used the roost from 2 December–13 February, and eagles used it from 29 December–15 March. On the nine mornings that the roost was used by both species, between one and three hawks and five and 28 eagles were present. No interspecific aggression was noted in the roost, and distances between hawks and eagles appeared similar to distances between conspecifics. Hawks left the roost 57–15 min before sunrise ($\bar{x} = 30$, SD ± 15), approximately the same time eagles departed. Hawks also tended to leave in the same direction as most departing eagles. The 0.6-ha roost consisted of 77 mature cottonwoods (*Populus deltoides*) that grew between Lake Andes and a cultivated field. Roost trees had a mean diameter of 51 cm (SD ± 20 cm) and an estimated median height of 18 m.

It is unlikely that a shortage of suitable roosting sites forced communal roosting because similar stands within 1 km of the roost were not used by individuals of either species. Ward and Zahavi (Ibis 115:517–534, 1973) proposed that communal roosting facilitates food-finding, and several workers have suggested that this explanation is applicable to Bald Eagles (Steenhof M.S. thesis, Univ. Missouri, Columbia, Missouri, 1976; Knight, M.S. thesis, Western Washington Univ., Bellingham, Washington, 1981; Stalmaster, Ph.D. thesis, Utah State Univ., Logan, Utah, 1981). Both Ferruginous Hawks and Bald Eagles were commonly seen during the day near concentrations of feeding waterfowl in agricultural fields near Lake Andes. Individuals of one or both species may have learned of these potential food sources from interactions at the roost.

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Serum chemical levels in captive female House Sparrows.—Until recently, there were relatively few studies which were conducted to specifically characterize the chemical constituents of the blood of birds. Even the well-established blood chemical levels of the domestic chicken (*Gallus gallus*) are mostly a result of the compilation of the data from a wide variety of other blood-related physiological investigations (Sturkie, Avian Physiology, Cornell Univ. Press, Ithaca, New York, 1954:32; Avian Physiology, 3rd ed., Springer-Verlag, New York, 1976:246; Van Tienhoven, Reproductive Physiology of Vertebrates, 3rd ed., Cornell Univ. Press, Ithaca, New York, 1983:180). Earlier, hematological investigations of nondomestic birds consisted of measurements of erythrocyte numbers and blood hemoglobin levels (Nice et al., Wilson Bull. 47:120–125, 1935), while later, blood protein levels also were determined (Dabrowski, Acta Biol. Cracoviensio, Ser. Zool. 9:259–275, 1966; Balasch et al., Poultry Sci. 52:1531–1534, 1973). More recently, the levels of carbohydrates, lipids, and serum enzyme activities have been among some of the other hematological values examined in wild and captive birds (Kern and de Graw, Condor 80:230–234, 1978; de Graw et al., J. Comp. Physiol. 129B:151–162, 1979; Driver, J. Wildl. Dis. 17:413–421, 1981; Gee et al., J. Wildl. Manage. 45:463–483, 1981; Franson, J. Wildl. Dis. 18:481–485, 1982;

TABLE 1
SERUM COMPONENTS AND ENZYME ACTIVITY LEVELS IN FEMALE HOUSE SPARROWS

Serum component (units)	No. of birds	Range	Mean ± SEM
Total protein (g/100 ml)	7	3.1–5.9	3.90 ± 0.23
Albumin (g/100 ml)	7	0.9–1.5	1.12 ± 0.08
Globulin (g/100 ml)	7	2.1–4.6	2.77 ± 0.33
Albumin/globulin ratio	7	0.3–0.6	0.44 ± 0.04
Calcium (mg/100 ml)	8	7.4–12.4	8.44 ± 0.72
Cholesterol (mg/100 ml)	6	197–228	211.00 ± 4.62
Glucose (mg/100 ml)	8	458–613	528.60 ± 22.36
Blood urea (mg/100 ml)	8	2.3–4.4	2.79 ± 0.25
Uric acid (mg/100 ml)	7	10.3–29.0	19.87 ± 2.27
Bilirubin (mg/100 ml)	7	0.6–2.2	1.13 ± 0.23
Alkaline phosphatase (U/L)	6	76–222	155.33 ± 20.16
Creatine phosphokinase (U/L)	8	356–6041	3357.1 ± 878.6
Lactate dehydrogenase (U/L)	8	1429–3947	2924.8 ± 285.6
Serum glutamate-oxalacetate transaminase (U/L)	8	112–1293	608.0 ± 137.8

Rehder et al., J. Wildl. Dis. 18:105–109, 1982). Similar data also were recently obtained in several common pet avian species (Rosskopf et al., Vet. Med./Small Anim. Clin. 77:1233–1239, 1982). The most comprehensive of these recent studies was that by Gee et al. (1981) who compared the hematological differences in 12 evolutionarily primitive species of captive cranes, geese, raptors, and quail. The modicum of similar comparative data in more recently evolved birds prompted the present investigation of the blood chemistry of the House Sparrow (*Passer domesticus*), as a representative of the evolutionarily most recent Passeriformes.

