

Pacinian Corpuscles in the Digits of the House
Musk Shrew (*Suncus murinus*)

— Preliminary note —

Katsutomo KATO¹, Hiroyuki TAHARA¹ and Tsutomu ODA²

Abstract The distribution and morphology of the digital Pacinian corpuscles in the laboratory house musk shrew, *Suncus murinus*, were examined by light and electron microscopes. The Pacinian corpuscles occurred bilaterally along the digital nerves in the connective tissue between the flexor digitorum tendons and palmar aspects of the phalanges. They were oval or ellipsoidal in shape and were small, bearing structural resemblance to those occurring in the articular capsules of the cat and man. The outer core of each corpuscle is comprised of approximately 10 layers of perineural lamellae. Because the digital Pacinian corpuscles are exposed to tendinous activity, they may be involved in the regulation of muscle tonus of the limbs in the house musk shrew.

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Key Words : *Suncus murinus*, Digits, Pacinian corpuscle,
Mechanoreceptor, Histology, Electron microscopy

Pacinian corpuscles are the large sensory nerve endings to be found throughout the mammalian body, and they are exceedingly variable with regard to size, form and distribution¹⁾²⁾. Physiologically, the Pacinian corpuscles play an important role as a rapid-adapting mechanoreceptor to pressure³⁾. The corpuscles in human skin have been frequently reported, since Lehmann(1741) first noted them and then Pacini (1835) described their structure. As for the digits of monkey and man, not only are the corpuscles found in the skin, but also they are abundant in the deeper regions such as

1 Department of Physical Therapy, The School of Allied Medical Sciences, Nagasaki University

2 Department of General Education, The School of Allied Medical Sciences, Nagasaki University

the articular capsules, the ligaments and aponeurosis⁴⁻⁷⁾. However, the corpuscles in the digits of the other mammals, especially relatively small-sized species as the mouse or rat, have not yet been described in detail. In the present study, the distribution and morphology of the Pacinian corpuscles observed in the fore and hind foot digits of the laboratory house musk shrew, *Suncus murinus*, a species of insectivores, are described.

Materials and Methods

Twenty adult house musk shrews bred in the Laboratory Animal Center for the Biomedical Research of Nagasaki University were used in this study. For the light microscopy, 15 animals were perfused through the ascending aorta with 10% buffered formalin under anaesthesia, and postfixed with the same fixative. The fore and hind feet were removed, and embedded in paraffin and celloidin according to standard methods. The serial sections were cut at thickness of 5 to 50 μm , and were stained by hematoxylin and eosin. Nerves were stained by Seto's silver impregnation method. For electron microscopy, 5 animals were perfused with 2.0% glutaraldehyde and 2.5% formaldehyde solution under anaesthesia. The digits were removed from the feet and immersed in the same fixative for 4 hours. The specimens were decalcified with 5% EDTA for 10 days. This was followed by a 2-hour postfixation in 1.0% OsO_4 solution, and then embedded in Epon. The semithin sections were stained with toluidine blue solution for light microscopy. The ultrathin sections were treated with uranyl acetate and lead nitrate. A JEM 1200EXII electron microscope was used for observations.

Observations and Discussion

In the digits of the house musk shrew, the Pacinian corpuscles occurred bilaterally along the digital nerves in the connective tissue between the flexor digitorum tendons and palmar aspects of the phalanges (Fig.1 and Fig.2). Cauna and Mannan⁴⁾ reported that the Pacinian corpuscles in human digits were found in five regions: 1) the deep part of the palmar corium, 2) the palmar subcutaneous fat deep to the zone of sweat glands, 3) the sides of middle and proximal phalanges adjacent to the periosteum, 4) between the flexor digitorum tendon and the palmar aspect of the middle and proximal phalanges, and 5) at the attachments of the some of the short distal muscles to the bases of the proximal phalanges. The corpuscles in the house musk shrew were only found in the region corresponding to the fourth region. On the other hand, according to the present authors' unpublished observations, some strains of the mouse and rat, species of rodents, have few digital corpuscles. This finding is interesting from the viewpoint of phylogenetic development of the

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mechanoreceptors. The corpuscles in the digits of the house musk shrew were oval or ellipsoidal in shape, averaging $260 \mu\text{m}$ in length and $130 \mu\text{m}$ in width. The size of the corpuscles varies according to mammalian species

