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## Blood Volume in Single and Parabiologic Rats

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15 to 21 microns. Although the range of both length and width was approximately 50 per cent greater in the mixed strain, the means of the two measurements were within .2 micron of those of the inbred strain. The means for the mixed strain were 22.57 microns for length and 17.83 microns for width, while in the inbred strain, the means were 22.75 and 17.86 microns respectively. The mean shape index for the random strain was .7934 and for the selected strain .7326. In the mixed strain the standard deviation for length was  $\pm 1.54$  and for width  $\pm .96$ ; in the inbred strain for length  $\pm 1.58$  and for width  $\pm .33$ .

In testing these measurements statistically to determine whether or not this difference was one of significance, it was found that the ratio of the difference of the mean widths of the two strains to its probable error was 1.698, which indicates that the slight increase in mean width of the inbred strain is not significant. In order for this difference to be of significance, the ratio must be 3.0 or above. The mean lengths were tested by the same method, and were found to have a significant ratio of 4.63.

In addition to this slight significant morphological difference between the two strains of the parasite, the writers have observed also a physiological difference. It was found that rats which had been immunized to infection by the inbred strain could be infected by the highly heterozygous strain, but that those animals immunized by the mixed strain by feeding the same size dose could not be infected by the inbred strain.

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## BLOOD VOLUME IN SINGLE AND PARABIOTIC RATS<sup>1</sup>

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(Introduced by E. Witschi)

The method described in this paper for the measurement of blood volume in rats is very similar to that used by H. P. Smith ('30) in his blood volume determinations on dogs.

Eight mg. per kg. body weight of Brilliant Vital Red (Evans) in 1 per cent solution was injected in the tail vein. After a lapse of 4 minutes blood samples were taken from the heart (usually 1 cc.), mixed with oxalate solution and centrifuged in a calibrated tube.

<sup>1</sup> Presented at the meeting of Iowa Academy of Science, April, 1932, Cedar Falls, Ia.

A reading is then taken of the respective volumes of blood cells and plasma-dye-oxalate solution. Standards are prepared in advance for the comparison of the dye-plasma-oxalate solution obtained from each animal.

The following formula then gives the amount of dye in mg. per liter of plasma:

$$\frac{S \times A_s \times R}{R_1 \times D_s} \times C = X; \text{ when: —}$$

- X equals mg. dye per liter plasma.
- S equals mg. dye per liter standard.
- D<sub>s</sub> equals dilution of standard.
- A<sub>s</sub> equals dilution of unknown.
- R equals length of standard tube in mm.
- R<sub>1</sub> equals colorimetric reading of unknown in mm.
- C equals correction for oxalate dilution.

Then,

$$P. V. = \frac{A}{B}; \text{ when: —}$$

- P. V. equals plasma volume in liters (x 1,000 for cc.).
- A equals mg. dye injected.
- B equals mg. dye observed per liter.

*Plasma Volume and Blood Volume Measurements of Single and of Parabiotic Rats*

(single animals)					
No.	P. V.	B. V.	B. Wt.	Pctg. B. Wt.	ANIMAL
2	10.4	26.0	250	10.4	
4	8.1	24.6	245	10.0	
5	10.9	25.9	285	9.1	♂
6	11.0	26.9	285	9.4	♂
(parabiotic animals)					
77	12.3	26.4	500	9.8	
	9.1	22.5			♀
79	10.2	20.4	440	8.8	
	9.6	18.5			♀
94	10.4	21.4	420	10.3	♀
	10.9	21.8			♀
98	10.5	22.1	400	10.6	
	9.2	20.4			♀
111	11.5	21.3	410	10.4	
	10.7	21.3			♀
112	11.2	21.1	380	10.9	
	10.0	20.4			♀
113	13.9	25.3	470	10.7	
	11.8	24.8			♀

- P. V. equals plasma volume in cc.
- B. V. equals blood volume in cc.
- B. Wt. equals body weight in grams.
- Pctg. B. Wt. equal percentage of body weight which is blood.

Hence,

$$B. V. = P. V. + (P. V. \times \frac{X}{Y}); \text{ when: —}$$

B. V. equals blood volume in liters ( $\times 1,000$  for cc.).

P. V. equals plasma volume in liters.

$\frac{X}{Y}$  equals ratio of cells to plasma in the blood.

In the accompanying table the plasma volume and blood volume measurements are given for both single and parabiotic rats. The weights of each member of a parabiotic pair could not be conveniently determined, so the combined weight is given, and equal amounts of dye were injected into each animal. The table indicates that there may possibly be a slightly higher percentage of blood in female than in male rats. The results as a whole show that about one-tenth of body weight is blood, which is slightly higher than given by other investigators.

#### LITERATURE CITED

SMITH, H. P. 1930: Studies on vital staining. II. The removal of Brilliant Vital Red from the blood stream. Distribution of dye between blood stream and body tissues. J. of Expt. Med. 51: 379.

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## THE EFFECT OF HEAVY RAINS ON THE ORTHOPTERA (GRASSHOPPER) POPULATION OF THE PRAIRIE

GEORGE O. HENDRICKSON

The general interest created by destructive grasshoppers in the past few years incited the author to some studies on populations of Orthoptera, particularly on prairie patches in Iowa. Correlations of the data with climatic information will be made at times to yield possibly valuable results. This article will point out that following several heavy rains in August, 1932, the number of grasshoppers had markedly decreased on a one acre plot of *Stipa spartea*—*Andropogon scoparius* association of prairie located 5 miles south of Stanhope and 22 miles northwest of Ames. As the grass had not been grazed, mowed or burned for **several years** the tract presented a thick cover of protective material. Corn bordered