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Outline of a classification of the lipoids.

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At the meeting of the American Society of Biological Chemists in December, 1919, the matter of a classification of the fats and related substances was brought before the members for discussion. It was decided that the available knowledge on the subject was insufficient to justify a classification at that time. While admitting the truth of the conclusion it has seemed to me since, that something might be gained by an attempt at classification,—in clarifying our ideas and in bringing the newer developments in the field into connection with the old—even though the scheme might later have to be radically changed or even abandoned. It is becoming more and more apparent, for example, that the fats and the substances ordinarily grouped under the name of lipoids are so intimately related both chemically and in metabolism—all being directly connected with the metabolism of the fatty acids—that they should be considered together, and when so considered they form a group which is believed to be as distinct and well defined as that of the carbohydrates and proteins. The following is an outline of proposed classification:

THE LIPOIDS.

The higher fatty acids, their naturally occurring compounds and certain substances found naturally in chemical association with them.

The group is characterized in general by insolubility in water and solubility in 'fat solvents'—ether, chloroform, benzol, etc.

Simple Lipoids.

Esters of the fatty acids with various alcohols.

Fats.—Esters of the fatty acids with glycerol. (fats which are liquid at ordinary temperatures are called oils.)

Waxes.—Esters of the fatty acids with alcohols other than glycerol. Beeswax, lanolin, cholesterol oleate.

Compound Lipoids.

Compounds of the fatty acids with alcohols but containing other groups in addition to the alcohol.

Phospholipoids.—Substituted Fats containing phosphoric acid and nitrogen—lecithin, cephalin, etc.

Glycolipoids.—Compounds of the Fatty acids with a carbohydrate and nitrogen but containing no phosphoric acid.—Cerebron, etc.

(Aminolipoids, Sulpholipoids etc.—Various groups which may be added as soon as they are sufficiently well characterized.)

Derived Lipoids.

Substances derived from the above groups by splitting, which have the general properties of the lipoids.

Fatty Acids of various series.

Sterols.—Alcohols, mostly large molecular solids, found naturally in combination with the fatty acids and which are soluble in "fat solvents"—Cetyl Alcohol ($C_{16}H_{33}OH$), Myricyl Alcohol ($C_{30}H_{61}OH$), Cholesterol ($C_{27}H_{43}OH$), etc.

NOTES ON THE CLASSIFICATION.

The group is specifically limited and defined in two ways;

1. Only substances are included which are chemically and metabolically related to the fatty acids.

2. Only naturally occurring substances are included.

The definitive chemical entity of the group is the fatty acid and it is intended to include only those substances which are closely concerned with the metabolism of the fatty acids. The second limitation—"naturally occurring" is intended to exclude organic compounds which have no relation to the metabolism of the fatty acids but which would otherwise be included owing to composition or physical properties.

The name "Lipoid" has been chosen for the group because

1. By derivation it is suitable.

2. When limited as above it is sufficiently definite for the purpose and yet general enough to include all necessary substances.

3. It is already in considerable use on the continent in approximately this (Bang, Czapek and most French investigators in the field).

The term "Lipin," introduced by Gies, although by derivation equally suitable, is believed to be less desirable because of the present practice among biochemists of making little or no distinction between—in and—ine (signifying the presence of nitrogen). For example MacLean uses the term lipin to mean lipoid substances containing nitrogen.

Very little originality can be claimed for the above classification and the writer freely acknowledges the help obtained from a study of earlier classifications, notably those of Bang, Leathes, Gies and MacLean. At the same time it is believed to be an improvement on preceding classifications in that it provides a definite chemical and metabolic basis which has hitherto been lacking.

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Sodium citrate and scurvy.

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An Italian child ten months old was brought to the Children's Clinic, Stanford Medical School, in October, 1919, suffering from severe scurvy. The child had been fed from birth on raw certified milk to which had been added sodium citrate in the proportion of one grain to each ounce of modified milk.

A series of seventeen guinea pigs was fed on oats and milk. In the case of nine of these guinea pigs sodium citrate was added to the milk in the following proportions: 2 animals, 0.25 per cent.; 2 animals, 0.50 per cent.; 3 animals, 1 per cent.; 1 animal 1.3 per cent.; 1 animal 2.0 per cent. The period of feeding in this series was ten to forty-six days. Of the animals to which sodium citrate was given all except one, to which 0.50 per cent. was given for forty-six days, developed scurvy. Of the eight animals to which milk and oats only were given two developed scurvy. These control animals were observed for periods of forty to forty-six days. The average milk intake was 39.1 c.c. of milk per day for the control animals and 41.6 c.c. for the sodium citrate animals.