

Hand-rearing Seven-banded armadillos *Dasypus septemcinctus* at the National Zoological Park, Washington

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The National Zoological Park obtained four baby Seven-banded armadillos *Dasypus septemcinctus* on 1 December 1969. They had been collected five days previously in savannah about 130 km from the town of Barra do Corda, Brazil. All four animals were ♂♂. Their eyes were open, indicating that they were approximately two weeks old, since the eyes of armadillos generally open at 12–18 days (Dennis Meritt, pers. comm.). Two of the armadillos were smaller and one of these died within six hours; one of the larger animals died the next night. At death, five upper and six lower molars were present on each side, not all fully erupted.

DIET

The animals showed no tendency to suck but lapped liquid food from a dish; their early attempts made them gasp as the nose was often immersed. Male 1 extended his tongue almost completely, often twisting it upside down, while ♂₂ extended his only about one-third as much and

did not twist it.

By the age of 4½ weeks the animals could feed themselves. Till then they had to be held at the food dish, ♂₁ eating more readily if held by hand, ♂₂ preferring to be wrapped in a towel. The milk formula, Orphalac, was supplemented with ViDaylin M and Ferrolip iron drops. After Day 3, Initol was added to combat diarrhoea. On Day 5 apple sauce and strained beef were also added. Solids were gradually increased: egg yolk, mixed cereal, cottage cheese, cooked sweet potato and dog meal. After the first month, Esbilac was substituted for the Orphalac-Initol mixture, and it is felt that had this formula been used initially, the diarrhoea might have been averted. In the third month Pervinal was substituted as vitamin supplement and by 18 weeks ground horsemeat was being fed. The food was mixed to the consistency of oatmeal. At 25 weeks mealworms were offered and accepted. Water was accessible at all times after the first week and each animal usually drank at least once a day.

AGE (weeks)	DIET*	FEEDING SCHEDULE	AMOUNT EATEN* (cc/feed)
2	Orphalac	every 2 hours	1-4
2½	2 cc Orphalac; 0.5 cc Initol; 0.5 cc water; ¼ tsp. apple sauce; ViDaylin M (1 drop each animal per day in feed)	every 3 hours	4-6
3	¼ tsp. Gerbers strained beef added to above	every 3 hours	4-6
3½	mixture doubled; 1 cc raw egg yolk and ¼ tsp. Gerbers mixed cereal added; Ferrolip (1 drop each animal per day in feed)	every 5 hours	5-6
4½	diet varied at some feeds by substituting cottage cheese for apple sauce, strained veal for beef, cooked egg yolk for raw	4 times/day: 0530, 1130, 1700, 2330	10
7	Esbilac (1 tsp. of 1 : 3 water mixture); 2 tsp. Gerbers Junior meat; ½ tsp. Gerbers egg yolk; ½ tsp. apple sauce or cottage cheese; 1 tsp. Gerbers mixed cereal	4 times/day	10-20
9	Cooked sweet potato and Ken-L-Ration dog meal (finely ground) substituted for strained meat	4 times/day	20
10	same	3 times/day; eat <i>ad lib.</i>	45-80 cc/day
13	same	same	55-90 cc/day
13½-22	gradual addition of raw ground horsemeat and chopped greens; milk reduced; Pervinal replaces vitamin drops		
22	daily diet (fed once/day; varying amounts eaten <i>ad lib.</i>): ½ cup ground Ken-L-Ration dog meal, ½ cup raw ground horsemeat, 1 tbsp. cooked sweet potato, 1 raw egg yolk, 1 tsp. Pervinal, approx. ¼ cup chopped greens, ½-1 cup water (mixed to oatmeal consistency)		

*quantities given are for both animals.

Table 1. Diet of two young Seven-banded armadillos *Dasypus septemcinctus* hand-raised at the National Zoological Park, Washington DC.

