Table 2: Externally visible changes (hair, skin, body weight)

Observed phenomenon / symptom	Occurrence in Loridae	In other species	Situation in which the phenomenon was observed; correlated symptoms	Possible cause, health disturbance diagnosed synchroneously	Further examination, diagnosis	Treatment, prevention
Hair						
Wet abdomen [61], [15].	In *N. pygmaeus* (n=2) [61]. In Loris (n=1), slightly moist abdomen after sleeping [15].	In other animals [61].	In *Loris*: in an animal with kidney disease [15].	Cause unknown. In *N. pygmaeus*: "it is unclear whether the lorises were urinating on themselves, lying in urine, or if this represents some other behaviour" [61].		
Moist or wet fur all over the body (not caused by external humidity such as rain). See also figure 3.1. [15]	In *Loris* [15], in *N. pygmaeus* (n=2) [32].			In *Loris*, several cases: a protozoan infection was diagnosed (*Blastocystis hominis*). After treatment with Metronidazol, moist fur vanished. On one occasion, very wet fur was observed in an entire *Loris* family group including a neonate, next to a *Cheirogaleus medius* group quarreling audibly because of an estrous. The loris-like chittering of the *Cheirogaleus* might have caused fighting among lorises; urination with excitement during fights has been observed in *Loris* several times. No other reason was found. In one case, a female with a stillbirth showed moist fur (sweat?). The dead baby was removed by a veterinarian, and the moist fur vanished [15]. In *N. pygmaeus*: cause unknown, two cases observed initially after animals had been acquired from a private owner in a very bad state of health [32].		*Metronidazol*, 0,1 ml/100g body weight per day, mixed into the daily milk pap, were readily consumed; no more symptoms after 5 days [15]
Wavy fur, especially on the upper thighs and sides of the hind part of trunk, fur looking a little fatty or moist (usually the fur looks dry, soft and velvety) [15]				Temporarily after grooming of the fur. If lasting: cause unknown; in some individuals, in very old animals [15]		
Loss of hair [61]. (See also below, under "Alopecia")	In *N. pygmaeus* (n=5) [32], [61].	In other animals [61].	In three cases: observed in very sick animals from inadequate husbandry conditions / illegal trade. Condition vanished with good care and improved health [32].	"No abnormalities were found on exam or skin biopsy, it is unclear if this was due to overgrooming or environmental conditions" [61].		

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Observed phenomenon / symptom	Occurrence in Loridae	In other species	Situation in which the phenomenon was observed; correlated symptoms	Possible cause, health disturbance diagnosed synchroneously	Further diagnosis	Treatment, prevention
Hair						
Overgrooming: loss of superficial hair, particularly in the sides of trunk; the colour of hair bases is superficially visible [15]. (See also figure 3.1).	In *Loris* (n=4) [15, 32], gastric trichobezoars, "probably due to overgrooming" have led to death in two angwantibos and one slow loris [10]	.	Observed in young shy male kept together with a larger and very active brother (although no quarreling or sign of social stress was observed); fur damage vanished after separation of the two animals. One case in a male housed solitary next to a female in estrous. [15]	Cause of overgrooming in *Loris*: most probably social stress or frustration [15]. Overgrooming in *Arctocebus*, *Nycticebus*: probably because of boredom or stress [10]. Subsequent formation of gastric trichobezoars is possible [10], [15]		Improvement of social situation; behavioural enrichment. Addition of paraffin oil to the food might help to prevent formation of gastric trichobezoars due to overgrooming [10],[15]
Self-mutilation	Not known from *Loris*.	*Otolemur crassicaudatu*	In *Otolemur crassicaudatus*: gnawing of the own extremities [10].	In *Otolemur crassicaudatus*: possibly due to boredom or stress in relatively small cages [10].		
Alopecia (loss of hair in certain parts of the skin, clearly delimited, often circular): see table 7, mycoses, under "Dermatomycoses"						
Hairless, in severe cases inflammated or sore sking in the region of the pelvis in contact with branches during resting [15]. Dermatitis / alopecia involving the lower back or gluteal region [61].	In *Loris* [15]. In *N. pygmaeus* (n=3) [61].		In *Loris*, in cages not cleaned for some time. New branches have in one case caused similar problems for unknown reasons [15].	Particularly in periods of unusually high air humidity, development of acid on the surface of urine-marked branches by bacteria may occur [15].		More frequent cleaning or replacing of branches by fresh ones [15]
Dermatitis / alopecia involving the lower back or gluteal region [61].. (See also figure 3.1).	In *N. coucang* (n=3) [61].					
Clotted fur in the circumanal region or (hind tip of the trunk) [15].. (See also figure 3.1).	In *Loris* (repeatedly) [15].			Indicates intestinal problems. The sympom might indicate a diarrhoea-like disorder, but no soft diarrhoeic faeces were found in this context. Cause unknown, possibly related with food poisoning in two cases, with disturbance of intestinal flora (dysbacteriosis, protozoan infection) in others? [15]		

