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Canadian Muskoxen in Central Europe – A Zoo Veterinary Review

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Abstract: This paper summarizes 29 years of veterinary experience maintaining a herd of muskoxen at the Tierpark Berlin-Friedrichsfelde, Berlin, Germany. The transplanted muskoxen acclimated to the zoo enviroment without fatalities. However, a few srriking changes were seen. They exhibit a high sensitivity to sudden changes in weather conditions (especially falling atmospheric pressure); there is a tendency for their qiviut to become sparser with time; rutting and subsequent calving occur later than in their native habitat. Details of medical conditions in both calves and adults ate given along with information on hematology and immobilization.

Key words: *Ovibos moschatus,* disease, parasitology, pediatrics, zoo medicine, review.

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Introduction

Muskoxen once roamed Northern Europe, but became extinct during the Pleistocene, presumably due to climatic changes as the glaciers retreated. To this day, climate requirements are the main limitation to successful breeding and maintenance of this species in continental Europe. The first reintroduction to Europe was in 1899, when two calves were captured from Greenland for the Duke of Bedford's zoological park at Woburn Abbey, England. From 1899 to 1969 about 300 calves were translocated from NE Greenland to Norway, Iceland and, unintentionally, to Sweden for display in zoos, domestication experiments, or for release into the wild (Alendal, 1980; Klein, 1988). Because the calf captures involved shooting all the adults within a group, the Association of European Zoo Directors banned purchase of muskox calves in 1926. In the early 60s, this situation began to change with the introduction of tranquilizer guns, faster transport and better zoo veterinary care. For recent information on maintaining muskoxen in Europe see Holst (1990).

The Tierpark Berlin-Friedrichsfelde, which was opened in 1955, covers an area of about 160 hectares, is located at 52'05°N., 13'04°E., at an elevation of 36m. In addition to a broad collection of wild ruminants, our first muskoxen (1.1 calves of the subspecies *Ovibos m. moschatus*) arrived in 1966 from the Alberta Game Farm, Edmonton, Alberta, Canada. Since then, the species has acclimated to our Central European conditions. This paper summarizes 29 years of experience maintaining captive muskoxen in a zoo environment.

Animal Maintenance

Table 1 provides a synopsis of muskox numbers, births and deaths at Tierpark Berlin-Friedrichsfelde betweem 1966–1995.

Table 1. Muskox stock development at Tierpark Berlin-Friedrichsfelde, 1966–1995.

	Total (males.females)	Source
Founding stock	2(1.1)	Canadian born, arrived in 1966
Additions	8(4.4)	Calves, Canada and European Zoo born
Births	31(14.17)	including abortions and stillbirths
Losses	35(18.17)	Table 2
Moved	1(0.1)	
Present	5(1.4)	

Housing

The muskox are kept in an 850 m^2 enclosure with metal fencing (1.6 m high with 6 horizontal steel tubes, 72 mm in diameter. The vertical tubes are 100 mm in diameter and 2.4 m apart). A 3 x 5 m^2 separate pen is available for bulls and/or any sick animals. The ground is a sandy soil with ballast-stones. A 2m-wide concrete slab along the fence provides an abrasion surface for hooves while a few oak trees and a wooden shelter provide shade. There is no mixing of muskoxen with other species.

Feeding

Nutrition of zoo kept muskoxen has not presented serious problems. The base in our zoo is a mixture of concentrates with a crude protein level of 23.9 % and metabolizable energy of 11.3 MJ/kg. This mixture ('pellets for herbivores' 50 %; kibbled oats 30 %; wheat bran 10 %; crushed barley 10%) is fed at the rate of 1.0 kg/animal/day, with the occasional addition of rolled oats, linseed or soya bean meal. In cases of diarrhea a special diet of crisp bread toast and ripe, dry oak are given. Vegetables in season are always provided (carrots and elder berries are favorites), as are green feed lucerne, grass, maize, rye, fresh leaves and branches of oak, willow, poplar, maple, plan-tree, and rowan. During the winter mixed hay from local grass is fed, (alfalfa being most preferred by the animals) and dried branches of oak and willow are provided. Reindeer lichen *Cladina rangiferina* is not often fed. Mineral supplements and multivitamins are added to the feed and salt licks and drinking water are available *ad libitum* (Seidel, 1979).

