ABSTRACTS

R. A. REINERS, Editor. ABSTRACTORS: J. G. Endres, Kazuo Fukuzumi, J. Iavicoli, K. Kitsuta, F. A. Kummerow, C. C. Litchfield, Gladys Macy, Louise R. Morrow, E. G. Perkins, and T. H. Smouse

• Fats and Oils

SEPARATION AND STRUCTURE DETERMINATION OF AN EICOSATRIENOIC AND AN EICOSADIENOIC ACID IN NAGI SEED OIL. S. Ito, Y. Koyama and Y. Toyama. *Bull. Chem. Soc. Japan* 36, 1439–44 (1963). (Rev. Current Lit. Paint Allied Ind. No. 272).

DETERMINATION OF POLYUNSATURATED FATTY ACIDS IN MILK FAT. C. Boatman and E. G. Hammond (Dept. of Dairy and Food Industry, Iowa State Univ., Ames). *J. Dairy Sci.* 48, 275–281 (1965). A concentrate of the polyunsaturated fatty acids of milk fat was prepared by low-temperature crystallization, and this concentrate was fractionated by chromatography on silica gel. Comparative analyses of the fractions by alkali isomerization, lipoxidase, and gas chromatography were carried out. Gas chromatography gave high determinations for nonconjugated dienoate and trienoate compared with the other two methods. This was attributed to the presence of unconjugatable positional isomers of linoleic and linolenic acids. The alkali isomerization and lipoxidase methods agreed closely for samples in which there was not much tetraenoate and pentaenoate.

SEMIAUTOMATED METHOD FOR THE COLORIMETRIC DETERMINATION OF PLASMA FREE FATTY ACIDS. A. Antonis (Medical Unit, St. George's Hosp. Med. School, London, England). *J. Lipid Res.* 6, 307–312 (1965). A semiautomated procedure is described for the estimation of plasma free fatty acids. The method requires the preliminary preparation of a phospholipid-free plasma lipid extract which is then analyzed automatically by a colorimetric procedure based on the solubility of copper soaps in chloroform, with subsequent complexing of the copper with diethyldithiocarbamate and measurement of the extinction at 440 mμ.

TWO-DIMENSIONAL THIN-LAYER CHROMATOGRAPHIC ISOLATION OF FATTY ACYL CARNITINES. B. Wittels and R. Bressler (Depts. of Pathology and Med., Duke Univ. Med. Center, Durham, N.C.). *J. Lipid Res.* 6, 313–314 (1965). A system of two-dimensional ascending thin-layer chromatography is reported in which palmityl carnitine can be completely separated from all phospholipids on a single chromatogram without the use of the ancillary procedures necessary in previously described systems.

QUANTITATIVE DETERMINATION OF PLASMA FREE FATTY ACIDS AND TRIGLYCERIDES BY THIN-LAYER CHROMATOGRAPHY. G. Schlierf and P. Wood (Inst. for Metabolic Res., Highland-Alameda County Hosp., Oakland, Calif.). *J. Lipid Res.* 6, 317–319 (1965). The relation between the area of a spot and the amount of lipid contained in it after thin-layer chromatography has been applied to quantitative determination of plasma free fatty acids and triglycerides. Satisfactory results were obtained for both lipid classes with a standard deviation of ± 8.1 and ± 8.5% respectively.

CHROMATOGRAPHY OF LIPIDS ON COMMERCIAL SILICA GEL LOADED FILTER PAPER. G. V. Marinetti (Dept. of Biochem., Univ. of Rochester School of Med. and Dentistry, Rochester, N.Y.). *J. Lipid Res.* 6, 315–317 (1965). Commercial silica gel loaded filter paper has been found to give good separations of neutral lipids and phospholipids. Unidimensional or two-dimensional chromatography can be used. Rat liver lipids and C^{14}-algae lipids were studied. An advantage over thin-layer chromatography is that several spot tests can be applied on the same chromatogram.

PURIFICATION OF PHOSPHOLIPIDS RECOVERED FROM THIN-LAYER CHROMATOGRAMS FOR INFRARED SPECTRAL ANALYSIS. A. H. Duthie and S. Patton (Dept. Dairy Sci., Penna. State Univ., University Park, Penna.). *J. Lipid Res.* 6, 320–322 (1965). An application of the Folch washing procedure for the removal of contaminants from phospholipid classes recovered from thin-layer chromatograms is described. The infrared spectra from the purified phospholipids are satisfactory for identification. The pattern of the major milk phospholipids separated on a thin-layer plate is presented.

ACETIC ANHYDRIDE-TRIFLUOROACETIC ACID ACETOLYSIS FOR THE ESTIMATION OF GLYCEROL IN PHOSPHATIDYL CHOLINE BY GAS-LIQUID CHROMATOGRAPHY. K. S. Holla and D. G. Cornwell (Dept. Physiol. Chem., The Ohio State Univ., Columbus, Ohio). *J. Lipid Res.* 6, 322–324 (1965). Low glycerol recoveries are obtained when acetic anhydride-acetic acid acetolysis is used to dephosphorylate lecithin prior to glycerol (and fatty acid) analysis by saponification-acetylation and gas-liquid chromatography. Quantitative glycerol recoveries are obtained for both phosphatidyl choline and phosphatidyl ethanolamine when a modified acetolysis using acetic anhydride-trifluoroacetic acid is employed. Modified acetolysis is limited to the analysis of glycerol alone since unsaturated fatty acids are destroyed.

LIPIDS AND COMPONENT FATTY ACIDS OF THE NEWFOUNDLAND SQUID, ILLEX ILLECEBROSUS (LE SUEUR). P. M. Jangaard and R. G. Ackman (Fisheries Res. Board of Canada, Tech. Res. Lab., Halifax, N.S.). *J. Fish Res. Bd. Canada* 22, 131–37 (1965). The component fatty acids of the muscle, liver, and viscera lipids from the squid, *Illex illecebrosus* (Le Sueur), caught in Newfoundland waters have been determined by gas-liquid chromatography (GLC). Silicic acid chromatography was used to segregate the main groups of lipids and the fatty acid composition of each fraction was determined on two organosilicone polyester columns. The lipids from the muscle consisted mainly of phospholipids with three fatty acids, palmitic (16:0), eicosapentaenoic (20:5), and docosahexaneoic (22:6) acids making up 80% of the total. The liver contained mainly triglycerides with a fatty acid composition similar to liver oils in other marine species.

FATTY ACID DISTRIBUTION IN LIPIDS OF MARINE PLANKTON. H. Brockerhoff, M. Yurkowski, R. J. Hoyle and R. G. Ackman (Fisheries Res. Board of Canada, Tech. Res. Lab., Halifax, N.S.). *J. Fish. Res. Bd. Canada* 21, 1379–84 (1964). In the diatom, *Skeletonema costatum*, as well as in a zooplankton sample, the polyunsaturated fatty acids of the triglycerides were found accumulated in the β-position of the glycerol. This fatty acid distribution pattern is typical for animal fats, in particular for fish oils. Together with the recent demonstration that fish and invertebrates retain in part the structure of ingested triglycerides, the findings of the present study show that the typical structure of marine triglycerides originates in phytoplankton and is to a large degree retained through the marine food chains. The fatty acid composition of several other lipid fractions of the plankton samples was also determined.

GRAPESEED OIL IN FRANCE. G. Balbi and R. Massoni. *Double Liaison*, 1964, No. 105, 61–6.—A review. (Rev. Current Lit. Paint Allied Ind. No. 274).

FRACTIONATION OF LINSEED OIL FATTY ACIDS BY CRYSTALLISATION. E. Uksila, P. Roine, E.-L. Syväoja and A. Alivaara. *Acta Chem. Scand.* 17 (10), 2622–7 (1963). Linseed oil fatty acids or their "acid" Na soaps were crystallised from absolute or aqueous methanol, using temperatures as low as —40C. The solid and liquid fractions were separated by centrifuge filtration and their fatty acid compositions determined by gas/liquid chromatography. (Rev. Current Lit. Paint Allied Ind. No. 274).

NEW CHEMICAL TECHNIQUE FOR STUDYING THE HOMOGENEITY OF THE PEROXIDES IN AUTOXIDISING FATS. A. R. S. Kartha. *Indian J. Chem.* 2 (3), 118–22 (1964). A new chemical technique, involving selective destruction of fat peroxides with antioxidants for testing the homogeneity of fat peroxides is described. It has been shown that actively autoxidising fats contain two distinct peroxide forms showing different decomposition rates in the presence of added antioxidants; the form more readily attacked by antioxidants has been termed peroxide I and the other peroxide II. The distribution pattern of peroxides I and II in pure fatty acid esters is the same as that in natural fats, indicating that the nature of the fatty acid molecule combinations does not influence peroxide formation in non-conjugated unsaturated systems. Peroxide I is not detectable in fats during the induction period. After active autoxidation has started it increases gradually to a maximum value of 40-50. The increase in peroxide I never exceeds 30% of the increase in peroxide value and after the maximum value of 40-50 is reached further increase in peroxide value is due entirely to accumulation of peroxide II. However, the relative proportions of the two forms produced at different temperatures show marked variations, particularly below 60C. The formation and level of peroxide I are not affected by the formation and level of peroxide II and peroxide I level is probably directly controlled by its own subsequent transformation rates, which increase with concentration. (Rev. Current Lit. Paint Allied Ind. No. 273).

THE ANTIOXIDANT EFFECT OF ASCORBIC ACID IN THE PROCESS OF AUTOXIDATION OF ANIMAL FATS. S. Zalewski and H. Karpinski. *Przem. Spoz.* **18** (3), 163–8 (1964). The antioxidant effect of ascorbic acid results in the formation of a synergistic system, regenerating the natural antioxidants. The true action of ascorbic acid is not one of stabilization, and, in certain cases, can actually catalyze autoxidation. The synergistic action of ascorbic acid diminishes with the irreversible inactivation of the antioxidant. (Rev. Franc. Corps Gras).

FAT-SPLITTING: ITS MECHANISM AND KINETICS. M. K. Bhattacharjee and N. G. Wagle (Dept. of Chem. Tech., Univ. of Bombay, Bombay, India). *Indian Oil Seeds J.* **8**, 285 (1964). From present day knowledge it is concluded that the fat splitting reaction is essentially a homogeneous reaction of the first order. The reaction rate is greatly dependent on the temperature and presence of catalysts. The maximum degree of hydrolysis attainable (i.e., the degree of splitting at equilibrium) is independent of the temperature, the oil-water ratio used, the method of splitting, the presence or absence of catalysts, and probably, even of the nature of the fat. The point of equilibrium is controlled only by the concentration of glycerol. These considerations are of prime importance for investigating industrial aspects of fat-splitting.

STABILITY OF CASTORSEED AND OIL. III. RESISTANCE TO OXIDATION OF CASTOR OILS. M. M. Paulose and K. T. Achaya (Reg. Res. Lab., Hyderabad, India). *Indian Oil Seeds J.* **8**, 337 (1964). The unsaponifiable matter of castor oil carries an antioxidant principle. On chromatographic fractionation using alumina, maximum antioxidant activity coincided with high tocopherol content, suggesting that tocopherol is the major natural antioxidant present in castor oil. The total tocopherol content in 5 crude castor oils varied from 22.5 to 49.0 milligrams per 100 grams of oil, and in 4 refined oils from 2.8 to 12.1 milligrams per 100 grams of oil. Thin layer chromatographic examination of the unsaponifiable matter of castor oil, after removal of sterols, revealed the presence of alpha, beta, gamma and delta tocopherols of which alpha was a minor component. Degumming or refining of castor oil reduced its oxidation stability. Addition of castor phospholipid to degummed castor oil caused an improvement in stability. The optimum phospholipid content for the particular oil used lay between 0.30 and 0.35 per cent. Nitrogen compounds which are not phospholipids are present in considerable amounts even in refined castor oils. Silicic acid column chromatographic fractionation and analysis by thin-layer and paper chromatography of castor phospholipid fractions as such and after acid and alkali hydrolysis, showed that about 83 per cent of the phospholipids consist of cephalin and its degradation products. Some 13 per cent was lecithin and other phospholipids totaled 4 per cent. In ricinoleic-containing glycerides, peroxide development is very slow. Even removal of the natural antioxidants reduces only slightly the stability of castor oil to autoxidation.

THE DETECTION OF MARGARINE AND FOREIGN FATS IN BUTTER. MODERN METHODS. R. Guillaumin (Lab. of the Inst. for Fats and Oils, Paris, Fr.). *Rev. Franc. Corps Gras* 12, 29–39 (1965). The author presents applications of some of the new analytical techniques that can be used to detect adulteration of butter with margarine and other fats. The detection of sterols by the use of gas, paper or thin-film chromatography on the unsaponifiables permits the detection of small amounts of margarine. If the margarine used for adulteration contains coconut or palm kernel oil, a measurement of the C_{12} to C_{10} ratio of the fatty acid percentages from gas chromatography will indicate margarine adulteration. With use of temperature programming, the component triglycerides of butter and margarine can be distinguished and an adulteration of butter determined. The detection of *trans* isomers in butter by infra-red spectroscopy indicates margarine adulteration. A quantitative determination of tocopherols in butter will indicate if a vegetable fat high in tocopherols has been added.

SEPARATION OF FATTY ACETYLENIC, ETHYLENIC, AND SATURATED COMPOUNDS BY THIN-LAYER CHROMATOGRAPHY. M. W. Roomi, M. R. Subbaram, and K. T. Achaya (Regional Res. Lab., Hyderabad, India). *J. Chromatog.* **16**, 106–110 (1964). Direct or reversed-phase thin-layer chromatography was used to separate acetylenic, ethylenic, and saturated acids, methyl esters, and alcohols of 22, 18, and 11 carbon chain lengths. Products corresponding to pelargonic, myristic, palmitic, arachidic, linoleic, and linolenic acids were also included. Systems are described which will resolve: (a) compounds of the same chain length but of different types of unsaturation; (b) compounds of different chain lengths but the same type of unsaturation; and (c) certain difficult pairs such as various saturated homologues.

THIN-LAYER CHROMATOGRAPHIC SEPARATION AND COLORIMETRIC ANALYSIS OF BARLEY OR MALT LIPID CLASSES AND THEIR FATTY ACIDS. D. E. Walsh, D. J. Banasik, and K. A. Gilles (Dept. of Cereal Technol., North Dakota State Univ. of Agric. and Applied Sci., Fargo, N. D.). *J. Chromatog.* **17**, 278–287 (1965). A method for detailed quantitative analysis of barley and malt lipids was developed. Extractable lipids are fractionated into four broad classes of compounds: phospholipids, mono- and diglycerides, triglycerides, and hydrocarbons. The hydroxamic acid colorimetric test for esters was modified to measure quantitatively lipids that contained the ester group while the dichromic acid test for organic compounds was modified to measure quantitatively lipids which did not contain the ester group. Each broad lipid fraction can be further analyzed for fatty acid composition by thin-layer chromatography. The method was found to give quantitative results for both fatty acid analysis and lipid fraction analysis.

THE PROTECTION OF MILK FAT TOCOPHEROLS DURING SAPONIFICATION WITH ASCORBIC ACID. V. N. Krukovsky (Dept. of Dairy and Food Sci., New York College of Agric., Cornell Univ., Ithaca, N. Y.). *J. Agr. Food Chem.* 12(3), 289–292 (1964). An analytical procedure utilizing the addition of ascorbic acid in the chemical determination of tocopherols is described. It enables one to determine concurrently and with a high degree of precision vitamins A and E and carotenoids on the unsaponifiable matter of fat, permitting the analysis of six samples in one day.

RAPID CLEANUP OF DAIRY PRODUCTS FOR ANALYSIS OF CHLORINATED INSECTICIDE RESIDUE BY ELECTION CAPTURE GAS CHROMATOGRAPHY. B. E. Langlois, A. R. Stemp, and B. J. Liska (Dept. Animal Sci., Purdue Univ., Lafayette, Ind.). *J. Agr. Food Chem.* 12(3), 243–245 (1964). An extraction and cleanup technique for dairy products prior to analysis for selected insecticide residues by gas chromatography is described. Using this procedure, 25 to 35 samples per eight hour day may be analyzed for nanogram quantities of the insecticides. Added insecticides were recovered in excess of 90%.

FORCED VOLATILIZATION CLEANUP OF BUTTERFAT FOR GAS CHROMATOGRAPHIC EVALUATION OF ORGANOCHLORINE INSECTICIDE RESIDUES. D. E. Ott and F. A. Gunther (Agr. Expt. Sta., Riverside, Calif.). *J. Agr. Food Chem.* 12(3), 239–243 (1964). A new device employing a forced volatilization principle is described for complete physical cleanup of butterfat prior to the analysis of organochlorine insecticide residues. Detection is by means of microcoulometric gas chromatography. The entire method requires about an hour for a two gram sample and readily responds to about 0.5 ppm each of seven possible organochlorine insecticide residues in butterfat.

GAS-LIQUID CHROMATOGRAPHY OF VOLATILE FATTY ACIDS FROM FORMIC ACID TO VALERIC ACID. I. CARBOXYLIC ACIDS AS STATIONARY PHASES. R. B. Jackson (Fodder Conservation Sec., C.S.I.R.O., Highett, Victoria, Australia). *J. Chromatog.* **16**, 306–310 (1964). The use of behenic acid and sebacic acid as liquid phases for the gas-liquid chromatography of C_1 to C_5 fatty acids is described. Complete resolution of all normal and iso-acids was obtained on 122 cm columns containing sebacic acid as the liquid phase at 135C. With behenic acid as the liquid phase the separations of formic from acetic acid and isobutyric from n-butyric acid were not quite complete at 135C, however, complete separation was obtained at 115C. Both columns showed satisfactory stability at 135C.