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Observed phenomenon / symptom	Occurrence in Loridae	In other species	Situation in which the phenomenon was observed; correlated symptoms	Possible cause, health disturbance diagnosed synchroneously	Further diagnosis	Treatment, prevention
Trauma, external lesions; bleeding						
Bite wounds: small punctual wounds caused by the canine-like first upper premolars or lower canines, occasionally heavy bleeding; with or without subsequent inflammation. Bite wounds in *Loris* most frequently discovered on the hands and forearms; in two cases, stiff fingers or loss of fingers were the result. Face, feet and other parts of the body may also be concerned. In the nuchal region with its thick skin, which may be turned towards the opponent during fights, and other parts of the body well covered with fur, lesions may be inconspicuous. Three very old, blind animals were badly injured during fighting in their group; two of them had to be euthanised because of severe injury of the lower jaw [15, 32, 61]. After severe fighting, considerable skin lesions on top of the head occurred in three cases [15, 34]. In one case, fighting of mates led to the loss of an eye [27].	In *Loris* (cause of death in 2 of 14 dead animals at the Duke University Primate Center; two other fatal cases known. [15, 32, 61], in *N. pygmaeus* (n=6; one case fatal) [61]; in *N. coucang* (n=11 cases which required medical attention) [61].		In slow lorises, in some cases cellulitis and abscessation developed. Death of one juvenile slow loris secondary to septicemia from bite wounds [61].	A consequence of fighting, may for instance occur during pre-estrous, in old females no longer receptive kept together with a sexually interested male whose approach is continuously rejected by the female, after births when females may defend the neonate against approach of curious conspecifics, in territorial fights or in hungry and stressed animals [15].		Large cage with hideaways such as foliage, densely furnished with branches, allowing some privacy. In cases of more severe social stress: separation of the animals, at least for some time. Bite wounds usually heal well without treatment. In case of severe or lasting inflammation, *Bidocef S* (broad-spectrum antibiotic for human babies, 2 ml for a 250 g - animal), mixed into the daily baby pap, was readily consumed [15]. In one case, a secondary bacterial and fungal infection of a wounded ear made chemotherapy necessary [34]
Lacerated wounds on limbs: [15].	In *Loris* (n=2)		One toe injury with considerable loss of blood; the animal made a tired and sick impression afterwards, often resting with narrow eyes. One lesion of the skin on the knee detected after a transport [15].	Toe wound observed after noisy fireworks close to the breeding colony, possibly caused by a panicky flight reaction? [15].		In the case with loss of blood, the animal got iron added to the food for some time [15]

Table 2: Externally visible changes (hair, skin, body weight)