Seasonal Responses

Climate change

Muskoxen are affected by sudden changes in weather conditions (especially falling atmospheric pressure and heat-waves): We typically see reduced appetite, diarrhea, and a dull attitude in response to sudden climate change. Changing the food, adding anti-diarrhea agents, and cooling the enclosure by lawn- sprinkler has overcome such phases.

Qiviut Shedding

Under Central European conditions, shedding of the underhair occurs earlier in the spring than in Canada (Tener, 1965; Pohle, 1981). Yearlings begin shedding in early March and adults in early April, although periods of cold weather will slow this process. Pregnancy will also delay shedding, which is finished shortly after calving. Most of the animals finish shedding by the end of July and growth of the winter pelage is evident in August. In calves, shedding begins in late July and is finished by late October. The outer hair is continually shed and replaced in all muskoxen. Generally, our 3 Canadian born animals, exhibit the fine underhair described by Wilkinson (1975), but females (between 12–16 years old) develop sparser, paler hair, possibly an adaptation to our mild climate. From the outset, the animals born here, and in the Munich zoo, have a thinner, shorter underhair (reduced by approximately 20 %). In these latter animals the shedding process begins about 3 weeks later and extends into late Octobet.

Rutting/calving season

Our original Canadian bull showed signs of sexual maturity (protrusion of the penis during erection) at 12-months-old, with his first successful copulation at 2.5-years-old. The Berlin born calf, Alf, matured at 6-months-old and bred at 3.5-years-old. The typical rutting odor, caused by the bull urinating on the caudal abdominal region, begins at the end of June. Highly aggressive male rutting behavior is first evident at the age of 3–4 years, with a seasonal peak of rutting activity in the third week of September. Structures within the enclosure (trees, stones, fences) are attacked and often demolished. The aggressive displays and attacking of female muskoxen can be provoked by the sight of zoo personnel. The mean rutting season is finished by the end of October, with the exception of young bulls (2-years-old) who have an extended rutting season

to the end of December. This has been related to calving in late July/early August.

In general, calves are born between 1 to 22 of June (with a concentration between 1–9 June). Birth weights range between 7.5–12.3 kg (7.5–8.9 kg in first deliveries). The age of cows at first calving was 3–4 years with calving in consecutive years (Pohle, 1981).

Pediatric Medicine

Infectious diseases

The highest mortality is among calves (Table 2). Acute cases of pneumonia, catarrhal enteritis and colisepticemia occurred with the clinical signs of dullness, inappetence, fever (>39,5°C), tachycardia, dyspnea/tachypnea, initially moderate to high leukocytosis, while in the final stages leukopenia, anemia, and cardiovascular (infection-related) collapse occurred. With the exception of *E. coli* 086:K61, no bacterial pathogens could be identified due to antibiotic treatment. The suspected initiating factor for this problem is extremely high ambient temperatures (June–September, often more than 28°C). The calves become very inactive recumbent with no food intake. Pneumonia at the beginning was unilateral (under-sided) by hypostasis. Routine preventative programs, used in other zoo ruminants (multivitamins including Selenium; gamma globulin, from cattle; and an iron supplement – all given at birth and 14 days later, plus vaccinations against tetanus at weeks 8 and 12) were ineffective against this condition.

Table 2. Cause of death in young and adult muskoxen kept at Tierpark Berlin-Friedrichsfelde, 1966–1995.

Condition	Calves		Adult		
	(n)	%	(n)	Age range	%
Infectious Diseases	10	43.6	6	6.5–15.5	54.5
Stillbirths	5	21.8			
Abortions	3	13.0			
Ileus/intussusception	3	13.0			
Metabolic Disorder	1	4.3			
Heart Failure	1	4.3	1	3.1	9.1
Toxins			2	7.5, 8.8	18.2
Accident			1	2.6	9.1
Old Age			1	21.5	9.1

Abortions and stillbirth

Three abortions occurred in two multipara cows of 6, 8 and 13 years old. No pathogenic agents could be isolated and the causes of the abortions are unclear. Five cases of stillborn calves (3.2) from 3 cows have occurred; one of them had an abortion at 8 years-old and for the next two consecutive years produced stillborn calves (2.0). The calves were fully developed and no pathogens identified. As with the abortions, the causes remain unknown.

