tween 40 and 41° C., but that between 10 and 38° C. there are no gross, readily perceptible alterations in the amount of blood flow. Throughout this range the wing and tail membranes retain the comparative pallor characteristic of low-temperature conditions. When the change does occur, it is so sudden and so notable that students readily perceive the difference even at a distance of several feet. Exact measurements of temperature differences between the arterial and venous flow are expected to reveal even more interesting information.

That bats might possess somatic and spermatogenic thermal homogeneity seemed as reasonable as to have supposed that the birds might do so; however, the morphological arrangements in both of these animals seem to point to a provision for heat protection, and it is now reasonable to proceed to the acquisition of more exact physiological data, with the expectation that lower testicular temperatures can be demonstrated during the period of spermatogenesis.

If neither of these animals can be shown to possess somatic and spermatogenic thermal equality, the condition should still be sought in other organisms. However, if it is demonstrated that this thermal difference is universal, as our present limited information suggests it may be, it seems probable that some profound and fundamental difference will be found in the basic physical or chemical attributes of these two classes of cells.

References

1. Colbert, E. H., Cowles, R. B., and Bogert, C. M. *Bull. Amer. Mus. nat. Hist.*, 1946, **86**, Art. 7, 333–373.
2. Cowles, R. B. *Science*, 1939, **90**, 456–466; *Amer. Nat.*, 1940, **74**, 542–561.
3. Cowles, R. B. *Science*, 1945, **101**, 221–222; *Amer. Nat.*, 1945, **79**, 160–175; 561–567.
4. Cowles, R. B. *Science*, 1946, **103**, 74–75.
5. Cowles, R. B. *J. Entomol. Zool.*, 1946, **38**, 4, 49–54.
6. Cowles, R. B., and Bogert, C. M. *Bull. Amer. Mus. nat. Hist.*, 1944, **38**, Art. 5, 265–296.
7. Cowles, R. B., and Burleson, G. L. *Amer. Nat.*, 1944, **79**, 417–435.
8. Cowles, R. B., and Nordstrom, Ann. *Science*, 1946, **104**, 586–587.
9. Riley, G. M. *Anat. Rec.*, 1937, **67**, 327.
10. Wells, L. J. *Anat. Rec.*, 1935, **62**, 409; 1935, **64** (Suppl. 1), 138.

Carbon and Hydrogen in Rubber Hydrocarbon

Henry J. Wing

16 Grandview Avenue, Stamford, Connecticut

Analyses, by combustion, of rubber hydrocarbon separated from rubber latex and crystallized from ethereal solutions at low temperatures yielded combined percentages of carbon and hydrogen which totaled slightly less than 100 (*4*). Midgley (*1*) assumed the difference to be due to oxygen, and he and his co-workers have used the results to substantiate their argument that natural rubber is not a true hydrocarbon but contains a small amount of oxygen in chemical combination.

Later, Roberts (*2*) reported that he had isolated the portion of rubber which contained oxygen. This he called caoutchol, to distinguish it from the hydrocarbon, which he named caoutchene. He used Midgley's results to confirm his findings, which he attempted to apply in a new way to the familiar two-phase theory of Fessenden as an explanation of the properties of rubber. However, Schidrowitz (*3*) has indicated that the method used by Roberts to separate the caoutchol is not free from possible criticism. Some steps in the procedure, e.g. milling, promote oxidation.

Since publication of the analyses made at the Bureau of Standards the values for the atomic weights of carbon and hydrogen have been changed from 12.00 and 1.0078 to 12.010 and 1.0080, respectively. When these earlier results are recalculated with the new atomic weights, the sums of carbon and hydrogen are increased by 0.061 per cent. When the results reported in the earlier paper are corrected for two typographical errors and this increment is added, the recalculations are as shown in Table 1.

TABLE 1

Composition of Rubber (Recalculated)

	Hydrogen	Carbon	Sum	Ratio Hydrogen: Carbon
Rubber hydrocarbon uncrystallized	11.85	88.03	99.88	0.1346
	11.84	88.11	99.95	.1343
	11.77	87.66	99.43	.1342
	11.85	88.03	99.88	.1346
	11.82	87.92	99.74	.1344
Average			99.78	
Crystallized once	11.86	88.06	99.92	.1346
	11.82	88.02	99.84	.1343
Average			99.89	
Crystallized three times	11.87	88.31	100.18	.1344
	11.86	88.13	99.99	.1345
Average			100.05	
General average			99.87	

Several things should be said about these results if they are to be used as a basis for judging whether oxygen constitutes a part of the normal rubber molecule: (1) The sum of carbon and hydrogen found increased with increasing purification of the rubber. (2) The most carefully purified material gave an average sum of carbon and hydrogen in excess of 100 per cent, and the four analyses of hydrocarbon which had been recrystallized at least once averaged 99.97. (3) The differences between analyses of the same material were greater than the average difference between the sum of hydrogen and carbon and 100 per cent. The latter cannot, therefore, be regarded as certainly significant. (4) The absolute purification of the rubber hydrocarbon cannot be assumed. Substantially all probable impurities, including water, ether, dissolved or adsorbed gases, inorganic material, and products of oxidation of the rubber itself, would have lowered the sums of hydrogen and carbon observed.

