

BRIEF NOTE

DORSAL AND ANAL GLANDS IN THE EASTERN CHIPMUNK,
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Scent marks are important mechanisms of exchanging information among conspecifics, orienting individuals within home ranges, or integrating reproductive and social behavior in many species of mammals (Eisenberg and Kleiman 1972). For example, ground squirrels (*Spermophilus* spp.) frequently scent mark by rubbing large, macroscopic, dorsal glands against substrata (Steiner 1974). Size and use of dorsal glands in this genus are related to social organization. The most social ground squirrels have large glands and frequently scent mark; in contrast, the least social species have smaller glands and never scent mark, except perhaps in a passive manner when individuals accidentally touch tunnels of entrances to burrow systems during passage (Kivett *et al* 1976).

The eastern chipmunk, *Tamias striatus*, is a diurnal ground squirrel common to the eastern deciduous forests of North America (Hall and Kelson 1959). Eastern chipmunks are solitary and territorial as adults, and each occupies a burrow system distinct from those of others (Yahner 1978). Mucous and sebaceous oral glands have been described in the eastern chipmunk (Quay 1965), but the presence of glands in other regions of the body have not been reported to our knowledge. The social organization of *T. striatus* is similar to certain solitary species of *Spermophilus* (see Kivett *et al* 1976, Yahner 1978), and anal, or perhaps vaginal, secretations may be an important

means of synchronizing mating activity in both *T. sibiricus* (Dobroruka 1972) and *T. striatus* (Yahner 1978). We, therefore, inspected tissue in the dorsal and the anal regions of *T. striatus* for the occurrence of scent glands.

Two captive, adult male chipmunks were sacrificed, and the skins were removed and fixed in alcohol-formalin-acetic acid. The skins were examined macroscopically, both at removal and after fixation, for the presence of dorsal and anal glands. Portions of tissue from the skin of one male were removed from the central region of the shoulder blades and from the anal region. The tissue specimens were washed in running tap water and then dehydrated by the standard procedure in graded percentages of ethyl alcohol. After the final immersion in absolute alcohol they were de-alcoholized in xylol and then embedded in Paraplast by gradual infiltration through a mixture of xylol and Paraplast and finally Paraplast alone. The tissue specimens were then sectioned at 10 μ . Each fifth section from both the cranial half of the dorsal tissue and the right side of the anal tissue, and all sections of the caudal half of the dorsal tissue and left anal tissue were mounted on slides, hydrated, and immersed in Bouin's fixative. After 30 minutes, the slide preparations were washed in running tap water and then stained by the rapid phosphotungstic acid-hematoxylin method.

No dorsal glands were detected in fresh or fixed skins, either macroscopically or with a dissecting microscope. Microscopic examination of the dorsal sections revealed no glands (mucous, sebaceous,

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or sudoriferous) either associated with hair follicles or isolated from follicles.

In the anal sections, numerous sebaceous glands were observed in association with hair follicles around the anal orifice and in the entire perineal region (fig. 1).

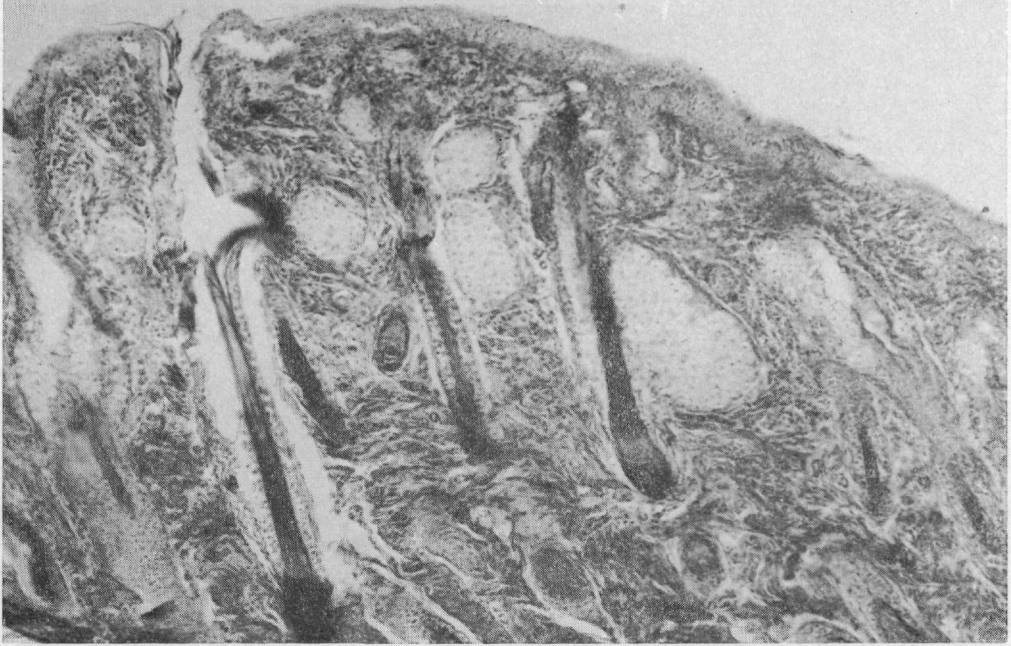


FIGURE 1. Typical section through the perineal region showing hair follicles and associated sebaceous glands. $\times 100$.