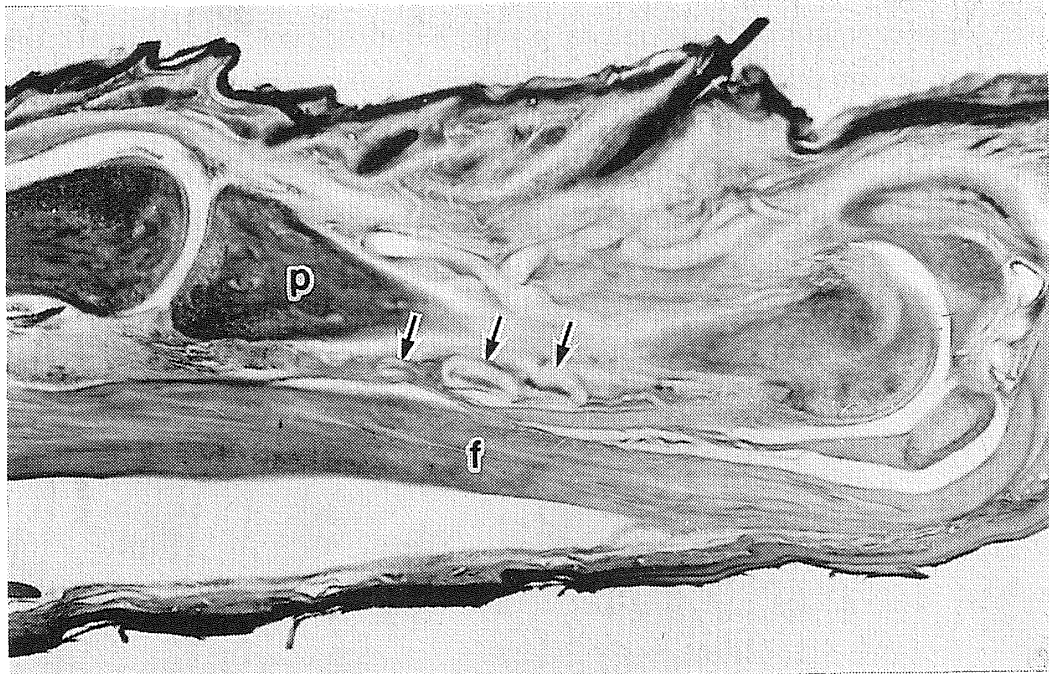


Fig. 1 A digit of the hind foot (stained by Seto's silver impregnation method). Some Pacinian corpuscles (arrow) with nerve fiber occur between middle phalanx (p) and the flexor digitorum tendon (f). Longitudinal section, x 50.



Fig. 2 A digit of the fore foot (Semithin section, stained by toluidine blue). A cluster of the Pacinian corpuscles occurs in the connective tissue between phalanx (p) and flexor digitorum tendon (f). Cross section, x 250.

and tissues¹⁾. The digital corpuscles of the house musk shrew are small, and bear structural resemblance to those occurring in deeper parts as articular capsules⁸⁾, often regarded as small Pacinian corpuscles in a review by Freeman and Wyke⁹⁾. The electron micrograph in Fig. 3 clearly indicates that the corpuscle consists of three major zones: a multilayered perineural capsule which refers to the outer core, the neighboring inner core and the nerve fiber with its ending. The outer core consists of concentrically 10 layers or so of arranged cytoplasmic lamellae. The corpuscle has one or more inner cores. The inner core consists of closely packed cytoplasmic lamellae, which are bilaterally arranged in two groups, one on each side of the amyelinic axon, and its ending. They are separated by the longitudinal clefts, which are full

