Confectionery Fats: Their Current Status and Potential Market

R. O. FEUGE,[1] Southern Regional Research Laboratory, New Orleans, Louisiana

Of the fat products used by the confectionery industry—cocoa butter, milk fat, emulsifiers, shortenings and other varieties—confectionery fats, which by definition consist of hard butters other than cocoa butter, have been a focus of interest. Although cocoa butter is, of course, the fat used in largest volume in manufacturing confections, confectionery fats, which are used in chocolate-type bar goods and confectionery coatings, offer the greatest potential for expanded use. The U.S. Dept. of Commerce reports that in 1962 the confectionery industry used approximately 41 million lb oils and fats, excluding cocoa butter; confectionery fats probably constituted most of this total. In another survey made in 1962, representatives of the industry estimated that 16 million lb cocoa butter-like fats were used in confectionery coatings alone.

The potential market for confectionery fats—in fact, even an estimate of the annual poundage—is implicit in a study of the present market for cocoa butter. In 1962, 639 million lb cocoa beans, which contain approx 50% fat, were imported. At present, however, cocoa butter is in a class by itself. Not only is it a highly desirable product, but competition from other hard butters is restricted by government regulations. For a confection to be labeled "chocolate," it must contain no fats other than cocoa butter and, depending on the type of chocolate, a small amt of milk fat. However, representatives of the confectionery industry believe that if a really good cocoa butter-like fat is developed, the regulations governing labeling will be changed. In the meantime, the market for chocolate-type products in which the use of cocoa butter-like fats is permitted can be expanded.

The potential poundage for confectionery fats can be estimated partially from disproportions inherent in the production of chocolate. After the roasted and cleaned cotyledons (nibs) of the cocoa bean are ground to make chocolate liquor, a portion of liquor is pressed to obtain cocoa butter and cocoa powder. The cocoa butter and the unpressed liquor are used almost entirely in the manufacture of chocolate. The cocoa powder (fat content, 10–26%), something of a byproduct, is marked at a price about one-third that of the butter. A coating chocolate contains ca. 32% cocoa butter, including the fat in the liquor, and 5–20% of the nonfat components of the cocoa bean. Molding chocolate contains a somewhat lower amt of cocoa butter, ca. 25%. Obivously, in the production of chocolate there is a built-in shortage of cocoa butter. One individual well versed in manufacturing practices has estimated, therefore, that the potential market in the U.S. for a good cocoa butter-like fat amounts to ca. 15% of the wt of the cocoa beans imported; i.e., approx 100 million lb fat/year.

An additional aspect of the situation should be mentioned. The pressing of chocolate liquor to obtain cocoa butter and cocoa powder is claimed to impair the chocolate flavor. The resulting cocoa powder makes confections and drinks which are considered inferior to those made with chocolate liquor. Availability of a good confectionery fat would obviate the need for pressing chocolate liquor.

Characteristics Desired of a Hard Butter. Because fat is the external phase which binds together the several ingredients of chocolate and chocolate-type confections, the physical properties of the fat are of the utmost importance and to a large extent determine the quality and acceptability of the confection. Foremost among the physical properties desired of a hard butter are a melting point a few degrees below the temp of the human body (37.0C), a short melting range and brittleness and snap at room temp (25.0C). Fats which possess these properties result in a hard, brittle candy which melts in the mouth with a pleasing, cooling sensation.

Gloss and resistance to deterioration of surface texture are other desired characteristics. Gloss translates into a structure consisting mostly of hard, minute crystals of fat. The retention of gloss on storage and aging requires that unwanted polymorphic transformations in the fat do not occur. During processing, the fat must be readily convertible to relatively stable polymorphs and preferentially to the thermodynamically stable polymorphs. Gloss retention also requires that the fat contain the least possible amt of liquid phase at the storage temp. The presence of liquid undoubtedly causes some of the minute fat crystals to dissolve and redeposit in larger crystals. Temp cycling enhances this recrystallization, and also promotes possible polymorphic changes. Fat bloom, which is the term used to describe unwanted changes in surface texture, is of immediate economic importance to the manufacturing confectioner. Occasionally, fat bloom has prevented the sale of large lots of candy.

Contraction sufficient for release from a mold after solidification is another important requirement of confectionery fats. Not only should the contraction be sufficient in degree, probably 1–2% in terms of linear contraction, but it also should occur promptly on solidification. The need

(Continued on page 26)

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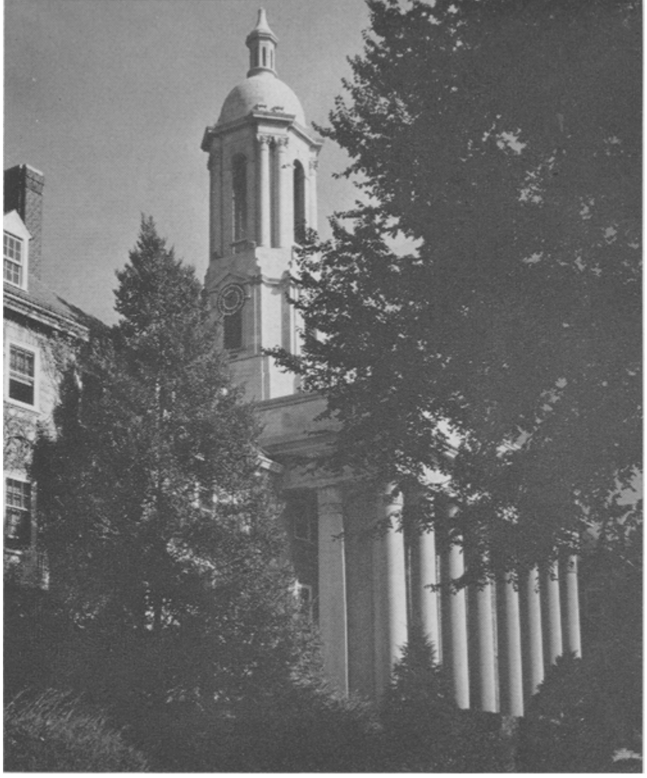
[1] A laboratory of the So. Utiliz. Res. and Dev. Div., ARS, USDA.

