

from the stimulus generalization capacity of the bird, which sets up a gradient of response to songs differing in degrees from the one the bird learned early in life.

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DIURESIS ON THE DESERT? EFFECTS OF FRUIT- AND NECTAR-FEEDING ON THE HOUSE FINCH AND OTHER SPECIES

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The ability to concentrate urine is usually emphasized in the study of the water balance of desert birds and mammals. In our tendency to focus on the most stressed animals, we may overlook ameliorating circumstances provided by diet or behavior. Poulson and Bartholomew (*Condor* 64:245-252, 1962) reported urine and serum osmotic concentrations from the desert-dwelling House Finch (*Carpodacus mexicanus*) while exposed to laboratory temperatures of 24.6 to 25.7°C. Urine concentrations ranged from about 130 to 850 mOsm. These concentrations were about 0.4 times serum osmotic concentration (hypo-osmotic urine) when the birds drank distilled water ad libitum, and about 2.3 times serum (hyperosmotic) when they were drinking 0.3 M NaCl. The birds were concentrating their wastes in order to conserve water by the high urine concentration; at the low concentration, osmotic work was performed to void excess water and conserve salts while doing so.

In the suburban bajada-desert scrub environment of this study (near Tucson, Arizona), air temperatures range from lows of 20 to 25°C, to highs of 36 to 40°C in late summer. House Finches under these conditions show classic symptoms of heat stress: gaping, panting, wing elevation to expose axillary regions, and seeking shade. One might expect that evaporative water loss would necessitate maximal urine concentration under these conditions.

In order to collect urine samples in the field for a confirmation of this expectation, I captured House Finches by mist-net between 31 August and 5 September. When cloacal contents were voided by hand-held birds, the fluid was taken into microcapillary tubes. The contents were analyzed immediately thereafter on a Wescor 5100B vapor pressure osmometer. The mean osmotic concentration of the fluid from nine birds was 183 ± 75.2 mOsm/kg (range 81 to 317 mOsm/kg; 2-4 determinations per bird). Air temperatures at time of collection ranged from 26 to 36°C (mean $30^\circ \pm 3.5$). A blood sample from one finch had an osmotic concentration of 335 mOsm/kg; this value falls midway in the range for the laboratory-maintained birds described by Poulson and Bartholomew (1962). The urine concentration of this individual was 179 mOsm/kg, 0.53 of blood concentration.

At the time, the finches appeared to be feeding mostly on the fruit of the prickly pear cactus (*Opuntia engelmanni*), the fluid of which is bright magenta, sweet, and to me was intermediate in taste between watermelon and beet juice. The osmotic concentration of the prickly pear juice was 457 ± 40.4 mOsm/kg, ($n = 6$) presumably due largely to sugar.

Urine samples were obtained from three additional species of fruit- and nectar-feeding birds inhabiting hot, arid environments. Urine osmotic concentrations, mostly hypo-osmotic, are listed in Table 1. Plasma samples were not taken, but would be expected to fall within the avian range of 300-350 mOsm/kg.

In order to attempt an explanation of this unexpected finding of hypo-osmotic urine during obvious heat stress, we must consider the processes by which water would reach the cloaca. When the House Finch ingests the juicy pulp of *Opuntia* fruit, sugars and other nutrients available before or after enzymatic breakdown would be absorbed across the gut wall by diffusion and/or active transport. The latter process would tend to reduce the concentration of fluid remaining in the gut below 457 mOsm/kg. Similarly, sugar removed

TABLE 1. Urine osmotic concentrations from fruit and nectar-feeding birds of the desert.

Species	n*	Air temperature (°C + 1 SD)	Urine concentration (mOsm/kg + 1 SD)
Black-chinned Hummingbird (<i>Archilochus alexandri</i>)	30 (20)	30 ± 4.9	89 ± 52
Verdin (<i>Auriparus flaviceps</i>)	1 (1)	30	222, 167
Hooded Oriole (<i>Icterus cucullatus</i>)	2 (2)	28	104, 300
House Finch (<i>Carpodacus mexicanus</i>)	9 (5)	30 ± 3.5	183 ± 75.2

* n = number of samples (number of birds in parenthesis).

from nectar of flowers or artificial feeders by the guts of the Black-chinned Hummingbird, Verdin, and Hooded Oriole would tend to leave behind a very dilute fluid. Hainsworth (J. Comp. Physiol. 88:425-431, 1974) found that Black-chinned Hummingbirds were 97-99% efficient in assimilating the sucrose from solutions of 0.5 to 2.0 M concentration.

The water remaining in their guts could be assimilated osmotically, and any excess over that required for evaporative cooling would be filtered into the nephrons of the kidney. Braun and Dantzer (Am. J. Physiol. 222:617-629, 1972; 226:1-8, 1974; 229:22-228, 1975) have demonstrated that reptilian-type nephrons in the avian kidney are functioning during diuresis but cease to filter during anti-diuresis, so that filtration is via the mammalian-type, or looped, nephrons which can conserve water by concentrating the urine.

If the birds of this study had been partially dehydrated by the demands of evaporative cooling, the fluid arriving in the cloaca from the kidneys would be hyperosmotic to plasma. The cloaca could function to reabsorb more of the fluid.

One might question whether the hypo-osmotic urine was not merely a "nervous diuresis" resulting from handling. However, three Black-chinned Hummingbirds caged over oil and fed on a 0.77 M sucrose solution produced 48-h urine samples with a concentration of 26-46 mOsm. Samples taken while the birds

were hand-held immediately before or after these pooled samples were collected ranged from 51 to 64 mOsm.

While the three passerine species were not similarly caged, the possibility that the hypo-osmotic urine was a handling artifact can be reasonably excluded simply because of the unlikelihood that osmotic work would be done during anti-diuresis in the kidney only to be undone in the cloaca, where the action is one of further water reabsorption, not dilution in any case. Handling should stimulate premature ejection of a larger volume but not of hypo-osmotic fluid. Furthermore, a House Finch captured and handled identically on 2 November 1979, after the *Opuntia* fruits were no longer available, voided two samples with concentrations of 770 and 380 mOsm/kg.

Despite the warm environment and evidence of heat stress, the birds were left with a water excess and the necessity of performing osmotic work to reduce the urine concentration to slightly over one half the concentration of body fluids. One wonders what portion of the desert summer actually poses a threat of desiccation to birds with these feeding habits.

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NEST DISCOVERY AND SELECTION BY BROWN-HEADED COWBIRDS

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Recent observations by Norman and Robertson (1975) and experiments by Rothstein (1976), Thompson and Gottfried (1976), and Lowther (1979) focused attention on how Brown-headed Cowbirds (*Molothrus ater*) find and select nests to parasitize. However, the relative importance of host activities and characteristics of nest, nest site, and nest contents to discovery and selection of nests by cowbirds remains unclear. The purposes of

this note are to evaluate current knowledge, to present additional evidence, and to encourage additional experimentation on this subject.

Deposition of a cowbird egg in a host's nest is probably the culmination of two processes: discovery of nests and selection from these of the nest in which to lay an egg. Little is known of the process of nest discovery, although observation by cowbirds of nest building is widely considered to be important (e.g., Friedmann 1929, Hann 1941, Laskey 1950, Payne 1973, Norman and Robertson 1975). However, Norman and Robertson (1975) saw female cowbirds apparently searching for and finding nests, and V. Nolan (pers. comm.) and Thompson (pers. observ.) occasionally have found recently deposited cowbird eggs in unused nests, which suggests that host activity may not be absolutely essential for nest discovery.

Selection of a nest in which to deposit an egg may depend on some or all of the following: nest-building