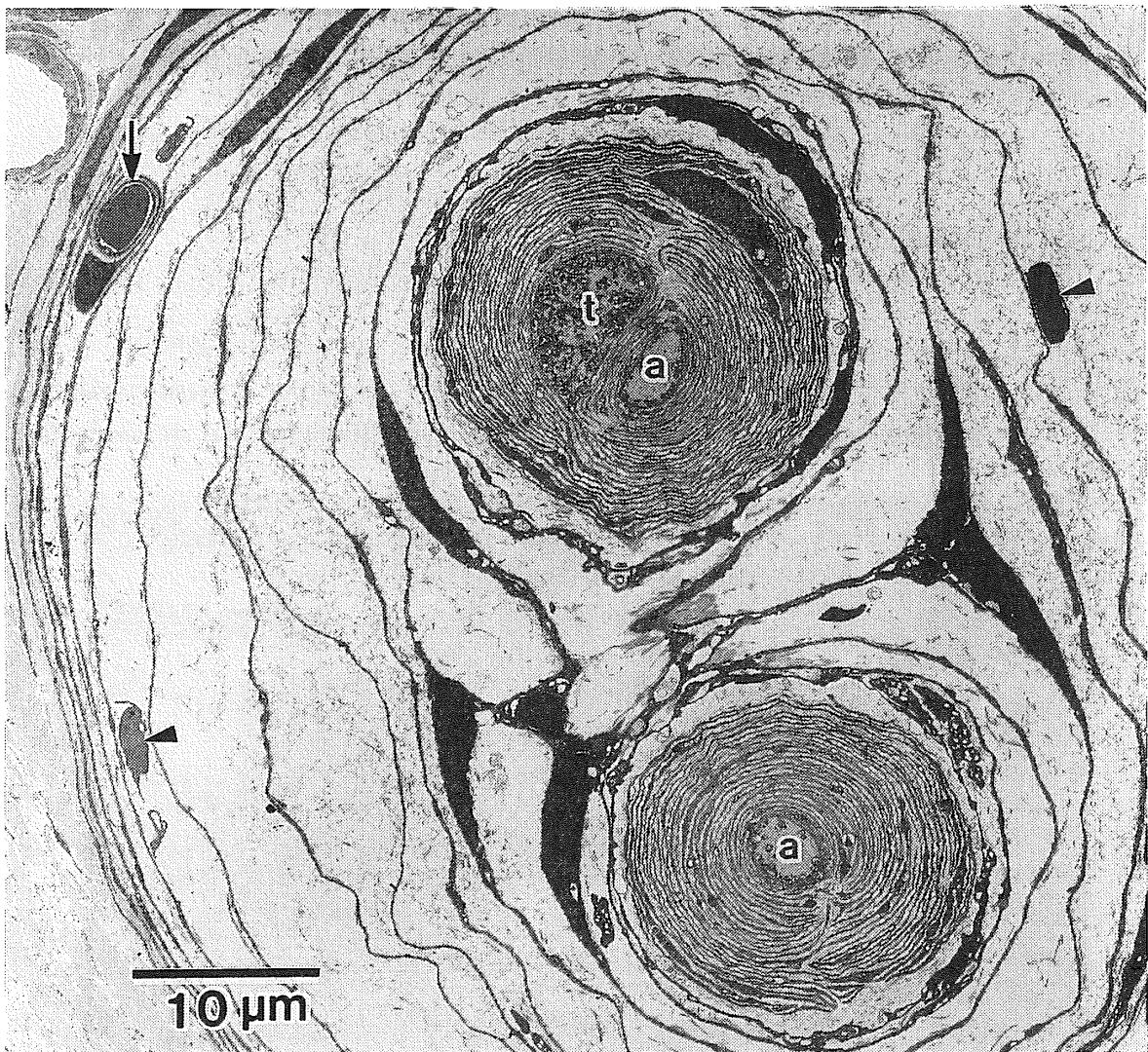


Fig. 3 A Pacinian corpuscle has two inner cores, one of which includes both an axon (a) and an axon terminal (t). High concentrations of mitochondria are seen in the axon terminal. There are usually capillaries (arrow) and macrophages (arrowhead) in the perineural capsule (or outer core). Cross section, x 2,300.

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of liquid and collagen fibrils (Fig. 4). The inner core often contains more than one axon, which possesses dispersed mitochondria, neurofilaments and neurotubules. Especially, the axon ending is characterized by the great concentration of mitochondria (Fig. 3). The Pacinian corpuscle acts physiologically as a rapid-adapting mechanoreceptor^{6-7,10}. In the house musk shrew, *Suncus murinus* of a small-sized mammal, the digital Pacinian corpuscles are exposed to tendinous movements. This suggests that they regulate the activities of the limb musculature, in the same way as those of man and monkey.