Plans Nearing Completion for Symposium on "QUANTITATIVE METHODOLOGY IN LIPID RESEARCH"

Pennsylvania State University

August 3-7, 1964



"Old Main" at Penn State

Will Supplant 1964 Annual Short Course

Progress in lipid chemistry and the application of new knowledge and techniques to the many problems in lipid research have been so great in the past few years that it is difficult for the relative newcomer in the lipid field to properly appreciate and evaluate the status of this field. One of the most effective means by which the vast amount of information available can be brought before the research community is in the form of a symposium, carefully organized to present the broad general scope of the advances in lipid chemistry and their applications. Careful reviews and evaluations are necessary and quantitative methodology is particularly important.

Sponsored by Education Committee

Through the efforts of the AOCS Education Committee, a Symposium on "Quantitative Methodology in Lipid Research" has been organized for August 3–7, 1964 at Pennsylvania State University. This educational endeavor will supplant the annual Short Course. Arrangements for the Symposium are under the direction of George Rouser, Chairman of the Organizing Committee; Noel Kuhrt, Chairman of the Education Committee; and Nicholas Pelick, Chairman for Local Arrangements. Chairman of the group sponsoring AOCS at Penn State is D. W. Shigley, Associate Professor of Biochemistry, College of Science. The Symposium will consist of a series of formal presentations with ample time for discussion. Applied Science Laboratories with their nearby facilities have arranged for those attending the Symposium to have access to their laboratories where many different types of apparatus utilized in lipid research will be available for examination and techniques can be discussed. Most of the Symposium contributions will emphasize new findings.

Will Feature Specific Problems and Techniques

The program will feature quantitative methodology as applied to specific problems in lipid research. This means of presenting new methodology in lipid chemistry has been chosen because discussion of methods without discussing applications to specific problems is of limited value. The means presently being utilized for the quantitative isolation of various lipid classes will be described in discussions of the methods suitable for fractionation of lipids from brain, nerve, erythrocytes, plasma, plants, and skin.

It is now apparent that the analysis of tissue lipids usually involves the composition of various biological membranes. A careful review of the lipid composition of subcellular particles, the myelin sheath, and the erythrocyte membrane will be presented and attempts to formulate quantitatively the structures of some of these biological membranes will be described.

After isolation of lipid classes, fatty acid composition is frequently studied in detail. Those engaged in such studies will appreciate the thorough discussions of the means for determining fatty acid composition. This will include methods for the quantitative isolation of fatty acids and proof of structure with emphasis on methods for normal saturated and unsaturated and hydroxy acids.

Recent advances in thin-layer chromatography, infrared spectroscopy, and gas-liquid chromatography have made

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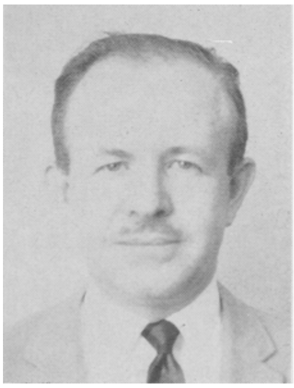
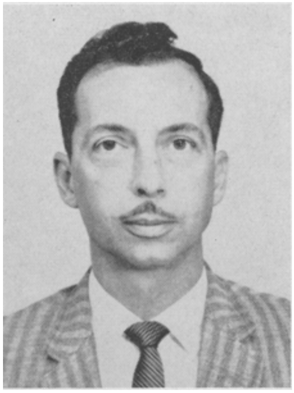
George Rouser

N. H. Kuhrt

Nicholas Pelick



J. W. Shigley



A. V. Graci
Chairman

S. C. Miksta
Co-Chairman

Next Stop Chicago!

38th Fall Meeting Committees Forge Ahead

The Pick-Congress Hotel in Chicago will be the site of the Fall Meeting of the American Oil Chemists' Society, Oct. 11–14, 1964. Early in February General Chairman Angelo Graci met with committee chairmen and hotel representatives to lay the ground work for a convention that will combine technical stimulation with just the right measure of entertainment. Early in May is not too soon for you to start planning for Chicago.

The Technical Program planned by R. A. Reiners is already taking on an international aspect with papers scheduled from several foreign countries. With 60% of the booths sold, there is every indication that the large gain in exhibits achieved last fall in Minneapolis will be equaled or exceeded in Chicago. Exhibits Chairman, D. P. Arndtsen, has placed the exhibits close to the areas used for meetings, social events and registration. Relaxation has not been forgotten. Mel Ott's entertainment program is set and the ladies can anticipate a special program tailored to their interests by Cecilia Gilmore.