Ileus/intussusception

Three cases of acute, fatal ileus occurred in two female, mother-raised calves at 4 and 6 weeks old, and on day 4 in bottle-fed male. These all occurred during an extreme weather phase (July, 28–32°C) with symptoms of pneumonia and colic. Symptomatic therapy, including antibiotics, was not effective.

Other

An unidentified metabolic disorder in a male calf led to lethal nephrosis (after prerenal dysproteinemia) over a 5 week course following severe trauma. Another male (14 months old) died of heart failure after a second chemical immobilization for treatment of a metacarpal fracture.

Susceptibility to Stress

For about the first 8 months, calves are very susceptible to stress. Social interactions or catching by hand resulted in immediate hyperventilation and a body temperature increase of 1–2°C within 4–7 minutes. Althougt apocrine sweat glans are associated with hair follicles (Flood *et al.*, 1989), body cooling is done mainly through the muzzle. To minimize risks of hyperthermia, all handlings are done as quickly as possible during cool times of the day. Body temperature can be reduced by cooling with a lawn-sprinkler. These dramatic reactions have never been seen in hand-reared calves. Mechanisms for regulating core body remperature in newborn calves have been described in detail by Blix *et al.* (1984).

Diarrhea and Parasites

Diarrhea is always seen in calves following a sudden change of weather or with massive coccidial infections. Treatment is based on the identification of the etiologic agent (Table 3). Of importance in bouts of diarrhea is the constant control and cleaning of the calves' analogenital region and use of an insecticide powder for protection from *Lucilia sericata*-caused

Table 3. Parasitological findings and treatment in muskoxen at Tierpark Berlin-Friedrichsfelde, 1966–1995.

Parasites	Intensity	Drug	Dosage mg/kg bw	Route
Nematodes	(+) – ++	Fenbendazole, Panacur® (HOECHST)	8	p.o.
Strongyloididae		Ivermectin, Ivomec® (MSD-Agvet)	0.2	s.c.
Stongyloides sp.		Mebendazole, Mebenvet® (JANSSEN)	20	p.o.
Strongylidae		Thiabendazole, Thibenzol® (MSD-Agvet)	50	p.o.
Oesophagostomum sp.				
Trichostrongylidae				
Haemonchus sp.				
Haemonchus contortus				
Trichostrongylus sp.				
Ostertagia sp.				
Cooperia sp.				
Metastrongylidae				
Dictyocaulus viviparus				
Ascarididae				
Ascaris sp.				
Trichuridae				
Trichuris ovis				
Capillaria longipes				
Tapeworms		Praziquantel, Droncit®	8	p.o.
Echinococcus granulosus	(+)*	(BAYER)		
Moniezia sp.	+			
Coccidia**	(+) – ++			
E. arloingi, E. crandallis		Sulfadimidine (various products)	100	i.m.,p.o.
E. faurei, E. intricata,		Sulfathiazole Socatyl® (ASID)	200	p.o.
E. ninakohlyakimovae,				
E. parva				
Sarcocystis sp.	(+)			
Flies				
Lucilia sericata	+ – ++	Bromocyclen, Alugan® (HOECHST)	Local	Powder

(+) = trace burden, + = moderate burden, ++ = heavy burden, * = post mortem finding, ** = Tscherner (1973).

myiasis, a potentially serious ectoparasite problem under zoo conditions.

Two parasite groups have proved troublesome in calves; Coccidia and Trichuridae: High intensity coccidia burdens are seen particularly from the 4th month of life (when the forestomach system begins to work) and result in reduced growing rate, emaciation, and diarrhea. Adults seem to be resistant to these coccidia (Tscherner, 1973). Ova of two species of Trichuridae (Table 3) are regularly identified in cases of diarrhea and treatment is needed, even in minimal, small intensity burdens.

An interesting observation is that both maternal and hand reared eat great quantities of sand from the enclosure (visible about 30 hours later in their feces). If prevented from eating sand to protect them from coccidia-oocysts, 1.5 days later a profuse diarrhea occurs. To stop and prevent this we provide heat sterilized humus soil (about 100 g twice/day, which is accepted).

