Acids, alkalies, salts, glucosids, and toxin diffuse into 0.9 per cent. watery NaCl solution more quickly than into a similar solution containing agar-agar and gelatin. This reduction in rapidity of diffusion increases with increase in concentration of the jelly. Ten per cent. gelatin exerts a greater inhibition than two per cent. agar-agar, and 25 per cent. gelatin exerts greater restraint than 10 per cent. gelatin. The ratio between the rate of diffusion and the concentration of the colloidal suspension is, in the case of gelatin, nearly inversely proportional to the square root of the concentration of the colloid. In the case of agar-agar, with which the possibility of varying the concentration is far less than with gelatin, the inhibitory influence is less marked and does not conform to this rule. Voigtländer's results are applicable to the special case of agar-agar jelly.

The influence of colloids upon the injurious effects produced by bile salts upon the pancreas is due, apparently, to a modification by reduction of the diffusibility of the bile salts, which result diminishes the concentration of the salts brought in contact with the pancreatic tissues in a unit of time.

Seventeenth meeting.[1]

Laboratory of the Department of Health, of New York (East 16th St.). May 23, 1906. President Flexner in the chair.

43 (135). **"Analogies between the phosphorized fats obtained from the brain and kidney,"** with exhibition of products: **EDWARD K. DUNHAM.**

So much attention has been directed to the protein constituents of protoplasm that it has become usual to regard proteins as the physical basis of life. Relatively recent investigations have, however, indicated that all cells contain complex substances of a fatty or lipoid nature, in which phosphorus and nitrogen are conspicuous elements. Many of these lipoids possess remarkable physical properties. In contact with water or alkaline liquids, they pass into colloidal solution after imbibing large quantities of water with the production of "myelin forms." They also differ from neutral fats in doubly refracting light. Such physical characters and the complex molecular constitution of these lipoids appear to justify the assumption that they, as well as proteins, are essential con-

[1] *Science*, 1906, xxiii, p. 979; *American Medicine*, 1906, i (N. S.), p. 155.

stituents of protoplasm and that a study of living matter must include the consideration of these compounds of the fatty acids.

The phosphorized fats, or lipoids, which have been most carefully studied have been obtained from the brain,[1] but even as derived from this source, where they are believed to be present in relatively large amounts, their constitution and mutual relationships have not been clearly established.

During investigations of alcoholic extracts of kidneys, the writer has been led to infer that substances closely related to the lipoids derived from the brain may be obtained by similar methods from the kidney, and the purpose of the present communication is to report a few representative analyses from among those upon which the inference just stated is based.

Extracts of finely divided renal tissue, freed from obvious fat, made with hot 85 per cent. alcohol, yield a precipitate, upon cooling, which contains a variety of lipoids, while certain others remain in solution. For convenience, those lipoids which are relatively insoluble in cold alcohol may be classed as the "protagon" group, and those not precipitated on chilling as the "lecithin" group. A preliminary purification of the "protagon" group was effected by treating the crude precipitate with benzol, which left a small residue undissolved. From the concentrated solution in benzol a powdery precipitate was formed upon the addition of a mixture of acetone and rhigolene and became pure white when repeatedly washed with the latter mixture, in which it was nearly if not wholly insoluble. This precipitate was soluble in hot 85 per cent. alcohol, from which it separated in discoid crystals on cooling the solution. It corresponded in solubilities to Liebreich's "protagon" or to an impure sphingomyelin described by Thudichum, and obtained from the brain. It contained 2.869 per cent. of phosphorus and 3.126 per cent. of nitrogen. A portion of this precipitate was dissolved in hot 85 per cent. alcohol and an alcoholic solution of lead acetate was added to excess. The mixture was boiled and filtered while hot. Upon cooling, a heavy white crystalline precipitate formed. This was removed by filtration and recrystallized from 85 per cent. alcohol four times. The

[1] Thudichum: Die Chemische Konstitution des Gehirns des Menschen und der Tiere. Tübingen, 1901.

white crystalline powder so obtained was analyzed. (See Table I, 160 A.) A second sample of the same substance, prepared by the same method from another lot of kidneys, but recrystallized only once, and therefore, which was less pure, contained nearly the same percentages of phosphorus and nitrogen, allowance being made, in the calculations, for the 1.77 per cent. of lead in it (Table I, 160 B).