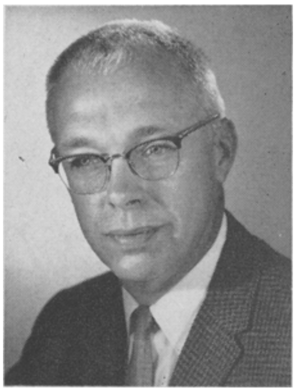
Deadline for Titles and Abstracts—July 15

The program committee under the able direction of R. A. Reiners, invites the submission of papers describing the technical activities of the membership. Manuscripts reporting on such subjects as chemical reactions, analytical and physical properties, soaps and detergents, processing and utilization, general and instrumental analysis, biochemistry and nutrition, coatings and polymers, and general properties of fats and oils will be welcomed. The receipt of title, author's name, speaker's name and a 100–300 word abstract well in advance of the July 15, 1964 deadline will be much appreciated. This information should be sent to: R. A. Reiners, Corn Products Co., Moffett Technical Center, Box 345, Argo, Illinois 60502.

Plan . . . Schedule . . . Arrange . . . Prepare for Chicago in the fall!

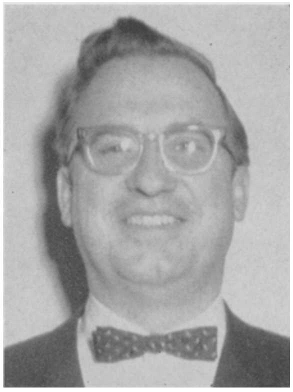
D. P. Arndtsen
Exhibits

R. J. Buswell
Publicity



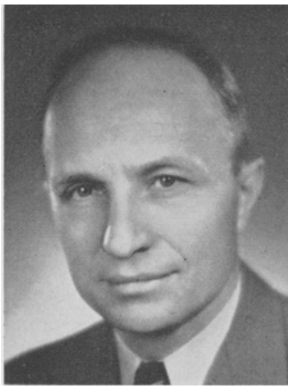
R. A. Reiners
Technical Program

J. C. Lamping, Jr.
Registration



M. L. Ott
Entertainment

Cecilia Gilmore
Ladies' Program



N. W. Ziels
Treasurer

A. A. Rodeghier
Advisor

A. F. Kapecki
Advisor

C. W. Hoerr
Advisor

Gladly the Cross Hedge I'd Bear

The speculator enters the market to risk money in hopes of profit. The hedger enters the market to avoid risking money. The speculator decision is an absolute one, i.e. no entry = no risk. The hedge decision is not absolute, since there is risk either in or out. The absolute decision has been taken when the cash trade that requires the hedge is made. With the possible exceptions of futures short sales by deliverable warehouses in delivery markets versus delivery qualities, or purchases of futures by cash market shorts who can apply any received grade on their short, all hedge positions entail some basis or spread risks. These arise because seldom will all elements of a cash market act precisely the same. The risks in difference for a short hedger or a long hedger increase roughly in proportion to a long list of factors. Among them are:

1. Geographic distance from deliverable location if the item always was across or has moved across the line that prevents back hauls into, or delivery on the futures market. Soybean oil in Ohio is not deliverable but soybean oil in Indiana is deliverable. This raises the possibility of oil in Ohio weakening independently of the board. This is much less likely for Indiana oil. But in general, geography holds, i.e. oil in Rotterdam could be under some conditions vastly weaker than futures, by a much larger amount than Ohio oil.
2. Differences in quality or condition of manufacture. Sample grade beans change more versus #2 yellow than do #3 yellow; crude soybean oil changes less versus refined soybean oil than does crude soybean oil against bulk white margarine.
3. Degree of substitutability in principal applications. Feed barley will change less against corn than will feed barley versus malting barley.
4. Time from harvest or peak production of either or both, if harvests or peak production periods are different. Spring wheat changes less against winter wheat in January than it does in June or September. Corn oil changes less against cottonseed oil in March than in October.
5. Disparities against normal or historical spread or basis relationships.

What we are really saying is that basis and spread risks in a given hedge situation increase roughly in proportion to the elements or cross hedges or out-of-position hedges that are present. Out-of-position generally refers to geography and maybe also quality. A cross hedge is a position in the futures of one item, intended to offset a cash position in an entirely different item, i.e. short soybean meal versus an inventory of cottonseed meal. Both out-of-position and cross hedges are unavoidable because it is impossible to have a separate futures market for every commodity item in every location. The risks in out-of-position and cross hedges are accepted because the risk in not hedging is frequently much greater than the risk in hedging. Firms whose business is such as to inherently require risk-taking, must make a constant succession of decisions as to which risks they will keep and which risks they will try to offset. To some it would seem that the decision is rather which risks to take and which ones to avoid completely. However, it is not that simple. When a general wave of cattle feed bookings is taking place, a feed mixer must participate, i.e. go short the feed, even if he is very bullish on ingredients and a short position makes him very nervous. In most areas of the country, cottonseed moves in one rush; when it is gone there is no more. For every ton the seed processor turns down because he is bearish on seed and/or products, he has irrevocably forfeited running time. A flour miller may be very bearish on millfeeds but they can not be sold ahead in any volume. So for every bushel of wheat he has in the house he is indisputably long nearly 20 lb of millfeeds. Obviously all of these people and many others have a marketing problem. For many, their attempt at a solution has involved a form of statistical and financial Russian Roulette. In this game you keep your unhedged position precisely and exactly the same. The theory is the pain when you are shot (when the market goes against you) will be precisely and exactly offset by the feeling of relief when you are not shot (when the market goes with you). Others just dither along, arranging their accounting system so as to produce as little information as possible as to raw material costs, positions, risks, profits and losses on the theory that what the board of directors doesn't know won't hurt them or you. Another alternative is to try to accumulate as much market information and history as possible. This can at least set the stage for intelligent cross hedging when the situation calls for it, or total risk acceptance when cross hedging is inappropriate. The key then is to try to determine when the former situation prevails, and when the latter. Market analysis, spread analysis, relationship analysis are the approaches used; the tools are imagination, time, historical prices and as much current market information as is available, plus a slide rule or alternatively a wife who is good at numbers. Sometime useful relationships are uncovered, sometimes not. Here are a couple of common hedge problems. Corn gluten feed and