Serum constituents were measured in eight female House Sparrows by an Abbott VP Bichromatic Analyzer. The serum samples were obtained from four adults on 24 November and 4 December 1981. The birds, which were trapped locally, were caged for 2–4 weeks before sacrifice, during which time they were kept under natural photoperiods in an enclosed room at about 10–15°C, and provided with chick starter mash (approx. 16% protein) and water, ad lib. All birds were ether-anesthetized and blood samples obtained via cardiac puncture at about 17:00. The samples were transferred to clotting tubes, and upon clotting at room temperature, were centrifuged at 2800 rpm for 5 min. The collected serum was recentrifuged at the same speed and time, and frozen for assay the following morning. The assay procedure involved placing approx. 300–500 μl of serum into a sample cup in the analyzer. An onboard-computer controlled the batch-operated assay of the serum components. In a few instances, insufficient serum volume prevented the assay of some of the components (Table 1).

The level of serum total proteins in the House Sparrow (Table 1) is within about 20% of the levels reported in all other reproductively quiescent, captive or free-living birds (Dabrowski 1966, Balasch et al. 1973, Driver 1981, Gee et al. 1981, Rosskopf et al. 1982). The House Sparrow's serum albumin (A), globulin (G), and the A/G ratio (Table 1), however,

are similar only to those reported in free-living corvids (Dabrowski 1966). The 27–163% lower A/G ratios in the sparrow than the more primitive Gruiformes, Anseriformes, Falconiformes, and Galliformes (Driver 1981, Gee et al. 1981) is due to marked differences in either, or both, A and G. Serum calcium levels (Table 1) are similar to those of nonbreeding hens (Sturkie 1976:322) and pigeons (*Columba livia*) (Welty, The Life of Birds, 3rd ed., Saunders Co., New York, New York, 1982:165), and within 25% of those of captive, primitive birds (Gee et al. 1981), pet birds (Rosskopf et al. 1982) and wintering free-living and winter-captive White-crowned Sparrows (*Zonotrichia leucophrys*) (Kern and de Graw 1978).

Serum total cholesterol levels in the sparrows (Table 1) ranged from about 15% higher than in Falconiformes to 50% higher than in Gruiformes (Gee et al. 1981). Although cholesterol also was 50% higher than in captive White-crowned Sparrows, it should be noted that the cholesterol levels reported for the White-crowned Sparrows were for free-cholesterol, which is often about 25–50% less than the total blood cholesterol levels (Kern and de Graw 1978, de Graw et al. 1979, Kern, pers. comm.). The sparrow's cholesterol levels, however, were near the same levels found in the Hawaiian Goose (*Nesochen sandvicensis*) (Gee et al. 1981), cockerels (Van Tienhoven 1983:180) and hypercholesteremic strains of atherosclerotic pigeons (Wartman and Connor, J. Lab. Clin. Med. 82:793–808, 1973; Subbiah and Siekert, Br. J. Nutr. 41:1–6, 1979).

The House Sparrow was found to be markedly hyperglycemic (Table 1) when compared to most other birds (Sturkie 1976:211; Whitehead et al., Br. J. Nutr. 40:221–234, 1978; Gee et al. 1981). Whether these twice-normal glucose levels are characteristic of passerines, or caused by hormonal imbalances, or other stresses associated with captivity, is not known. That the sparrow's blood glucose concentration is only 18–32% greater than the upper normal ranges reported for pet Canaries (*Serinus canaria*), Cockatiels (*Nymphicus hollandicus*), and Budgerigars (*Melopsittacus undulatus*) (Rosskopf et al. 1982), suggests that high blood glucose levels may be typical of small, captive granivorous birds. Alternatively, the hyperglycemia may have resulted from gluconeogenesis from the high-protein diet the sparrows were fed, since it is known that small passerines only require about 8% protein diets for maintenance in captivity (Martin, pp. 365–379 *in* Proceedings of the General Meeting of the Working Group on Granivorous Birds, IBP, PT Section, S. C. Kendeigh and J. Pinowski, eds., Warsaw, Poland, 1972; Parrish and Martin, Condor 79:24–30, 1977). This possibility is further supported by the twice-normal uric acid levels in the House Sparrow (Table 1) than other birds (Driver 1981, Gee et al. 1981, Rosskopf et al. 1982). Similar increases in uric acid levels have been reported in chickens fed higher than normal protein diets (Featherson, Poultry Sci. 48:646–652, 1969). The presence of normal blood urea concentrations (Table 1) was to be expected as high-protein diets did not affect blood urea levels in chickens (Bell et al., Biochem. J. 71:355–364, 1959).

