

rigorous proof of the accepted theory requires an elementary composition of $C = 65.70$, $H = 10.79$, $N = 1.74$, $P = 3.86$. It further requires the nitrogen of the molecule to be composed entirely of choline. Hence lecithin should not contain even a part of its nitrogen in the form of free amino groups.

The work up to the present has satisfied many of the requirements. The fatty acids and the glycerophosphoric acid have been identified; and MacLean has prepared, at least once, a sample of lecithin that was free of amino-nitrogen. However, this one sample was very incompletely analyzed. All other samples of lecithin prepared by various workers contained amino-nitrogen in their molecule, and from the standpoint of elementary analysis showed a marked disagreement with the theory. This is well illustrated by the following table:

Author.	Source.	C.	H.	N.	P.	Choline, Per Cent.
Thudichum	Brain	66.75	18.67	1.81	4.00	.....
Baskoff	Liver	64.64	10.71	1.95	4.00	.....
Heffter . . . . .	"	.....	.....	.....	.....	25
Stern and Thierfelder . .	Egg	64.63	10.96	1.79	3.95	.....
MacLean	"	64.18	10.60	1.87	3.95	66
Erlandsen	Heart	66.29	10.17	1.87	3.95	42
MacLean	"	66.27	10.32	1.85	3.97	41.4
Eppler	"	66.46	10.69	1.87	4.03	.....
MacLean . . . . .	"	.....	.....	1.89	4.04	68
"	Not given	.....	.....	1.85	4.00	66
"	From $CdCl_2$ salt	.....	.....	1.87	4.15	98.7

The analytical data obtained by Ritter on hydrolecithin showed better agreement with the theory, and one might have been inclined to regard the material of Ritter as such that contained all the necessary and sufficient proof in favor of the conventional theory. Unfortunately, Ritter did not determine the amino-nitrogen of the reduced lecithin, and hence failed to furnish definite proof of its purity.

Indeed, the present report contains data unmistakably proving that hydrolecithin of an elementary composition fully harmonizing with the theory may be and generally is impure, containing between 10 and 20 per cent. of its nitrogen in the form of amino-nitrogen.

This finding has a great significance because of its bearing on the structure of cephalin, and the work is presented in its present

incomplete state because of this. On the basis of recent work on the hydrolytic products of cephalin a certain structural formula has been assumed. This formula requires an elementary composition of $C = 66.17$, $H = 10.57$, $N = 1.88$, and $P = 4.17$. However, all samples analyzed beginning with Thudichum and up to the present by most recent investigators consistently had the average composition of $C = 60.00$, $H = 9.30$, $N = 1.80$, and $P = 3.80$.

On the basis of these considerations, one may argue that if cephalin and lecithin both had the composition required for them by the theory, then a mixture of the two should possess practically the same elementary composition as either one of them in the pure state. On the other hand, if lecithin possessed the composition assumed by the theory and cephalin that found empirically, then a mixture containing 80 per cent. of the one and 20 per cent. of the other should possess a carbon content of about 64 per cent. Conversely, if a mixture of the two reduced substances possessed an elementary analysis of $C = 65.3$, $H = 11.20$, $N = 1.75$ and $P = 3.85$, as was actually found, it would justify the conclusion that both lecithin and cephalin possess the composition assumed for them by the theory.

The material analyzed by us contained 80 per cent. hydrolecithin and 20 per cent. of an impurity. It was found that the material yielded on hydrolysis besides the choline also the base aminoethanol which was isolated as the gold chloride salt. Hence it was reasonable to assume that the 20 per cent. of impurity consisted of hydrocephalin. If cephalin had the composition found by experience then a substance consisting of 80 per cent. of hydrolecithin and 20 per cent. of cephalin should have an elementary composition of $C = 64.56$, $H = 10.49$, $N = 1.75$ and $P = 3.84$. On the other hand if both lecithin and cephalin possess the structure assigned to them by theory then the above mixture of the reduced bodies should have the elementary composition found by experiment. Thus the facts presented in this report furnish evidence in favor of the prevailing theory of the molecular structure of lecithin and of cephalin. They also indicate the method by which the reduced cephalin may eventually be obtained. Efforts in this direction are now in progress.