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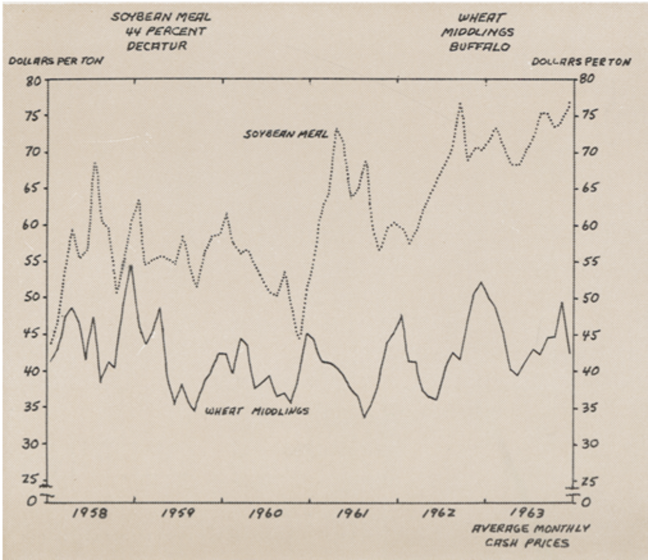

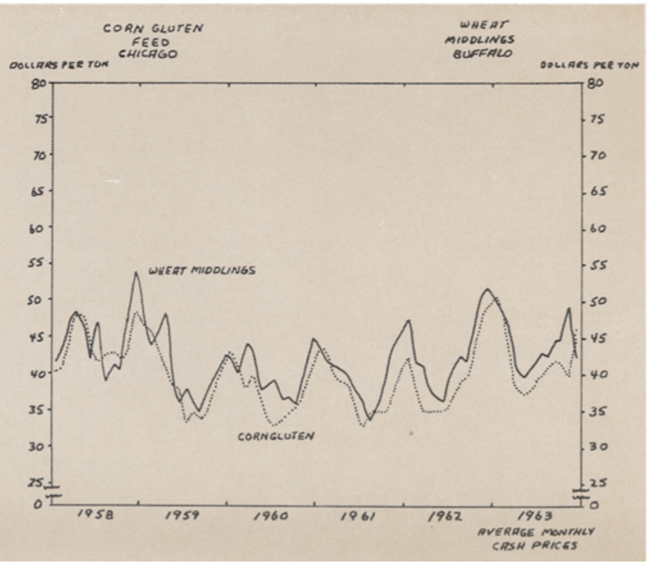

• *Local Section News*

North Central Section

C. W. Hoerr

C. W. Hoerr, AOCS Secretary, spoke to the North Central Section, Mar. 4, at the Builders' Club, Chicago, on the subject, "Quo Vadis." He graciously substituted for Executive Secretary C. H. Hauber, who was ill.

Mr. Hoerr painted a tremendous inside picture of the Society, discussing problem areas in detail: especially budget and the Journal. He also clearly pictured the functions and aims of the National Program and Planning Committee, and touched upon the subject of the Journal of Lipid Research; showed how (through the Committee on International Relations) AOCS was making efforts to promote the Society overseas—making closer contacts with the oils and fats people in those areas.

Section Officers for 1964–65 were elected: Cecelia Gilmore, President; D. P. Arndtsen, Vice President; R. J. Evans, Secretary; Louise R. Morrow, Treasurer; H. M. Smith and R. J. Buswell, Members-at-Large.

Final meeting of the year (Ladies' Night) is scheduled for May 6 at the Furniture Club, 666 N. Lake Shore Dr., so plan to bring your wife. Harry Volkman, local NBC Weatherman, will be the featured speaker. Get-together at 6 p.m.; dinner served at 6:45 p.m. Plan to be present.

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Next Stop Chicago!

Deadline for Abstracts, Titles—July 15, 1964

Early in May is not too soon to start planning to make Chicago your next stop! The Technical Program is already taking on an international aspect for the 38th Fall Meeting at the Pick-Congress Hotel, Chicago, Ill., Oct. 11–14, 1964.

Sixty per cent of the Exhibit Space is already sold, and there is every indication that this important phase will equal or exceed that of Minneapolis.

Relaxation has not been forgotten. The entertainment program and the special events for ladies promise to be tailored to your interests.

Make your next stop Chicago!