QUANTITATIVE GAS-LIQUID CHROMATOGRAPHY OF VOLATILE FATTY ACIDS. A METHOD FOR THE DETERMINATION OF C_1 TO C_6 ACIDS IN BIOLOGICAL MATERIAL. C. W. Lanigan and R. B. Jackson (Fodder Conservation Sec., C.S.I.R.O., Melbourne, Australia). *J. Chromatog.* **17**, 238–244 (1965). A stationary phase comprising 20 parts of behenic acid and 4 parts of phosphoric acid on 100 parts of Chromosorb W (acid washed) gives excellent gas-liquid chromatographic separations of C_1 to C_6 normal acids when wet nitrogen is used as the carrier gas. This column was found to tolerate substantial amounts of water vapour, thus mixtures of fatty acid sodium salts extracted from biological systems could be chromatographed. The detector was a commercial glass electrode with an auto-titrator.

THE PAPER PARTITION CHROMATOGRAPHY OF UNSATURATED LIPIDS AS THEIR π-COMPLEXES WITH SILVER IONS. A. G. Vereshchagin (Inst. of Plant Physiol., Academy of Sci., Moscow, U.S.S.R.). *J. Chromatog.* **17**, 382–386 (1965). Unsaturated fatty acid methyl esters and triglycerides were separated as their silver ion complexes by reversed-phase partition chromatography in the system 70 to 100% aqueous methanol, saturated with silver nitrate and dodecane. The fatty acid composition of single fractions was determined by gas-liquid chromatography. The unsaturated methyl esters were completely separated from the saturated methyl esters of the same polarity, and from the unsaturated esters with different carbon atoms or double bond number and different positions of the double bonds in the aliphatic chain. The method may be used on an analytical or preparative scale.

THIN-LAYER CHROMATOGRAPHY IN THE STUDY OF ESTER SULPHATES. F. S. Wusteman, K. S. Dodgson, A. G. Lloyd, F. A. Rose and N. Tudball (Dept. of Biochem., Univ. College, Cardiff, Great Britain). *J. Chromatog.* **16**, 334–339 (1964). Thin-layer chromatography on silica gel has been applied to the separation of sulphate esters of alkyl, aryl and steroid hydroxy compounds from each other and from their parent unsulphated compounds. The value of this technique in studies on the biochemistry of sulphate esters is discussed.

THE ANALYSIS OF OILS AND FATS BY GAS CHROMATOGRAPHY. G. R. Jamieson, and E. H. Reid (Chem. Dept., Paisley College of Technol., Paisley, Renfrewshire, Great Britain). *J. Chromatog.* **17**, 230–237 (1965). A comparison is made of six procedures of obtaining methyl esters of fatty acids from oils and fats and also of two gas chromatographic instruments for the separation of these esters. Whether flame ionization or beta ray ionization detectors are used, good agreement of results was obtained. However, of the six methylation procedures used, the sodium methoxide catalyst procedure was found to give low yields of lauric acids for a coconut oil sample. By modifying this methylation method, results were found to be in agreement with the other methods.

THE ANALYSIS OF MIXTURES OF ANIMAL AND VEGETABLE FATS. V. SEPARATION OF STEROL ACETATES BY THIN-LAYER CHROMATOGRAPHY IN REVERSED-PHASE SYSTEMS AND ON SILICA GEL G-SILVER NITRATE LAYERS. J. W. Copius-Peereboom and H. W. Beekes (Gov. Dairy Sta., Leiden, The Netherlands). *J. Chromatog.* **17**, 99–113 (1965). This paper reports an investigation of the analysis of sterols by thin-layer chromatography by amplifying the previous method of a reversed-phase system undecane/acetic acid-acetonitrile (1:3). The sterols separated by this method were identified by their carbon numbers. It was found that several critical pairs of sterols can be resolved by adding bromine to the mobile phase. The investigation of silica gel G-silver nitrate layers showed that sterols or their acetates separate according to their degree of unsaturation. The procedures for accomplishing a clear separation are described in detail.

FATTY ACID ESTERS LABELED WITH TRITIUM OR CARBON-14. GAS-LIQUID CHROMATOGRAPHY. J. Bezard, P. Boncrot, and G. Clement (Lab. of Animal Physiology, Dept. of Sciences, Dijon, Côte d'Ar, France). *J. Chromatog.* **14**, 368-377 (1964). Fatty acid esters labeled with tritium can be collected after gas-liquid chromatography under the same conditions as esters labeled with C^{14} at the first carbon atom. Comparison of the radioactive tracings obtained under different conditions showed that the results were the same for both types of labeled fatty acids. The time during which a column is used has no effect, as long as the power of resolution remains intact.

THE PARTITION OF POLAR AND NON-POLAR LIPIDS IN A REVERSED-PHASE CHROMATOGRAPHIC SYSTEM. A. G. Vereshchagin (K. A. Timiryazev Inst. of Plant Physiology, Academy of Sci. of the U.S.S.R., Moscow). *J. Chromatog.* **14**, 184–188 (1964). Reversed-phase chromatography studies have shown that the logarithm of the partition coefficient of saturated and unsaturated higher fatty acids and the partition coefficient of triglycerides are linear functions of the polarity constants of these lipids. By quantitative bromination of double bonds the polarity of triglycerides is increased. The reversed-phase chromatography of brominated glycerides makes possible the separation of otherwise inseparable triglyceride mixtures.

CHROMATOGRAPHY OF LIPIDS IN PRESENCE OF AN ANTIOXIDANT, 4-METHYL-2,6-DI-TERT-BUTYLPHENOL. J. J. Wren and A. D. Szczepanowska (The Lyons Labs., London, Great Britain). *J. Chromatog.* **14**, 405–410 (1964). Inclusion of small quantities of 4-methyl-2,6-di-tert-butylphenol in solvents protects lipids from autoxidation during chromatographing, manipulation, and storage. Since this compound has a higher chromatographic mobility than most lipids, it does not affect their separation. It is easily detected and removed when necessary.

VOLATILE ACIDS FROM MENHADEN OIL. J. R. Chipault, and E. McMeans (The Hormel Inst., Univ. of Minn., Austin, Minn.). *J. Agr. Food Chem.* **13**(1), 15–17 (1965). The acidic constituents of a highly volatile fraction collected during molecular distillation of menhaden oil were examined by paper chromatography. Tentatively identified were formic (or acetic), acrylic, propionic, crotonic, butyric, and valeric acids, and an unknown compound with a polarity greater than formic acid but less than pyruvic or lactic acids.

HYDROXY-UNSATURATED OILS AND MEAL FROM *Dimorphotheca* AND *Lesquerella* SEED. R. E. Knowles, K. W. Taylor, G. O. Kohler and L. A. Goldblatt (Western Regional Res. Lab., Albany, Calif.). *J. Agr. Food Chem.* **12**(5), 390–392 (1964). Methods are reported for recovering oil and meal from *Dimorphotheca* and *Lesquerella*. The solvents do not remove oil from the intact seeds, thus the seed coat must be broken; but the presence of active lipolytic enzymes in the crushed seed necessitates prompt extraction of oil after the seed is crushed to produce oils with low free fatty acid content.

RESOLUTION OF N-ACIDS AND N-ALCOHOLS BY "ADSORPTION" CHROMATOGRAPHY ON KIESELGUR FILMS. S. J. Purdy and E. V. Truter (Textile Chem. Lab., The Univ., Leeds, Great Britain). *J. Chromatog.* **14**, 62–64 (1964). Mixtures of even-numbered, *n*-alcohols containing 10 to 26 carbon atoms can be separated on kieselgur G films with cyclohexane as the developing solvent within a distance of 10 cm. The *n*-acids under the same conditions separate less satisfactorily but can be separated by continuous development.

THIN-LAYER CHROMATOGRAPHY OF β-SITOSTERYL ESTERS. E. D. Bergmann, R. Ikan and S. Harel (Dept. of Org. Chem., Hebrew Univ., Jerusalem, Israel). *J. Chromatog.* **15**, 204–206 (1964). Fifteen esters of β-sitosterol were separated by thin-layer plates of silica gel G and six solvent systems. Spots were detected by spraying with a chloroform solution of antimony trichloride and alcoholic solution of phosphomolybdic acid.

THE SEPARATION OF FATTY ACID METHYL ESTERS (INCLUDING "CRITICAL PAIRS") BY THIN-LAYER PARTITION CHROMATOGRAPHY. T. W. Hammonds and G. Shone (Tropical Prod. Inst., London). *J. Chromatog.* **15**, 200–203 (1964). The separation of critical pairs of fatty acid methyl esters has been carried out by thin-layer partition chromatography, complete separation of linolenate and laurate, linolenate and myristic, and almost complete separation of oleate and palmitate being achieved. Development time was twenty minutes and spots were detected by a saturated aqueous solution of ferric chloride followed by a sodium molybdate solution.

COMPLETE STRUCTURAL ANALYSIS OF FATTY ACID MIXTURES BY THIN-LAYER CHROMATOGRAPHY. L. D. Bergelson, E. V. Dyatlovitskaya, and V. V. Voronkova (Inst. for Chem. of Natural Prod., U.S.S.R. Academy of Sci., Moscow). *J. Chromatog.* **15**, 191–199 (1964). A method for the complete structural analysis of complex mixtures of fatty acids has been developed based on two-dimensional thin-layer chromatography of their methyl esters on silica gel and identification of the unsaturated acids by oxidative cleavage directly in the adsorbent layer. Both positional and stereoisomers of the unsaturated fatty acids may be determined.

A METHOD FOR THE UNIDIMENSIONAL SEPARATION OF PHOSPHOLIPIDS BY THIN-LAYER CHROMATOGRAPHY. C. M. Redman and R. W. Keenan (The Rockefeller Inst., New York 21, N. Y.). *J. Chromatog.* **15**, 180–185 (1964). A phenol-water-ammonia solvent system has been used to separate most of the known phospholipids and lysophospholipids on thin-layer plates of silica gel G. The spots were identified by chromatographing after mild alkaline hydrolysis, various staining reactions, and comparison with known compounds. A procedure is described which makes it possible to determine the radioactivity incorporated into the individual phospholipids with a high degree of precision.

SEPARATION OF GEOMETRIC ISOMERS OF MONOENOIC ACIDS BY TLC ON COMMERCIAL TALC. J. P. Carreau and J. Raulin (Centre

de Recherches sur la Nutrition du C.N.R.S., Bellevue, S. & O., France). *J. Chromatog.* **15**, 186–190 (1964). This paper describes a method of thin-layer chromatography on commercial talc with which elaidinized octadecamonoenoic and dienoic fatty acids can be separated from mixtures of saturated fatty acids and *cis* and *trans* isomers of unsaturated fatty acids. By combining this method with gas chromatography, elaidic acid can be determined with good accuracy.

THE QUANTITATIVE SEPARATION AND ESTIMATION BY THIN-LAYER CHROMATOGRAPHY OF LIPIDS IN NERVE TISSUE. S. N. Payne (Human Nutrition Res. Unit, National Inst. for Med. Res., London). *J. Chromatog.* **15**, 173–179 (1964). Lipids from brain tissue have been estimated densitometrically after separation on a thin-layer plate consisting of Kieselgel G developed with propanol-ammonium hydroxide (39:11). Standard error on five determinations on three different days for lipids present in large amounts is 2%, but on lipids present in smaller amounts, the standard error may be as much as 10%.

1964 SOYBEAN RESEARCH AT THE NORTHERN REGIONAL RESEARCH LABORATORY. L. L. McKinney (Northern Reg. Res. Lab., Agric. Res. Serv., U.S.D.A., Peoria, Ill.). *Soybean Dig.* **24** 34–40 (1964). In efforts to increase the utilization of soybean oil and soybean meal, three major areas of research are discussed which are currently being investigated at this laboratory. These include (1) developing the flavor stability of soybean oil required for cooking oils; (2) developing new industrial products from soybean oil; and (3) developing soy products suited to the needs and dietary habits of protein-deficient countries.

FLAME IONIZATION DETECTOR RESPONSE FOR THE CARBONYL CARBON ATOM IN THE CARBOXYL GROUP OF FATTY ACIDS AND ESTERS. R. G. Ackman and J. C. Sipos (Fisheries Res. Board of Can., Technol. Res. Lab., Halifax, Nova Scotia, Can.). *J. Chromatog.* **16**, 298–305 (1964). The response of the carbonyl group in free fatty acids was investigated. It was found that its response was less than a methylene carbon atom in short chain acids but approaches the response of a methylene carbon atom in fatty acids of six or more carbon atoms. In esters, a complex molar response pattern was obtained, apparently due to scission of the ester linkage with the lower acids to yield an alcohol with a response of half a methylene carbon atom, and an acid group fragment with little or no response. In saturated fatty acid esters of nine or more carbon atoms, the net loss in response falls to the equivalent of one methylene carbon atom and the relative response is then proportional to the relative weight per cent carbon content based on the number of carbon atoms in the fatty acid chain. Formate esters give slightly higher responses than other esters of the same chain length. Alternatively, in the esters other than formates the carboxyl group may give an increasing response as the fatty acid chain length increases.

THERMAL PEAKS ACCOMPANYING SOLUTE PEAKS IN PREPARATIVE SCALE GAS CHROMATOGRAPHY. J. Peters and C. B. Euston (F & M Scientific Corp., Avondale, Pa.). *Anal. Chem.* **37**, 657–660 (1965). Temperature variations have been measured radially across a 1-inch diameter preparative column, and it is suggested that these variations contribute to the decrease in efficiency observed as column diameter is increased. The high sample loadings frequently used in preparative scale gas chromatography increase these temperature differences and further reduce column efficiency. Programmed temperature preparative columns were considered, and the gradients existing were recorded. Gradients frequently reach several degrees centigrade and are related directly to program rate. Similar measurements on temperature-programmed columns show that the temperature at the column center lags the wall by about 1 minute for a 1-inch diameter column. The temperature difference thus is proportional to heating rate, and may reach several degrees at high programming rates.

MICRO VAPOR-PHASE HYDROGENATION ACCESSORY FOR GAS CHROMATOGRAPHIC ANALYSIS OF FATTY ACID ESTERS OF GLYCERIDE OILS. T. L. Mounts and H. J. Dutton (Northern Reg. Res. Lab., Peoria, Ill.). *Anal. Chem.* **37**, 641–644 (1965). Complex mixtures of polyunsaturated and saturated fatty acids, as they occur in glycerides of natural origin, have been simplified by hydrogenation of double bonds before introduction of their esters into a gas chromatographic column. A micro vapor-phase hydrogenation accessory for attachment at the injection port of gas chromatographic equipment has been developed. Its use combines the hydrogenation and chromatography steps and provides a rapid technique for simplification of complex mixtures of fatty acid esters. Application of this technique to a variety of oils is described and results are compared with analysis of the products of the same oils obtained from separate batch hydrogenations.

STUDIES DIRECTED TOWARD THE SYNTHESIS OF PLASMALOGENS I. ALKENYLGLYCEROLS. C. J. Craig, D.P.G. Hamon, H. W. Brewer, and H. Harle (Dept. of Pharmaceutical Chem., Univ. of Calif., San Francisco, 22). *J. Org. Chem.* **30**, 907–910 (1965). Debromination of the glycerol α-bromo cyclic acetals by means of lithium in dimethoxyethane afforded alkenyl ethers which were shown by infrared and n.m.r. spectroscopy, vapor phase chromatography, and periodate titration to consist of a mixture of the *cis*- and *trans*-1-alkenyl- and the *cis*- and *trans*-2-alkenylglycerols in the ratio of approximately 47:53, and of total *cis* to total *trans* compounds in the ratio of 4:5.

A LIGHT-SCATTERING STUDY OF ULTRASONICALLY IRRADIATED LECITHIN SOLS. D. Attwood and L. Saunders (School of Pharmacy, Univ. of London, London, Great Britain). *Biochim. Biophys. Acta* **98**, 344–350 (1965). Light-scattering methods have been used to investigate change in size and shape of lecithin aggregates in aqueous dispersion undergoing ultrasonic irradiation. It has been shown that large, highly asymmetric particles within the coarse lecithin dispersion are broken down during the irradiation process to produce almost symmetrical aggregates with a particle weight of about $2 \cdot 10^6$. Sols irradiated for times greater than 10 min have been shown to be stable over a period of a week.

SEPARATION AND ESTIMATION OF TOCOPHEROLS IN VEGETABLE OILS BY THIN-LAYER CHROMATOGRAPHY. M. K. Govind Rao, S. Venkob Rao and K. T. Achaya (Regional Res. Labs., Hyderabad-9, India). *J. Sci. Food Agr.* **16**, 121–4 (1965). A method for separation of α-, β-, γ- and δ-tocopherols by thin-layer chromatography and their subsequent colorimetric estimation, is described. Recovery is 97–98%, and no pretreatment of the unsaponifiable matter is necessary. The contents of individual tocopherols in castor, cottonseed, groundnut, neem, safflower, sesame, and soybean oil are recorded. Some literature values are included for comparison.