Bilirubin values in the House Sparrows (Table 1), surprisingly, were 2- to 9-fold greater than those found in the evolutionarily more primitive birds examined by Gee et al. (1981). That bilirubin values were near the normal ranges reported in human serum (Abbott Laboratories, Diagnostics Division, A-Gent Bilirubin, South Pasadena, California, 1980) probably is due to the higher erythrocyte numbers typical of small passerine birds, such as House Sparrows (Nice et al. 1935; Sturkie 1976:58; Chilgren and de Graw, Auk 94:169–171, 1977), than most other birds (Balasch et al. 1973, Sturkie 1976:58, Gee et al. 1981).

The relatively high serum enzyme activities of alkaline phosphatase in the sparrows (Table 1) were near those determined in fall-captive Sandhill Cranes (*Grus canadensis*) (Gee et al. 1981), American Black Ducks (*Anas rubripes*) (Franson 1982), and Mallards (*A. platyrhynchos*) (Driver 1981). Serum glutamate-oxalacetate transaminase (SGOT) activities were near the exceptionally high enzyme levels reported in Northern Bobwhites (*Colinus virgin-*

ianus) (Gee et al. 1981). In contrast, serum creatine phosphokinase (CPK) enzyme activities in the sparrows were 1.5 times those of fall-captive Mallards (Driver 1981), while lactate dehydrogenase (LDH) levels were about 3 times the highest values found in captive bobwhites, Peregrine Falcons (*Falco peregrinus*) (Gee et al. 1981), and Greater Indian Hill Mynas (*Gracula religiosa*) (Rosskopf et al. 1982). The exceptionally high SGOT and LDH enzyme levels in the sparrow may be attributed to drastic physiological changes which occurred when the birds were sacrificed since death-associated elevations of these enzymes have been previously reported in Mallards (Driver 1981). Elevations in LDH also have been reported to be caused by hemolysis (Rosskopf et al. 1982), although there was little evidence of hemolysis in the serum samples of the sparrows in this study. The markedly high CPK levels in the sparrows may have resulted from muscular damage during confinement and handling, since Driver (1981) found increases in CPK activities in captive and bait-trapped Mallards.

Although the results from avian blood analyses, especially serum enzymes, are difficult to compare when obtained from different laboratories (Gee et al. 1981), the values obtained in the sparrows in the present study are likely comparable with those reported by Driver (1981), Gee et al. (1981), Franson (1982), and Rosskopf et al. (1982). This is because the present results, as well as the results of those workers, were obtained by employing similar standardized autoanalyzer techniques. At the same time, there are a multitude of other factors, such as physical and environmental conditions, handling and sampling techniques, circadian and circannual rhythms, as well as sex, age, diet, and state of health of the birds, which could greatly affect the comparability of the data among these studies.

In spite of these and other limitations, it is apparent that the serum protein components, calcium, glucose, urea, and total cholesterol levels in House Sparrows are approximately near those previously reported in other more recently evolved passerine birds. Whether the exceptionally high bilirubin and uric acid levels present in the House Sparrow are typical of other passerines requires further study. It is probable that the elevated serum enzyme levels in the House Sparrow may not be typical and resulted from either disease or stresses associated with handling, sacrificing, and captivity of the birds. If our results also are representative of noncaptive House Sparrows, then they also imply that the levels of serum components previously reported in fowl, and other more primitive birds, are not necessarily typical of those found in the more recently evolved small passerine birds.

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Comments on Blancher and Robertson's "double-brooded Eastern Kingbird."—A note by Blancher and Robertson (Wilson Bull. 94:212–213, 1982) entitled "A double-brooded Eastern Kingbird," has prompted me to comment on its inculsion in a recognized, refereed journal. The authors describe a case of a supposed double brood in a pair of Eastern Kingbirds (*Tyrannus tyrannus*) (a species not known to be double-brooded), without presenting conclusive proof of the event. A pair of Eastern Kingbirds raised a brood of young, one (banded) of which fledged successfully, and then later a female was found incubating three eggs in a