Meetings

AOCS National Meetings

1964—New Orleans, Roosevelt Hotel, April 19–22
Chicago, Pick-Congress Hotel, October 11–14

Deadline for Abstracts, Titles—July 15, 1964

Deadline for submission of Abstracts and Titles of papers for presentation at the Chicago Meeting this Fall is July 15, 1964.

1965—Houston, Shamrock-Hilton Hotel, April 25–28
Cincinnati, Netherlands Hilton Hotel, October 11–13
1966—Los Angeles, Statler Hilton Hotel, April 24–27
Philadelphia, Bellevue-Stratford Hotel, October 4–6
1967—New Orleans, Roosevelt Hotel, May 7–10
Chicago
1968—Memphis
New York, Statler Hilton Hotel

AOCS Section Meetings

North Central—May 6, 1964, Furniture Club of America, 666 No. Lake Shore Drive, Chicago, Ill.

North East—June 2, 1964—Whyte's Restaurant, New York, N. Y.

Southwest—May 14, 1964, at the Rodger Young Auditorium, Los Angeles, Calif.

Other Organizations

April 16–18, 1964—2-Day Course on Evaluation and Interpretation of Physical and Chemical Testing Methods, Kankakee, Ill., co-sponsored by The American Society for Quality Control and the Joliet Section of the American Chemical Society.

April 26–30, 1964—49th Annual Meeting, American Association of Cereal Chemists, Royal York Hotel, Toronto, Can.

*May 20–23, 1964—Symposium on Modern Methods in the Analysis of Organic Compounds, Eindhoven, Holland. GHCd group of Analytical Chemists and the Section for Analytical Chemistry of the Royal Dutch Chemical Society.

*June 1–4, 1964—6th Annual Symposium on New Coatings and New Coating Raw Materials, North Dakota State University, Fargo, N. D.

June 10–12, 1964—42nd Congress of the International Association of Seed Crushers, Weisbaden, Germany.

*June 15–19, 1964—Gordon Research Conference on Lipid Metabolism, Kimball Union Academy, Meriden, N. H.

June 21–26, 1964—American Society for Testing and Materials Annual Meeting, Conrad Hilton Hotel, Chicago, Ill. (Materials Testing Exhibit)

Sept. 7–12, 1964—IV International Congress of Surface Activity, Brussels, Belgium.

Oct. 12–18, 1964—First World Fat Congress, Hamburg, Germany.

*Oct. 29–30, 1964—28th series of lectures on Coating Materials and Pigments, Berlin, Germany. Royal Dutch Chemical Society.

*Nov. 1964—1st International Congress of Agricultural and Food Industries in Tropical and Sub-Tropical Regions, Abidjan, Ivory Coast, Africa.

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* Addition to previous calendar.

Symposium Plans . . .

(Continued from page 6)

it desirable to discuss these techniques thoroughly.

Progress in the chemical synthesis of lipids has progressed to the point where many useful and important substances can be prepared for very precise quantitative studies and the chemical synthesis of phospholipids and sphingolipids will be considered in detail. Whereas the lipid classes isolated from biological sources are almost invariably mixtures of many molecular species, the synthetic lipid chemist is now able to prepare individual molecular species containing a variety of saturated and/or unsaturated fatty acids. These methods will increasingly serve as the basis for the precise quantitative work of all types and particularly those areas where high purity and a precisely known structure are required, such as the film properties of lipids and quantitative chromatographic and infrared methods. Methods presently available will be reviewed and evaluated, and new approaches will be described.

Studies of special functions of lipids require special techniques and are becoming increasing important. The problems encountered and the special methods that may be utilized in studies of special functions of lipids will be emphasized in discussions of the role of lipids in blood coagulation, the pharmacologically active acidic lipids (particularly the prostaglandins that affect the contraction of smooth muscle), and the insect attractant lipids. These special functions have many important basic biological and practical implications. The difficulties involved in studying substances that are active in extremely small amounts and have unusual chemical structures will be apparent from these contributions.

Newest Literature To Be Reviewed

A great deal of new information will be presented. The Symposium will feature careful reviews of the literature with evaluations of the best techniques available and ample time for discussion has been planned. Persons interested in lipid research are invited to attend the Symposium and urged to communicate their intentions at the earliest possible time in order that the most appropriate facilities can be arranged. The Journal will keep you abreast of developments.

Make your desires known to George Rouser, City of Hope Medical Center, Department of Biochemistry, 1500 E. Duarte Rd., Duarte, Calif.

A list of speakers and titles of their presentations follows:

AOCS Symposium Presentations

"QUANTITATIVE METHODOLOGY IN LIPID RESEARCH"

Pennsylvania State University
University Park, Pa.
August 3-7, 1964

C. F. Allen—"X-Ray Fluorescent Analysis of Lipids"; "Plant Lipids"

Erich Baer—"Synthesis of Glycerol Phospholipids"

Sune Bergström—"Chemical and Biological Properties of the Prostaglandins"

James Berry—"Lipids of Intact Nerve and During Wallerian Degeneration"

K. K. Carroll—"Diet and Fatty Acid Composition of Lipids"

D. Chapman—"Infrared Spectroscopy of Lipids"

Sidney Fleischer—"Lipid Composition of Subcellular Particles"; "Functions of Lipids in Mitochondria"

R. S. Henly—"Preparative Gas Chromatography in the Lipid Field"

E. C. Horning—"Gas Chromatography of Sterols"

Martin Jacobson—"Isolation and Characterization of Insect Attractant Lipids"