PREPARATION OF PURE ERUCIC ACID. D. Chobanov, M. Agova, A. Popov, E. Chooparova and C. Hadjikolev (Bulgarian Academy of Sciences). *Chem. & Ind. (London)* **1965**, 606. A procedure for the preparation of pure erucic acid is described which involves the acid soap crystallization technique in combination with urea complexes. Reversed-phase chromatography showed the absence of other acids. A concentrate of erucic (greater than 90%) can be easily prepared applying the acid soap crystallization technique only.

ON THE FLAVOUR VOLATILES OF FATS AND FAT-CONTAINING FOODS. I. DEGRADATION OF THE PEROXIDES OF AUTOXIDIZED SUNFLOWER AND LINSEED OILS. C. H. Lea and A. Hobson-Frohock (Low Temperature Research Station, Cambridge). *J. Sci. Food Agr.* **16**, 18–27 (1965). Refined sunflower and linseed oils purified by stripping in a molecular still, treatment with silicic acid and steam deodorization were autoxidized at 37C to an oxygen absorption of approximately 100 μmoles/g. The amounts of peroxide, non-volatile carbonyl and volatile carbonyl were determined in the oxidized oils before and after destruction of the peroxides by heating in vacuum. The peroxides (mainly linolenate) of the linseed oil decomposed more readily than those (mainly linoleate) of the sunflower oil, and produced a higher proportion (60% as compared with 40%) of carbonylic compounds. In both oils nearly half of the total carbonyl groups formed were in volatile compounds. Not more than 1–2% of the volatile carbonyls could have been formed from the non-peroxidic precursors. The presence of 0.01% disodium EDTA just perceptibly reduced the decomposition, but citric acid and carboxymethylmercaptosuccinic acid both increased it slightly, possibly because of their decidedly acid reaction.

THE COMPOSITION OF BOMBACOPSIS GLABRA SEED OIL. J. A. Cornelius, T. W. Hammonds and G. G. Shone (Tropical Products Institute). *J. Sci. Food Agr.* 16, 170–2 (1965). The plant is found in tropical Africa and South America. The kernel accounts for 78.3% of the seed; the kernel contains 45.2% oil (moisture-free basis). The oil has a iodine value of 54 and gas-liquid chromatography of the methyl esters gave the following composition: palmitic 43.0, stearic 2.8, oleic 12.0, linoleic 7.8, and sterculic 34.5%.

PRODUCING EDIBLE OIL FROM GRAIN. W. Martin. U.S. 3,163,545. A substantially oxidation-free process of preparing an edible oil having substantially no oxygen present as part of a peroxide radical for use in the preparation of a food product, comprises the following steps: (1) extracting from a first charge of grain at a temperature below 230F and in the absence of caustic refining an unctuous first yield containing a substantial portion of the polyunsaturated fatty acid materials in the grain; (2) extracting from a second charge of grain at a temperature below 230F a second unctuous yield; (3) separating from the second yield the antioxidants including crude gum; (4) admixing the first yield with the antioxidants to form the edible oil; (5) then freezing the admixture until needed for such use to maintain the mixture substantially free of peroxide oxygen.

SEPARATION OF FATTY MIXTURES. W. A. Singleton (Chemetron Corp.). *U.S. 3,173,935.* A process of separating fatty material selected from the group consisting of (1) mixtures of saturated and unsaturated fatty acids and (2) mixtures of relatively saturated and unsaturated triglycerides into saturated and unsaturated fractions by crystallization comprises: (1) forming a solution of the fatty material in a solvent for the same which also contains from 0.01 to 1% of a crystal promoter, (2) chilling the solution to a temperature sufficiently low that the more saturated fatty components of the mixture are precipitated in the form of discrete non-slimy, readily filterable, sand-like crystals, (3) separating the crystals from the mother liquor, and (4) removing the solvent from the mother liquor to obtain an unsaturated fatty material fraction. The crystal promoter is a compound selected from the group consisting of polyvinyl fatty acid esters, fatty acid esters of polyhydric alcohols containing at least 4 hydroxyl radicals, polyamide resins and aluminum salts of fatty acids in fibrous mycelle structure, the aluminum salts being suspended in an oil selected from the group consisting of fatty acids and fatty acid triglycerides. The promotor contains between 4 and 700 saturated fatty acid radical chains extending in more than one plane, each of the chains having between 16 and 22 carbon atoms.

WINTERIZING GLYCERIDE OILS. W. J. Kirkpatrick (Pennsalt Chemicals Corp.). *U.S. 3,173,936.* The oil is chilled at least partly in relative quiescence to solidify higher melting substances therein and then centrifuged to separate the winterized oil and the solidified portions. The improvement comprises super cooling the chilled oil with solid portions by moving it rapidly through a super-cooling zone to reduce its temperature to at least 40F and then immediately effecting the centrifugation.

PROCESS FOR THE PRODUCTION OF EDIBLE FATS. B. F. Teasdale and G. A. Helmel (Canada Packers Ltd., Toronto). *U.S. 3,174,868.* Palm kernel oil is hydrogenated to an iodine value of less than 3, and the hydrogenated oil is divided into 2 portions. The first portion is interesterified to randomly rearrange the fatty radicals of the oil and then blended with the hydrogenated oil in proportions of about 15–85% by weight of the interesterified hydrogenated oil on the weight of the blended product. The coating thus produced a Wiley melting point from 35–46C.

PREPARING EDIBLE OILS FROM TALL OIL FATTY ACIDS. B. Costigliola and B. F. Teasdale (Canada Packers, Ltd.). *U.S. 3,175,916.* A process for the conversion of tall oil fatty acids into edible triglycerides comprises esterifying tall oil fatty acids with glycerol in the presence of a catalytic quantity of $SnSO_4$ at a temperature of 200–280C for 2.5–6.5 hours. The molar proportion of fatty acids and glycerol in the reaction mixture is approximately 3 to 1.

PROCESS FOR IMPROVING FLAVOR AND TASTE OF SOYBEAN OIL. T. Kuwata, S. Takumi, and T. Hashimoto (Nikki Kagaku Kabushiki Kaisha, Tokyo). *U.S. 3,169,981.* A process for improving flavor and taste of soybean oil comprises hydrogenating refined soybean oil in the presence of a copper chromium manganese oxide catalyst under a hydrogen pressure of one atmosphere at a temperature of 150–220C. The catalyst is present at a concentration of 0.1–0.2% by weight of the oil. During processing the iodine number is reduced to 110–115 and content of linolenic acid is reduced to zero.

INTERESTERIFICATION PROCESS. J. Burgers, C. W. Motl and P. Swiden (Procter & Gamble Co.). *U.S. 3,170,798.* The process of effecting random molecular rearrangement of fatty triglyceride esters containing no more than 0.1% free fatty acid consists of the following steps: (1) dispersing with agitation in the fatty triglyceride esters from 0.02–0.08% (on weight of esters) of alkali metal hydroxide in the form of an aqueous solution containing from 1–12% hydroxide, and from 0.10–0.30% of glycerine, while maintaining the esters at a temperature high enough to melt all solids present but not greater than 160C; (2) immediately heating the dispersion to a temperature within the range of 120–200C at reduced pressure, thereby removing water, and maintaining the esters within that temperature range until there has been substantial rearrangement of the esters; (3) destroying the catalyst present in the rearranged esters by adding an edible acidic material such as phosphoric acid or citric acid, in an amount equal to 1 to 5 equivalents of alkali metal hydroxide; (4) removing from the esters oil-insoluble material thereby formed; and (5) then removing free fatty acids present in the esters.

METHOD OF RENDERING FATTY MATERIALS. J. R. Harrison and M. J. Andera (Rath Packing Co.). *U.S. 3,180,880.* A continuous process for rendering fatty material comprises grinding the material, advancing the ground material countercurrent to a stream of hot, noncondensable, combustion gas while constantly agitating the material. The material is in contact with the gas for a time sufficient to dry the material, melt the fat and denature the protein. The stream flows at a rate sufficient to entrain dry lightweight solid components of the material. The fat is separated from the rendered solids. The rendered solids and the lightweight components are combined to form a mixture which is then pressed to extract the remaining fat.

UNIVERSAL SHORTENING COMPOSITION. A. S. Geisler (Atlas Chemical Industries, Inc.). *U.S. 3,185,575.* A universal shortening composition suitable for both baking and frying consists of a fat base and from 0.5 to 8.0% of an emulsifier consisting of a polyoxyethylene isosorbide fatty acid ester which has an HLB value in the range of 8 to 18.

• Fatty Acid Derivatives

ISOMERIC ARYLSTEARIC ACIDS. F. D. Smith, H. E. Kenney and A. J. Stirton (Eastern Reg. Res. Lab., Philadelphia, Pa.). *J. Org. Chem.* 30, 885–888 (1965). The viscous oily arylstearic acid from oleic acid and an aromatic compound, with aluminum chloride as the condensing agent, was found by gas-liquid chromatography of alkyl aryl ketone oxidation products to be a mixture of 12 positional isomers with substitution at C-6 to 17 in the fatty acid chain. Distribution of isomers depends in part on the relative reactivity of the particular aromatic compound. Substitution predominates at the C-17 atom and at positions near the middle of the chain. Crystalline arylstearic acids isolated in low yield from the viscous oil are the 17-aryl isomers. Phenylstearic and ethoxyphenylstearic acids formed with methanesulfonic acid as the condensing agent are also mixtures of 12 positional isomers.

FATTY ACID POLYAMIDE. G. J. Benoit, Jr. (California Res. Corp.). *U.S. 3,169,980.* Described is the polyamide of fatty acids and tetraethylene penta-amine in which the fatty acids are mixtures of 5–30 mole per cent of stearic and 70–95 mole per cent of methyl branched-chain fatty acid containing about 18 carbon atoms, produced in the dimerization and hydrogenation of linoleic acid. The polyamide contains from 1 to 3 amine groups in addition to the amide groups.

• Biochemistry and Nutrition

FATTY ACID ESTERIFICATION AND CHYLOMICRON FORMATION DURING FAT ABSORPTION IN RAT: III. POSITIONAL RELATIONS IN TRIGLYCERIDES AND LECITHIN. M. Whyte, D. S. Goodman, and A. Karmen (Lab. of Metabolism and Lab. of Tech. Development, Nat. Heart Inst., Bethesda, Maryland). *J. Lipid Res.* 6, 233–240 (1965). Chylomicron triglyceride and lecithin obtained after feeding mixtures of three or four free fatty acids to rats were hydrolyzed using pancreatic lipase and phospholipase A respectively. The distribution of fatty acid mass and radioactivity in the substrate materials and in the cleavage products was determined by gas-liquid chromatography. The incorporation of exogenous (labeled) fatty acids into different positions was nearly random in the triglycerides but markedly nonrandom in lecithin where saturated acids, especially stearic acid, were predominantly esterified at the α'-position and polyunsaturated fatty acids at the β-position. Specific radioactivity measurements were interpreted as showing greater than random amounts of endogenous (unlabeled) palmitic acid on the α'-position of lecithin and, to a small extent, of endogenous linoleic acid on the β-position of triglyceride.

INCORPORATION OF LIPOPROTEIN-BORNE TRIGLYCERIDES BY ADIPOSE TISSUE IN VITRO. L. Margscheid and E. Shafrir (Lab. of Clin. Biochem., Dept. of Biochem., Hebrew Univ.-Hadassah Med. School, Jerusalem, Israel). *J. Lipid Res.* 6, 247–257 (1965). Rat adipose tissue was shown to take up triglycerides (TG) upon incubation with isolated human or rat serum lipoproteins. In the physiologic TG concentration range, the uptake in 3 hr was proportional to TG concentration in the medium, without regard to the nature of the TG carrier (lipoproteins of different density classes or chylomicrons). At low TG concentrations an increase in fractional uptake was found. The TG incorporated were found partly in the fat layer and partly dissolved in an aqueous tissue compartment. When doubly labeled TG (fatty acid-C^{14}, glycerol-H^3) were used, the TG of the soluble compartment retained the initial C^{14}/H^3 ratio of radioactivity, were released in part from the tissue upon reincubation in protein-free medium and were still contained in intact lipoproteins, immunochemically identical with the original lipoproteins of the medium. On the other hand, the TG in the fat layer had undergone partial transesterification, as inferred from the increase in the ratio of isotope radioactivity. TG elaborated within the tissue by esterification of free fatty acids or by synthesis from glucose were not released into any of several media investigated, so that the release mentioned above does not represent a physiologic mechanism for surrender of tissue fat.

CELLULAR ASPECTS OF ETHANOL-INDUCED FATTY LIVER: A CORRELATED ULTRASTRUCTURAL AND CHEMICAL STUDY. C. T. Ashworth, F. Wrightsman, B. Cooper, and N. R. Di Luzio (Dept. of Pathology of the Univ. of Texas Southwestern Med. School, Dallas, Texas). *J. Lipid Res.* 6, 258–268 (1965). Fatty liver induced by acute intoxication was studied chemically, histologically, and electron microscopically in rats. Six hours after administration of ethanol and corn oil, hepatic lipids (mainly triglycerides) had increased by 32%. Electron microscopy revealed concurrent marked accumulation in cytoplasmic vesicles of droplets measuring 500–2500 A. In control animals receiving an isocaloric amount of glucose plus corn oil, lipid droplets also appeared to enter liver cells in vesicles; they were visible mainly in peripheral portions of the cytoplasm. In alcohol-treated animals, however, the small lipid particles were more numerous and were present in vesicles throughout the cytoplasm. These smaller droplets appeared to fuse, forming larger droplets, and others were contiguous with the normally occurring larger storage lipid droplets. A possible explanation, that these changes represent an ethanol-induced impairment of the metabolism of lipid entering the liver cells, is discussed.

PATHOGENESIS OF ETHANOL-INDUCED FATTY LIVER: III. IN VIVO AND IN VITRO EFFECTS OF ETHANOL ON HEPATIC FATTY ACID METABOLISM IN RAT. R. Scheig and K. J. Isselbacher (Dept. of Med., Harvard Med. School). *J. Lipid Res.* 6, 269–277 (1965). Addition of ethanol to rat liver slices enhanced triglyceride, phospholipid, and fatty acid synthesis from acetate-1-C^{14} and pyruvate-2-C^{14} by liver slices. The type of fatty acid synthesized (i.e., primarily saturated) was not altered by the presence of ethanol. These effects of ethanol on liver slices are probably not germane to the induction of fatty liver, since they were not observed after ethanol administration to the intact animal. The fatty acids accumulating in the liver after oral administration of ethanol consisted primarily of unsaturated fatty acids similar to those found in adipose tissue; the incorporation of circulating free fatty acids into hepatic triglycerides was increased. Also, the amount and rate of triglyceride formation from saturated and unsaturated fatty acids were significantly increased in liver homogenates and microsomes after ethanol administration but not upon *in vitro* addition of ethanol to liver slices.

RAT LIVER AND PLASMA LIPIDS AFTER CARBON TETRACHLORIDE ADMINISTRATION. P. H. Stern, T. Furukawa, and T. M. Brody (Dept. of Pharmacology, Univ. of Mich. Med. School, Ann Arbor, Mich.). *J. Lipid Res.* 6, 278–286 (1965). Oral administration of CCl_4 to rats produced (a) decreased cholesterol, phospholipid, and triglyceride plasma concentrations and elevated triglyceride levels in liver, (b) several hours later, a growing increase in plasma FFA, and (c) still later, increased plasma cholesterol, triglyceride, and phospholipid concentrations and continually rising liver triglyceride.

DIETARY AND GONADAL HORMONE EFFECTS ON LIPID METABOLISM IN THE RAT. L. Aftergood and R. B. Alfin-Slater (Div. of Nutr. Science, School of Public Health, Univ. of Calif., Los Angeles, Calif.). *J. Lipid Res.* 6, 287–294 (1965). Hepatic cholesterol, triglyceride, and phospholipid concentrations, plasma cholesterol levels, cholesterol biosynthesis, and fatty acid patterns in plasma lipids and liver lipid fractions, have been studied in intact, gonadectomized, and hormone-treated gonadectomized male and female rats fed a fat-free diet, a control diet containing fat, and a diet containing cholesterol, to determine relationships between diet, sex hormones, and lipid metabolism. Both estradiol benzoate and testosterone propionate affected lipid metabolism; in general, the estrogenic influence was more pronounced and more predictable. The greatest effects were found in animals fed the essential fatty acid-deficient diet (a sex difference in susceptibility to essential fatty acid deficiency has previously been reported). It is concluded that the effect of estrogenic deficiency on lipid metabolism includes: (a) decreased hepatic cholesterol biosynthesis; (b) increased hepatic sterol ester and decreased phospholipid concentration; (c) increased depletion of unsaturated fatty acid in plasma and liver during essential fatty acid deficiency; and (d) increase in severity of essential fatty acid deficiency symptoms, using as criteria the ratios of trienoic to tetraenoic fatty acids in plasma and liver lipids.

INFLUENCE OF DIETARY FATTY ACIDS ON PHOSPHOLIPID FATTY ACID COMPOSITION IN SUBCELLULAR PARTICLES OF RAT LIVER. A. Yamamoto, M. Isozaki, K. Hirayama, and Y. Sakai (Second Dept. of Internal Med., Osaka Univ. Med. School, Osaka, Japan). *J. Lipid Res.* 6, 295–300 (1965). Male rats were divided into three groups and fed a fat-free diet (Group A), a diet supplemented with 7% of ethyl linolenate (Group B), and as a control, a diet supplemented with 7% of ethyl

linoleate (Group C) for 3 weeks. Fatty acid compositions of cardiolipin, "cephalin," and lecithin in column chromatographic fractions of the liver mitochondrial and microsomal lipids were determined. In the cardiolipin fraction, the percentages of palmitoleic and oleic acids increased markedly in group A, as did that of linolenic acid in group B; linoleic acid decreased. In all groups the "cephalin" fractions was richer in highly unsaturated fatty acids than the lecithin fractions. In group A a marked decrease of arachidonic acid in the lecithin fraction matched the increases of oleic and eicosatrienoic acids. The increase of eicosatrienoic acid during linoleic acid deficiency was most markedly shown in the inositol-containing fraction. Mitochondrial and microsomal lipids were similar in all cases.