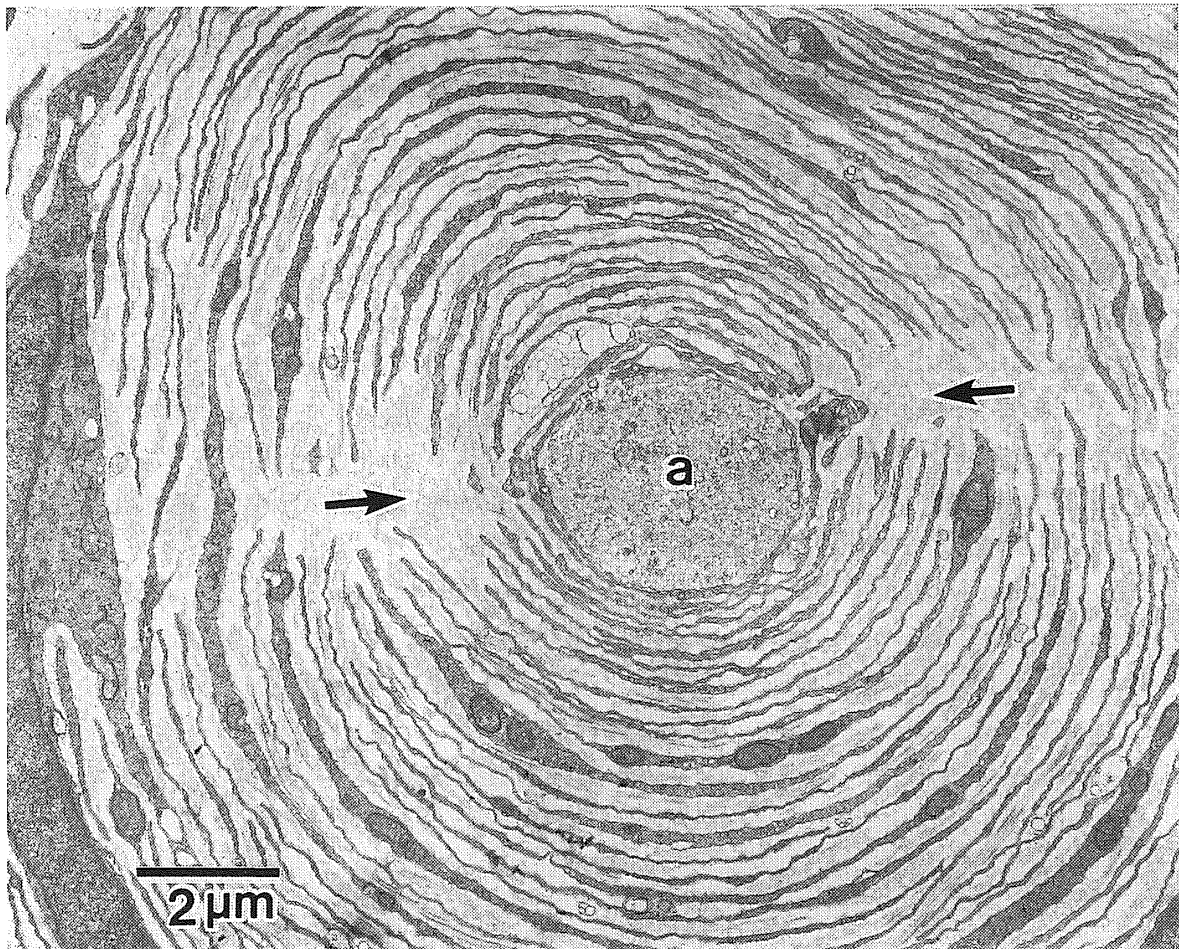


Fig. 4 An inner core with about 40 cytoplasmic lamellae and a symmetrical longitudinal cleft (arrow). a, Axon. Cross section, x 8,500.

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ジャコウネズミ（スンクス）の指における

パチニー小体の分布と形態

— 予 報 —

加藤 克知¹ 田原 弘幸¹ 小田 力²

1 長崎大学医療技術短期大学部理学療法学科

2 長崎大学医療技術短期大学部一般教育

ジャコウネズミ（スンクス）足指におけるパチニー小体の形態と分布を光学顕微鏡および電子顕微鏡を用いて調べた。パチニー小体は長径約 260 μm 、幅径約 130 μm の卵円体ないし楕円体である。形態学的にはネコやヒトの関節包にみられる小型の小体に類似する。周縁は 10 層程度の神経周膜細胞の層板（外棍）からなり、その内部には 30 ないし 40 の細胞質層板からなる内棍と神経終末部が含まれる。パチニー小体は指の屈筋腱と指骨の間の深部結合組織中に両側性に局在し、他の部位には認められない。位置関係から、これらのパチニー小体は指屈筋腱の緊張に曝されていると考えられる。すなわち、ヒトなどの比較的大型のほ乳類と同様に、ジャコウネズミにおいても、指のパチニー小体は体肢の筋活動の反射的制御に関与していることが示唆される。

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