The Hemoglobin Content of the Blood of Mice of the RIII and CBA Strains*

F. Goulden, and F. L. Warren, B.Sc.

[From The Chester Beatty Research Institute, The Royal Cancer Hospital (Free), London, England]

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The hemoglobin content of mouse blood has been little investigated, and until the recent outstanding work of Strong and his collaborators (2, 3, 4, 5, 6) practically nothing was known about the normal physiological variation of mouse blood pigment with such factors as age and strain. Strong's interest in the hemoglobin content of the blood of mice susceptible to spontaneous cancer was aroused by the fact that agents affecting the cell in its oxidation-reduction relationships are capable of eliciting profound effects on development. In a study of the hemoglobin life curves in different strains of mice Strong made the important observation that there is a precocious drop in the hemoglobin level in those mice that are known to be more susceptible to the development of spontaneous cancer as compared with those that are more resistant.

Parsons (1) has shown that the induction of cancer by some carcinogens is preceded by the deposition of iron in certain tissues. A similar effect obtains in mice bearing spontaneous tumors (8). Carcinogenic hydrocarbons that have been rendered water-soluble by conversion into endo-succinates have a strong hemolytic action in vitro (9).

In connection with further investigation of the iron content of mouse tissues (10) it was considered necessary to obtain concurrently data on the hemoglobin content of the blood. Such data are recorded in the present paper. Since Strong's experiments were confined to female mice the present work was extended to include estimations on male mice from a high- and a low-cancer strain.

MATERIALS AND METHODS

The mice used in these experiments were of two strains. CBA (agouti) mice were selected as the low-mammary-cancer strain in order to afford a basis of comparison with Strong's results. As a high-mammary-cancer strain mice of the RIII line were chosen. This strain was developed at the Radium Institute of Paris by Mme. Dobrovolskaia-Zavadskaia. The incidence of spontaneous mammary cancer in the females of this line has been given as about 72 per cent of all females living to about 7 months. In the mice of the colony used in these experiments the spontaneous incidence was high. Up to 1940 the incidence approached 100 per cent in female mice living at 6 to 8 months of age. Since that time there has been a gradual lengthening of the latent period, at the moment unexplained, which is now over one year (400 to 450 days).

All mice used for hemoglobin estimations were kept on the same adequate diet. No mouse was used for more than two bleedings, and a period of at least 12 weeks was allowed to elapse between two such measurements. The animals were removed from food 12 hours before bleeding.

The oxyhemoglobin content of blood can be rapidly and accurately estimated with the help of a photoelectric colorimeter. Szigeti (7) has described a suitable method for use with the Hilger photoelectric absorptiometer and this method was employed. Calibration of the instrument was carried out with a blood sample in which the pigment content had been determined spectrophotometrically. Blood samples were drawn from the tail after amputation of about 1 to 2 mm. of the tip. The sample was easily collected by inserting into the blood droplet the tip of a standard 0.1 ml. blood pipet previously rinsed with saturated sodium oxalate solution. Duplicate samples of 0.05 ml. were taken on each occasion of bleeding. The contents of the pipet were blown out into 10 ml. of 0.04 per cent ammonia solution. The ammoniacal solution was well shaken and transferred to the cells of the absorptiometer. The average time between dilution and reading in the colorimeter was 15 minutes. The method was tested for reproducibility by measuring the hemoglobin content of the blood of the same animal on successive samples taken at intervals of about 1 minute. Agreement between duplicates was good.

RESULTS

Estimations were carried out on male and female mice of both strains at different ages. The values ob-
Male mice of the CBA strain have hemoglobin contents of whole blood of 15.9 gm. at 0 to 400 days, 15.5 gm. at 400 to 600 days, and 14.8 gm. at 600 to 900 days. Thus, from about the 200th to the 700th day of life there is a fall in hemoglobin of 1.1 gm. per 100 ml. Females of this strain show values of

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16.7 gm., 16.5 gm., and 16.0 gm. at the same respective average ages—a decrease of 0.7 gm. per 100 ml. over about 500 days. At all ages the blood hemoglobin is higher in females than in males. The sexual difference is about 5 per cent in the lower age group and increases to 8 per cent at 600 to 900 days of life. It may be noted that the value of 16.7 gm. per 100 ml., determined in these experiments for female breeding CBA mice at 0 to 400 days, is comparable with the value found by Strong for CBA female breeders at 200 days of age, i.e., 16.3 gm.

In male mice of the RIII strain there is no significant difference between mice of the age groups 0 to 400 days and 400 to 600 days. The hemoglobin contents are 13.45 gm. and 13.35 gm. respectively. Females of this line, however, show a notable difference. The hemoglobin value of 16.4 gm. at 0 to 400 days falls to 14.7 gm. at 400 to 600 days, a decrease of 1.7 gm. This fall occurs quite sharply at or about the 400th day.

The sharp decrease occurs at approximately the age (400 days) at which mammary cancer begins to appear in the colony of RIII female mice used in these experiments. It should be emphasized that no mouse bearing a palpable tumor was used for hemoglobin determinations.

**SUMMARY**

Blood hemoglobin has been estimated in both sexes of two strains of mice. In both strains (CBA, low-mammary-cancer; RIII, high-mammary-cancer) the concentration of blood pigment is higher in female mice than in male mice at all ages. Female mice of the RIII strain show a rapid fall of blood hemoglobin between the ages of 360 and 430 days. This fall amounts to about 10 per cent of the blood pigment initially present and occurs at the age at which spontaneous mammary carcinoma normally begins to appear in female mice of this strain.

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**REFERENCES**


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