

TAILLESSNESS IN THE RAT

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THREE FIGURES

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INTRODUCTION

There seems to be a general opinion that when a rat appears without a tail it means the loss of the tail by accident early in the animal's life, and it is usually suggested that it was bitten off by another rat at the time of birth or soon after. The objects of this paper are to describe skeletal conditions in the region posterior to the thoracic vertebrae of several tailless rats, and to correct the existing impression that a tailless rat occurs through the accidental loss after birth of a once existing tail. As to the word tailless; by tailless we mean here "with no caudal vertebrae." There are cases, of course, where, from disease or from some accident after birth, the tail has become simply a stub, but in these cases some caudal vertebrae remain.

HISTORICAL SURVEY

Little data seems to have been recorded concerning the tailless condition of the higher animals. Short tails have been noted among cats, fowls, and dogs, while the number of caudal vertebrae has been found to vary in some other animals, but only

among dogs have cases been recorded where the caudal vertebrae of a mammal were completely absent.

Hind ('89), Anthony ('99), Kennel ('01), and Davenport ('05) all give accounts of mating Manx cats or short-tailed cats with the long-tailed variety and having the short tail appear in many of the offspring. The ordinary cat, according to Flower ('85), has twenty-two caudal vertebrae, and according to Jayne ('98), eighteen to twenty-six. As to the number of caudal vertebrae of the short tailed cats, Flower ('85) gives three for the Manx cat, Anthony ('99) describes six, and Kennel ('01) speaks of six 'post-sacral' vertebrae in a so-called tailless cat.

Concerning fowls, Godron ('65) in a footnote says that complete lack of coccyx has been observed in a large number of fowls and that the character is very readily transmitted. He does not give any details of vertebral conditions in these cases, but, from descriptions of other 'rumpless' fowls, we conclude that the coccyx here probably was not completely lacking. In the ordinary fowl Davenport ('06) gives the number of free, caudal vertebrae as five, followed by a fused portion, the uropygial bone. Davenport ('06) describes a rumpless game female as having two unsymmetrically formed and intimately fused caudal vertebrae, followed by a knob of bone about 1 mm. in diameter, Darwin ('83) speaks of the caudal vertebrae in three rumpless fowls as being few in number and anchylosed together into a misformed mass. He also reports the inheritance of rumplessness in fowls, as does Davenport ('06).

Some other animals have been recorded as showing variation in the number of their caudal vertebrae. Bateson ('94) gives the following:

Man: (Normal number of caudal vertebrae, according to Flower, '85, three to four). A male with sacral and caudal vertebrae anchylosed together and of uncertain number; a female with the coccyx of three pieces anchylosed together.

Anthropoid apes:

Chimpanzee: (Normal number of caudal vertebrae, according to Flower, '85, five). One animal had six caudal vertebrae and others had two to four.

Orang-utan: (Normal number of caudal vertebrae, according to Flower, '85, four). One animal had three caudal vertebrae, three each had two caudal vertebrae, a fifth had the caudal vertebrae anchylosed with the sacral, and a sixth had only one caudal vertebrae.

Sloths: Among the sloths there was considerable variation from the normal number of caudal vertebrae.

None of the above refer to an absolutely tailless condition. We have, however, recorded by Godron ('65), a complete absence of caudal vertebrae in the dog. He examined by palpation the sacral region of a tailless female water spaniel and found at the end of the vertebral column a rounded, bony surface which he took to be the last sacral vertebra, and concluded that the coccyx was gone completely. (According to Flower, '85, the caudal vertebrae of the dog number from fifteen to twenty-three.) In his account of this female he states that, when she was mated with a tailless brother, six of the litter of seven were absolutely tailless. When she was mated with a long-tailed male water spaniel, the litter of four were all tailless like the mother. The grandfather of these dogs had a rudimentary tail 3 cm. long. Godron ('65) speaks also in a footnote of a tailless species of dog, the Dalmatian hound or brach-hound of Bourbonnais.

In all of these accounts of short-tailed and tailless animals the conditions referred to are congenital and not the result of accident.