HOUSING

The armadillos were first housed in a human baby incubator (Garden Armstrong Co.), maintained at a temperature of 26.6-29.4°C. We found that a constant 32.2°C was too warm and caused lethargy, while too low a temperature made the animals shiver and grow cold and flaccid. A careful check had to be kept at all times for signs of sudden chilling which seemed to occur at almost any temperature below 33°C. As a source

of extra warmth, a hot water bottle was placed in the incubator, and either this or a radiator was also used when the animals were exercising or feeding outside it (room temperature 25.5-26.6°C). A cloth was provided for burrowing purposes.

A week after arrival the animals became very active and a divider had to be placed in the incubator to prevent them climbing on to the heating apparatus. By five weeks the incubator was used as a daytime cage, and at night the animals were

kept in a cardboard box, turned on its side, with towels and a hot water bottle. They were carried to and from the zoo in this box. By the following week they could be left on their own in the author's house during the day, except at feeding times.

When, at 13 weeks, the animals were returned to the zoo, they were put in a wire mesh cage measuring 3.6 × 1.8 m. The screen mesh sides were panelled with plywood to a height of 0.9 m to prevent climbing. The dirt-covered wooden floor was lightly scattered with timothy hay. Furnishing consisted of a log, a small mat of grassy sod, a basin of water for bathing and a wooden nest box 0.3 m³. Room temperature ranged from 22.8–26.1°C.

HEALTH

Diarrhoea was a problem for the first month. The condition improved a little with the addition of 0.05 cc of Kaopectate to each feed and eventually disappeared with the change of milk formula and as more solids were eaten. The normal stool ranged from moderately loose and unformed to a concretion of pellets.

Faecal checks, beginning 10 December, revealed an abundance of *Strongyloides* larvae and *Amoeba*. On 23 May one teaspoon of Equizole was mixed with the feed, but the parasites were still present the next month when the animals were sent to Lincoln Park Zoo, Chicago.

Although the eyes of both animals were open on arrival, they closed shortly thereafter, became swollen and exuded pus – probably due to lack of humidity. They were swabbed open with warm water or mineral oil and Chloromycetin was applied daily. Both right eyes cleared but the left remained infected; ♂₂ was cured by the third month but ♂₁ lost the vision of his left eye.

At four months, ♂₁ temporarily lost the use of his left foreleg, probably due to a pulled muscle. When ♂₂ was 19 weeks old he lost a claw from his left forepaw, perhaps from digging at a favourite wooden crack. The toe swelled and the animal stopped eating, but after 0.5 cc BiCillin was administered intramuscularly in the hindleg it was active and feeding within 24 hours.

GROWTH

As the armadillos had hardly eaten for the five

AGE (days)	WEIGHT (g)		NOSE-TAIL BASE (mm)		TAIL (mm)	
	♂ ₁	♂ ₂	♂ ₁	♂ ₂	♂ ₁	♂ ₂
16	74.7	70.7				
17			120	112	70	72
19	80.0	78.7	115	114	72	77
24	86.0	86.2	117	115	75	73
29	90.7	84.1	118	117	76	78
34	105.0	90.0				
35			110	109	84	77
38	124.7	110.1				
44	156.8	145.8				
46			132	132	85	84
54	220.1	206.2				
55	241.1	218.1	147	152	101	96
56	246.2	229.1				
62	298.0	271.0	163	159	100	102
69	362.0	335.2	181	180	105	104
76	464.0	426.0	200	194	109	113
83	566.3	490.0	206	199	116	118
92	673.4	549.1	215	211	126	120
	hair developing on chest					
97	729.0	634.0	212	199	125	120
124	921.0	780.2				
208*	1250	1023				

*At Lincoln Park Zoo, Chicago.

Table 2. Growth rate of two young Seven-banded armadillos *Dasypus septemcinctus* hand-raised at the National Zoological Park, Washington DC.

days after capture, their weights on arrival at two weeks of age were less than normal. By 1½ months these weights had roughly doubled. Although the original four animals were probably quadruplets (3), there was a visible difference in the size of the two survivors, which increased from 4 g at two weeks to 227 g at eight months (Table 2).