FAT METABOLISM IN HIGHER PLANTS. XXI. BIOSYNTHESIS OF FATTY ACIDS BY AVOCADO MESOCARP ENZYME SYSTEMS. S. Yang and P. Stumpf (Dept. of Biochem. and Biophysics, Univ. of Calif., Davis, Calif.). *Biochim. Biophys. Acta* **98**, 19-26 (1965). In the avocado mesocarp, both the particulate and the supernatant fractions readily synthesize long-chain fatty acid from suitable substrates. The particulate fraction can utilize effectively acetate, acetyl-CoA and malonyl-CoA but malonic acid is inactive. The supernatant fraction can only utilize malonyl-CoA or malonic acid. Data indicate that acetyl-CoA carboxylase is present in the particulate fraction but absent in the supernatant while the converse is true for malonyl-CoA synthetase (malonate: CoA ligase (AMP)). The supernatant fraction synthesizes only palmitic and stearic acids, mainly in the form of glycerides. Unsaturated fatty acid synthesis is associated with the particulate fraction. Possible factors controlled the extent of C_{16} and C_{18} fatty acids in these systems are discussed.

XXII. ENZYMIC SYNTHESIS OF 14-HYDROXY-11-EICOSENOIC ACID BY PARTICULATE PREPARATIONS OF AVOCADO MESOCARP. *Ibid.*, 27–35. The polar acid formed by incubating acetyl-1-C^{14}-CoA with sonically solubilized enzyme from avocado particulate particle was identified as 14-hydroxy-11-eicosenoate with most of the radioactivity associated on the carboxyl carbon. 14-Hydroxy-11-eicosenoate is synthesized by incubating ricinoleate and acetyl-CoA with avocado particulate particle. Cofactors include ATP, TPNH, and DPNH. Bicarbonate ion is not required and malonyl-CoA is inactive. This elongation system appears to be specific for long-chain hydroxy fatty acids.

EVIDENCE FOR THE ACTIVATION OF FATTY ACIDS IN LIVER MITOCHONDRIA BY HIGH-ENERGY INTERMEDIATES OF OXIDATIVE PHOSPHORYLATION. L. Wojtczak, H. Zaluska and Z. Drahota (Dept. of Biochem., Nencki Institute of Exp. Biol., Warsaw, Poland). *Biochim. Biophys. Acta* **98**, 8–18 (1965). Synthesis of phospholipids and oxidation of fatty acids were studied in isolated rat-liver mitochondria using C^{14}-labelled fatty acids and P^{32} α-glycerophosphate. Without added ATP the synthesis of phospholipids (mainly phosphatidic acid) was strongly inhibited by anaerobiosis and cyanide. The oxidation of fatty acids proceeded without the addition of ATP and was not inhibited by either 2,4-dinitrophenol, oligomycin or azide. These results are interpreted as indicating the activation of fatty acids by high-energy non-phosphorylated intermediates of oxidative phosphorylation.

CHAIN-SHORTENING OF STEARIC ACID IN THE INTACT RAT. J. Elovson (Dept. of Physiological Chem., Univ. of Lund, Lund, Sweden). *Biochim. Biophys. Acta* **98**, 36–40 (1965). Stearic acid-3-C^{14} was prepared by a malonic ester synthesis. It was dissolved in an albumin solution and injected intravenously into fasted and re-fed rats. Elimination of one acetate unit at the carboxyl end, to form palmitic acid-1-C^{14}, occurs in the liver and extra-hepatic tissues. The absolute amount of the palmitic acid-1-C^{14} formed by chain-shortening is higher in fasted rats, where it accounts for about 10% of total recovered saturated-fatty-acid activity. However, when chain-shortening is considered in relation to total breakdown of stearic acid to acetate it appears that, in both fasted and re-fed rats, the breakdown of 10–20% of the labeled stearic acid entering the β-oxidation sequence is arrested at the palmitic acid level.

THE DISTRIBUTION OF PLASMA FATTY ACID TRANSFERASE-LIKE ACTIVITY IN RAT TISSUES. J. Glomset and D. Kaplan (Div. of Endocrinology and Metabolism, Dept. of Med., University of Wash., Seattle, Wash.). *Biochim. Biophys. Acta* **98**, 41–46 (1965). Rat tissues were assayed for cholesterol-esterifying activity employing a previously developed method for the determination of cholesterol-esterifying activity in plasma. To reduce contamination of the tissues by plasma the rats were first exsanguinated and then perfused with isotonic sucrose. To aid in evaluating possible extraneous effects of the tissue homogenates on the assay, controls were included in which a known amount of plasma enzyme was homogenized with each tissue and the recovery of added enzyme subsequently determined. The tissues were found to contain relatively low concentrations of activity compared to the plasma. The results are consistent with the concept that the cholesterol-esterifying activity of rat plasma is due to an enzyme which is primarily extracellular both in location and in function.

THE COMPOSITION OF MILKFAT DIGLYCERIDES AND PARTIAL GLYCERIDES OBTAINED BY PANCREATIC-LIPASE HYDROLYSIS. A. Boudreau and J. Deman (Dept. of Dairy Sci., Univ. of Alberta, Edmonton, Canada). *Biochim. Biophys. Acta* **98**, 47–52 (1965). Fresh milkfat was found to contain from 4.4–6.6% of diglycerides. The small amounts of free fatty acids present preclude the possibility that the diglycerides are the result of lipolysis and it is suggested that they are formed in the synthesizing cells of the mammary gland. The fatty acid composition of the natural diglycerides was similar to that of diglycerides obtained from pancreatic ligase (EC 3.I.I.3) hydrolysis of the milkfat. The relatively high concentration of short-chain fatty acids in the diglycerides does not favour the mechanism of milkfat triglycerides synthesis proposed by Patton and McCarthy. Evidence was obtained for a preferential attack of pancreatic lipase on milkfat glycerides containing short-chain fatty acids. The generally proposed theory that milkfat contains the short-chain fatty acids predominantly at the external positions on the glyceride molecules seems incorrect. Capric, lauric, myristic and palmitic acids were predominantly located at the internal, stearic and oleic acids at the external positions on the glycerides of milkfat.

LIPID METABOLISM AND THE LAYING HEN. III. PLASMA LIPOPROTEIN LIPASE IN RELATION TO THE ONSET OF LAYING. P. Heald, Bridget Furnival and K. Rookledge (Twyford Laboratories Ltd., Twyford Abbey Road, London, N.W. 10). *Biochim. Biophys. Acta* **98**, 66–72 (1965). It has been shown that the plasma of the mature laying domestic fowl contains small quantities of lipoprotein lipase (glycerol ester hydrolase, EC 3.I.I.3). Plasma from non-laying immature pullets frequently contains none. Intravenous injection of heparin produced a marked increase in plasma lipoprotein lipase, both in mature and immature pullets and in the cockerel. In four birds studied over a period of 8 weeks during which they came into lay, no correlation was found between the endogenous levels of plasma free fatty acids and lipoprotein-lipase activity. In one bird only was there a significant correlation between plasma free fatty acids and lipoprotein lipase, after heparin injection. It is concluded that endogenous plasma lipoprotein-lipase activity does not make a significant contribution to the levels of plasma free fatty acids by intravascular lipolysis of circulating lipoproteins.

FATTY ACID ADSORPTION BY LIVER- AND ADIPOSE-TISSUE PARTICLES. L. Reshef and B. Shapiro (Dept. of Biochem., Hebrew Univ.-Hadassah Med. Sch., Jerusalem). *Biochim. Biophys. Acta* **98**, 73–80 (1965). Liver and adipose-tissue particles, mitochondria and microsome, remove palmitic acid-C^{14} from serum albumin at 0F. The albumin was not taken up together with the fatty acid. The partition of the fatty acid was dependent on the relative amounts of serum albumin and particle protein and was independent of the amount of fatty acid. Adipose-tissue particles had a much higher affinity for the acid than those of liver, when calculated on the basis of protein content. The concomitant release of fatty acids from the tissue, on the other hand, was decreased by increasing the concentration of fatty acids in the medium. The net result of fatty acid movement was dependent on the relative amounts of medium fatty acid and particle protein. The fatty acids adsorbed were bound to the more insoluble part of the mitochondria and were not removed by sonication or extraction with 0.25% sodium cholate. Only with higher cholate concentrations (1.15%) or with digitonin (1%) could "solubilization" be achieved. The fatty acid in these "solutions" moved on electrophoresis at pH 7.2 with a protein to the negative pole. Particles obtained after sonication of mitochondria also took up palmitate-C^{14}. This activity disappeared upon extraction

of the lipids. The lipids present in the particles weakened the bond of the fatty acids to albumin, bringing about their precipitation on centrifugation.

MECHANISMS FOR REMOVAL OF CHYLE TRIGLYCERIDE FROM THE CIRCULATING BLOOD AS STUDIED WITH GLYCEROL-C^{14} AND PALMITIC ACID-H^3 LABELED CHYLE. T. Olivecrona and P. Belfrage (Dept. of Physiological Chem., Univ. of Lund, Lund, Sweden). *Biochim. Biophys. Acta* **98**, 81–93 (1965). Chyle containing triglyceride labeled both in the glycerol (C^{14}) and the fatty acid (H^3) moiety was injected into carbohydrate-fed male rats, and tissue-lipid radioactivity studied at several time intervals. The liver at short times contained mainly labeled neutral lipids with a ratio C^{14}/H^3 of 0.7–0.8. At later times, this ratio decreased and fatty acid label entered into the phospholipids. It is argued that these data are compatible with the view that the liver contained unchanged chyle triglyceride and in addition triglycerides and phospholipids formed from fatty acids released upon hydrolysis of the chyle triglyceride. The adipose tissue showed ratios C^{14}/H^3 below 0.3, and it is argued that this tissue probably took up mainly fatty acids released on hydrolysis of the chyle triglyceride, probably by lipoprotein lipase in the adipose tissue. The data on the other tissues indicate that the spleen, the lungs, and the small intestine, like the liver, can remove intact chylomicron triglyceride from the circulating blood. The skeletal muscle and the heart, on the other hand, take up mainly fatty acids liberated on hydrolysis of the chyle triglyceride, and in this respect resemble the adipose tissue. The kidney gave intermediary data and may use both mechanisms.

LIPID RELEASE AND TRANSPORT IN INSECTS. H. Chin and L. Gilbert (Biol. Sci., Northwestern Univ., Evanston). *Biochim. Biophys. Acta* **98**, 94–110 (1965). When isolated fat body of the silkmoth, cockroach or grasshopper was incubated with (carboxyl-C^{14}) palmitate, the C^{14}-labeled fatty acid was rapidly incorporated into the neutral lipids of the fat body. When this "prelabeled fat body" was reincubated with insect hemolymph, a rapid release of C^{14}-labeled diglyceride took place from the fat body into the hemolymph, whereas no significant release of triglyceride occurred. This diglyceride release was specific for insect hemolymph. No significant release of diglyceride occurred into a solution of bovine serum albumin, egg albumin or rat plasma. In contrast, free fatty acid was released not only into the insect hemolymph but also into synthetic media. Diglyceride release was markedly inhibited by cyanide, 2,4-dinitrophenol and azide, whereas the release of free fatty acid was accelerated by these chemicals. The greatest rate of release of diglyceride was observed from adult silkmoth fat body, and the lowest from diapausing pupal fat body. Electrophoretic analysis of the hemolymph showed that the diglyceride released into the hemolymph was complexed to one of the hemolymph proteins. This diglyceride-protein complex seems to be the most likely form by which long-chain fatty acids are transported in the insects studied.

STUDIES OF THE α-GLYCERYL ETHER LIPIDS OCCURRING IN MOLLUSCAN TISSUES. G. A. Thompson, Jr. and Pearl Lee (Dept. of Biochem., Univ. of Washington School of Med., Seattle, Wash.). *Biochim. Biophys. Acta* **98**, 151–59 (1965). Tissues of *Katherina tunicata, Thais lamellosa, Octopus dofleini,* and *Prothothaca staminea* were examined for α-glyceryl ether-containing lipids. Phospholipids of the species analyzed contain glyceryl ethers amounting to as much as 25 mole % of the total phospholipid phosphorus. The neutral lipids of all species also contain glyceryl ether derivatives. Analysis of the glyceryl ethers by gas-liquid chromatography showed that in most cases chimyl alcohol (1-0-hexadecyl glycerol) and batyl alcohol (1-0-octadecyl glycerol) predominate, although many variations were noted in the distribution patterns. In some cases cyclic acetal derivatives of the plasmalogens were prepared to allow comparison of the vinyl ether side-chains with those of the saturated ethers. A new method employing $LiAlH_4$ allows the rapid isolation in pure form of cyclic acetals as well as glyceryl ethers. The presence of significant levels of glyceryl ether lipids in representatives from the four principal classes of mollusca indicates that these lipids are of widespread occurrence within the phylum.

PHOSPHOLIPASE-A ACTIVITY OF MAMMALIAN TISSUES. Jennifer Gallai-Hatchard and R. Thompson (Dept. of Chem. Pathology, Guy's Hospital Medical School, London). *Biochim. Biophys. Acta* **98**, 128–36 (1965). The phospholipase-A (phosphatide acyl-hydrolase, EC 3.I.I.4) activity of extracts of a number of different rat tissues has been determined by estimating the decline in the concentration of lecithin together with the increase in the concentration both of fatty acids and of lysolecithin, that occurs when the extract is incubated with lecithin under suitable conditions. Wide variations in the level of activity in different tissues were noted; apart from the high levels in pancreas and small intestine, moderately high activity was found in testis, spleen, lung and liver. Using rat testis, it has been shown that the greatest activity is present in glycerol-treated extracts of acetone-dried powders of the tissue.

BEHAVIOR OF PLASMA LIPOPROTEINS DURING EXCHANGE OF PHOSPHOLIPIDS BETWEEN PLASMA AND ERYTHROCYTES. T. Sakagami, O. Minari and T. Orii (Dept. of Chem., Sapporo Med. College, Sapporo, Japan). *Biochim. Biophys. Acta* **98**, 111–16 (1965). Participation of plasma lipoproteins in the exchange of phospholipids between plasma and erythrocytes *in vitro* was investigated with P^{32}-labelled plasma and non-labelled erythrocytes, and *vice versa*. Two major lipoproteins, α and β, partook principally in the exchange of lecithin and sphingomyelin. On the other hand, the lipoprotein fraction having a density greater than 1.21 participated mainly in the exchange of lysolecithin.

BIOSYNTHESIS OF α-SMEGMAMYCOLIC ACID. A. H. Etémadi and E. Lederer (Institut de Chimie des Substances Naturelles (C.N.R.S.)). *Biochim. Biophys. Acta* **98**, 160–67 (1965). *Mycobacterium smegmatis* was grown in presence of tetracosanoic acid-1-C^{14} and in another experiment in presence of methionine-Me-C^{14}. The degradation of the labeled α-smegmamycolic acid shows that tetracosanoic acid is incorporated as such and that the carbon of the methyl side chain comes from the methyl of methionine.

STUDIES ON THE CHEMISTRY OF MUCOLIPIDS: OCCURRENCE OF THE LONG-CHAIN BASE ICOSISPHINGOSINE, COMPOSITION OF FATTY ACIDS, FRACTIONATION ATTEMPTS. N. Z. Stanacev and E. Chargaff (Dept. of Biochem., College of Physicians and Surgeons, Columbia Univ., New York, N. Y.). *Biochim. Biophys. Acta* **98**, 168–81 (1965). Several mucolipid preparations from ox brain were studied with respect to their long-chain base and fatty acid constituents. The mixture of bases, released by acid methanolysis and isolated in the form of the neutral oxalates, was subjected to oxidative degradation by means of HIO_4, OsO_4-HIO_4, $KMnO_4$, and CrO_3. The analysis by gas-liquid chromatography of the reaction products or their derivatives demonstrated the occurrence of two principal long-chain constituents in almost equal quantities, namely, sphingosine and its C_{20} homologue, 2-amino-1,3-dihydroxy-*n*-eicosene-4, for which the name icosisphingosine is proposed, together with much smaller quantities of dihydrosphingosine and, probably, dihydroicosisphingosine. Stearic acid was the principal fatty acid constituent of the mucolipids, amounting in the purest preparations to 96–97% of the total fatty acids. Orienting experiments on the fractionation of mucolipid, in the form of its methyl ester, on a silicic acid column led to the isolation of two fractions some of whose properties are also discussed. The two long-chain base constituents were found in both fractions.