G. Kritchevsky—"Polymorphism and Infrared Spectroscopy"

A. Kuksis—"Gas-Liquid Chromatography of Glycerides and Bile Acids"

Aaron Marcus—"Human Platelet Lipids and Their Relationship to Blood Coagulation"

Nicholas Nicolaides—"Fatty Acids of Skin Lipids"

Nicholas Pelick—"Qualitative Thin-Layer Chromatography of Lipids"

Orville Privett—"Quantitative Thin-Layer Chromatography of Lipids"

N. S. Radin—"Hydroxy Fatty Acids"

George Rouser—"Human Brain Lipids: Normal and Pathological"

Herman Schlenk—"Proof of Structure of Fatty Acids"

John Showell—"Infrared Spectroscopy of Fatty Acids and Glycerides"

D. Shapiro—"Chemical Synthesis of Cerebrosides and Sphingomyelins"

F. A. Vandenheuvel—"Lipids in Biological Membranes"

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• *Industry Items*

E. F. Daly (1947) announces the organization of the North American Fibre Co., (of which he is president), with headquarters at 1060 Broad St., Newark, N. J. Vice president is E. J. Brinkmeyer (1963).

E. F. Daly

E. J. Brinkmeyer

Top management has a combined experience of 52 years in the liquid filtration field and in the manufacture of asbestos materials. The company will supply a complete line of filter media, consisting of blends of asbestos with cellulosic and other filter materials, for use as a precoat or to supplement other aids. This high-grade filter media will be customer-compounded to each user's needs, supplied from local stocks in key industrial cities in easy-to-handle 25-lb bags, or other sizes to fit customer's requirements.

Union Carbide's new biodegradable (soft) detergent alkylate plant at Institute, W. Va., is now in commercial operation. Its rated capacity is 150 million pounds per year. Operated by their Olefins Div., the plant is supplying tank car quantities of Ucane Alkylate to contract customers.

Girdler Corp., Louisville, Ky., has been awarded the contract for the Quaker Oats Co. package hydrogen plant to be built at Memphis, Tenn. It will supply 600,000 cu ft/day high purity hydrogen for the production of furfuryl alcohol, tetrahydrofurfuryl alcohol, tetrahydrofuran, methylfuran, methyltetrahydrofuran and gamma valerolactone.

Drew Chemical Corp., New York, N. Y., announces the acquisition of Vegetable Oil Products Co., Inc. A new corporation for its food-producing division, with head-

(Continued on page 16)

Cottonseed Outlook Can Be Bright

AOCS Members Active in Clinic

The 13th Annual Cottonseed Processing Clinic, held in New Orleans recently, closed on a note of optimism. It is sponsored by The Mississippi Valley Oilseed Processors Assoc. and the So. Utiliz. Res. and Dev. Div., USDA.

Cottonseed oil has been characterized as the best vegetable oil on the market by a research team investigating the relative values of these oils and of their saturated and polyunsaturated fat content. Tremendous strides have been made with regard to meal, both in improvement of quality and expansion of markets. Some West Coast firms are now selling 90% of their meals to the poultry trade. This should benefit the industry as a whole. These were some of the highlights of the closing notes of R. A. Phelps (1960). Dr. Phelps also cited research and feeding tests conducted by C. M. Lyman (1945) on the feeding of meals with extremely high gossypol content to swine.

In his address of welcome, C. H. Fisher (1951) stressed the role of all research and development in the U.S. today. A total of some $20 billion is being spent for these activities annually; and although only a small portion of this is spent for utilization research on agricultural commodities, results have been significant. Additional funds have been appropriated this year by Congress to strengthen this program. However, it was pointed out that there is a necessity for new knowledge if industry is to keep pace with rapidly changing world conditions.

In outlining current research on cottonseed products being conducted by the Southern Div., I. A. Goldblatt (1952) told of several projects aimed at developing new uses—particularly industrial. Among these are the production of polymers from fatty acids, a project on the hydroboration of cottonseed oil, and the development of plasticizers. He also told the group that a fat emulsion believed suitable for intravenous feeding has been prepared from cottonseed oil, new uses are being found for acetoglycerides, and that progress has been made toward development of a satisfactory cocoa butter-like fat. Investigation of the relation of gossypol to oil color is being continued, and several new projects having a direct bearing on the meal and oil industries have been initiated.

H. L. E. Vix (1946) reported that the activated alumina bleaching process has reached a stage of development to where it has definite commercial potential for normal and off-color cottonseed oils, and that alumina suitable for the process is now commercially available at a price to make the process economically feasible. He also reported that improved cotton batting is now being evaluated by the automobile, furniture and bedding industries. Their increased use of this product would provide greater outlets for first-cut linters. He touched briefly on acetone-hexane-water extraction, later reported by E. A. Gastrock (1941), who also gave operational procedures for the process. It is ready for commercial use, awaiting a sponsor.

G. A. Harper (1959) reviewing the recent conference on cottonseed protein concentrates, cited a prediction by H. L. Wilcke (1962) that the next big market for cottonseed and other vegetable protein is for human nutrition. Cottonseed's share in this market will depend largely on the amount of research on its particular problems.

G. A. Mann (1961) presented a paper on the amino acids of cottonseed protein, with particular reference to their response to heat.

These are but a few of the highlights of the Clinic, where AOCS members actively participated. Charles Hay (1952) was chairman for one session. Two of the moderators were Dr. Phelps and A. C. Wamble (1943).

