

ABSTRACT OF THE DISSERTATION

Ion Secretion by the Nasal Salt Gland
of an Herbivorous Desert Lizard, *Dipsosaurus dorsalis*

by

Lisa Colleen Hazard

Doctor of Philosophy, Graduate Program in Biology
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Professor Vaughan H. Shoemaker, Chairperson

Most vertebrates with salt glands are marine, and their glands secrete only NaCl. The salt glands of lizards can secrete potassium and bicarbonate as well as sodium and chloride. I investigated the control of ion secretion by the salt gland of the desert iguana (*Dipsosaurus dorsalis*). Salt secreted in response to injected solutes, hormones, and/or neurotransmitters was collected and analyzed for sodium, potassium, chloride, and bicarbonate. When glands were secreting, chloride was the major anion; bicarbonate secretion was very limited. KCl-loaded lizards secreted only KCl. NaCl loads stimulated sodium secretion but did not eliminate potassium secretion. Only treatments that included potassium or chloride increased secretion rate; sodium and other osmotic loads (e.g. sucrose) did not. Desert iguanas may use ion-specific chemoreceptors, rather than osmoreceptors, to detect changes to plasma ion concentrations. In NaCl-treated lizards, sodium secretion, potassium secretion, and cation ratio ($K/[Na+K]$) were repeatable within individuals over short periods (2-4 weeks). Cation ratio remained significantly repeatable over a two-year period. If this repeatability has an underlying genetic basis, natural selection could act on secretory ability. Atropine decreased secretion initiated by either potassium or chloride, suggesting that both ions act via the parasympathetic nervous system. Arginine vasotocin and vasoactive intestinal peptide did not initiate secretion. Aldosterone blocked sodium secretion and slightly increased potassium secretion. The aldosterone inhibitor spironolactone increased sodium secretion but had no effect on

potassium secretion. Prolactin decreased sodium secretion. This effect was not blocked by spironolactone. Thus, prolactin and aldosterone may reduce sodium secretion via different mechanisms. Total gland volume did not differ between sodium-secreting, potassium-secreting, and non-secreting lizards. In both potassium-secreting and sodium-secreting lizards, principal tubule volume increased; there were trends towards increased vasculature and decreased peripheral tubule and connective tissue volumes. The Na-K-2Cl cotransporter and Na, K-ATPase were found on the basolateral membranes of gland cells but not the apical membranes. Based on these results, a hypothetical model for ion secretion by desert iguana salt glands was constructed.