Medical problems in adult moskoxen

Infectious diseases

Generalized infections have been cause of death in 3.3 adult muskoxen (Table 2). Generally, no specific clinical symptoms occurred, activity and appetite were reduced, with occasional signs of pneumonia and nasal mucus. No pathognomonic changes in hematology, blood biochemistry or serologic tests were evident and fecal floats were negative for parasites. As a rule, animals are treated symptomatically

with broad spectrum antibiotics, cardiovascular drugs, and antiparasitics. Various pathogenic agents were found *post mortem* (different cocci, *Pseudomonas aeruginosa, Pasteurella multocida*, rickettsia). In addition, a variety of lesions were found: purulent pericarditis, and in a case of *Pasteurella* infection, cachexia. There was 1 positive identification of Q-fever (Wisser *et al.*, 1993). All these diseases occurred during or shortly after the rutting season (mid September to late December) – possibly from immunosupression.

Toxins

One of our adult males died from renal failure caused by *ad lib.* ingestion of green oaks (Wundersee *et al.*, 1979). Following this incident management changed to ensure that muskoxen do not have access to large volumes of freshly fallen oaks. Very occasionally, oak-related diarrhea is seen.

In cases of unintentional overfeeding with high energy protein feed, laminitis has occurred, with prolapsed penis in the male. This was successfully treated by withholding protein feed for a few days.

One 9-year-old cow died following a 7 hour course of incoordination and cardiogenic convulsions. Post mortem examination found epicardial and myocardial hemorrhage, hepatomegaly, tubulonephrosis, and generalized congestion. No pathogenic agents were identified, but the lesions and clinical symptoms indicate a peracute toxemia.

Trauma

The most frequent injuries among adults were wounds (often infected), contusions, scratches, hematomas and lameness caused by the rutting bull during the months August to October. Medical intervention followed general surgical procedures, involving treatment under anesthesia, local and general broad spectrum antibiotics, tetanus-prophylaxis and contact insecticides against myiasis. Treatment was often complicated by dangerous, stress-related hyperthermia.

Reproductive disorders

Abortions and stillbirths, the most serious reproductive problem, were reported under pediatrics. Other problems, chronic lochial discharge in a primapara cow and placental retention following an abortion, were successfully treated using standard protocols. For basic information of the reproductive biology and endocrinology in muskoxen see Rowell (1991, 1993), for clinical details see Seidel (1995).

Parasites

In general the intensity of parasity of burdens in our adult muskoxen remained subclinical. Fecal examinations for parasites were performed at the parasitological laboratory (head: Dr. W. Tscherner) of the zoo. Moderate intensity burdens of *Strongyloides sp.*, *Dictyocaulus sp.* and *Moniezia sp.* were seen during the first two years after the muskoxen arrived here. Treatments followed standard procedures (Table 3).

A severe infestation with *Lucilia sericata* can result in serious clinical symptoms, e.g. a 10-year-old rutting bull with purulent secretion between and around the horn bases, had a serious infestation of maggots of this fly. After unsuccessful local treatment, the left horn was amputated at its base. Continued antibiotic treatment was again unsuccessful and the bull died of a generalized infection. At necropsy a purulent pleuropneumonia and pericarditis due to *Pasteurella* infection, were identified. In addition, old tuberculosis in intestinal lymph nodes were found. This is the first identification of TB in muskoxen at this zoo and to date no further cases have been identified.

Geriatrics

One female, shipped to us as calf, reached the age of 21.5 years-old. She produced 7 living calves, had 3 stillbirts and 2 abortions. She had her last calf at 17 years-old. After a healthy life she died of heart failure while sleeping.

Immobilization

Detailed reports on chemical immobilization for managing free-living muskoxen have been given by (among others) Jonkel *et al.* (1975), Patenaude (1982), and Dieterich (1984); information from captive herds and zoo kept muskoxen, using injectable and inhalant agents are provided by Jones (1971), White *et al.* (1985), and Seidel (1979, 1985). Since all painful treatments in muskoxen require full chemical immobilization, we have tested a number of agents, the results of which are listed in Table 4.