Observed phenomenon / symptom	Occurrence in Loridae	In other species	Situation in which the phenomenon was observed; correlated symptoms	Possible cause, health disturbance diagnosed synchroneously	Further diagnosis	Treatment, prevention
Trauma, external lesions; bleeding						
Traumatic lesions, focal subcutaneous hemorrhage or edema, superficial abrasions	In *Loris* (n=1) [32], in *N. coucang* (n=1) [61]		Postmortem findings after increasing weakness. The degree of trauma present alone would not have been life threatening. One *N. coucang* died after complications, having become entrapped in a cargo net used for climbing [61].	In weak animals before death, equilibrium problems have been observed. Chutes may also occur in healthy animals, for instance during fighting, in playful youngsters and in connection with climbing facilities too thick to allow a safe grip. Hemorrhage found postmortem in the ventral pelvic section of one *Loris* may have been trauma related or can be associated with vitamin E deficiency induced steatitis; however, the presence of edema in the adjacent muscle suggested trauma as a cause [32].		
Focal area of skin slough [61].	In *N. pygmaeus* (n=1) [61].			Etiology undetermined [61].		
Hemorrhagic syndrome as a cause of death [61].	In *N. pygmaeus* (n=2 of nine dead animals at the Duke University Primate Center) [61].					
Blood in the mouth [15], [32].	In *Loris* (n=2) [15], [32].		Immediately before / after death [15], [32].			
Vanishing of tattoos after local necrosis of skin and formation of scab [15]			In *Loris* (n=1 [15]); reports about unreadable or vanished tattoos in *Loris* [32].	Observed after rather thick, possibly too dense tattooing; in other cases, tattoos remained well readable [15].		
Erosions of lips and rhinarium [32].	In *Loris* (n=1) [32].		In an old animal found dead after suffering from kidney disease and wasting syndrome [15].	Cause unknown; possibly postmortem damage by insects such as mealworms in the litter? [15].		

Table 2: Externally visible changes (hair, skin, body weight)

Observed phenomenon / symptom	Occurrence in Loridae	In other species	Situation in which the phenomenon was observed; correlated symptoms	Possible cause, health disturbance diagnosed synchroneously	Further diagnosis	Treatment, prevention
Skin or parts of the body locally reddened, swollen						
Skin or parts of the body (not vaginal region) reddened, swollen [15].	In *Loris* [15].		In connection with visible bite wounds or not. In cases of fighting: stay in the lower parts of the cage, showing a characteristic crouched posture indicating social stress, or running about, trying to leave the cage, indicate severe social stress of inferior animals [15]	Several cases of inflammation, usually because of bite wounds [15]		In severe or lasting cases, *Bidocef S* (broad-spectrum antibiotic for human babies), 2 ml for a 250 g - animal, mixed into the daily milk formula, was readily taken [15]
	In *Loris* (n=1) [15].		Distal part of the toe enlarged and reddened. Symptom as in inflammation due to a wound, but lasting in spite of antibiotic treatment, some signs of pain during locomotion, but usually normal-looking locomotion. Reduced food consumption. Correct diagnosis after amputation [15].	A basalioma was diagnosed; see under "tumours" [15].		Surgical removal. Healed. [15]
Genital region of females reddened, rim of vaginal opening slightly swollen; vagina more or less opened [15].	In *Loris* [15].		Male following female with repeated low, hissing vocalization, trying to establish naso-genital contact	Normal sign of estrous; similar changes may occur before births. No health problem [15]		
Hairless, in severe cases inflammated or sore sking in the region of the pelvis / dermatitis / alopecia involving the lower back or gluteal region: see above, under "hair", "alopecia", and figure 3.1						
Superficially visible changes of the skin						
One or several of the following symptoms: swollen hands and feet, changes of the skin on knees, elbows and ankles: loss of hair, dark hairless skin which seemed to have lost elasticity and to "crack" during movement, causing lesions, haemorrhages, bleeding; loss of epidermis. [15], [17], [32].	In *Loris* (n=1) [32].		In an old animal with kidney problems, in addition suffering from environmental stress after transfer to an unfamiliar environment; additional symptoms in this case: signs of circulatory disturbance in the limbs (limited agility of limbs after sleeping period for some minutes), occasional signs of hypothermia after sleeping period. In this case, the changes vanished after recovery. In animals suffering from malnutrition due to wasting disease [15], [32]. "Pellagra-like condition". Death ("no case ... cured") [17].	Hypotheses: malnutrition or malabsorption? [17]. Problem due to disturbance of blood circulation in cases of malnutrition; the presence of retia mirabilia in which blood pressure of the arteries stabilizes the veins playing a role in cases of low blood pressure? [15].		Prevention of environmental stress; adequate diet, warm (electrically heated) sleeping place. See also under emaciation / kachexia: consideration of kidney disease or dysbacteriosis may be helpful [15]
Ulcerative dermatitis involving both tarsi [61].	In *N. pygmaeus* (n=1) [61].					
"Sore feet" [32].			In a young adult during quarantain stress, weeks before death [32].			

