Chapter 20  Scent Glands

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20.1 Introduction

20.1.1 Olfactory Communication: Sources and Mechanisms

Nearly all mammals have highly developed olfactory sensory abilities, as well
as physiological and behavioral mechanisms for sending, receiving and interpret­
ing olfactory information. Man is clearly one of the least well endowed in
these respects. Nevertheless, he has appreciated since early times that this warm­
blooded and furred brethren have special areas and structures in their skins
that emit strong and distinctive odors. The crude secretions of these cutaneous
organs, along with other odoriferous materials, were and sometimes still are
collected and used by particular peoples for various scent-related purposes,
from hunting and trapping food species to attracting the attention of presum­
tive mates.

Scientific interest in, and detailed descriptions of, integumentary scent glands
of mammals started early and with a chiefly morphological orientation. Soon,
however, the chemistry of scent gland secretions, especially of the musky sort,
attacked the interest of organic chemists, particularly in relation to then novel
ring structures, and to practical applications in perfume and cosmetics industries
(see Downing, Chap. 44, this Vol.). Concurrently scent gland anatomy and
histology were investigated by scientists within several different professional
areas. But the functional importance of many one of the multitude of known

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mammalian “scent” glands has been based until recently chiefly upon speculation and anthropomorphically biased interpretations, rather than upon objective tests. This state of affairs has been changing rapidly in recent years, however. Since the early 1960’s this has been progressing at an increasing rate, along with experimental studies on mechanisms of olfactory communication and its controls, but mainly in a very small number of laboratory or domesticated species. Greatly increased literature on this topic can be traced in large measure to new concepts and methods. On the conceptual side there have been multidisciplinary inputs, involving psychologists, ethologists, reproductive biologists, endocrinologists and others. On the methodological side, analytical techniques having great sensitivity and chemical specificity have made it possible to identify chemically the constituents within particular scent gland secretions that elicit specialized and reproducible animal responses in controlled test situations.

The pheromone concept has been most fruitful in fostering a paradigm encouraging experimental analysis of scent gland functions. Pheromones comprise a particular, and arbitrarily defined, class of chemical messengers. They were originally defined as being secreted to the outside environment by an individual animal, and to be then received by one or more other individuals of the same species, and within these responding recipients the pheromone prompts or affects the release of a specific reaction, as for example, a specific behavior or developmental process (Karlson and Lüscher 1959, Butler 1970). This relatively simple mechanistic definition and conception of “pheromones” has been more broadly and easily applicable in the case of insect chemical communication than in that of mammals. Within mammals as a group, pheromonal activities have been claimed for substances of very diverse origins (diet, urine, feces, cecum, bile, placenta, coagulating glands, saliva, Harderian glands, vagina, bacterial activity, etc.) and less commonly from specialized integumentary glands. These proposed sources of, or contributors to, mammalian pheromones are not mutually exclusive and sometimes involve different steps or processes within a single mechanism. It is suggested also that a named pheromone having the same function in related species, may in fact have different origins. An example of this is the rodent “maternal pheromone”, which attracts preweanling young to their mother, or in some species to lactating conspecifics. It has been studied intensively in laboratory rats (Rattus norvegicus) where it is carried in the feces but originates in the cecum, probably through microbial action (Leon and Moltz 1972; Leon 1978; Moltz and Lee 1981; Kilpatrick and Moltz 1982; Kilpatrick et al. 1983). A functionally analogous pheromone has been experimentally demonstrated in gerbils (Meriones unguiculatus), but it is eliminated when the mother’s enlarged ventral integumentary scent gland is removed (Gerling and Yahr 1982). This same scent gland in the same species appears to have other pheromonal functions as well (Thiessen et al. 1969, 1974; Wallace et al. 1973). It can be concluded from this and other cases that: (1) there may often be more than one pheromone or pheromonal source capable of eliciting a particular response, (2) skin glands comprise only one of many possible sources of pheromones and of a particular pheromonal action, and (3) components of one particular integumentary scent gland can possibly have multiple pheromonal func-