No sebaceous glands occurred laterad or dorsad to these regions. In addition to sebaceous glands, aggregations of glandular tissue were noted in the walls of the anal canal and extending into the perineum. This glandular tissue was observed between the external anal sphincter and the connective tissue layer of the canal (fig. 2) and also extending a short distance cranial between the external and internal anal sphincters. Ducts lined by thick stratified squamous epithelium opened near the anal orifice (fig. 3).

Scent marking with dorsal regions of the body was never observed in eastern chipmunks during 2500 hours of field study (Yahner 1978); thus, the absence of dorsal glands is not surprising. This supports the contention that glandular secretions, at least during the nonbreed-

ing season, are of minor importance for intraspecific communication in this species compared to other ground squirrels (e.g. *Spermophilus*; Kivett *et al* 1976).

Anal glands in *Tamias* appear to be modified sebaceous glands, and the loca-

tion of the glands largely corresponds to those described in the Richardson ground squirrel, *S. richardsonii* (Sleggs 1926). Anal glands in *Tamias* are a plausible source of reproductive pheromones. The alveoli of the anal glands in our specimens, which were sacrificed in early December, however, seemed to be in a quiescent stage. Recrudescence of gonads and accessory reproductive structures in male eastern chipmunks does not begin until late December or January (Neff and Anthony 1963), and mating does not occur until mid-February (Yahner and Svendsen 1978). Examination of additional specimens at various times of the year would be necessary to determine whether or not maximal development of anal glands correlates with reproductive condition and breeding activity.

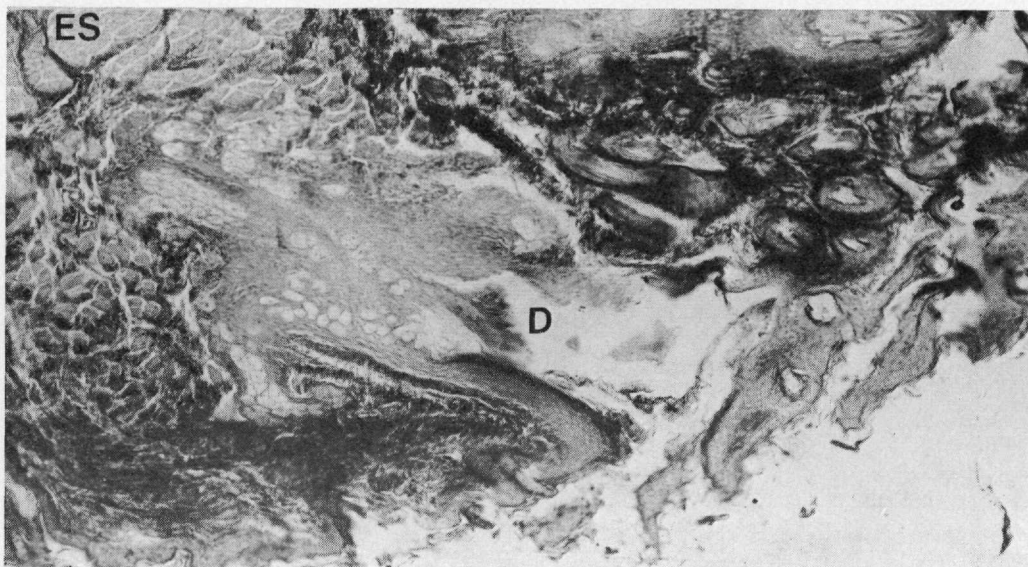


FIGURE 2. (upper) Obliquely longitudinal section through the anal canal, AC. A mass of glandular tissue, G, shows at extreme left center and another aggregation below and to the right of the larger aggregation. The external anal sphincter muscle, ES, appears in the lower left corner and in the upper right corner. Note the numerous hair follicles in cross section. A higher magnification would show an abundance of sebaceous glands attached to the hair follicles. $\times 62$.

FIGURE 3. (lower) Section through a main duct of an anal gland. Note the thick stratified squamous epithelium lining the duct, and the pale sebaceous-type cells that may be discharging into the lumen, D, of the duct. Fibers of the external anal sphincter, ES, appear in the upper left corner. In this section, the anal canal is not shown but it was above the duct and a little to the right. $\times 100$.

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