FRACTIONATION AND CHARACTERIZATION OF WAX D, A MACROMOLECULAR PEPTIDOGLYCOLIPID OF MYCOBACTERIUM TUBERCULOSIS. I. BIOCHEMICAL INVESTIGATIONS OF WAX D OF HUMAN STRAIN $H_{37}R_A$. A. Tanaka and M. Kitagawa (Dept. of Biochem., Faculty of Med., Kyushu Univ., Fukuoka, Japan). *Biochim. Biophys. Acta* **98**, 182–93 (1965). Acetylation of wax D, a macromolecular peptidoglycolipid of *Mycobacterium tuberculosis*, proceeds smoothly at room temperature and makes the further chromatographic separation of wax D into three main groups possible. These groups consist of: 1) four fractions free from amino acids (30%), 2) two fractions containing only glutamic acid, alanine and diaminopimelic acid (30%), and 3) one fraction containing many amino acids including those which had not hitherto been recognized in wax D (14%). Direct measurement of the molecular weight of the subfractions of acetylated wax D by a surface-balance technique gives precise values. Acetylated wax D remains soluble in ordinary organic solvents, which facilitates further purification. Information about a possible biological role played by the hydroxyl groups of wax D is obtainable through acetylated wax D.

THE INCORPORATION OF MEVALONATE-2-C^{14} AND ACETATE-1-C^{14} INTO LIPIDS OF AORTA AND HEART HOMOGENATES OF THE TURTLE (PSEUDYMIS SP.). C. Terner and F. R. Darey (Dept. of Biol., Biological Science Center Boston Univ., Boston, Mass.). *Biochim. Biophys. Acta* **98**, 194–203 (1965). Of a number of animal species tested, the turtle (*Pseudymis sp.*) was found to have an aorta from which a metabolically active homogenate could be prepared by means of a conventional Potter homogenizer. Aorta and heart homogenates incorporated mevalonate-2-C^{14} into their lipids more readily than acetate-1-C^{14}. When mevalonate-2-C^{14} was the labeled substrate, C^{14}-labeled cholesterol esters and glycerides, accompanied by C^{14}-labeled unsaponifiable metabolites, were isolated from heart and aorta lipids. Cholesterol was free from measurable radioactivity. Phosphatidylethanolamine and polyglycerophosphatide were the fractions of highest specific activity isolated from heart and aorta phospholipids, when either mevalonate-2-C^{14} or acetate-1-C^{14} had been the labeled substrate. Phosphatidylcholine was of low specific activity. As a precursor of fatty acids, mevalonate differed from acetate in not giving rise to labeled long-chain fatty acids, but in supplying volatile short-chain acids which were incorporated into glycerolipids. In the tissues studied, mevalonate was a more powerful labeling agent of the major classes of lipids than acetate.

THE LIPID COMPOSITION OF NORMAL RAT THYMUS. D. Abramson and M. Blecher (Dept. Biochem., Schools Med. and Dentistry, Georgetown Univ., Wash. D.C.). *Biochim. Biophys. Acta* **98**, 117–27 (1965). Thymic lipids (representing 2.6% of tissue wet weight) from two strains of normal, adult, white rats have been subjected to a variety of chromatographic techniques and chemical analyses leading to the complete separation and quantification of lipid components. Neutral lipids and phospholipids were separated on silicic acid by a batch procedure; neutral lipids represented from 66 to 60% of total lipids. Individual neutral lipids were separated and isolated using column chromatography on Florisil; neutral lipids were mainly triglycerides (82–85%) with cholesterol (6–10%) and cholesterol esters (3–4%) representing significant contributions to the total; smaller amounts of lower glycerides and free fatty acids were also present. Individual phospholipids were separated and isolated by two-dimensional thin-layer chromatography on Silica Gel G; 8 phospholipids were identified with phosphatidyl choline (49–50% of total), phosphatidyl ethanolamine (19%), phosphatidyl inositol (12%), spingomyelin (10–11%), and phosphatidyl serine (5–7%) representing the main components; small amounts of lysolecithin, phosphatidic acid and cardiolipin were also present.

STUDIES ON THE COMPOSITION AND STRUCTURE OF THE PHOSPHATIDYLCHOLINE, PHOSPHATIDYLETHANOLAMINE AND TRIGLYCERIDE ISOLATED FROM RABBIT LIVER. J. Moore and D. Williams (Nat'l Inst. Res. in Dairying, Shinfield, Reading, Great Brit.). *Biochim. Biophys. Acta* **98**, 137–50 (1965). The purpose of the investigation was to determine the extent to which the composition of the fatty acids in the α and β positions of the glycerophosphatides and triglycerides in the livers of rabbits could be altered by the inclusion of different types of fat in the diet. Five groups of rabbits were given diets containing either 20% maize oil, 24% butter, 20% butterfat, 20% hydrogenated coconut oil or 0.8% maize oil. After 30 wks. the animals were killed and the lipids were extracted from the livers. Pooled samples of pure phosphatidylcholine, phosphatidylethanolamine and triglyceride were prepared from the liver lipids of each group by chromatography on columns of silicic acid. The positional distribution of the various fatty acids in the glycerophosphatides was determined after degradation with phospholipase A (phosphatide acyl hydrolase, EC 3.I.I.4) and that in the triglycerides after partial hydrolysis with pancreatic lipase (glycerol ester hydrolase, EC. 3.I.I.3). In all three glycerolipids there was a distinct tendency for stearic and palmitic acids to occur mainly in the α or α,α' positions where as the unsaturated acids together with myristic acid occurred mainly in the β positions.

FATTY ACID COMPONENTS OF RAT-TISSUE LIPIDS. J. M. Connellan and C. J. Masters (Univ. of Queensland). *Biochem. J.* **94**, 81–84 (1965). The lipids of rat heart, kidney, skeletal muscle and liver were separated by chromatography on silicic acid into cholesterol ester, triglyceride, free fatty acid, and phospholipid fractions. The fatty acid compositions of these fractions were determined by gas-liquid chromatography. Phospholipid was the predominant fraction in all the tissues, with muscle containing the highest percentage of triglyceride, and kidney the most free fatty acid, monoglyceride and diglyceride. The C_{12}–C_{22} acids represented in general more than 90% of all the fatty acids present. In the phospholipids of heart, kidney and muscle, two unidentified fatty acids were present as minor components. Palmitic acid was always present in highest concentration in the cholesterol ester fraction; oleic acid was present in greatest percentage in the triglyceride fraction; arachidonic acid was in highest concentration in phospholipid, and in lowest concentration in the triglyceride fractions. The fatty acid compositions of the cholesterol ester fractions were broadly similar for all the extrahepatic tissues.

PHOTOLYSIS OF CHOLESTEROL DURING BIOLOGICAL EXPERIMENTS. I. M. Hais and N. B. Myant (Hammersmith Hosp., London). *Biochem. J.* **94**, 85–90 (1965). When dilute aqueous emulsions of radioactive cholesterol are exposed to daylight, extensive photolysis may take place. This results chiefly in the formation of substances more polar than cholesterol, some of which are probably acidic. Substances less polar than cholesterol are formed to a smaller extent. Photolysis is greatest when the emulsions are strongly acidic or strongly alkaline. Photolysis takes place rapidly if radioactive cholesterol stored in the dry state, either on glass or on filter paper, is exposed to daylight. If precautions are taken to minimize exposure to daylight during analysis and storage of the samples, the amount of non-enzymic alteration of cholesterol in biological experiments may be negligible.

THE COMPONENT FATTY ACIDS OF LIPIDS FROM SOME STREPTOMYCES SPP. A. Ballio, S. Barcellona and L. Boniforti (Instituto Superiore di Sanita, Rome). *Biochem. J.* **94**, 11C–13C (1965). The analysis of fatty acid methyl esters gave the following results: (a) occurrence of the homologous series of straight-chain saturated acids from C 12–17, with palmitic acid as the main component; (b) occurrence of the homologous series of saturated iso acids from C 12–17, with the C 14, 15 and 16 members as main components; (c) occurrence of odd-numbered saturated anteiso acids, namely the C 13, 15 and 17 members, with the C 15 acid as main component; (d) detection of small amounts of unsaturated fatty acids (probably with 16 and 17 carbons) as shown by their disappearance after hydrogenation; (e) absence, or presence in only trace quantities, of acids with chain length greater than C 17 and smaller than C 12; (f) great preponderance over other acid components of 4 branched-chain fatty acids (12-methyltridecanoic acid, 12- and 13-methyltetradecanoic acid, and 14-methylpentadecanoic acid, which account for approximately 75% of the total fatty acids of the Streptomyces spp.

STUDIES ON ESSENTIAL FATTY ACID DEFICIENCY. EFFECT OF THE DEFICIENCY ON THE LIPIDS IN LIVER MITOCHONDRIA AND OXIDATIVE PHOSPHORYLATION. L. A. Biran, W. Bartley, C. W. Carter and A. Renshaw (Univ. of Oxford). *Biochem. J.* **94**, 247–51 (1965). Dietary deficiency of EFA results in a 2-fold increase in the neutral lipid content of liver mitochondria as compared with the corresponding value for stock-fed rats. Deficiency produces changes in the pattern of the constituent fatty acids of the main phospholipid fractions of liver mitochondria which were similar to those previously reported for the lipids of whole liver. There is a fall in the content of C 18:2 acid and to a smaller extent of C 20:4 acid associated with a rise of 16:1, 18:1 and 20:3 acids. Deficiency results in small decreases in the phosphorylation quotients of liver mitochondria during oxidation of succinate and pyruvate, but the values lie within the range reported for normal mitochondria. Mitochondrial respiration with succinate is decreased as a result of deficiency but no change was observed with pyruvate as substrate.

VISUAL ACUITY OF ESSENTIAL FATTY ACID-DEFICIENT RATS. A. R. Hands, N. S. Sutherland and W. Bartley (Univ. of Oxford). *Biochem. J.* **94**, 279–83 (1965). Rats were maintained on a diet deficient in fat and on a normal diet of rat cubes. In bright illumination, both deficient and normal rats had the same ability to discriminate between black and white stripes. With an illuminance of 0.002 ft. lambert, supplemented rats could discriminate as efficiently as at 0.7 ft. lambert, but deficient animals were unable to discriminate at 0.002 ft. lambert. Control rats had 14% of docosahexaenoic acid in

their retinal fats but the deficient rats had only 1%. Deficient animals had no vitamin A stores in the liver whereas the control animals had about 190 i.u./g.

THE METABOLISM OF CHOLESTEROL IN THE PRESENCE OF LIVER MITOCHONDRIA FROM NORMAL AND THYROXINE-TREATED RATS. K. A. Mitropoulos and N. B. Myant (Hammersmith Hosp., London). *Biochem. J.* **94**, 594–603 (1965). Cholesterol-26-C^{14} and -4-C^{14} were incubated with liver mitochondria from normal and thyroxine-treated rats, and the radioactivity was measured in the CO_2 evolved during the incubation, in a BuOH-extract of the incubation mixture and in a volatile fraction containing substances of low molecular weight derived from the side chain of cholesterol. In the presence of cholesterol-26-C^{14}, mitochondria from thyroxine-treated rats produced more radioactivity in CO_2 and in the volatile fraction, and less radioactivity in the fraction containing the polar steroids, than did mitochondria from normal rats. In the presence of cholesterol-4-C^{14}, mitochondria from thyroxine-treated rats produced the same amount of radioactivity in the polar steroids as did normal mitochondria. Thyroxine treatment had no effect on the capacity of the mitochondria to oxidize propionate to CO_2. These results are best explained by supposing that thyroxine stimulates a rate-limiting reaction leading to the cleavage of the side chain of cholesterol, but has little or no influence on the hydroxylations of the ring system or on the oxidation of the C_3 fragment removed from the side chain.

PREPARATION OF VITAMIN D_3. K. R. Bharucha and F. M. Martin (Canada Packers Ltd.). *U.S. 3,176,029.* A process for the treatment of the irradiation products of 7-dehydrocholesterol comprises: treating the irradiation products with ethanol to remove a portion of the unreacted provitamin and provide a residual ethanol gum; dissolving the gum in methanol; precipitating an adduct of vitamin D_3 and provitamin from the methanol solution; and separating the precipitated adduct from the solution.

METABOLISM OF TRIPALMITIN-1-C^{14}-LABELED SERUM LOW-DENSITY LIPOPROTEINS BY THE ISOLATED PERFUSED GOAT LIVER. Laura Evans, S. Patton, R. McCarthy, and J. Holter (Dept. of Dairy Science, Pa. Agricultural Exp. Station, University Park, Pa.). *J. Dairy Sci.* **48**, 44–50 (1965). After perfusing for 2 hr., the defibrinated perfusate, liver, and bile were analyzed for distribution of radioactivity and changes in lipid concentrations and fatty acid composition. It was shown that more than 80% of the activity from tripalmitin-1-C^{14} labeled serum low-density lipoproteins (LDL) was taken up and retained by the liver, and 2% of the activity was transferred to the serum high-density lipoproteins (HDL). Isotopic flux also occurred to the serum protein-bound nonesterified fatty acids, blood cells, bile, and CO_2. C^{14} was of highest specific activity, generally, in the triglycerides, but was present also in the other lipid classes, including sterols. A general decrease in the concentration of total lipids and lipid classes occurred during perfusion. Triglycerides, however, were more saturated in the LDL. Oleate was the major unsaturated fatty acid in most lipid classes. Phospholipids represented the major portion of liver tissue lipids and contained 49% stearate.

DIETARY FAT SUPPLEMENTS, BODY WEIGHT AND OSTEOARTHRITIS IN DBA/2JN MICE. L. Sokoloff and O. Mickelsen (National Institutes of Health, Public Health Service, Bethesda, Md.). *J. Nutr.* **85**, 117–21 (1965). Dietary supplements of saturated fats, either in the form of lard or hydrogenated safflower oil, had no demonstrable deleterious effect on the development of degenerative joint disease in male DBA/2JN mice. Although the lard resulted in greater obesity than did the cottonseed oil supplement, the weight gain was more rapid and greater when safflower oil was used rather than 2 hydrogenated products of safflower oil having iodine numbers equal to that of the cottonseed oil and lard, respectively.

EFFECT OF EGG YOLK AND PHOSPHATIDE ON ANTHRAX INFECTION OF RATS AND GUINEA PIGS. W. D. Sawyer, R. W. Kuehne and W. S. Gochenour, Jr. (U.S. Army Medical Unit, Fort Detrick, Md.). *Proc. Soc. Exp. Bio. Med.* **118**, 105–08 (1965). Suspension of anthrax spores or vegetative cells in phosphatidyl ethanolamine, or the related phosphatides, phosphatidyl serine and phosphatidyl inositol, markedly reduced the intraperitoneal median lethal dose for guinea pigs and Sprague-Dawley rats, thus duplicating the effect of whole chicken egg yolk. Quantitative considerations indicated that the amount of phosphatidyl ethanolamine present in yolk could account for the effect of yolk. Lecithin, the other major phosphatide of yolk, was ineffective. Phosphatidyl ethanolamine appeared to influence the initial phases of host-bacterium interaction.

SOYBEAN FLOUR FOR HUMAN CONSUMPTION. G. Loew. *Rev. Argentina de Grasas y Aceites* **5**, 78–83 (1963). Review.

(Continued on page 384A)

• *New Literature*

PERKIN-ELMER has a new 20-page brochure, L-30, describing two low-cost infrared spectrophotometers. Specifications of the instruments, Perkin-Elmer Models 237B and 337, are detailed with illustrated examples of instrument resolution, range and speed. (Instrument Group, Perkin-Elmer Corporation, Main Avenue, Norwalk, Connecticut.)

T. SHRIVER & COMPANY, INC., is issuing their revised catalogue on filter presses and "ALP" power-actuated filters. It includes data for determination of filtration requirements and step-by-step guides for the selection of the right type and size of filter. (892 Hamilton St., Harrison, N.J.)

EMERY INDUSTRIES, INC., has prepared Bulletin No. 600A, describing 3101-D Isostearic Acid, a unique liquid isomer of stearic acid which combines the saturation of stearic acid with the liquid nature and solubility characteristics of oleic acid. (4400 Carew Tower, Cincinnati, Ohio 45202.)

F & M SCIENTIFIC CORPORATION has an 8-page bulletin describing the standard line of F&M columns and column accessories. (Route 41 & Starr Road, Avondale, Pa. 19311.)

E. H. SARGENT & CO., has released a bulletin on the Sargent Recording pH State, which is used in both research and routine studies of reaction kinetics and stoichiometry recording of reaction curves under closely controlled conditions of temperature, mixing and pH. (Department pHs, 4647 West Foster Ave., Chicago, Ill. 60630.)

PARR INSTRUMENT CO., INC., has presented a new Pressure Reactor Catalog, No. 65-2 illustrating their bench scale pressure reactors, hydrogenation apparatus, general purpose bombs and pressure vessels. (221 Fifty-third St., Moline, Ill. 61265.)

WILKENS INSTRUMENT AND RESEARCH, INC., lists a series of gas chromatograph presentations on gas chromatography, including a 12-page bulletin, W-117, "Chromatographic Techniques for Simulated Distillation." (P. O. Box 313, Walnut Creek, Calif.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS, has available their 1964 ASTM Proceedings, Volume 64. This 1200-page book includes technical papers on fatigue, metals, concrete, soils, road and paving materials and general testing. (Price prepaid, $12; to ASTM members, $8. ASTM, 1916 Race Street, Philadelphia, Pa. 19103.)

T. SHRIVER & COMPANY, INC., has available a 24-page illustrated catalogue, No. 65, presenting information on products and applications of filter presses and "ALP" pressure filters. (810 Hamilton Street, Harrison, New Jersey.)

