eliminated in areas where it conflicted with man. Now it is fully protected in many national parks. Giraffe were formerly captured in stockades (Ogrizek, 1954; Stanston, 1955) or by lassoes (Webb, 1954) but now they are usually drugged by darts (Pienaar et al., 1966). Drugs and tranquilizers are used in the circulation experiments discussed earlier. They have also been used to allow Foster (pers. comm.) to put a radio transmitter collar onto a giraffe to study home range. In most of his work, Foster has identified individuals by photographing the left side of each animal's neck. The arrangements of the spots are unique in each individual, so that it can always be identified once photographed.

**BEHAVIOR.** Dagg (1970) has studied tactile encounters between individuals in a herd of 18 captive giraffe. The two sexually-active males were the most active in initiating such encounters, and the four calves the least active. Nosing and necking were the most common forms of such encounters, followed by rubbing and hitting (18% and 14%). Sniffing genitalia and "urine testing" were infrequent and usually done by a bull to a cow. Necking matches were rare and were almost exclusively involved in the female although the males are restricted to males (Cow, 1971). These types of behavior are apparently not seasonal, either in captivity or in the wild. Mating was observed twice and was similar to mating in the wild (Inns, 1958), with the female following the male and mounting her when she stood a number of times over a several hour period. The giraffe were all tolerant of each other generally, the dominant male sometimes allowing the
second males make sexual advances to a female in heat. During the day most giraffes are found in early morning and in the late afternoon, although some at least also browsed after dark (Innis, 1958). In the wild they spent more time hunting for food during the dry season than during the growing season, and less time resting and cuddling (Innis, 1958). Giraffe communicate indirectly with other giraffe and other species by either standing motionless and staring at possible danger or stampeding from it. Either reaction sooner or later attracts the attention of other animals. Giraffe can communicate by vocal noises, but they do so rarely. Occasionally a giraffe will grunt when alarmed, annoyed, or hungry and a female and her calf may call to or low to a giraffe that does not move far, generally. In South Africa, browsing giraffe averaged 0.21 km./hr. (Innis, 1958). Giraffe have only two gait: walking and galloping at speeds up to 56 km./hr. (Arbuthnot, 1954). These have been analysed by Dagg and De Vos (1968a and b) and Bourdelle (1934) and compared with the gait of other pectoran species. The walk of the giraffe is notable because an individual swings the two legs on one side of its body forward almost in unison. Its long, slender neck and large inertias of the body influenced the evolution of the gait. The movement of the long, heavy neck of the giraffe is correlated with that of the legs. This is particularly true in the gallop. In the resting of fences (Dagg, 1962b and d). The neck is also used to express various emotions in the giraffe (Backhaus, 1961). In the standing animal the neck of the neck is about 50° to 60° in adults and to 30° in calves. If it wants to look at an object, it lowers its neck and head until they are nearly horizontal with the ground. It may begin a sparring match this way. If one giraffe submit to a stronger one, it holds its neck high, with its nose pointing upward. If it is alert or nervous, it holds its head more nearly perpendicular than usual, with its mouth pointing to the ground and its nostrils open wide. If it is preparing to flee, it turns its body at an angle to the disturbance. When it shakes its head, it holds its neck about 45° from the horizontal. There is evidence that giraffe are more intelligent than other ruminants, but they can learn to beg for food in captivity, to recognize human beings, and to answer to their names. The chief activity of the giraffe is browsing, at times they stretch up as high as they can reach for leaves and at other times they bend low over a thorn bush. They often drink regularly at dams, rivers, or cattle troughs but they can apparently go for long periods without water too (Mason, 1937; Vesey-Fitzgerald, 1960). They approach water cautiously, frequently standing some distance away for several times between drinks. They can swallow with their heads at ground level however. In general, giraffe exhibit offensive behavior intraspecifically by hitting other giraffe with their horns and heads, and defensive behavior interspecifically by kicking out at predators with their hind hooves. Giraffe sleep deeply perhaps 20 minutes a night, folding their necks along beside their lying bodies to do so. Calves sleep for up to an hour (Grzymek, 1956b; Immelmann, 1958; Haagen, 1959; Backhaus, 1961; Immelmann and Gross, 1962). They rest for much longer periods, sometimes during the middle of the day. During such rest they often ruminate, chewing each bolus for about a minute before swallowing it and regurgitating the next. They rest either while standing, when their necks may bow down slowly toward the ground, or while lying. They lie down by bending first their front and then their hind legs. They get up again by resting first on their front "knees," then on their hind foot and then on their front feet (Dagg, 1962b; Zannier-Tanner, 1965). Occasionally giraffe, especially calves will, run about for no apparent reason, but there is no more highly organized play. A grooming animal licks itself with its tongue or bites its hide with its mouth (Backhaus, 1961). It may also rub itself against bushes to relieve itching in the skin. Flies are kept away in part by swishes of the giraffe’s tail.

**GENETICS.** Wallace and Fairall (1965) have analyzed chromosomes of a male and a female giraffe, both drugged, from Kruger National Park. The modal number of chromosomes per cell was 30. The 28 paired autosomes were mainly metacentric and submetacentric with one pair of acrocentric chromosomes which were small. The large X chromosomes were submetacentric and the small Y chromosome metacentric. Little work has been done on phenotypic genetics in giraffe, although spotting intermediate in appearance between that of two races has been noted whose races are adjacent (Stik, 1959; Rohr-Meyer, 1911; Dagg, 1962a; Anon., 1910). Krumbiegel (1951) and Dagg (1960) described such racial hybridizations in captivity. Dagg concluded that the number, area and shape of the spots on an animal are inherited, but not in the simple manner suggested by Spinage (1968). She also concluded that horn development is not under close genetic control, despite the emphasis on the horns in many early taxonomic studies.

**REMARKS.** Not all of the works cited were seen by the author.

**LITERATURE CITED**


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