Table 2: Externally visible changes (hair, skin, body weight)

Observed phenomenon / symptom	Occurrence in Loridae	In other species	Situation in which the phenomenon was observed; correlated symptoms	Possible cause, health disturbance diagnosed synchroneously	Further diagnosis	Treatment, prevention
Superficially visible changes of the skin						
Gangrene / necroses of finger tips [32]	In *Loris*: n=2 [32].		Before death (n=2), in animals suffering from end stage renal failure, in connection with emaciation [32]			
Hemorrhage under the soles of feet [32].	In *Loris* (n=1) [32].		In an old animal after death of kidney disease and wasting syndrome [15].	Cause unknown [15].		
Veins in the ears enlarged, visible (see figure 1.3) [15]			Room temperature unusually high in most cases observed; male lorises in such periods in addition showed a prominent, pink scrotum during sleeping period [15]	Interpreted as a means to reduce body temperature by emitting heat through the ears. [15]		
Changes of pigmentation of the ear rims: *L. t. nordicus* (n=2) with formerly yellow ears developing a distinct dark ear rim (one or both ears concerned), in one case in connection with slight morphological changes of the outer ear [15].	In *Loris* (n=2) [15].		In animals with wasting disease [15].	Hypothesis: due to changes of blood circulation? [15]		
Superficially yellow colour of skin in *L. t. nordicus* (ears, muzzle, lower arms) [15]	Normal in the *L. t. nordicus* at Ruhr-University; less visible in *Loris* forms with dark pigmentation [15].		Not related to any disease [15].	Cause unknown [15].		
Jaundice; icterus			In four exported animals after arrival "very yellow skin" was interpreted as a sign of jaundice (n=4); three of these animals died from quarantain stress. Fatty liver was diagnosed [32]; slight jaundice in one animal which died of kidney disease and in one with a fatal trichobezoar [15]			
Yellow colour lacking in *L. t. nordicus*, ears pale pink [15]	in *L. t. nordicus* (n=2) [15], [32]		One case at Ruhr-University, cause unknown [15]. In the case of four exported animals, in whom after arrival "very yellow skin" was interpreted as a sign of jaundice, the skin of the only surviving animal later turned to "normal" (?) pink [32]	Cause unknown [15].		