• *New Members*

Active

E. D. Bitner, Chemist, Northern Utilization Research Branch, Peoria, Ill.

B. K. Blenkinship, Chief Chemist, Schwarz Laboratories Inc., Mount Vernon, N. Y.

D. G. Cornwell, Professor, Ohio State University, Columbus, Ohio.

D. R. Erickson, Research Chemist, Swift & Company, Chicago, Ill.

W. B. Fields, Chemist, Swift & Company, Hammond, Ind.

J. T. Geoghegan, Chemist, Arizona Chemical Co., Stamford, Conn.

R. C. Hatter, Edible Production Superintendent, Lever Brothers Co., Los Angeles, Calif.

P. B. Hosmer, President, White & Hodges Inc., Lowell, Mass.

Hideo Marumo, Chief Chemist, Lion Fat & Oil Company Ltd., Tokyo, Japan.

S. J. Niegowski, Assistant Director of Research, Welsbach Corp., Philadelphia, Pa.

Asao Nishimura, Research, Showa Sangyo K.K., Yokohama, Japan.

Sadao Ohara, Chief of Research, Showa Sangyo K.K., Yokohama, Japan.

M. L. Rosenthal, Vice-President, Robeco Chemicals Inc., New York, N. Y.

Salvatore Ruggieri, Assistant, Institute of General Pathology, Florence, Italy.

Masayasu Takao, Assistant Manager, Lion Fat & Oil Co. Ltd., Tokyo, Japan.

R. H. Thackery, Consultant, Russell Thackery & Associates, Columbus, Ohio.

Arthur D. F. Toy, Director of Research, Victor Chemical Div., Stauffer Chemical Co., Chicago Heights, Ill.

Shigeru Uno, Section Head of Planning Dept., Lion Fat & Oil Company Ltd., Tokyo, Japan.

Laurentius van Dennen, Professor of Biochemistry, Laboratory of Organic Chemistry, Utrecht, Netherlands.

Haruo Watanabe, Vice-Chief of Research, Showa Sangyo K.K., Yokohama, Japan.

G. E. White, Chemist, Curtis & Tompkins, Ltd., San Francisco, Calif.

V. S. Whitner, Biochemist, Public Health Service, Communicable Disease Center, Atlanta, Ga.

Crastes de Paulet, Professor, Institute of Biology, Faculty of Medicine, Herault, France.

Individual Associates

P. D. Mills, Assistant Plant Manager, Desoto Chemical and Coatings Inc., Orange, Calif.

Corporation Associates

M & M Enterprises Inc., C. A. Murray, Manager and President of Savannah Laboratory, Savannah, Ga.

Industry Items . . .

(Continued from page 14)

quarters in Wilmington, Calif., will be known as Drew Foods Corp.

Foster D. Snell, Inc., New York, N. Y., has announced the formal incorporation of Foster D. Snell de Venezuela, S. A., where laboratory facilities at Caracas have been in actual use since early last year. These analytical laboratories, originally active in the field of fats and oils, will extend their activities in the near future to include controls for manufacturing and quality, as well as fine chemical preparation.

Stepan Chemical Co., Northfield, Calif., has announced its entry into the field of fermentation chemistry, through the acquisition of Bzura Chemical Co., Inc., and its subsidiary, Bzura, Inc., New Jersey manufacturers of citric acid, maleic acid and fumaric acid. These newly acquired facilities will be in production before the end of the year.

The Rendering Industry. Versatile Materials Open New Fields of Industrial Application

DEAN SPECHT, Executive Director, National Renderers Association, Chicago, Illinois

Since World War II, America's output of inedible animal fats and proteins has grown at a prodigious rate. Its annual volume is now nearly double that of 1947 and almost four times the yearly average of the late 1930s.

And it's going to keep right on growing.

Beef slaughter alone is expected to rise by an additional half million head each year for the next five years . . . an increase of ten percent by 1967. Similar increases also can be expected for hogs, sheep, chickens and turkeys as the world's growing population and rising living standards demand more and more meat products of every type. Obviously, this will have a great effect on nearly every facet of the fats and oils industry.

Prior to the 1930s, the usage of inedible tallows and greases was almost unvarying for nearly 100 years. Tallows were saponified to form soaps for the cleaning, laundry and detergent industries. Tallows and fatty acids were used to make candles, cosmetics and textile processing aids. Heavy metal salts or soaps were used as lubricating grease bases or lubricating adjuncts. Stearic acids were used in rubber compounding, in the manufacture of buffing compounds, as a mold release agent and for the manufacture of a few esters.

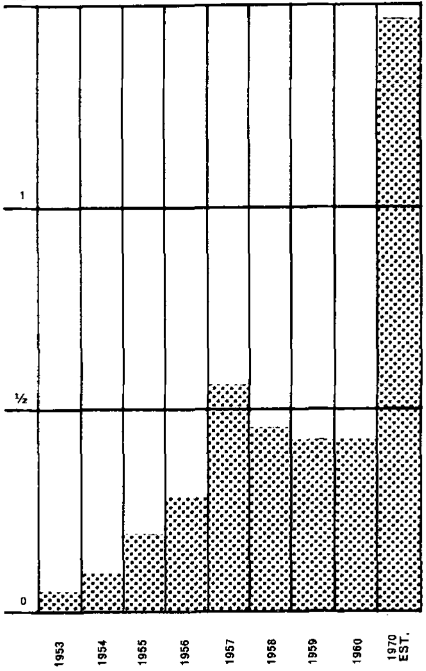
The big market for tallow, though, was the soap industry, which was by far the largest consumer and literally dominated the market.