Hematology/Blood Biochemistry

There are numerous publications regarding physiological blood value in free-living captive Canadian and Alaskan muskoxen (Dieterich, 1970; White *et al*, 1985; Dieterich & Fowler, 1986; Tedesco *et al*, 1991; Groves, 1992), but less is known about zoo

Table 4. Immobilizing/narcotic agents used in muskoxen at Tierpark Berlin-Friedrichsfelde, 1966–1995.

Compounds	n	Trade Names (SOURCE)	Dose mg/kg i.m./i.v./p.o.	Antagonist	Trade Name (SOURCE)	Dose mg/kg i.m./i.v.	Induction Time	Recovery Time
Acepromazine Maleate	1	Vetranquil® (ALBRECHT)	–/–/0.6	– –	– –	– –	2-3 hrs	8-10 hrs
Propiopromazine Hydrochloride	3	Combelen® (BAYER)	0.1/–/–	– –	– –	– –	20-40 min	5 hrs (max)
Xylazine & Ketamine	9	Rompun® (BAYER) various	0.5-1.5/–/– 1.0-2.0	Yohimbine – –	various – –	–/0.1-0.3	3-6 min	30-70 min
Etorphine	4	Large Animal Immobilon® (C-Vet)	0.016-/–/– 0.018	Diprenorphine	Large Animal Revivon (C-Vet)	twice the etorphine dose - i.v. & i.m.	1-4 min	2-4 min

Table 5. Blood chemistry values from 11 healthy muskoxen raised at Tierpark Berlin-Friedrichsfelde, 1966–1995.

Parameter	Units	Value	Parameter	Units	Value
RBC	T/l	5.4-9.9	Na	mmol/l	138-142
Hb	g/l	88-144	K	mmol/l	4.1-5.6
PCV	g/l	0.25-0.50	Ca	mmol/l	2.2-2.6
WBC	G/l	4.9-12	Cl	mmol/l	74-129
Ly	%	40-65	P	mmol/l	1.7-2.6
Mo	%	2-5	Glucose	mmol/l	3.3-6.4
Eos	%	3-10	Bili	mmol/l	3.5-17.1
Bas	%	0-3	Protein	g/l	60-76
Neutro	%	45-60	Albumin	g/l	22-38
ALAT (GPT)	IU/L	18-34	Creat	mmol/l	159.1-300.5
ASAT (GOT)	IU/L				

kept muskoxen (Jones, 1971; Seidel, 1979; Hawkey, 1983). During the last 26 years most of our blood collections have been made for diagnostic purposes. The results from 11 samples, collected from healthy animals, are presented in Table 5 (Seidel, 1995).

We generally found hematological reflections of disease similar to other bovids: leukocytosis (with relative lymphocytoses) in inflammations and respiratory diseases, neutrophilia in general septicemia; reduced erythrocyte count, hematrocrit and Hb under etorphine-xylazine narcosis, and hypochromemia in Q-fever infection (Seidel, 1979; Hawkey, 1983; Wissel *et al.*, 1993).

Conclusions

- Canadian born muskoxen adapted to central European climatic and zoo conditions without serious medical or technical problems. The animals survived an average of 8.5 years, with one cow reaching 21.5 years-old.
- Breeding success is poor and a calf mortality of 84 % is extremely high (only 5 calves reached adulthood).
- More veterinary research is needed to reduce calf losses, especially trough prevention of infectious diseases and thermoregulatory disorders.

References

Alendal, E. 1980. Overføringer og årsaker til utsetting av moskusfe i Norge og på Svalbard. – *Norsk Polarinst. Mèdd.* 107: 23–38.

Blix, A. S., Grav, H. J., Markussen, K. A. & White, R, G. 1984. Modes of thermal protection in newborn muskoxen. – *Acta Physiol. Scand.* 122: 443–453.

Dieterich, R. A. 1970. Hematologic Values of Some Arctic Mammals. – *J. Am. Vet. Med Assoc.*157: 604–606.

Dieterich, R. A. 1984. Muskox medical practices. – *In*: Klein, D. R., White, R. G. & Keller, S. (eds.). *Proceedings of the First International Muskox Symposium.* Biol Pap. Univ. Alaska, Spec. Rep. 4, Fairbanks, AK. 167–169.

Dieterich, R. E. & Fowler, M. E. 1986. *Musk-oxen. In*: Fowler, M. E. (ed.). *Zoo and Wild Animal Medicine.* 2nd ed., Saunders Co., Philadelphia, PA. 996-998.