BIO-RAD LABORATORIES have published Price List Q, "Materials for Ion Exchange Adsorption Gel Filtration," a 46-page indexed catalogue. (32nd & Griffin Avenue, Richmond, Calif.)

E-C APPARATUS CORPORATION, have available technical bulletins describing recovery of individual protein zones from acrylamide gel electrophoresis separations, in the preparation of pure proteins. Albumin, lactic dehydrogenase, haptoglobin and prealbumin globulins are some of the protein variants recently isolated successfully by Elution Convection. (226 S. 40th St., Philadelphia, Pa. 19104.)

ABSTRACTS: BIOCHEMISTRY AND NUTRITION

(Continued from page 361A)

THE ISOLATION OF COPROSTANOL FROM STEROL ESTERS OF HUMAN FECES. R. S. Rosenfeld (Montefiore Hospital, Bronx). *Arch. Biochem. Biophys.* **108**, 384–5 (1964). Coprostanol has been isolated as the main sterol in the nonsaponifiable fraction of fecal sterol esters in 5 subjects. Coprostanol esters are probably formed either by microbiological reduction of cholesterol prior to esterification or by reduction of cholesterol esters.

THE ORIGIN AND FUNCTION OF SOME METHYL GROUPS IN BRANCHED-CHAIN FATTY ACIDS, PLANT STEROLS AND QUINONES. E. Lederer (Inst. de Chimie des Substances Naturelles, C.N.R.S.). *Biochem. J.* **93**, 449–68 (1964). This is a review with about 150 references discussing 1) the various ways invented by living cells for producing methyl-branched fatty acids, 2) the origin of the "extra methyl group" of the C_{28} and C_{29} sterols (e.g. ergosterol, β-sitosterol), and 3) the biological function of the methyl side chain of vitamin K and the ubiquinones. Four different mechanisms that can lead to methyl-branched fatty acids are known, the first two being the most prevalent: 1) C-methylation with the participation of methionine; 2) incorporation of propionic acid; 3) incorporation of the branched chains of leucine and isoleucine, leading to the iso and anteiso acids, respectively; 4) incorporation of mevalonic acid. In the C-methylation leading to tuberculostearic acid and to ergosterol, only two of the three hydrogen atoms of the methyl group of methionine are transferred. Both of the carbon atoms of the ethyl side chain of the C_{29} phytosterols come from methionine. An essential function is suggested for the methyl side chain of vitamin K and the ubiquinones in oxidative phosphorylation and perhaps in other biological reactions such as a catalyst for prothrombin synthesis.

STUDIES ON ESSENTIAL FATTY ACID DEFICIENCY. EFFECT OF THE DEFICIENCY ON THE LIPIDS IN VARIOUS RAT TISSUES AND THE INFLUENCE OF DIETARY SUPPLEMENTATION WITH ESSENTIAL FATTY ACIDS ON DEFICIENT RATS. L. A. Biran, W. Bartley, C. W. Carter and A. Renshaw (Univ. of Oxford). *Biochem. J.* **93**, 492–8 (1964). EFA-deficient diets resulted in marked changes in constituent fatty acids of the nitrogenous-phospholipid and cardiolipin fractions of heart, kidney, liver and skin. In the nitrogenous-phospholipid fraction, there was a replacement of arachidonic acid and linoleic acids by palmitoleic acid, oleic acid and eicosatrienoic acids. In the cardiolipin fraction, where linoleic acid is normally the predominant unsaturated fatty acid, dietary deficiency resulted in replacement of this acid and to a lesser extent of arachidonic acid by palmitoleic, oleic and eicosatrienoic acids. In the brain, where the normal concentration of linoleic acid is low, little change was observed in the deficient rats in the amount of linoleic or arachidonic acid. EFA-deficient diets caused a decrease in the proportion of linoleic acid and a rise in those of palmitoleic, oleic and eicosatrienoic acids in the neutral lipid fractions of heart, kidney and liver. The concentration of arachidonic acid, which is low in the neutral lipids of most normal tissues except brain, was little changed as a result of dietary deficiency. Dietary supplementation of animals with corn oil (equivalent to 200 mg of linoleic acid) over a period of 16 days reversed the changes induced by deficiency in the fatty acid constituents of the neutral lipid, nitrogenous phospholipid and cardiolipin fractions of heart, kidney and liver.

CAN CHANGES IN THE AMERICAN DIET PREVENT CORONARY HEART DISEASE? S. Dayton, M. L. Pearce, and Elva Hiscock (Veterans Administration Center, Los Angeles). *J. Am. Dietet. Assoc.* **46**, 20–5 (1965). This is an interim report of a study begun in 1959 to determine the possible usefulness of a diet high in unsaturated fat. Although data on morbidity and mortality are still too meager to permit conclusions as to the effectiveness of the experimental diet, considerable information on the metabolic effects of such a diet has been acquired and is described. Thus far the study has shown: the long-term acceptability of a diet containing predominantly unsaturated fat; serum cholesterol decrements induced by such a diet (16% of baseline values) are maintained for at least 52 months; fatty acid composition of adipose tissue and atheromata slowly changes in the direction of the composition of the dietary fat; for periods up to 5 years, the diet is without apparent harmful effects. There is no evidence of vitamin E inadequacy.

DIET AND CARDIOVASCULAR DISEASE. Margaret J. Albrink (West Virginia University). *J. Am. Dietet. Assoc.* **46**, 26–9 (1965). A. review of the dietary habits of mankind and the changes in these habits suggests that an increase in total calories rather than of dietary fat coincides with the increase in atherosclerotic vascular disease in affluent countries. Serum triglycerides, unlike serum cholesterol, are associated with various measures of body fatness and may thus be used to test the importance of caloric excess in the pathogenesis of coronary

artery disease. The fact that elevated triglyceride concentration is more closely associated with coronary artery disease than is serum cholesterol concentration, particularly after age 50, supports the possibility that over-nutrition in general rather than an increased intake of dietary fat may be responsible for the increased incidence of coronary artery disease.

LIPIDS OF CANCEOUS TISSUES. III. SPECULATION OF THE CAUSE OF CANCER GENERATION FROM VIEWPOINT OF FAT CHEMISTRY. Kazuo Fukuzumi (Nagoya Univ., Nagoya). *Yukagaku* **14**, 54–8 (1965). Experimental studies revealed that *trans-trans* or *cis-trans* conjugated diene hydroperoxide existed in the lipids from the tissue of bronchial carcinoma and from cancerous pleural fluid. From these facts and other literatures into consideration, a hypothesis is proposed that the cancer is generated due to oxidized lipids accumulating in the living body. The reason why Japanese suffer more from gastric and liver cancers than American or English may be due to the difference of food habits. Japanese suffer less from lung cancer than American or English due possibly to the difference of living circumstances. The decrease in catalase activity in cancer, generation of cancer by radiant rays and production of cancer by arsenic are explained by this hypothesis. Thus, it may afford a general understanding of cancer generation. Inhibition of β-oxidation in cancerous tissue is also explainable by the hypothesis.

HYPERCHOLESTEROLEMIA IN CHICKS INJECTED WITH β-ESTRADIOL. C. Whiteside,, H. Fluckiger, J. Longenecker, J. Barboriak and H. Sarett (Dept. of Nutr. Res., Mead Johnson Res. Center, Evansville, Ind.). *J. Atheroscler. Res.* **5**, 1–8 (1965). Injection of β-estradiol in 1-wk.-old White Leghorn cockerels resulted in marked increases in plasma cholesterol and phospholipids similar to findings in 4-wk.-old chicks. Liver weights and levels of liver lipids were increased as much as twofold by β-estradiol injection. The ratios of β/α-lipoproteins were increased much more in the 1-wk.-old chicks. *In vitro* incorporation of acetate-C^{14} into cholesterol was highest on the second day following injection of β-estradiol in 1-wk.-old chicks, while peak plasma cholesterol levels occurred on the 6th day. The rate of acetate-C^{14} incorporation into cholesterol was still about 10 times the normal rate on the 6th day. Increases in plasma lipids and rate of acetate-C^{14} incorporation into cholesterol by liver in these chicks were greater with 5 mg β-estradiol than with 2.5 mg. The use of a stock diet or of a fat-free purified diet for the chicks did not significantly influence the findings.

SEASONAL VARIATION IN THE RESPONSE OF CHICKS TO DIETARY CHOLESTEROL. C. Whiteside and H. Fluckiger (Dept. of Nutr. Res., Mead Johnson Res. Center, Evansville, Ind.). *Poultry Sci.* **44**, 257–59 (1965). In the routine use of cholesterol-fed White Leghorn cockerels for testing hypocholesteremic agents, marked changes in the response of the chicks to dietary cholesterol were observed among groups hatched on various dates. These findings prompted a study of other factors which might be related to season of hatch and response of chicks to dietary cholesterol.

In Vitro INCORPORATION OF RADIOPHOSPHORUS INTO THE PHOSPHATIDES OF NORMAL HUMAN BLOOD CELLS. M. Westerman and W. Jensen (Dept. of Med., Univ. of Pittsburgh School of Med., Pittsburgh). *Proc. Soc. Exp. Biol. Med.* **118**, 315–19 (1965). The incorporation of P^{32} into the phosphatides of the formed elements of normal human blood has been measured. A characteristic pattern was described for erythrocytes, leukocytes and platelets. Radiophosphorus is incorporated into red cell phosphatidic acid. The variable and high rates of incorporation of P^{32} into certain phosphatides of red cells, white cells and platelets would indicate the necessity of assessing this function by these cells when making such measurements in whole blood.

FATTY ACID DIGESTIBILITY IN LAYING HENS FED YEAST CULTURE. L. Tonkinson, E. Gleaves, K. Dunkelgod, R. Thayer, R. Sirny and R. Morrison (Okla. State Univ., Stillwater, Okla.). *Poultry Sci.* **44**, 159–64 (1965). Five experiments were made to test the effect of Yeast Culture and lecithin on the fat digestibility in rations fed to laying hens. Corn oil, tallow and Sifteen were the three types of fat added to the rations in the various experiments. A cross-over design was used in the five experiments, with the treatments being reversed at the end of 6 weeks and then continued for an additional 6 weeks. Fecal samples were collected at the end of the fourth, sixth, tenth and twelfth weeks. The feed and feces were analyzed for fatty acids, and digestibility was determined by the chromic oxide technique. Comparisons of fat digestibility were made between the fourth and tenth weeks and between the sixth and twelfth weeks. The results indicate that Yeast Culture and lecithin had beneficial effects upon the digestibility of tallow, both separately and in combination.

(Continued on page 388A)

• *New Products*

ALOE SCIENTIFIC DIVISION OF BRUNSWICK, St. Louis, Mo., has introduced the new Wide Range Precision "Speegrav" for photoelectric determinations of specific gravities of liquids within the range of 0.5500 to 3.0500 which do not attack glass.

E. H. SARGENT & CO., Chicago, Ill., has released the Model DR pH Meter (Digital Direct Reading). It combines the explicit accuracy of a digital read-out with the electrical accuracy of a precise potentiometer.

TRUE-CUT PRODUCTS, INC., Goleta, Calif., offers a new design in a fluid sampler, for automatic sampling under difficult conditions. It is so designed that each sample segment is of exactly the same volume, regardless of the stream pressure, temperature or viscosity.

IONICS RESEARCH, INC., Houston, Texas, offers a flow programmer that shortens analysis time and improves resolution of complex mixtures. It may be used as a substitute for an adjunct to conventional programming devices.

INFOTRONICS CORP., Houston, Texas, is introducing a G-10 digital peak corrector and scaler for accurate correction or weighting of individual peak areas in chemical analysis.

WATERS ASSOCIATES, Framingham, Mass., announces the availability of the new Model R-4 Laboratory Liquid Chromatography Detector Assembly. This system includes a flowing reference Continuous Differential Refractometer with maximum sensitivity of 0.0000001 refractive index units.

APPLIED SCIENCE LABORATORIES, INC., State College, Pa., announces the availability of the SIL-PREP kit. The kit includes 20 ampoules, each containing 1 cc of a mixture of 3 parts hexamethyldisilazane, 1 part trimethylchlorosilane and 9 parts pyridine. The kit precludes the need to become involved in mixing these corrosive agents.

(Continued from page 385A)

LIPID PEROXIDATION IN NUTRITIONAL MUSCULAR DYSTROPHY. J. W. C. Bird and N. A. B. Szabo (Dept. Physiol. and Biochem., Rutgers Univ., New Brunswick, N. J.). *Proc. Soc. Exp. Biol. Med.* 117, 345–50 (1964). α-Tocopherol and ubiquinone concentrations, and lipid peroxidation were investigated in gastrocnemius, masseter, heart and liver tissues of the guinea pig during the initial stages of nutritional muscular dystrophy. The tissues of animals fed a vitamin E deficient diet for 15 or 21 days contained significantly less α-tocopherol and ubiquinone than normal tissues. Heart and liver tissues from animals on the vitamin E deficient diet for 15 days showed greater than normal lipid peroxidizability. Gastrocnemius and masseter muscles did not show a significant increase in lipid peroxidizability until after 21 days on the diet. Supplementation of the deficient diets with dl-α-tocopherol reduced lipid peroxidizability to normal levels. Addition of dl-α-tocopherol acetate to incubating homogenates from tissues of animals on each of the dietary regimens reduced lipid peroxidation only in tissues from animals on the vitamin E deficient diet.

METABOLISM OF ETHYL ARACHIDONATE-1-C^{14} IN RATS FED COMPLETE OR FAT-FREE DIETS. J. G. Coniglio, J. T. Davis, and Sara Aylward (Dept. of Biochem., Vanderbilt Univ. School of Med., Nashville, Tenn.). *J. Nutr.* 84, 265–71 (1964). Rats fed complete or fat-free diets absorbed 69 to 77% of a tracer dose of orally administered ethyl arachidonate-1-C^{14} in 6 hours. The arachidonate-1-C^{14} was 95% pure by gas-liquid radiochromatography and was used without further purification. Of the activity absorbed the amount expired as $C^{14}O_2$ was 7% by the animals fed the fat-free diet and 10% by those fed the complete diet and by rats fed the fat-free diet but given acute supplementations of arachidonic acid. A small amount of C^{14}-activity was observed in liver, heart, and testes; the bulk of the radioactivity was in the carcass. About 25% of the administered dose was in carcass water-soluble compounds, extractable with ethyl ether. Livers of fat-deficient rats and those fed the supplement had lower C^{14} content and concentration than controls, but in heart and gonads the concentration of C^{14} was similar in the 3 groups. The major portion of the radioactivity in liver was observed in microsomes and in mitochondria and as phospholipid. Most of the radioactivity was associated with a material which had a retention time (gas-liquid chromatography) similar to that of arachidonic acid. However, in heart and gonads of fat-deficient animals, a decreased proportion of activity was in arachidonic acid and increased amounts in shorter chain acids.

KIDNEY BEANS (PHASEOLUS VULGARIS) AND THE EFFECTIVENESS OF VITAMIN E FOR PREVENTION OF NUTRITIONAL MUSCULAR DYSTROPHY IN THE CHICK. H. F. Hintz and D. E. Hogue (Dept. of Animal Husbandry, N. Y. State College of Agriculture, Cornell Univ., Ithaca, N. Y.). *J. Nutr.* 84, 283–87 (1964). Groups of one-day old chicks fed a vitamin E-free diet contracted nutritional muscular dystrophy (NMD) at the rate of 95 to 100%. The addition of 20 to 25 IU of vitamin E/kg of diet decreased the incidence to 5 or 6%. Adding raw kidney beans in addition to the vitamin E increased the incidence of NMD to 45 to 100%, indicating the beans contain an antivitamin E factor. Extracting and autoclaving the beans indicated 2 antagonists to vitamin E; one, alcohol-soluble and heat stable and the second, not alcohol-soluble and heat labile.

A NEW INHIBITOR OF IN VITRO CHOLESTEROL BIOSYNTHESIS. J. F. Douglas (Wallace Laboratories, Div. of Carter Products, Inc., Cranbury, N. J.). *Proc. Soc. Exp. Biol. Med.* 117, 190–92 (1964). Benzyl N-benzyl carbethoxy-hydroxamate (W-398) was found to inhibit *in vitro* cholesterol biosynthesis. Evidence has been obtained to indicate that the stage of inhibition is prior to the formation of mevalonic acid.

THE CHEMISTRY OF 9-HYDROXY-α-TOCOPHERONE, A QUINONE HEMIACETAL. W. Durekheimer and L. A. Cohen (Nat. Inst. of Arthritis and Metabolic Diseases, Nat. Insts. of Health, Bethesda 14, Md). *J. Am. Chem. Soc.* 86, 4388–93 (1964). Oxidation of α-tocopherol with N-bromosuccinimide or with tetrachloro-o-quinone in aqueous acetonitrile leads to the formation of 9-hydroxy-α-tocopherone, the cyclic hemiacetal tautomer of tocopherylquinone. At pH 5.5, the dienone has a half-life time of 44 min.; in petroleum ether, the half-life time is extended to 3–4 hr. The compound is converted into the quinone by acid or alkali and is readily reduced to tocopherol, by a variety of agents. The oxidation-reduction potential of a tocopherol, measured for the first time under reversible conditions, was found to be +720 mv. Oxidation of α-tocopherol in the presence of acetate ion leads to an analogous, highly labile acetoxydienone. The energetcis of chromanols and quinones in oxidative phosphorylation are discussed in light of the new data.

