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COMMENTARY

HEMATOLOGICAL STUDIES IN BIRDS

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Hematological studies carried out on several aspects of the biochemistry and physiology of birds have been increasing, in particular those concerned with the determination of normal values of blood parameters. Avian hematology has been used in ornithological studies, because it gives biological data for these animals, their biology, and the detection of possible pathological states. Determination of nutritional and physiological condition, by the use of some biochemical components, can be very important in the understanding of ecological and behavioral problems. Nevertheless, some precautions must be taken. Hematological values, including chemical components, are known to be influenced by many factors: physiological state, age, sex, nutritional condition, circadian rhythm, seasonal changes, and others (Okumura and Tasaki 1969; Twiest and Smith 1970; Gee et al. 1981; Chaplin et al. 1984; Ferrer et al. 1987; García-Rodríguez et al. 1987a, 1987b). So, when we try to study the effect of one of these factors, we must be sure that the others are under control.

Puerta et al. (1990) recently examined hematology and blood chemistry values in Common Cranes (*Grus grus*), establishing age differences in plasma levels of urea, uric acid, and triglycerides. They also reported that the cholesterol levels were similar in young and adults. Other papers detecting differences between the sexes or among related species have been recently published by the same authors (Puerta et al. 1989a, 1989b). In all these papers, the authors have not considered the influence of circadian rhythms on hematological values. García-Rodríguez et al. (1987b) show that it is necessary to take into account the diurnal variations of blood parameters for studies on avian hematology.

Using Buzzards (*Buteo buteo*) and Eagle Owls (*Bubo bubo*), to represent diurnal and nocturnal raptors, García-Rodríguez et al. (1987b) studied the values of 15 blood parameters, including three enzymes, at periods throughout the day. Five of these parameters (glucose, uric acid, urea, calcium, and triglyceride) showed statistically significant circadian rhythms in both species. Three blood parameters (phosphorus, cholesterol, and cholinesterase) underwent statistically significant circacian rhythms only in the Buzzards, and two chemical values (albumin/globulin and amylase) exhibited diurnal variations exclusively in the Eagle Owls. Only five parameters did not show diurnal rhythms. These results in birds of prey reinforced conclusions in other groups of animals, including humans (Heaton and Hodgkinson 1963, Winget et al. 1967, Conroy and Mills 1970, Twiest and Smith 1970, Klein et al. 1985, Rintamaki et al. 1986, Saarela et al. 1986) and forced us to reject any hematological studies on the influence of sex, age, or taxonomy in related groups that have been performed without considering chronobiological aspects.

Puerta et al. (1990) reported higher urea levels in adults of Common Cranes than in young birds. As an example, values of urea in Eagle Owls varied from 21–28 mg/dl at 08:00 to 8–13 mg/dl at 10:00. They also report significant variations in uric acid and triglyceride levels according to age, but uric acid varied from 14–26 mg/dl at 07:00 to 6–10 mg/dl at 14:00 in Eagle Owls, and triglyceride from 500–2,500 mg/dl at 06:00 to 50–200 mg/dl at 10:00 in this species. The data that Puerta et al. (1990) give for Common Cranes are useful for delimiting normal levels in blood values of this species, without considering differences in age, sex, and circadian rhythms, and is a good contribution to the hematology of birds. However, I think that their conclusions on age differences are highly speculative, as the blood samples may not have been taken at the same time. This is not stated in the section on Methods.

Puerta et al. (1990) interpreted the apparent lower uric acid levels in adult birds as a result of feeding restraint, as described by Sykes (1971). They ignored the fact that the metabolic effect of fasting on uric acid concentration is not general for all birds. In fact, decreases in plasma uric acid concentration during fasting have only been well documented in King Penguin chicks (Cherel and Le Maho 1985). In other groups, such as raptors, gulls, or chickens, uric acid concentration increases during fasting (Okumura and Tasaki 1969, Jeffrey et al. 1985, Ferrer et al. 1987, García-Rodríguez et al. 1987a). So, in the absence of fasting and refeeding studies in cranes, the interpretation of Puerta et al. (1990) is not plausible.

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REPLY TO FERRER

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Our recent paper "Hematology and blood chemistry of wintering Common Cranes" (Puerta et al. 1990) dealt with both the cellular and plasma composition of animals captured momentarily on their winter quarters and let free again once a blood sample was obtained. Ferrer rejects the differences observed in the concentration of three plasma components, urea, uric acid, and triglycerides, between young and adult birds. This is based on his observations about the existence of circadian rhythms in the plasma concentration of such molecules in two species of raptors: six Buzzards (*Buteo buteo*) and six Eagle Owls (*Bubo bubo*) (García-Rodríguez et al. 1987). He argues that such rhythms could be the origin of the detected age-related differences in Common Cranes (*Grus grus*).

On reviewing their work, it seems surprising that, despite collecting blood every 4 hr, they calculate the mean value of a 24-hr period even in the plasma components that exhibited daily fluctuations. Moreover, although blood was collected every 4 hr, they could only distinguish a reduction in the above-mentioned plasma components during the 8-hr period of daylight. Indeed, the circadian rhythms they presented were based on three intervals of 8 hr each. Even more, as they stated in their results, the great individual dispersion of some of the data made them inconclusive.

At present, Ferrer rejects our results because they were not recorded on an hour-to-hour time schedule. We must state that blood sampling in Common Cranes was carried out during the daylight (8 hr), i.e., during the natural period of activity of both Common Cranes and human beings (that photoperiod influences many physiological tasks is a fact not reported for the first time by Ferrer's group). And more accurately during December, precisely the same month in which Ferrer carried out his observations. Therefore, it seems evident that Ferrer's study was carried out with the same annual pattern and with similar daily intervals of time as ours. Accordingly we do not understand the reasons