erythrocytes and platelets found in mammals may be significant. The loss of leukocytes from the peripheral blood and marrow is approximately as rapid as that observed in mammals, indicating that the cellular mechanism for defense against infection is depressed. The relative resistance of the parakeet intestinal tract, however, may be an important factor in limiting access of pathogenic organisms to the blood stream and thus permit survival. Fluid and electrolyte loss through vomiting, diarrhea, and hemorrhage, often observed in mammals, is also not as great in the parakeet.

The observation of Stearner *et al.*(4) that chicks exposed to 1000 r at a rate of 43 r per minute died within 24 hours in acute renal failure is of interest in view of the cloudy swelling seen in the renal epithelium of the parakeet. Although in the parakeet these changes were not accompanied by an elevation of the blood uric acid level, there is evidence of progressive kidney damage followed by renal failure months after irradiation. Kidney damage following ionizing radiation has also been observed in mice(14).

Summary. The LD 50-30 for adult parakeets exposed to total body irradiation by x-rays at the rate of 23 r per minute is 1800 ± 75 r. The destruction and regeneration of the hematopoietic tissue is similar to that observed in mammals. The kidneys may be more susceptible and the intestinal tract less so than the same organs in mammals.

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Plasma Iron Studies in Normal Beagle Dogs.* (22447)

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Plasma iron values ranging from 50 μg% to 292 μg%(1) and 71 μg% to 285 μg%(2) have been observed in mongrel dogs. Plasma iron values were therefore studied in a highly bred stock of dogs maintained under relatively standard environmental conditions. Studies included comparisons among animals, weekly fluctuations in individual animals, differences between 24-hour fasting and non-fasting states, sex differences, and correlations with weight and age. This study is part of a larger study on the effects of radioisotopes in beagle dogs.

Methods. The 36 animals are a part of a colony of about 350 beagle dogs. They are

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housed in modern kennels with outdoor and indoor facilities where they are permitted a moderate amount of exercise. They are under the constant care of a full-time veterinarian and a full-time staff of 5 kennel personnel. During the experimental period there were no bacterial infections observed, and no parasites were found on periodic deworming procedures. Blood was drawn into oxalated test tubes and the plasma was analyzed for total iron by a modification of a previously described procedure(3). All glassware used was carefully cleansed with detergent, tap water, potassium dichromate sulfuric acid cleaning solution, and double-distilled water. Daily blanks showed an average contamination of 5.7 μg/tube (4.8 μg to 6.3 μg). The mean deviation between 2 aliquots of 30 samples was 1.04% ± 0.4 (2 S.E.). The average deviation between duplicate samples from 2 sites of venipuncture in 4 dogs was 3.8% ± 2.6 (S.E.). The recovery of a known amount of standard iron solution added to 9 plasma samples was 93.8% ± 1.6 (2 S.E.).

Results. A summary of the data on 34 dogs, comparing 24-hour fasting, non-fasting, male, female, and total groups is presented in Table I. With 3 exceptions, the same animals that were tested following a 24-hour fast were tested 1 to 2 weeks later under non-fasting conditions. One determination at 1- to 2-week intervals for a total of 2 determinations was done for both conditions. There is no apparent difference between 24-hour fasting and non-fasting dogs. The statistics were computed on the basis of total determinations for each condition, rather than on the basis of means for each animal as was done with male, female, and total groups. Since no differences were found between fasting and non-fasting states, all the values for each animal under both conditions were used in computing the values for male, female, and total groups. There were no differences between the group of 20 males and 14 females. For the total group of 34 animals a mean of 167 μg% ± 32.3 (S.D.) and range 89 μg% to 286 μg% were found.

Two additional dogs and one of the above

TABLE I. Statistical Summary of Plasma Iron Values under Different Conditions.

Group	No. animals	No. determinations	Mean±S.D., μg %	Range, μg %
24-hr fasting	30	52	163 ± 36.3	92-286
Non-fasting	33	58	171 ± 35.4	89-277
Male	20	67	166 ± 26.1	89-284
Female	14	43	169 ± 44.1	92-286
Total	34	110	167 ± 32.3	89-286

34 (2 male and 1 female) were studied weekly for 16, 15, and 10 weeks respectively (Table II). Each individual dog showed a wide range of values and varying means with large standard deviations.