STUDIES OF THE METABOLISM OF POLYUNSATURATED ACIDS BY SHORT-TERM EXPERIMENTS. J. J. Rahm and R. T. Holman (The Hormel Inst., Univ. of Minn., Austin, Minn.). *J. Nutr.* 84, 149–54 (1964). Short-term feeding experiments were examined as a method for studying the metabolism of fatty acids. Rats which had been maintained with fat-free diets for 60 days were administered supplements of individual polyunsaturated fatty acids at levels ranging from 50 to 1000 mg/day. Characteristic changes in the fatty acid composition of the liver lipids, which were investigated previously after feeding 40 mg of polyunsaturated fatty acids daily for 60 days to weanling rats, were observed when as little as 50 mg of the same acids were fed for 5 days to adult EFA-deficient rats. An optimal dietary amount of either linoleic acid or linolenic acid, judged by maximal response in the metabolites of these in the liver, was 200 to 400 mg/day/animal. High dietary levels of either linoleic acid or linolenic acid resulted in an apparent decrease in the levels of the metabolites of these in the liver lipids. Norlinoleic acid (17:ω6) was converted to 19:2ω6 in the tissues but was not dehydrogenated. Dietary linolenic acid was shown to exert an inhibitory effect upon the conversion of arachidonic acid (20:4ω6) to 22:5ω6.

EFFECT OF DIETARY α-TOCOPHEROL ON PROTEIN METABOLISM IN VITAMIN A-DEFICIENT RATS. O. A. Roels, A. Guha, M. Trout, U. Vakil and K. Joseph (Columbia Univ., Inst. of Nutr. Sciences, N. Y., N. Y.). *J. Nutr.* 84, 161–66 (1964). Rats maintained on a vitamin A-deficient diet were fed at 2 levels of α-tocopherol. Control animals were pair-fed. Higher dietary α-tocopherol caused an increase in the liver stores of vitamin A in the control animals. Vitamin A deficiency increased liver concentration of α-tocopherol and lowered serum albumin but increased globulins. *In vitro* incorporation of C^{14}-amino acids into diaphragm protein was significantly higher in the tissue of vitamin A-deficient rats fed at the lower α-tocopherol intake than in pair-fed controls. In contrast, the incorporation of C^{14}-amino acids into protein from diaphragm of vitamin A-deficient rats receiving the higher α-tocopherol intake was significantly lower than that of pair-fed controls. These changes in protein metabolism may be explained through the effect of vitamin A and E on membrane properties.

EFFECTS OF HIGH LEVELS OF DIETARY VITAMIN A ACETATE ON TISSUE TOCOPHEROL AND SOME RELATED ANALYTICAL OBSERVATIONS. W. J. Pudelkiewicz, Lorna Webster and L. D. Matterson (Poultry Science Dept., Storrs Agricultural Expt. Station, Univ. of Conn., Storrs, Conn.). *J. Nutr.* 84, 113–7 (1964). The total tocopherol content of liver tissue and plasma was determined after 2-week-old vitamin A-depleted chicks had received 0.5, 5, 50, 500, and 5,000 mg of vitamin A acetate/kg of diet for 5, 10, and 20 days. The tocopherol content in the tissues was markedly depressed especially at the highest levels of vitamin A intake. The depletion of tocopherol from the tissues at the highest levels of vitamin A intake was similar to that previously encountered by feeding a vitamin E-low basal diet. Decreasing liver tocopherol values with time at a dietary level of 17.6 mg of dl, α-tocopheryl acetate/kg may be indicative of a gradually increasing tocopherol requirement of the rapidly growing chick. Florex chromatography was unsatisfactory in removing the large amounts of vitamin A in the liver. Hydrogenation of the vitamin A followed by chromatography through Florex proved to be satisfactory.

NUTRITION OF SALMONOID FISHES XIII. THE α-TOCOPHEROL REQUIREMENT OF CHINOOK SALMON. A. N. Woodall, L. M. Ashley, John E. Halver, H. S. Olcott and J. Van Der Veen (Bur. of Sport Fisheries and Wildlife, Western Fish Nutr. Lab., Cook, Washington). *J. Nutr.* 84, 125–35 (1964). Tocopherol-deficient diets containing 1 or 5% of stripped herring oil were supplemented with zero, 10, 20, 40 and 80 mg of α-tocopherol/100 g of dry diet and were fed to duplicate lots of chinook salmon *(Oncorhynchus tshawytscha)* fingerlings for 24 weeks. Separate lots of fish were fed diets containing 1% of trilinolein and supplemented with 10, 20, 40 and 80 mg of tocopherol/100 g of dry diet. In a second feeding trial the diet containing 5% of herring oil was supplemented with 2.5, 5.0, 10, 20 and 40 mg of tocopherol/100 g of dry diet and was fed to duplicate lots of fish. The deficiency syndrome included: poor growth; exophthalmia; ascites; ethrocyte fragility; anemia; clubbed gills; epicarditis and ceroid deposition in the spleen. The symptoms were more severe in the fish fed the unsupplemented diet containing 5% of herring oil than they were in the fish fed the 1% herring oil diet and were not observed in fish fed diets supplemented with tocopherol. Under the experimental conditions used, a requirement of less than 3 mg of α-tocopherol/100 g dry diet was indicated. The herring oil used in diet preparation contributed 0.5 mg of tocopherol/100 g of dry diet (0.1 mg/g oil).

THE EFFECT OF β-SITOSTEROL ON THE METABOLISM OF CHOLESTEROL AND LIPIDS IN RATS ON A DIET LOW IN FAT. *Biochem. J.* 92, 385–90 (1964). Intraperitoneal injection of β-sitosterol into rats fed on a low-fat, cholesterol-free diet led to (a) decreased concentrations of cholesterol and lipid in the tissues, (b) increased incorporation of labeled carbon into cholesterol, fatty acids and expired carbon dioxide and (c) decreased fecal excretion of sterols. There were no major changes in fatty acid composition of the lipids.

SEQUENTIAL CHANGES IN LIVER AND HEART LIPIDS AFTER GIVING LINOLEATE OR LINOLEATE PLUS PYRIDOXINE TO RATS DEPLETED OF FAT AND PYRIDOXINE. Genevieve E. Scheier and Mary A. Williams (Univ. of California, Berkeley). *Biochem. J.* 92, 422–9 (1964). Analyses were made of liver and heart lipids of male weanling rats, depleted of pyridoxine and fat and given supplements of methyl linoleate with or without 30 μg of pyridoxine daily for 1, 2, 4 and 6 days. In the liver, linoleate plus pyridoxine produced a higher concentration of liver cholesterol esters, phospholipids and phospholipid arachidonate, and a lower concentration of phospholipid linoleate, than treatment with linoleate alone. Treatment with linoleate significantly increased phospholipids and phospholipid arachidonate in comparison with initial values. In the heart, linoleate plus pyridoxine produced higher concentrations of phospholipids, phospholipid arachidonate and cholesterol. Linoleate alone caused a significant decrease in phospholipid arachidonate and increased phospholipid linoleate. Rats given linoleate plus 10 μg pyridoxine daily gained as much weight as those given linoleate plus 30 μg pyridoxine, but differed considerably in the composition of their liver and heart lipids.

PLASMA FATTY ACIDS OF NEWBORN AND NEONATAL RUMINANTS. W. M. F. Leat (A.R.C. Institute of Animal Physiology, Babraham, Cambridge). *Biochem. J.* 93, 22 P (1964). Analysis of the plasma fatty acids of the neonatal suckling lamb at various times after birth showed that dramatic changes occurred the first 48 hr., when the composition began to approach that of the maternal plasma lipids. Linoleic acid rose from 0.7% to 13.7% and linolenic from 0.2% to 3.5% with concomitant decreases in oleic and palmitoleic acids. These changes were almost entirely confined to the cholesterol ester and phospholipid fractions. The author suggests that a further function of sheep colostrum is to provide the newborn lamb with linoleic acid which is known to be essential for growth and well-being in some animals.

THE FREE AND ESTERIFIED STEROL PRESENT IN BOVINE ADRENAL CORTEX AND MEDULLA. D. I. Cargill and R. P. Cook (Univ. of St. Andrews, Dundee). *Biochem. J.* 93, 504–12 (1964). Diethyl ether-ethanol extracts of bovine adrenal cortex and medulla were made and fractionated on Florisil to give free and esterified sterol fractions. The cortex contained (mg/100 g fresh wt.): cholesterol, 286, of which 15.4% was esterified; cholestanol, 0.230; methostenol, 0.460, of which 55% was esterified; and trace amounts of lanosterol, 7α- and 7β-hydroxycholesterol, a "stenediol," and a "keto sterol." The medulla contained: cholesterol, 415, of which 6.5% was esterified; cholestanol, 0.231; lanosterol, 0.392; and trace quantities of other sterol companions. The major fatty acids of the cholesterol ester of the cortex were (as % of the total): linoleic, 21.7; oleic, 21.1; palmitic, 20. The same major acids appear in the medulla, their respective percentage weights being 28.2, 14.8, and 19.

LIPIDS OF THE ACETONE-INSOLUBLE FRACTION FROM RED-CLOVER (TRIFOLIUM PRATENSE) LEAVES. R. O. Weenink (Dept. of Scientific and Industrial Research, Wellington). *Biochem. J.* 93, 606–11 (1964). An improved fractionation procedure utilizing diethylaminoethylcellulose column chromatography was used to separate the constituents of the acetone-insoluble fraction from red-clover leaves. The approximate composition of the fractions was (by wt.): waxes, 23%; galactolipids, 25%; phospholipids, 52%. The phospholipid composition (molar proportions) was: phosphatidylcholine, 37%; phosphatidylglycerol, 23%; phosphatidylethanolamine, 15%; phosphatidylinositol, 2%; uncharacterized acidic compounds, 13%; other unknown compounds, 10%. With the exception of phosphatidylglycerol, the fatty acid compositions of the phospholipids fractions were similar with palmitic and linoleic acids together accounting for 70–80% of the total fatty acids present. Phosphatidylglycerol contained only 9% linoleic but 31% of an unknown acid, probably a C_{18} unsaturated fatty acid, which occurred in only minor amounts in the other lipids. The galactolipids were more unsaturated than the phospholipids, linolenic acid being the principal fatty acid constituent.

• Drying Oils and Paints

THE WETTING EFFECT OF SICCATIVES ON WHITE PIGMENTS AS DETERMINED WITH THE AID OF THE WETTING VOLUME. F. Kindervater (Boyer and Co., Leverkusen, Ger.). *Farbe Lack* **71**, 34 (1965). With the aid of the wetting volume, the wetting effect of siccatives on white pigments was determined both with and without the presence of linseed oil or alkyd resins. The results showed that siccatives have a wetting effect like linseed oil or alkyd resins but that this effect is only very slightly increased when these substances and siccatives are present at the same time.

VARIATIONS ON URETHANE OILS. A. C. Jolly (Beck, Koller, and Co., Ltd., Beckacite House, Speke, Liverpool 19, England). *J. Oil Colour Chem. Assoc.* **47**(12), 919–942 (1964). Details for preparing and testing urethane oils are given. The effect of substituting "non-yellow" oils for linseed in the urethane oil synthesis is shown. A tobacco seed oil-based urethane was considered to be best in respect to drying and hardness. The use of fish oil is discussed and results obtained from synthesizing such types of urethane oils are presented. Chief advantages of urethane oils when compared with a linseed-based control are price, shorter tack-free times, and quicker hardening rate initially.

USE OF GAS-LIQUID CHROMATOGRAPHY IN THE FIELD OF DRYING OILS WITH OLEORESINOUS MEDIA. J. H. Greaves (Younghusband, Stephens and Co., Ltd., Barking, Essex, England). *J. Oil Colour Chem. Assoc.* **47**(7), 499–512 (1964). The limitations of using gas-liquid chromatography for qualitative work is noted and the methods for overcoming some of these limitations are discussed. The experimental procedure for obtaining chromatograms of methyl esters from processed oils and alkyds is described and the results discussed.

VERSATILITY OF CHROMATOGRAPHIC TECHNIQUES IN THEIR APPLICATION TO PAINT RESEARCH. S. M. Rybicka (Paint Res. Sta., Waldegrave Rd., Teddington, Middlesex. England). *J. Oil Colour Chem. Assoc.* **47**(7), 475–499 (1964). A comparison of chromatographic techniques and their application to problems in paint research is given. Details are given of the methods used at the Paint Research Station and the results obtained in analysis of solvent systems in lacquers, the characterization of commercial turpentines and dipentenes, solvent retention of lacquer films, the fatty acid composition of drying oils, the separation of minor constituents of linseed oil. the analysis of glycerolysis products, the examination of volatiles of natural oils, and the pyrolysis of polymers.

VARNISH HOLDING PROPERTIES OF VARIOUS TIMBERS. K. L. Jones. *Austral. Paint J.* **10**(5), 17–9 (1964). A report of a lecture. A long-oil alkyd and a tung/linseed phenolic varnish were applied to 16 timbers and their durability was studied. As a result of the tests the timbers are placed in order of merit. (Rev. Current Lit. Paint Allied Ind. No. 273).

NEW DEVELOPMENTS IN SURFACE COATINGS. F. Armitage. *J. Oil Col. Chem. Assoc.* **47**(4), 309–11 (1964). A summary of a lecture which covered emulsion paints, colour-measuring instruments, zinc-rich primer, water-based primers, strip coating of Al and powder coating. (Rev. Current Lit. Paint Allied Ind. No. 273).

BUTYL TITANATE AS A CATALYST FOR POLYMERISATION OF LINSEED OIL. J. M. Zafar, E. R. Saxena, D. S. Datar and S. Husain Zaheer. *Indian J. Tech.* **2**(4), 124–8 (1964). Viscosity data indicate that polymerisation of linseed oil at 250C takes place in two stages, the first being linear and the second three-dimensional. The presence of butyl titanate up to 0.2% concentration accelerates polymerisation. A higher proportion appears to cause dimerisation of conjugated double bonds with non-conjugated double bonds, thus reducing double bond functionality and further polymerisation. Ultraviolet and infrared spectra of the polymerised products show that, compared with conjugated *trans-trans* bonds, *cis-cis* conjugated double bonds polymerise slowly and are left over even after polymerisation. Butyl titanate, particularly at higher concentration, has an adverse effect on the colour of the oil, possibly due to an oxidising action. A polymerised oil of satisfactory colour and viscosity is obtained by heating linseed oil at 250C for 10 hr using 0.2% butyl titanate. (Rev. Current Lit. Paint Allied Ind. No. 274).

STUDY OF THE DRYING AND THERMAL POLYMERISATION OF OILS WITH A VIEW TO THE STUDY OF THEIR YELLOWING. A. Toussaint and A. April. *Papers presented at the VII F.A.T.I.P.E.C. Congress, Vichy*, 1964, 19–32 (in French). The drying of linseed oil and alkyd films has been studied through the modifications appearing in the infrared spectra in the course of time. The experiments were carried on in different atmospheres: air, pure dry oxygen, and argon. The examination of the spectra leads to the following conclusions. The presence of O_2 does not appear to be a necessary condition for the final production of a "dry" film; its main effect is, on the one hand, the formation of hydroperoxides at the expense of methylenic groups $-CH_2-$, and, on the other hand, the acceleration of the building up of conjugated ethylenic double bonds, as well as the *cis* → *trans* isomerisation. In the absence of humidity, the drying demands an initiation period, which seems to indicate that water plays an important role as accelerator of drying. As far as the alkyds are concerned, the main reactions leading to cross-linking seem to be of the Diels-Alder addition type as well as a special type of free-radical mechanism. The cross-linking of linseed oil could be explained by a vinyl polymerisation mechanism in the first stage and by mechanisms similar to those mentioned in the case of alkyds in the second stage. A very small proportion of C—O—C bonds has been observed in the dry film; in the presence of air and oxygen, the formation of numerous ketonic groups conjugated with ethylenic double bonds and carboxlic functions has been detected. Mechanisms of photosensitised reactions are suggested. Results concerning the modifications occurring in fatty acids submitted to thermal treatment (stand oils and alkyds) are briefly mentioned. (Rev. Current Lit. Paint Allied Ind. No. 274).

CO-OPERATIVE SURVEY OF EXTERIOR HOUSE PAINTS. S. Werthan. *Am. Paint J.* **48**(57), 53–76 (1964). A report of an extensive exposure program of solvent-based white and tinted paints containing ZnO at six sites in U.S.A. for up to 5 yr. is given. The pigment comprised either TiO_2:ZnO(1.25:2.6) or TiO_2:leaded ZnO(1.25:4.0) with whiting/Mg silicate extender in a range of alkyd and modified oil vehicles. There was little difference in behaviour of the leaded and lead-free ZnO systems and the majority of the paints performed well. In another series to study mildew resistance Ba metaborate was found to be less effective than ZnO and additions of Ba metaborate to a ZnO paint were less effective than a mercurial fungicide. Some deep-tone paints were also examined and incorporation of ZnO was slightly more effective than Cu_2O. (Rev. Current Lit. Paint Allied Ind. No. 274).

DETERMINATION OF THE CHALKING OF PAINT FILMS BY KEMPF'S METHOD. MODIFIED PROCEDURE. Anon. (Titangesellschaft). *Kronos Facts, Testing Methods*, **1964**, 5.3.1.—Chalking can be numerically assessed by the method of Kempf. This method is suitable for tinted and white paints, but not for emulsion paint films. Kempf's method employs the swollen gelatin film of a photographic paper which is applied under constant pressure by a plunger to the surface of the paint film. The loose pigment particles are then picked up by the film of gelatin and thus are made available for estimation. (Rev. Current Lit. Paint Allied Ind. No. 274).