Flood, P. F., Stalker, M. J. & Rowell, J. E. 1989. The hair follicle density and seasonal shedding cycle of the muskox *Ovibos moschatus*. – *Can. J. Zool.* 67 (5): 1143–1147.

Groves, P. 1992. *Muskox Husbandy.* Biol. Pap. Univ. Alaska, Rep. 5. Fairbanks, AK. 148 pp.

Hawkey, C. M. 1983. The value of clinical hematology in the veterinary care of zoo animals. *Symp. Zool. Soc.* London. unpubl. manuscript.

Holst, B. 1990. *International Studbook for Muskox* (Ovibos moschatus). 1st edition, Copenhagen Zoo. 114 pp.

Jones, D. M. 1971. Sedation of a bull musk ox (*Ovibos moschatus*). – *Zool. Garten N.F.* 40: 138–142.

Jonkel, C. J., Gray, D. R. & Hubert, B. 1975. Immobilizing and marking wild muskoxen in Arctic Canada. – *J. Wildl. Manage.* 39: 112–117.

Klein, D. R. 1980. The Establishment of Muskox Populations by Translocation. – *In*: Nielsen, L. & R. D. Brown (eds.). *Translocation of Wild Animals.* The Wisconsin Humane Society, Inc., Milwaukee, WI & Caecar Kleberg Wildlife Research Institute, Kingsville, TX. 298–313.

Patenaude, R. P. 1982. Chemical Immobilization of Muskox. – *In*: Nielsen, L., Haigh, J. C. & M. E. Fowler (eds.). *Chemical Immobilization of North American Wildlife.* Wisconsin Human Society, Inc., Milwaukee, Wl. 439–447.

Pohle, C. 1981. Tiergartnerische Beobachtungen bei der Haltung und Zucht von Moschusochsen (*Ovibos m. moschatus*) im Tierpark Berlin. – *Zool. Garten N.F. 51:* 289–322.

Rowell, J. E. 1991. *Reproductive Biology and Endocrinology in Captive Muskoxen.* Ph.D. thesis, University of Saskatchewan, Saskatoon, Sask. 203 pp.

Rowell, J. E., Pierson, R. A. & Flood, P. F. 1993. Endocrine changes and luteal morphology dyring pregnancy in muskoxen (*Ovibos moschatus*). – *J. Reprod. Fertil.* 99: 7–13.

Seidel, B. 1979. Tierarztliche Gesichtpunkte der Gefangenschaftshaltung von Moschusochsen (*Ovibos moschatus*). – *Zool. Garten N.F.* 49: 131–160.

Seidel, B. 1995. Moscusochse (Schafsochse). – *In*: Goltenboth, R. & Klos (eds.). *Krankheiten der Zoo- und Wildtiere.* Blackwell Wissenschafts-Verlag, Berlin.

Tedesco, S., Buczkowski, S., Adamczewski, J. & Flood, P. F. 1991. Hematology and serum biochemistery values in muskoxen. – *Rangifer* 11(2): 75–77.

Tener, J. S. 1965. *Muskoxen in Canada – a biological and taxonomic review.* Queen's Printer, Ottawa. 166 pp.

Tscherner, W. 1973. Kozidien bei Wiederkauern im Tierpark Berlin. – *Verh. ber. Int. Symp. Erkrg. Zootiere* 15: 103–11.

White, R. J., Cribb, P. H., Glover, G. & Rowell, J. 1985. Halothane Anesthesia in a Muskox (*Ovibos moschatus*). – *J. Zoo Anim. Med.* 16: 58–61.

Wikinson, P. F. 1975. The length and Diameter of the Coat Fibres of the Musk Ox. – *J. Zool, London.* 177: 363–375.

Wisser, J., Strauss, G. & Henschke, J. 1993. Chronisch verlaufende Q-Fieber-Infektion beim Moschusochen (*Ovibos moschatus*) – *Verh. ber. Int. Symp. Erkrg. Zootiere* 35: 181–187.

Wundersee, W.-J., Pitschke, H. & Hundsdorff, P. 1979. Zur Eichelfutterung in Zoologischen Garten. – *Ver. ber. Int. Symp. Erkrg. Zootiere* 21: 357–363.

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