protein of the Shope papilloma virus. None of these appear to be present in extraordinary amounts. In common with other viruses examined thus far(9,13,14), the protein of the papilloma virus has a preponderance of acidic amino acids over the basic ones, and hence differs from the proteins combined with nucleic acid in such substances as sperm. A summation of the amino acid residues and the nucleic acid in the papilloma virus leaves about 7% of the material unaccounted for. However, the nucleic acid figure taken from the data of Taylor *et al.*(7) is admittedly a crude estimate and, as judged from the phosphorus content of his preparations, is almost surely low. Further investigation of the nucleic acid content together with additional amino acid analyses may resolve the discrepancy, but at present the possible existence in papilloma virus preparations of material in addition to protein and nucleic acid cannot be excluded with the same degree of assurance as in the case of certain plant viruses. Finally, the amino acid values reported here must be considered subject to revision owing to the small number of analyses made.

13. Knight, C. A., *J. Exp. Med.*, 1947, v86, 125.

14. Knight, C. A., *Ann. Rev. Microbiol.*, 1949, v3, 121.

Received November 28, 1950. P.S.E.B.M., 1950, v75.

Regular Diurnal Physiological Variation in Eosinophil Levels in Five Stocks of Mice.* (18365)

FRANZ HALBERG AND MAURICE B. VISSCHER.†

From the Department of Physiology, University of Minnesota, Minneapolis, Minn.

Characteristic eosinophil levels for inbred, mature, male mice were defined in a previous study. They were found to be distinctive for some of the strains investigated(1). It was emphasized, however, that the determinations were made in the morning, at a time when the activity of the mice had presumably declined over a period of several hours from its high point around midnight(2). Furthermore, it was noted that the determinations made during the regular periods of maximal activity may differ from the "characteristic" level.‡

An additional study was therefore undertaken, designed to compare the midnight levels of circulating eosinophils in the tail blood of mice with the "characteristic" morning level.

Procedures and materials were comparable to those specified for the determination of the characteristic eosinophil morning level(1). The blood samples in which the night levels were determined had to be collected—for practical reasons—over a period of time from 9:00 P.M. to 1:00 A.M. Two independent series of determinations were made: both in midsummer, with an interval of a week between them.

The *results* are listed in Table I and indicate that under standardized conditions the numbers of circulating eosinophils show remarkable but regular variations. The significance

* This investigation was supported in part by a research grant from the Division of Research Grants and Fellowships of the National Institutes of Health, U. S. Public Health Service, and by research funds of the Graduate School of the University of Minnesota.

† With assistance of Arthur G. Litman, Victor M. Riddle and Paul C. Royce.

1. Halberg, F., Bittner, J. J. and M. B. Visscher, in press.

2. Bänder, A., *Z. f. d. ges. exp. Med.*, 1950, v115, 229.

‡ For the B_1 subline of the C_{57} Black strain the P value for the significance of the difference between the midnight level of 223 ± 23 cells per cu cm and the morning level of 1022 ± 44 cells per cu mm was smaller than 0.001.

TABLE I. Eosinophils Per cu mm of Tail Blood at 2 Different Periods of the Day in 5 Stocks of Inbred Mice.

Stock	N	Morning level Mean ± st. error	N	Midnight level Mean ± st. error
B_4 (Subline 4 of C_{57} black)	15	700 ± 59	7	369 ± 42
D_8 (Subline 8 of dilute brown)	14	297 ± 42	7	30 ± 10
Zb (Fostered line of C_3H)	14	198 ± 19	7	30 ± 6
Ax (Fostered line of A)	14	168 ± 15	7	55 ± 8
ZD_8F_1 Hybrids, Z° x $D_8{}^\circ$)	14	130 ± 14	5	40 ± 15

TABLE II. Comparison of Differences Between Eosinophil Levels at 2 Periods of the Day in 5 Stocks of Inbred Mice.

Stock	Diff. ± S.E.*	t†	P_t‡
B_4	431 ± 92	4.68	<.001
D_8	223 ± 60	3.72	.002
Zb	168 ± 27	6.23	<.001
Ax	113 ± 22	5.23	<.001
ZD_8	90 ± 26	3.48	.003

* Differences expressed as morning minus night means of eosinophils per cu mm tail blood (see Table I) with their standard errors.

† Assuming homogenous variance within samples.

‡ Probability that a difference as large as that observed would be expected by chance alone.

of difference between the values obtained at the respective periods of the day is presented in Table II. The values in column P_t, calculated by means of Student's t value, are indicative of significance below the one percent level.

This difference between the midnight low and the morning high level in all the strains investigated and in the absence of any exogenous stress suggests that eosinopenia may occur physiologically in mice which have not been artificially stressed. Since the mouse is a nocturnal animal the greatest activity, as noted above, occurs at night. The question may legitimately be raised whether normal activity constitutes a physiological stress capable of exciting the same structures and mechanisms as are activated by exogenous stresses(3-5).

It may be noted that a similar difference has been recently reported for the lipid content of the adrenal cortex in white mice killed in midsummer at two different times of the day(2). In animals killed at 9:00 A.M. the zona fasciculata was filled *in toto* with lipid. In mice killed at midnight the lipid did not extend beyond the outer third of the fasciculata.

Summary. In 4 inbred strains and in one hybrid group of mice a regular diurnal variation of large magnitude in the circulating eosinophil count has been demonstrated. On the average, in these strains, the midnight count was less than one third of the morning level.

3. Dalton, A. J. and Selye, H., *Folia Hematologica*, 1939, v62, 397.

4. Spiers, R. S., and Meyer, R. K., *Endocrinology*, 1949, v45, 403.

5. Forsham, P. H., Thorn, G. W., Prunty, F. T. G., and Hills, A. G., *J. Clin. Endocrinol.*, 1948, v8, 15.

Received November 21, 1950. P.S.E.B.M., 1950, v75.

Transplantation of the Adrenal Gland in the Spleen of Rats. (18366)

DONALD EARL BERNSTEIN. (Introduced by G. R. Biskind.)

From the Department of Pathology, Mount Zion Hospital, San Francisco, Calif.

Previous communications(1,2) have reported the successful autotransplantation of the adrenal gland to the spleen of adrenalectomized animals. The present paper enhances the series previously reported(2), and includes data which suggest that reproduction is not inhibited when secretions from the adrenal

1. Butcher, E. O., *Endocrinology*, 1948, v43, 30.

2. Bernstein, D. E., PROC. SOC. EXP. BIOL. AND MED., 1950, v73, 175.