MATERIAL AND METHODS

The material for this study was obtained from The Wistar Institute rat colony and consisted of rats of the species *Mus norvegicus albinus* and *Mus norvegicus* (pied). Specimens for the work were not abundant, since, during the past nine years, only five tailless rats have appeared in the colony, although forty thousand rats have been observed. Of these five, one was eaten by an older rat soon after birth, one male is at present mated in the colony, and the remaining three rats were killed and examined.

The method of examining these rats was as follows: The animal was chloroformed, its body weight and body length taken,

and its skin and viscera removed. The vertebral column with pelvic girdle attached was partly cleaned of its masses of muscle, covered with a boiling hot, 2 per cent solution of 'Gold Dust' washing powder (a 1 per cent solution was used for the youngest rat), and kept at about 95°C. until the flesh was softened so that it could be removed. This was done in tap water and, in addition to the usual instruments, a bone-scraper and a tooth-brush were used. Care was taken not to separate the vertebrae in the region of and caudal to the pelvic girdle attachment. The bones now were dried and placed in corked vials with tar camphor balls to protect them from Anthrenus.

DESCRIPTION OF THE RATS EXAMINED

Of the three tailless rats whose vertebrae were examined, one was a female and two were males. The data concerning them are presented in table 1. The normal rat of this species (*Mus norvegicus*) has six lumbar vertebrae, four sacral, and twenty-nine to thirty-one caudal.

Rat No. 1, the female, was of the species *Mus norvegicus* (pied). Its parents were among some pied, pet rats of the colony. It was two years old when killed, its body weight was 171.3

TABLE 1

Data on tailless rats

RAT NO.	SPECIES	SEX	AGE DAYS	BODY WEIGHT	BODY LENGTH IN MM.	PARENTS	DATE OF KILLING
				<i>grams</i>			
1	<i>Mus norvegicus</i> (pied)	♀	730	171.3	193	among pied pet rats	12-14-'14
2	<i>Mus norvegicus albinus</i> ; half inbred; 11th generation	♂	388	190.9 (m o n t h earlier 210)	194	♀ × ♂ 10th stock gen. inbred	5-19-'14
3	<i>Mus norvegicus albinus</i> ; s t o c k strain	♂	30	21.7	89		2- 8-'15

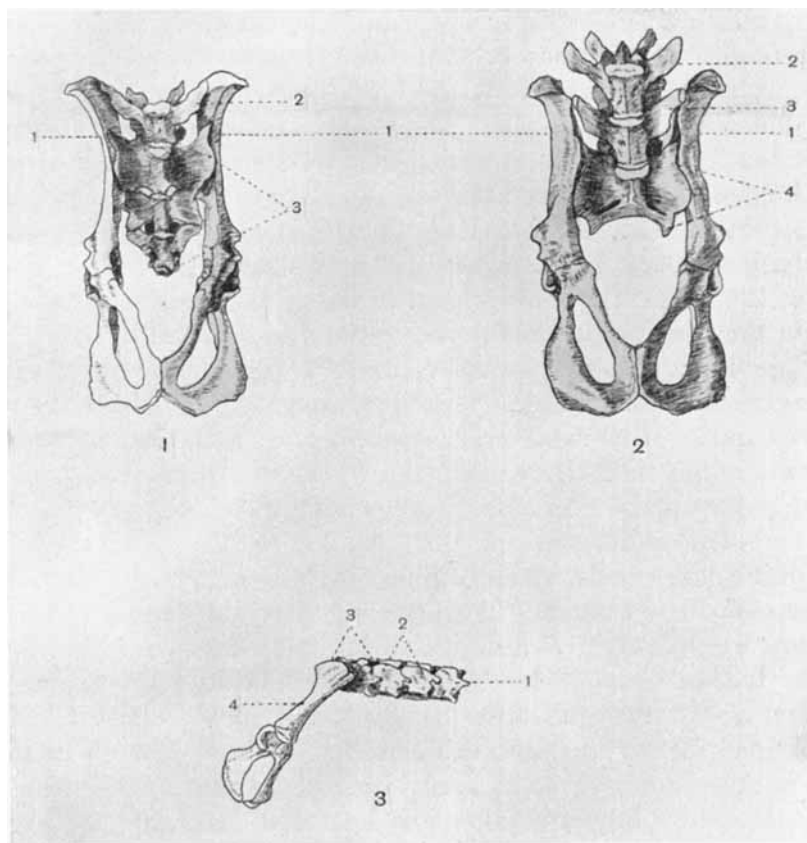


Fig. 1 Rat No. 1, ventral aspect; 1, pelvic girdle; 2, sixth lumbar vertebra; 3, three modified sacral vertebrae.