DEVELOPMENT OF BEHAVIOUR

When they arrived, the armadillos could already dig, walk, right themselves when turned on their back, wipe at their face with the forepaws to clean off foreign matter, defaecate and urinate spontaneously, and exhibited typical pre-defaecation movements including digging with the forepaws and kicking back with the hindfeet before squatting. Water and food were ingested by licking.

At Day 19 they could stand on their hindlegs, bracing with the tail, to test the air. At three weeks they could climb over a 15 cm barrier by hooking one forepaw over the edge and hauling themselves up. At Day 25 they could sit up and scrape the face clean with the forepaws. When exploring outside the nest area, they would follow any moving object. Scratching the ventrum with the hindfoot was well developed by four weeks.

From this age the animals showed an increasing

tendency to follow the feet of their keeper and at Day 30 one of them attempted to mount a foot. They were also beginning to exhibit more spontaneous exploratory behaviour away from the nestbox. They were first seen to gallop on Day 29 and to jump from a height of 45 cm on Day 37. On Day 31 rubbing was first observed; the animal leaned against an object and rocked to and fro. Nest-building was first seen on Day 39 and this tendency increased until by the seventh week the animals reacted positively whenever they encountered any loose tissue or newspaper in the cage area (1).

By Day 32 two sorts of vocalisation could be distinguished: a repetitive, clicking sound made when hungry and /or exploring, and a squeak if suddenly picked up or disturbed. At eight weeks a new vocalisation was heard – the 'whuffling' sound. This was especially noticeable during genital grooming, which had been increasing in frequency since the age of six weeks. At ten weeks one of the animals gave a low, rumbling growl when disturbed in a new nest site. The nest site had just been moved and immediately the animals became hyper-reactive to any disturbance. They would produce the high-pitched squeak when picked up and a startle reaction, such as jumping and running to the nest, could be induced

easily while they were foraging.

The tendency to follow the keeper's feet and to respond to them sexually persisted, until, at 11 weeks, the mounting and thrusting culminated in ejaculation. Semen taken from ♂₁ at 14 weeks was examined microscopically and found to contain a few mobile sperm.

At 18 weeks typical behaviour at the water dish consisted of digging in the water, lying in it, sliding sideways, rolling over and emerging to mark the floor around the edge of the dish. Lying and playing in water has also been noted for *Euphractus sexinctus* (2). Marking, which was first seen at five weeks, was effected by dragging the perineal region while moving forward.

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PRODUCTS MENTIONED IN THE TEXT

BiCillin: long-acting penicillin manufactured by Wyeth Laboratories, Inc., Philadelphia, Pennsylvania, USA.

Chloromycetin: ophthalmic ointment manufactured by Parke, Davis & Co., Detroit, Michigan, USA.

Equizole: anthelmintic powder manufactured by Merck Chemical Division, Rahway, NJ, USA.

Esbilac: a milk substitute manufactured by Borden Inc., Norfolk, Virginia, USA.

Ferrolip: liquid iron drops manufactured by Flint Laboratories, Morton Grove, Illinois, USA.

Garden Armstrong Co.: manufacturers of incubators, Cleveland, Ohio, USA.

Gerbers Products: baby foods manufactured by Gerbers Products Co., Fremont, Michigan, USA.

Intol: liquid additive for Orphalac manufactured by Riviana Foods, Topeka, Kansas, USA.

Kaopectate: anti-diarrhoeal liquid manufactured by Upjohn Co., Kalamazoo, Michigan, USA.

Ken-L-Ration: commercial dry dog food manufactured by Quaker Oats Co., Chicago, Illinois, USA.

Orphalac: a milk substitute manufactured by Riviana Foods, Topeka, Kansas, USA.

Pervinal: vitamin-mineral supplement manufactured by US Vitamin & Pharmaceutical Corp., New York, NY, USA.

ViDaylin M: multivitamin pediatric drops manufactured by Ross Laboratories, Columbus, Ohio, USA.

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