• Detergents

THE GERMAN LAW ON DETERGENTS. H. J. Heinz (German Soapmakers Union, Düsseldorf, Germany). *Riv. Ital. Sostanze Grasse* **41**, 514–8 (1964). The recently enacted German law on detergent biodegradability is discussed.

STUDIES ON THE TOXICITY OF SOME SURFACTANTS TO FISHES. R. Marchetti (Univ. of Milan, Italy). *Riv. Ital. Sostanze Grasse* **41**, 533–42 (1964). The toxic concentration of 17 anionic, 2 cationic and 18 non-ionic surfactants has been determined in a 6-hr. exposure at 15C. The investigation was carried out on *Carassius Auratus* and *Salmo Iridens* fishes. The toxic concentrations found for the anionics ranged from 8.5 to 43.7 g/l. Linear alkyl aryl sulfonates were found to be about twice as lethal as the corresponding branched compounds. No difference was found between dodecylbenzene sulfonic acid and its sodium salt. Toxicity increases with increasing water hardness in the case of anionic surfactants. No correlation was found between toxicity and surface tension values.

THE ANALYSIS OF MIXTURES CONTAINING ALKYL ARYL SULFONATES NEUTRALIZED WITH SODA AND WITH TRIETHANOLAMINE. A. V. DeRosa and A. Arpino (Fats and Oils Exper. Stat., Milan, Italy). *Riv. Ital. Sostanze Grasse* **41**, 619–22 (1964). A thin layer chromatographic method for the analysis of sodium and triethanolamine alkyl aryl sulfonates, commonly used in liquid detergent formulations, is described.

THE BEHAVIOR OF BIOLOGICALLY HARD AND SOFT DETERGENTS IN WATER PURIFICATION INSTALLATIONS. H. Spohn (Sunlicht

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G.m.b.H., Hamburg, Germany). *Tenside* 1, 18-26 (1964). Studies on detergent biodegradability were conducted in several water purification plants in Germany. Degradation of soft detergents reached at least 80% and often higher. Practical biodegradability results are greatly influenced by the actual mode of operation of the purification plant and significant data can only be obtained by extending the observations over a long period of time. Comparative results of previous studies by other workers are quoted.

SURFACE ACTIVITY ON SOLID SURFACES. O. Driedger and A. W. Neumann (Fraunhofer Inst. of Surf. Phys. and Chem., Marienthal-Pfalz, Germany). *Tenside* 1, 3–7 (1964). The measurement of the contact angle between liquids of higher surface tension and solids of lower surface tension makes it possible to determine the surface tension of the solid. In contact with liquids whose surface tension is lower than that of the solids, the solid surface tension becomes lower. The character of this surface tension lowering is studied in the case of single crystals and glass surfaces in the presence of various liquids.

THE SAFETY OF SYNTHETIC DETERGENTS. D. Wade (Procter & Gamble Co., Cincinnati, Ohio). *Riv. Ital. Sostanze Grasse* 41, 550–4 (1964). The physiological characteristics of modern synthetic detergents are reviewed.

NONYL PHENOL-ETHYLENE OXIDE CONDENSATES AS NONIONIC SURFACE ACTIVE AGENTS. R. V. Ainscow (Lankro Chem. Ltd.). *Mfg. Chemist* 36, 44 (1965). Chemical inertness, reproducibility of product, compatibility with other compounds, structural flexibility and low cost, coupled with a high degree of surface activity under a variety of conditions, underline current market acceptance of the nonyl phenol-ethylene oxide condensates as a most versatile group of surface active compounds.

A SIMPLE U.V. ABSORPTIMETER FOR THE ESTIMATION OF CERTAIN NONIONIC EMULSIFIERS AND OTHER AROMATIC COMPOUNDS. D. E. Herring (E. R. Howard Ltd., Suffolk, G. B.). *J. Soc. Cosmetic Chemists* 16, 79 (1965). The construction and circuitary of an inexpensive U.V. absorptimeter are described. It is shown that this simple instrument is useful for the estimation and detection of emulsifiers and other compounds showing U.V. absorption.

SUCROSE ETHERS. V. R. Gaertner (Monsanto Co.). *U.S. 3,170,915.* Described are compounds of the formula R—CH_2—sucrose in which R is selected from the group consisting of alkyl radicals, alkenyl radicals having the olefinic double bond beyond the α-position relative to the ether oxygen atom, and alkyloxy radicals having from 8 to 24 carbon atoms, and alkaryl radicals having a total of 14–24 carbon atoms and from 8–18 carbons in at least 1 alkyl radical attached to the aryl ring, and the sucrose is linked to the methylene group through the oxygen atoms of one of the hydroxyl groups of the sucrose.

BIODEGRADABILITY OF AMPHOTERIC DETERGENTS. I. A. Eldib (Eldib Engineering and Research, Inc.). *Soap Chem. Specialties* 41(5), 77–80, 161, 163–5 (1965). This paper is a report on the biodegradability of amphoteric surfactants of the N-alkyl β-aminopropionate type known as "Deriphats" and manufactured by General Mills, Inc. Chemistry of amphoterics, the test procedure, and analytical techniques are described. The amphoterics studied are at least 88% biodegradable at all times under conditions simulating municipal sewage treatment. Under the same conditions, the branched chain alkylbenzene sulfonates (TPABS) are no more than 60% biodegradable.

BUILT LIQUID DETERGENT. B. H. Gedge (Procter & Gamble Co.). *U.S. 3,169,930.* A process for preparing a substantially non-aqueous built liquid detergent comprises the following steps: (a) admixing a liquid nonionic detergent surface active agent constituted of a water solubilizing polyoxyethylene group in chemical combination with an organic hydrophobic compound selected from a group consisting of polyoxypropylene, alkyl phenol and dialkyl phenol in which the alkyl group contains from 6–12 carbons, the reaction product of an excess of propylene oxide and ethylene diamine, and aliphatic alcohols having from 8–18 carbons, the nonionic detergent having a molecular weight of about 300–11,000, with a colloidal suspension of dehydrated polyphosphate salts (sodium pyrophosphate or tripolyphosphate) in a dehydrating vehicle selected from a group consisting of glycols of 2-4 carbons, glycerol, 1-octanol, monoethanol amine, or mixtures thereof, the nonionic detergent agent being added in an amount in excess of about 0.50 times the amount of the colloidal polyphosphate; and (2) from this resulting mixture distilling off the dehydrating vehicle thereby leaving the dehydrated polyphosphate salts in colloidal suspension in the nonionic agent.

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Newly Formed Cryobiology Group Announces August Meeting

Of considerable interest to some members of AOCS is the Society of Cryobiology, established in late 1963 by a group of persons concerned with the lack of adequate communication among investigators in the various phases of low temperature biology.

The activities of the society consist of annual meetings and publication of a journal. The first annual meeting was held August, 1964, in Washington, D. C., and several hundred persons were in attendance. Disciplines represented included botany, bacteriology, food science, engineering, biophysics, surgery, physiology and several others. The meeting consisted of five symposia, a considerable number of original research papers, and a display in industrial equipment. The topics covered ranged from the freezing of blood, to food, to freezing treatments for ulcers and Parkinson's disease. The next meeting will be held August 2-4, 1965 at the Park Motor Inn, in Madison, Wisconsin.

The current president of the society is Dr. B. J. Luyet, Director of the American Foundation for Biological Research, Madison, Wisconsin. Inquiries concerning subscriptions should be directed to: Cryobiology, 4200 Heathfield Road, Rockville, Maryland 20853. Inquiries concerning membership should be directed to: Owen Fennema, Babcock Hall, University of Wisconsin, Madison, Wisconsin.

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DIRECT MOLECULAR ASSOCIATIONS BETWEEN DETERGENT AND HYDROPHILIC SOLUTE IN NON-AQUEOUS SOLVENT. M. Loncin, R. Tutundjian and D. Jacqmain (CERIA, Brusseles, Belg.). *Rev. Franc. Corps Gras* 12, 23–27 (1965). It has been shown that in a perchlorethylene-surfactant-water system, the dissolution of hydrophilic materials does not always occur through the medium of the micellar water. Direct molecular association between the surfactant and the hydrophilic material often play the principal role.

DETERGENT COMPOSITIONS AND PREPARATION THEREOF. B. B. Dugan (Colgate-Palmolive Co.). *U.S. 3,177,147.* Described is a process for the preparation of a bleached particulate detergent composition having an apparent density of less than 0.45 g/cc. From 2–65% by weight of a water-soluble foaming synthetic organic detergent selected from the group consisting of anionic and nonionic synthetic organic detergents, 10–75% of an alkaline hydratable inorganic sodium phosphate salt which forms a stable hydrate at room temperature, 2–10% of a hydrotrope such as sodium toluene or xylene sulfonate, 15–40% of water, and 0.25–1% of H_2O_2 are mixed to form a paste capable of retaining small oxygen bubbles without substantial coalescence at a temperature of 35–60C. Mixing of the paste is stopped prior to any substantial loss of oxygen generated subsequent to the addition of the H_2O_2 to the mixture. Oxygen is liberated from the H_2O_2 into the paste in an amount sufficient to bleach and to expand the paste to a final volume at least 2.5 times the initial volume by the generation of small oxygen bubbles in dispersed form. The expanded paste is set under quiescent conditions to a friable mass, and the mass is granulated to form particles of a bleached detergent composition containing from 15–35% moisture.

LAUNDERING COMPOSITION. D. C. Wood and R. C. Davis (Whirlpool Corp.). *U.S. 3,177,149.* A laundering composition particularly adapted for laundering woolens consists essentially of: from 5–20 parts of a cleansing detergent reaction product of between 2–20 mols of a member of the class consisting of ethylene and propylene oxide per mol of a mixture of ethylhexyl, tridecyl and isohexadecyl alcohols; from 2–30 parts of an amine member of the class consisting of monoethanol-, diethanol-, triethanol-, N-methyl ethanol-, N,N-diethyl ethanol-, dimethyl ethanol-, N-butyl ethanol-, N,N-dibutyl ethanol-, N,N-diisopropyl ethanol-, N-aminoethyl ethanol-, and N-ethyl diethanolamine; benzyl dimethyl-, dimethyl-, phenyl ethanol-, monopropanol-, diisopropanol-, mixed isopropanol-, and dibutyl isopropanolamine; morpholine, N-methyl-, N-(2-hydroxyethyl)-, 2,6-dimethyl-, and N-ethyl-morpholine; and from 0.7–20 parts of a wool lubricant.

LIQUID DETERGENT COMPOSITIONS. L. H. Smithson, Jr. and O. K. Moore (California Research Corp.). *U.S. 3,175,977.* Described is a liquid detergent concentrate adapted upon dilution with water to give an aqueous liquid detergent solution having a low cloud point. The concentrate consists essentially of, by weight, 25–50% of a mixture of sodium and ammonium sulfonates of alkylbenzenes having a molecular weight between 215 and 250, 2–30% urea, and the remainder water. The weight ratio of the sodium alkylbenzene sulfonate to the ammonium alkylbenzene sulfonate ranges from 60:40 to 90:10.

AQUEOUS SHAMPOO COMPOSITIONS. F. W. Olson, Jr. (Colgate-Palmolive Co.). *U.S. 3,179,595.* An aqueous liquid shampoo composition protected against freezing at temperatures above 25F consists of: an aqueous preparation of 25–85% water and 5–55% of a water soluble organic anionic detergent salt selected from the group consisting of higher fatty acid soaps containing 10–18 carbons, higher alkyl sulfate salts containing 10–18 carbons, and higher alkyl substituted benzene sulfonate salts in which the alkyl constituent contains 10–18 carbons. The antifreeze agent is a mixture of glycerine and sorbitol at a concentration of 5–20%. The glycerine and sorbitol are present in a ratio of 1:1 to 13:1 respectively. The viscosity of the composition is substantially the same as that exhibited by a similar composition in which the glycerine and sorbitol are replaced by an equal weight of water.

LIGHT DUTY LIQUID DETERGENT. L. H. Smithson, Jr. (California Research Corp.). *U.S. 3,175,978.* A detergent solution having a clear point below about 40F consists essentially of by weight, based on the solution, of the following ingredients in the indicated proportions, sufficient water being present to give 100%: (a) 15–20% of a mixture of sodium and ammonium sulfonates of alkyl benzenes having an average molecular weight between 250–300, the weight ratio of the sodium to ammonium alkyl benzene sulfonate ranging from 25:75 to 75:25; (b) 5–10% of the ammonium salt of the sulfate ester of alkyl phenoxy polyoxyethylene ethanol having 8 to 18 carbon atoms in the alkyl group and 4 to 20 oxyethylene groups; (c) 1.2 to 3% of inorganic sulfate selected from the group consisting of sodium and ammonium sulfate; (d) 0 to 3% of an alkylolamide foam-improving agent (lauric diethanolamide or lauric isopropanolamide); (e) 15–16% of low-molecular weight alcohol; (f) 2–4% of urea.

HYDRATION OF SODIUM TRIPOLYPHOSPHATE. C. Y. Shen (Monsanto Co.). *U.S. 3,174,934.* A process for the preparation of a detergent composition containing hydrated sodium tripolyphosphate comprises the following steps: slurrying sodium tripolyphosphate into an aqueous medium containing an amount of water equal to at least ½ of the weight of the sodium tripolyphosphate to give a pH of at least 11.5; maintaining the pH of the slurry between 11.5 and 12.5 until at least 50% of the sodium tripolyphosphate has been converted to the hexahydrate; and then reducing the pH of the resulting slurry to below about 10.5.

MILLED DETERGENT BAR. R. H. Okenfuss (Procter & Gamble Co.). *U.S. 3,178,370.* A homogeneous synthetic, mechanically worked, milled detergent consists of: (a) 12–30% by weight sodium alkyl benzene sulfonate in which the alkyl group contains from 9–15 carbons; (b) 10–25% sodium tripolyphosphate; (c) 25–55% sodium bicarbonate; (d) 2–15% trisodium orthophosphate; (e) 0–5% of an amide selected from ammonia amides, monoethanol amides, and diethanol amides of fatty acids having an acyl chain of from 8–18 carbon atoms; (f) 0–5% silicate solids with an $Na_2O:SiO_2$ ratio of from 1.0:0.90 to 1.0:3.25; and (g) 5–25% water. The total of (a), (b), (c) and (d) is from 85–92% by weight.

SOAP BAR FOR DRY SKIN. R. E. Farrar and A. L. Schulerud (Colgate-Palmolive Co.). *U.S. 3,179,596.* A milled and plodded toilet soap bar particularly suitable for cleansing dry skin and depositing oleaginous soap bar constituent on the skin comprises 70–80% soap substantially free of inorganic salts, unreacted fats and oils and glycerol. About 10–25% of the soap is of saturated fatty acids of 8–14 carbon atoms and 90–75% of 16–20 carbon atoms. It is derived from an oil charge of 10–25% coconut oil and 90–75% tallow, 4–7% petrolatum, 30–70% of the petrolatum of glycerol, 1–2.5% lanolin and 10–16% water.

DETERGENT COMPOSITION. N. R. Smith (Procter & Gamble Co.). *U.S. 3,179,598.* An unbuilt, high-sudsing, light-duty liquid detergent composition having a pH of from 6.5 to 9.0 and having special utility for washing under acidic conditions consists of: (1) 20–40% by weight of a sulfate detergent having the formula $R(C_2H_4O)_x—SO_4—Me$ in which R is a straight chain alkyl group having from 10–14 carbon atoms with at least 50% of the alkyl groups having 12 carbon atoms; x is a number from zero to 4; and Me is selected from the group consisting of monoethanolamine, diethanolamine, triethanolamine, ammonium, sodium, and potassium cations; (2) a trialkyl amine oxide having one straight chain alkyl group having from 10–14 carbons, with at least 50% of the alkyl groups having 12 carbons, and 2 short chain alkyl groups having 1–2 carbons, in an amount sufficient to give a weight ratio of sulfate detergent to amine oxide of from 3/1 to 7/1; (3) at least 5% but not more than 40% of the composition of a solubilizing agent selected from the group consisting of methyl, ethyl, n-propyl alcohols, and mixtures thereof, the agent being sufficient to provide a pourable homogeneous composition; and (4) the balance water.

DETERGENT COMPOSITION. S. L. Eaton and E. F. Gebbhardt (Procter & Gamble Co.). *U.S. 3,179,599.* The same composition as above except that it contains 2–10% of an alkyl glyceryl ether sulfonate having a straight chain alkyl group having 10–14 carbons with 50% having 12 carbons, the cation of the sulfonate being selected from the group consisting of monoethanolamine, diethanolamine, triethanolamine, ammonium, sodium, and potassium cations and mixtures thereof, the amount of the sulfonate being at least 20% of the amount of the amine oxide.

• *Referee Application*

SECOND NOTICE: Charles R. Norris of Barrow-Agee Laboratories, Inc.; P.O. Box 858, Shreveport, Louisiana, 71102 has applied for a Referee Certificate on Cottonseed, Oil Cake and Meal, Protein Concentrates, Cottonseed Oil and Soybean Oil. Interested parties wishing to comment on this certification should communicate with the Chairman of the Examination Board. Please write to R. T. Doughtie, Jr., Chairman of the Examination Board, P.O. Box 17469, Memphis, Tennessee 38117.