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Uropygial gland in birds

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Introduction

The uropygial (oil/preen) gland is the largest skin gland in birds. It is a bilobed sebaceous gland and located dorsally at the base of the tail (between the fourth caudal vertebra and pygostyle) and variable in both shape and size. It constitutes 0.05%–1.14% of the body weight. It is a holocrine gland enclosed in a connective tissue capsule and made up of glandular acini. Each lobe has a central cavity that collects the secretion from tubules arranged radially around the cavity. The gland secretion is conveyed to the surface via ducts and open at the top of a papilla (nipple-like structure).

Distribution Amongst Species

Some or all species in at least nine families of birds lack a uropygial gland, mostly the ones unable to fly or the ones that produce powder down for feather maintenance. These include Kiwis (*Apterygidae*), Emu (*Dromaiidae*), Ostriches (*Struthionidae*), Rheas (*Rheidae*), Cassowaries (*Casuariidae*), Pigeons and doves (*Columbidae*), Amazon Parrots (*Psittacidae*) and woodpeckers (*Picidae*).

Secretions

The gland secretes preen oil through the dorsal surface of the skin. The oil contains a complex and variable mixture of substances formed greatly of aliphatic monoester waxes, formed of fatty acids and monohydroxy wax-alcohols. Some types of diester waxes called uropygiols which containing hydroxy fatty acids and/or alkane-diols exist in the secretions of the uropygial gland of some groups of birds. Preen gland secretion of some, but not all, birds have shown to be antimicrobial. Some birds harbor bacteria in preen gland (e.g. *Enterococcus phoeniculicola* and *Corynebacterium uropygiale*). Some of those bacteria

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add to the antimicrobial properties of preen wax.

The bird transfers the preen oil to its body during preening by rubbing its beak and head against the gland opening and then rubbing the accumulated oil on the feathers of the body, wings, and on the skin of the feet and legs.

Function

Feather And Body Integrity

Preen oil maintain the integrity of feathers. In waterbirds, the preen oil maintains the flexibility of feathers and keeps feather barbules from breaking. In some species, preen oil maintain the integrity of the horny beak and the scaly skin of the legs and feet. In some species, preen oil contains a precursor of vitamin D, which is converted to vitamin D by the action of sunlight and then absorbed through the skin.

Anti-Parasitic Effect of Preen Oil

Preen oil can work against microbes that degrade feathers by its antibacterial qualities or through the action of bacteria that live in the preen gland of the bird. By forming physical barriers, preen oil prevents the bacilli-secreted enzymes from reaching the feather keratin. Green Wood Hoopoe's (*Phoeniculus purpureus*) and Red Knot's (*Calidris canutus*) preen oil control the development of bacteria like *Bacillus licheniformis*. Preen oil may possibly influence feather-degrading bacteria by three modes. First, the preen oil may prevent feather-degrading bacteria from reaching the feather surface by simply forming a physical barrier. Second, the chemical compounds present in preen oil itself have their own antimicrobial activity. The preen oil isolated from Northern Gannet (*Morus bassanus*) contains the wax 3,7-dimethyloctan-1-ol, which controls the development of many bacteria *in vitro*. Third, antibiotics-like substances produced by symbiotic bacteria that are cultured within the preen gland are spread on the feathers by preening behaviour of the birds.

Cosmetic Effect

Secretions of the uropygial gland of greater flamingos (*Phoenicopterus roseus*) contain carotenoid, organic pigments which give flamingos their pink colour. During the breeding season, greater flamingos increase the frequency of their spreading uropygial secretions over their feathers and thereby enhance their colour.

Preen Oil in Pheromone Communication

Chemical compounds of birds can be found in a variety of forms, including blood, stomach oils, faeces, and plumage odor. The uropygial (preen) gland, salt gland, salivary gland, and ear (wax) glands are among the glands that generate sebaceous compounds in birds. In addition, the epidermal cells called sebokeratocytes of birds also produce sebaceous substances. Lipid-like secretions are produced by some specialized structures in birds, such as powder down.

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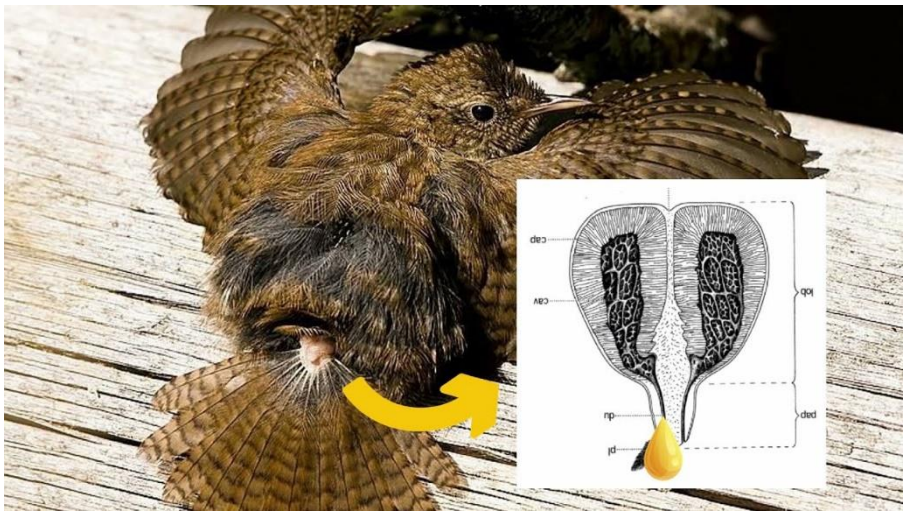
Scents of birds contain volatile chemicals and have a notable range of aromas, like the tangerine-like perfume of crested auklets (*Aethia cristatella*), the musky plumage of storm-petrels (*Hydrobatidae*), the foul stench of the hoatzin (*Opisthocomus hoatzin*), the pleasant and dusty fragrance of the kakapo (*Strigops habroptilus)*, and the acrid, sour odor of hooded pitohuis (*Pitohui dichrous*) & variable pitohui (*P. kirkocephalus)*. Birds are keen responders to the chemicals from their surroundings through actions like nest building, navigation or foraging. Birds also display three kinds of chemo-senses such as trigeminal system, taste and olfactory communication. The secreted uropygial volatile compounds are coupled with avian odor, like noxious scent in *eurasian hoopoes* and *green woodhoopoes*. The colour and aroma of the uropygial secretions in females and young of the latter species are said to change throughout the nesting season, becoming black and smelling like rotten flesh.



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