Fig. 2 Rat No. 2, ventral aspect; 1, pelvic girdle; 2, fifth lumbar vertebra; 3, sixth lumbar vertebra; 4, two modified sacral vertebrae.

Fig. 3 Rat No. 3, right lateral aspect; 1, thirteenth thoracic vertebra; 2, two first lumbar vertebrae; 3, two or three modified lumbar vertebrae; 4, pelvic girdle.

grams, and its body length was 193 mm. The arrangement of the most posterior vertebrae of this rat and their relation to the pelvic girdle may be seen in figure 1. Supposing all the lumbar vertebrae to be present, we have here, posterior to the lumbar vertebrae, only three modified sacral vertebrae. Thus one sacral vertebra and all of the caudal vertebrae are missing.

The striking feature here then is that the vertebral column ends posteriorly about midway of the long axis of the pelvic girdle, far in from the posterior end of the body.

Rat No. 2, a male, was a half-inbred albino (*Mus norvegicus albinus*) of the eleventh generation. Its mother was a strict inbred of the tenth generation and its father a stock male. When killed it was 388 days old, its body weight was 190.9 grams (one month earlier it had weighed 210 grams), and its body length was 194 mm. The arrangement of the most posterior vertebrae and their relation to the pelvic girdle may be seen in figure 2. Supposing all the lumbar vertebrae to be present, we have here, posterior to the lumbar vertebrae, only two modified sacral vertebrae. Thus two sacral vertebrae and all the caudal vertebrae are missing. Here again the vertebral column ends posteriorly far up the long axis of the pelvic girdle, even anterior to the middle of its axis.

Rat No. 3, a male, was an albino rat (*Mus norvegicus albinus*) of unknown parentage. It was thirty days old when killed, its body weight was 21.7 grams, and its body length was 89 mm. This rat was small and in rather poor condition. The arrangement of the most posterior vertebrae and their relation to the pelvic girdle may be seen in figure 3. We have here no sacral vertebrae, but two good lumbar vertebrae and two or three modified lumbar vertebrae. The last (sixth and perhaps fifth also) lumbar vertebra, all of the sacral vertebrae, and all of the caudal vertebrae are missing. In this case then the vertebral column is more modified than in the other two rats, for here the vertebrae reach only to the anterior part of the pelvic girdle, and the girdle is attached to the column merely by a small surface near its anterior end. This mode of attachment allows the posterior end of the girdle to hang very low down, almost at right angles to the column. In the living rat the sagging of the girdle was very noticeable, as it allowed the head of the femur to drop far down and thus gave an odd appearance to the posterior part of the rat's body.

This completes the description of the three tailless rats whose bones have been examined. As to the tailless male albino rat

which has been mentioned as at present mated in the colony, we are confident from inspection that in this animal also the vertebral column ends far forward along the long axis of the pelvic girdle, for this condition may be felt distinctly by pressing the finger on the rat's back in the pelvic girdle region.

The vertebral structure of all the tailless rats which we have examined seems to show that the deformity is not due to an accident after birth, since in each case the column ends in the pelvic region far from the posterior end of the body. We conclude, therefore, that the rats were born tailless, and even more than tailless, since they lack more than the caudal vertebrae.

SUMMARY

An examination of the vertebrae of three tailless rats showed that all of them lacked all of the caudal vertebrae; and besides, the first lacked one sacral vertebra; the second, two sacral vertebrae; and the third lacked one (and perhaps two) lumbar vertebra and all four of the sacral vertebrae.

In each case the vertebral column terminated in the pelvic region far anterior to the posterior end of the body, showing that the tailless condition was due not to accident after birth but to a congenital deformity of the vertebral column.

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