The plasma iron of 28 dogs (mean of 2 to 4 determinations) ranging from 7.0 kg to 19.0 kg showed a small positive correlation with weight ($r = 0.39$, 0.05 level $= 0.37$). The plasma iron of 36 dogs was correlated with age over a range of 1 to 4 years with no apparent correlation ($r = 0.11$, 0.1 level $= 0.28$).

Since there are only 4 determinations for each dog, the following statistical procedure was used to summarize for the whole population variations observed from week to week in a single animal. A mean and its absolute deviations were computed for each of the 34 dogs. The grand mean of the individual mean deviations summarizes individual variations for the whole population. Hereafter this grand mean will be termed average variation. Its value is 22 μg% with S.D. of 11 μg%.

In Fig. 1 a dog's mean is represented with a plot of the average variation and its normal distribution. Two standard deviations (22 μg%) of the average variation (22 μg%) will include 95% of the mean differences. The average variation will be added to and subtracted from the individual dog's mean to show the expected variation. We are con-

TABLE II. Statistical Summary of Weekly Plasma Iron of 3 Dogs.

Group, wk	No. animals	No. determinations	Mean ± S.D., μg %	Range, μg %
16	1	16	139 ± 38.3	82-214
15	1	15	199 ± 64.2	110-292
10	1	10	161 ± 48.3	101-226

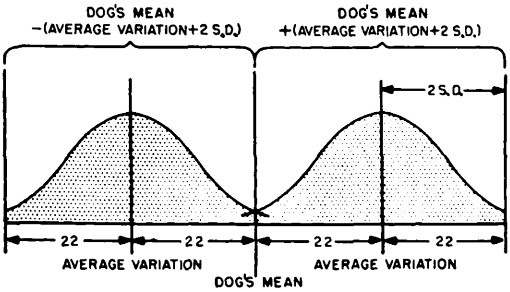

FIG. 1. Graphic description of variation of isolated plasma iron values in a dog *vs* its mean value.

cerned with the possibility of maximum deviation to be expected in a single animal; therefore, we consider the dog's mean + 22 μg% + 22 μg% (2 S.D.) and —22 μg% —22 μg% (2 S.D.). Simply stated, one would expect a control beagle dog's plasma iron over 2 to 4 determinations at 1- to 2-week intervals to fluctuate ± 44 μg% from its mean.

An analysis of variance to show the sampling errors of daily iron values out of the control population was made. Ten such days' samplings (8 samples per day) were analyzed with an F value of 4.5 which is beyond the allowed value of 2.67 for the 0.01 level. An unexplained difference of 2 days' values by the t test at the 0.05 level was found.

Discussion. In these dogs plasma iron showed no differences between 24-hour fasting and non-fasting states and no sex differences. There was no correlation between age and plasma iron over the range of 1 to 4 years. Over the weight range of 7.0 to 19.0 kg a low but definite positive correlation with plasma iron levels was observed. Using a standard breed of dogs in this study, a wide range of values similar to that in mongrel dogs was found. Since the weights of these animals remained constant over the testing period and the fluctuation was so variable, this variation cannot be attributed to weight changes.

Other investigators have found marked variations in people: 39 μg% to 170 μg%(4), 33 μg% to 221 μg%(5), and daily variations in a single person of the same magnitude as from person to person(6). If these large variations were due to fluctuating environment or genetic factors, they should have been reduced in this study. The plasma iron value fluctuates about 26% from a mean (167 ± 44) in a given animal of this study when the daily turnover from hemoglobin metabolism is about 300% of the total plasma content. The plasma iron concentration represents a very sensitive index to slight changes through the hemoglobin metabolism cycle of iron utilization and release.

A method was presented to characterize the normal variation in beagle dogs (Fig. 1). This statistical procedure will be used in following animals under various experimental conditions. One can then determine when a value falls outside the expected range for a given animal within 95% confidence limits and thus represents more likely a real change over the normal control situation.

Summary. Plasma iron in normal beagle dogs undergoes marked variation from week to week in a single animal, as well as from animal to animal. A low but significant positive correlation was found between plasma iron and weight over the range studied. No correlation was found with age under the conditions described. No differences were observed between 24-hour fasting, non-fasting, male, or female groups. A statistical method for characterizing weekly variation in a single animal has been presented. Reasons for this normal variation have been discussed.

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