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Heterogony of the Glutathione Content of New-Born Rabbits.

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Gregory and Goss have presented evidence[1, 2, 3] that the concentration of glutathione in new-born rabbits is correlated with adult body size. The methods of analysis as well as the results are treated exhaustively in the referred publications. However, if positive heterogony (Huxley[4]) exists in the accretion of glutathione, its rate of increase in relation to the rate of increase in body weight may be the same in the several breeds studied and yet give an indication of a correlation such as noted by Gregory and Goss. This point of view may be strengthened by allusion to Needham's theory of a uniform chemical ground plan of growth. Needham[5] presents evidence that the values of the coefficient of heterogonic growth tend to be very similar for the same substances in different species, so that the question arises whether or not the relationships obtained by Gregory and Goss are only a necessary mathematical consequence of positive heterogony of the glutathione. Some doubt is thrown on the question by the fact that the figure for glutathione content of the embryo pig and the rat throughout life as given by Needham indicates a k value of 0.84 and 0.85 respectively, or a condition of negative heterogony.

In order to check this point, the data presented by Gregory and Goss[1] were reanalyzed, so that heterogony constants were made available. Since the range of observations was rather limited, being confined to the normal variation of the breeds around the respective mean birth weights, the values of k obtained are not necessarily absolute values, but should be used only for comparison of the various breeds for the limited range of body weights available. Furthermore, in order to place the several breeds on a strictly comparable basis, only that part of the body weight distribution was used in which all of the breeds were represented, this being the

1 Gregory, P. W., and Goss, Harold, *J. Exp. Zool.*, 1933, **66**, 155.

2 Gregory, P. W., and Goss, Harold, *J. Exp. Zool.*, 1934, **69**, 13.

3 Goss, Harold, and Gregory, P. W., Proc. Soc. Exp. Biol. and Med., 1935, **32**, 681.

4 Huxley, J. S., 1932, Problems of Relative Growth, Methuen & Co., London, 276 pp.

5 Needham, Joseph, *Biol. Revs.*, 1934, **9**, 79.

segment between body weight logarithms of 0.500 and 0.800. The pure breeds available for the calculation were Flemish, Angora, New Zealand Red and Polish.

The crosses reported by Gregory and Goss (Flemish x Polish and New Zealand Red x Angora) were found to be too variable in that segment to yield straight lines when the logarithms of glutathione were plotted against the logarithms of body weight. It should be noted that the glutathione here refers to both glutathione and ascorbic acid contents since the analyses were made before the refinement of the technique permitted the separation of these 2 constituents of the total iodine reducing substance.

The k values were determined by grouping arrays of 0.1 interval in body weight logarithms and the use of the logarithmic regression formula given by Feldstein and Hersh.[6] Table I presents the k values and their standard errors for the 4 breeds with significant differences indicated in bold type.

TABLE I.
k Values of Four Breeds of Rabbits.

Breed	k	Adult Weight	Differences.	
Flemish	1.047±.032	4585-5000	Flem-NZR	—.208±.144
New Zealand Red	1.255±.105	3000-3600	Flem-Ang	.237±.035
Angora	0.810±.014	2480-3060	Flem-Pol	.430±.095
Polish	0.617±.089	1660-1700	NZR-Ang	.445±.106
			NZR-Pol	.638±.137
			Ang-Pol	.193±.090

It may be seen from the table that the k values follow the adult weights with the exception of the Flemish and New Zealand Red reversal. However, this discrepancy is evidently a result of sampling, since the difference in the k values between these 2 breeds is not significant.

Thus an indication that the correlation between glutathione and body weight is a real one is obtained through this method of analysis, confirming the earlier conclusions arrived at by Gregory and Goss.

TABLE II.
Analysis of Covariance of the Logarithms of Body Weight and Glutathione Content.

Source of variance	Sum of squares		Sum of products	Degrees of freedom	Mean square		Correlation coefficient	Regression of GSH on BW
	BW	GSH			BW	GSH		
Total	.954	2.262	1.137	103			.774	1.192
Between means of breeds	.298	1.457	0.545	3	.09933	.48633	.827	1.829
Within breeds	.656	0.805	0.592	100	.00656	.00805	.814	0.902

[6] Feldstein, M. J., and Hersh, A. H., *Am. Nat.*, 1935, **59**, 344.

For a further substantiation of this, an analysis of covariance of the logarithms of body weight and glutathione content was conducted, the results being presented in Table II.

It should be noted that the F values of the logarithms of body weight and of the logarithms of glutathione content are 15.14 and 60.41 respectively, the corresponding 1% point being 3.98, indicating highly significant differences between the means of the breeds with respect to these 2 variables. The difference in glutathione shows a considerably higher probability of significance than does body weight. Furthermore, a high correlation exists between the two, the fact that the correlation for the total is less than for either between or within breeds, being undoubtedly due to the discarding of fourth place decimals.

However, the significant fact apparent from the table is that while the regression of glutathione on body weight is only 0.902 within breeds, it is 1.829 between means of breeds. This indicates that for every unit of change in the logarithms of body weight within breeds, an increase of only 0.902 obtains in the logarithm of glutathione, while for every unit increase of logarithm of body weight between breeds, a change of 1.829 occurs in the logarithm of glutathione content. The inevitable conclusion is that each of the breeds has its characteristic glutathione content as well as a characteristic rate of change of this factor, which is correlated with the definitive adult size of the 4 breeds studied.

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Streptococcus Anticoagulant.*

EDWARD E. DART. (Introduced by W. H. Manwaring.)

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It was shown by Neter and Witebsky[1] that many bacterial species which produce no demonstrable fibrinolysin in veal-infusion broth do produce fibrinolytic factors if grown in the same medium plus 0.4-2% glucose. They found that in this glucose broth many fibrin-

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[1] Neter, E., and Witebsky, E., PROC. SOC. EXP. BIOL. AND MED.,1936, **34**, 549, 858.