Certainly the results leave very little, if any, of the weight of the rubber to be accounted for as normally combined oxygen. This is not all, however. The observed ratio of hydrogen to carbon is higher than the theoretical (0.1343) by an amount that appears less significant than it really is, in comparison with the total weight of carbon and hydrogen, because of the small weight of hydrogen. For the entire series of analyses the weight of carbon dioxide found was 0.21 per cent lower than that computed from the weight of rubber burned, the weight of the water being only 0.06 per cent low. For the four samples of recrystallized rubber, the carbon dioxide was 0.09 per cent low and the water 0.08 per cent high. These differences are in the direction we would expect if the discrepancy in the total weight were the result of probable impurities in the rubber, particularly water and ether; on the other hand, the presence of oxygen combined as hydroxyl would not affect the ratio of hydrogen to carbon, and in the form of other probable radicals it would reduce that ratio.

If the small difference between the theoretical value and the sum of hydrogen and carbon is to be considered significant, the difference between their theoretical and observed ratios must also be significant, and this definitely indicates incomplete purification rather than combined oxygen, as postulated by Midgley.

References

1. Midgley, T., Jr., Henne, A. L., Shepard, A. F., and Renoll, M. W. *J. Amer. chem. Soc.*, 1935, **57**, 2318.
2. Roberts, K. C. *J. chem. Soc.*, 1938, 215.
3. Schidrowitz, P. *India Rubber J.*, 1938, **95**, 565.
4. Smith, W. H., Saylor, C. P., and Wing, H. J. *Bur. Stand. J. Res., Wash.*, 1933, **10**, 476.

Variation Among Lamb Carcasses in the B Vitamin Content of Meat[1]

Sylvia Cover, Esther M. Dilsaver, and Rene M. Hays

Agricultural and Mechanical College of Texas, College Station

It is generally accepted that ruminants do not require the B vitamins. Hence, the variation in ration content may be assumed to have no effect on the B vitamin content of their meat.

Nevertheless, considerable difference in B vitamin content of the raw meat of different carcasses of beef has been reported (*1*). This difference has been questioned on the grounds that there was no way to remove the variation associated with carcasses from that associated with performing the analyses at different times. In more recent experiments with groups of lamb carcasses, however, there have been findings similar to those in the previous study. The additional evidence, moreover, was obtained from an experimental design improved to meet the previously mentioned criticism.

The experiment was originally planned to overcome as nearly as possible the suspected variation between carcasses. But the variation was notable even under these conditions. Because the details of the entire experiment of which this study is a part will be given in subsequent papers, only those details concerned with carcass differences will be given here.

The samples of meat were obtained as follows: Cubes of meat from a wholesale cut (triangle) were mixed for each of four carcasses separately. Enough cubes to weigh exactly 125 grams were taken from each of the four carcasses and combined to make one 500-gram sample. Equal numbers of 500-gram packages were placed in each of two flat pans and frozen in the deep freezer, where they were kept until needed. To obtain replications, this entire procedure was repeated with meat from other lots. Six replications were employed, making a total of 24 lamb carcasses. Storage periods between killing and freezing were held constant, as were those between freezing and analysis, so that these storage periods would not be a possible cause of variation in vitamin content. The same sample was used for the determination of the following B vitamins: thiamine, pantothenic acid, niacin, and riboflavin.

In preparation for testing, one of the two pans in a replicate was removed to the laboratory, where the samples were allowed to thaw in the refrigerator. Two of the samples were analyzed raw, the other samples after cooking. One week later the other pan of samples from the same replicate was removed and the raw samples treated in like manner. Thus, two combinations of the data on raw meat were possible: those associated with order of analysis and those associated with replications. Since the data were collected in this fashion, the variation associated with doing the analyses at different times could be removed from replications by an analysis of variance.

TABLE 1

Variation in Vitamin Content Between Replicates (Groups of Carcasses)

Replicate No.	No. of samples	Thiamine	Pantothenic acid	Niacin	Riboflavin
		Actual content (μg./gram dry free-fat basis)			
1	4	8.22	24.75	262.9	12.91
2	4	9.33	25.49	257.4	11.58
3	4	11.72	25.16	231.9	11.37
4	4	7.01	28.65	269.8	10.57
5	4	8.34	24.30	287.2	10.40
6	4	8.15	26.73	270.5	11.57
Greatest difference (highest —lowest).............		4.71	4.35	55.3	2.51
Percentage difference*......		67	18	24	24
F value of replicates†........		28.29‡	13.80‡	25.13‡	37.78‡

* Calculation $= \dfrac{\text{greatest difference} \times 100}{\text{lowest replicate}}$.

† Calculated from dry fat-free basis.

‡ Error terms were remainder after replicates, order, and O × R were removed.

F values needed for significance were: 0.05 level = 3.11, 0.01 level = 5.06.

The average vitamin content of each of the 6 replicates is given in Table 1. The variation is shown by the differences between the highest and lowest value, the percentage difference, and the F value. As will be seen, the difference between replicates is highly significant for all of the four vitamins in lamb. The percentage difference in each case is above any recognized value for experimental error. It would appear that the highly significant difference between replicates is associated with something other than the different occasions on which the analyses were made. Carcasses (or groups of carcasses) are apparently the dominant factor associated with replicates. It seems probable that the difference would have been even greater had the analyses been made on individual rather than on groups of carcasses.

[1] The work on which this paper was based was supported in part by a grant from the National Live Stock and Meat Board.