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Observed phenomenon / symptom	Occurrence in Loridae	In other species	Situation in which the phenomenon was observed; correlated symptoms	Possible cause, health disturbance diagnosed synchroneously	Further diagnosis	Treatment, prevention
Superficially visible changes of the skin						
In female *Loris*: loss of colour of the parts of the dark grey patch at the tip of the clitoris, in the proximity of the urethral opening, changing to pinkish. In one case in addition blood in the urine [15].	Occasionally slightly; 3 cases immediately after adding intestinal flora to food [15].			May be a sign of infection of the urinary tract. Increased susceptibility of animals with glucose in the urine (diabetes, kidney disease) seems likely [15].		In the case with blood in the urine, the changes vanished after immediate treatment with antibiotics [15].
4-mm fluid-filled cyst / vesicle in the skin of one thigh [32].	In *Loris* (n=1) [15].		Found in an old animal after death due to old age and kidney disease [32].			
Multiple dermal masses [61].	In *N. coucang* (several animals) [61].		Some of these were biopsied antemortem; others were diagnosed postmortem [61].	Diagnoses included sweat gland carcinoma, epidermal hyperplasia / hyperkeratosis, epidermal cyst, cystic dilatation of a sweat gland duct, hemangioma, basal cell carcinoma and an apocrine gland cyst [61].		
Changes of pigmentation: development of grey pigment patches on the muzzle and hands or development of dark rims in formerly yellow, unpigmented ears [15].	In *Loris* [15].		Grey pigment patches on the muzzle and hands: regularly seen in very old animals). Dark ear rims: transient, in two animals after loss of weight due to dysbacteriosis and kidney disease [15].	Pigment patches on limbs and muzzle: apparently a normal sign of old age. Dark ear rims: cause unknown; possibly related to disturbed circulation in the auricle? Vanished with improvement of health and nutritional state when a treatment was successful (see under dysbacteiosis) [61].		

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Observed phenomenon / symptom	Occurrence in Loridae	In other species	Situation in which the phenomenon was observed; correlated symptoms	Possible cause, health disturbance diagnosed synchroneously	Further diagnosis	Treatment, prevention
Weight, adipose tissue externally visible (see also figure 3.2; information about weight differences in Loris subspecies: see table under figure 3.2)						
Obesity, adiposity	In *Loris* (common) [15].		In humans: multifactorial. May be a consequence of too copious or high-calorie feeding. In some animal species, obesity occurs in spite of normal diet, possibly in connection with Diabetes mellitus or other diseases. Pubertal adiposity in humans usually caused by nutrition, seldom by endocrinopathology [5]			Adequate diet, promotion of activity [5]. Behavioural enrichment may prevent excess food consumption because of boredome [15].
Loss of weight, emaciation, cachexia, "wasting syndrome / disease" [32]	In *Loris*: after quarantain stress (n=1) [32], in old animals. After a period of too abundant feeding, loss of weight, dysbacteriosis and kidney disesae were observed in the majority of animals concerned [15].		Increased food consumption, unusual hunger, loss of weight in otherwise normal-looking animals occurred after a period of too abundant feeding during food choice tests [15]. Sudden loss of weight for unknown reason in the course of several months and subsequent death in a formerly slightly adipose animal was described; its mildly hypercellular fat had similarities to brown fat common in rodents and hibernating mammals, but also to compressed depleted fat; the marked weight loss supported the latter [32]. Deaths for unknown causes in zoos might partly be due to this phenomenon,	In *Loris*: cases caused by a gastric trichobezoar (n=1), by kidney disease and dysbacteriosis. (Diabetes mellitus was rather diagnosed in connection with adiposity). A high insulin level was found in one elderly animal euthanized because of kidney failure [15].	Kidney disease, diabetes: urine dipsticks for humans may be helpful (plastic foil spread on the cage floor may help to collect urine) [15]. Dysbacteriosis: diagnosis from fecal samples. Faeces of animals suffering from dysbacteriosis had an unpleasant smell until treatment with inulin improved the condition. In the animals concerned, normal intestinal flora was almost completely lacking; the content of *Candida sp.* was high [64].	Good, but not too copious or high-calorie diet; live insects. In animals with kidney disease: limited amount of protein in the diet; addition of a small amount of salt to the food may be helpful. In cases with dysbacteriosis after too abundant feeding, addition of *inulin* to the food (0.5 g per kg body weight, every day) led to the development of a healthy intestinal flora and improved state of health [64]
Other changes						
Occasionally small eye(s), ocular discharge / lachrymal secretion after sleeping period in a *Loris* Purulent ocular discharge over 3 years in a slow loris with a history of dental disease [61].	In *Loris* (n=1) [15]; in *N. coucang* (captive), (n=1) [61].			Eye problem probably secondary to dental disease. Several types of bacteria were cultured on different occasions [61].		