The solubilities and reactions of this substance correspond to those of the compound which Thudichum calls "sphingomyelin," when it contains, as impurities, small quantities of kerasin and a cerebroside to which he assigned no name. Upon hydrolysis with barium hydrate, this substance from the kidney yields ammonia, trimethylamin, a substance reducing Fehling's solution, and, apparently, an acid forming a barium salt which is insoluble in a mixture of absolute alcohol and ether. These cleavages are analogous to those observed by Thudichum on hydrolysis of his sphingomyelin.

A portion of the lead-free substance (160 A) was dissolved in hot 85 per cent. alcohol and precipitated with cadmium chlorid in alcoholic solution. The precipitate was removed by filtration, redissolved in 85 per cent. alcohol and kept at 30° C. over night. This procedure separates kerasin from sphingomyelin. The precipitate that had formed during the night was rapidly removed with a Buchner filter, pressed, dried and analyzed (Table I, 160 A—$CdCl_2$). The percentages of phosphorus and nitrogen in a second but less pure sample of this cadmium chlorid compound are also given (Table I, 160 B—$CdCl_2$), and, for comparison with these, the results of analyses of "sphingomyelin" and "apomyelin" by Thudichum. He obtained cadmium salts containing 16.86 per cent. $CdCl_2$ and 26.59 per cent. $CdCl_2$, and believed that these variations depend upon the relative abundance of compounds containing one and two molecules of cadmium chlorid, respectively; assigning the limits 16.4 per cent. $CdCl_2$ and 28 per cent. $CdCl_2$ to these two hypothetical compounds. The percentages of cadmium chlorid found in the similar products from the kidney fall within these limits, and the percentages of cadmium and chlorin are in close accord with the assumption that the cadmium is present as chlorid, thus indicating that the salt is an addition product.

The acetone rhigolene mixture used in the preliminary purification of the "protagon" group contains substances which possess solubilities similar to those of Thudichum's kephalin and myelin, both before and after precipitation with lead acetate. But these substances have not yet been obtained in sufficient quantities for satisfactory purification. They appear, however, to contain more phosphorus (over 4 per cent.) and less nitrogen (about 1 per cent.) than the analogue of sphingomyelin already considered, and these characters are also in harmony with Thudichum's analyses of kephalin, myelin and sphingomyelin.

From the "lecithin" group, a cadmium chlorid compound was obtained which, when purified with ether, acetone and alcohol, resembled the cadmium chlorid compound of paramyelin (Thudichum). The percentages of phosphorus and nitrogen in this compound (150 A—$CdCl_2$), in a second sample purified but once with ether and acetone (150 B—$CdCl_2$), and in Thudichum's paramyelin from human and ox brains, are given in Table II.

Still other compounds containing phosphorus, nitrogen and fatty acids have been obtained from renal extracts, and appear to be analogous to substances derived from the brain. But since all these compounds require much further study before their constitution, relations to each other and to substances originally present in the tissues can be understood, it is believed that this preliminary report need not be burdened with further, necessarily incomplete analytical data.

TABLE I.

160 A.	160 B.	160 A—$CdCl_2$	160 B—$CdCl_2$	Sphingomyelin.[1]	Apomyelin.
P 2.493	2.48	3.690	3.623	3.24	3.23
N 2.869	2.74	2.896	3.211	2.96	3.00
C 63.570	—	67.546	—	65.37	67.01
H 11.840	—	12.445	—	11.29	11.35
$CdCl_2$ —	—	25.380	25.362	16.63 to	26.59

TABLE II.

150 A—$CdCl_2$	150 B—$CdCl_2$	Paramyelin Cadmium Chlorid.[2]	
		Human Brain.	Ox Brain.
P 4.348	4.156	4.78	4.313
N 2.403	2.219	2.25	2.029
$CdCl_2$ 25.990	24.340	24.95	21.275

[1] Thudichum, l. c., p. 170.

[2] Thudichum, l. c., p. 153.