At the end of World War II, about 4 billion pounds of soap were produced in the United States each year . . . and tallow was its main ingredient. But then synthetic detergents moved in and practically took over. As a result, soap production plummeted to a level of slightly more than 1 billion pounds a year . . . and took tallow usage right down with it.

Research Stimulates New Uses—Markets

The rendering industry, reeling from this one-two punch of a drastically increasing supply of raw materials and a steadily decreasing market for their end products, lost no time in launching a research program designed to discover and develop new uses for the animal by-products which were threatening to glut the market. Through their mutual organization, the National Renderers Assoc., they have made great strides in accomplishing this objective.

The Growth of Fats in Feeds
Billion Pounds



(Continued on page 48)

• *New Literature*

Jarrell-Ash Co. now has available a 16-page technical catalog (No. 82-000) describing their Half-Meter Scanning Spectrometer for application in ultraviolet, visible and near infrared wavelength regions. Also described is their Model 84-000 Evacuable Double-Beam Spectrophotometer for work as low as 1100 A and as high as 2.5 microns. (26 Farwell St., Newtonville 60, Mass.)

Analabs, Inc. has recently published a handy booklet, "Guide to Stationary Phases for Gas Chromatography." Besides listing more than 200 references, indexed according to the materials separated, it lists brief notes about the separation, such as stationary phase used, the temperature and the solid support. (P.O. Box 5215, Hamden, Conn. 06518)

U.S. Peroxygen Corp. now has available descriptive technical material (Nonseparating Paste Literature) on 11 organic peroxide catalysts in nonseparating paste formulations, covering a range of products, including benzoyl peroxide in various percentages, cyclohexanone peroxide, lauroyl peroxide and numerous combinations. Requests for literature should state molding methods used. (850 Morton Ave., Richmond, Calif.)

Packard Instrument Co., Inc. has issued a 12-page brochure on gas chromatography systems. Bulletin 1015 describes the various instruments and components made by them that make up a complete system—enabling the user to make this system tailored to meet his individual needs. (Box 428, La Grange, Ill.)

F & M Scientific Corp. now has available a special issue devoted to biochemical applications of gas chromatography. "Facts & Methods for Scientific Research," Vol. 4, No. 3 reviews applications and techniques for the biomedical researcher and analyst from 1959 to the present. Major emphasis is placed on work accomplished during 1963. It is authored by C. C. Sweeley, Dept. of Biochemistry and Nutrition, University of Pittsburgh's Graduate School of Public Health—recognized authority in this field. The reference section contains 150 published articles, in addition to many recent investigations of interest. (Route 41 and Starr Rd., Avondale, Pa. 19311)

Custom Scientific Instruments, Inc. has published a new catalog (No. 64) containing illustrations and descriptions of 88 testers or equipment manufactured as standard products. Custom-built equipment is also stressed. (Kearny, N. J.)

Annual Report 1962-1963, Division of Dairy Research, Commonwealth Scientific and Industrial Research, Australia, is now available. It contains department reports, staff and a list of manuscripts published. (Melbourne 1963)

The French Oil Mill Machinery Co. has announced publication of two new product bulletins. Solvent Extraction (08-10-DG) is available either in Spanish or English; it describes their equipment for use in processing oil-bearing seeds and nuts, as well as the extraction of solubles from solids. Stationary Basket Extractor (08-45-B) explains the function of this equipment through use of cut-away photos and flow charts. The latter (only in English) is punched for catalog binding. (Piqua, Ohio)

Scientific Glass Apparatus Co., Inc. announces a new edition of "What's New for the Laboratory"—52 in the series. It features over 35 new items, including a "DSS" Series Gas Chromatograph by Micro-Tek, an I-R Moisture Analyzer, a plastic and rubber valve for manifold freeze-drying procedures, and a new line of freeze-dryers that cut operation time in half. (Bloomfield, N. J.)

City Chemical Corp. now has available a mammoth chemical catalog designed to serve all industry. It describes over 30,000 chemical listings together with prices for containers in both large and small quantities, cross indexed for easy reference. (Catalog Dept., 132 W. 22nd St., New York 11, N. Y.)

NEXT STOP CHICAGO!

Deadline for Abstracts, Titles—July 15, 1964

With the New Orleans Spring Meeting well past the stage of culminating in one of the most outstanding Annual Meetings in the history of AOCS, all eyes are now focused on Chicago—site of the 38th Fall Meeting, Oct. 11–14, 1964. Plans have been in the making for many months. See page 8.

Sawell Publications Ltd. has just released their 1964 edition of "Paint Trade Mannual of Raw Materials & Plant," listing over 3,000 items and more than 800 sources of supply for those engaged in the paint and printing ink fields. Tables dealing with resins have been revised to cover 84 pages, with details from all over the world. Here is a fully indexed (385 p.) reference, with maximum information in the most accessible form. (4, Ludgate Circus, London, E.C.4., England)

The Società Italiana per lo Studio della Sostanze Grasse has published papers presented at the 6th Italian Symposium on The Study of Fatty Substances held at Arezzo, October 1962. Copies may be obtained for 2,000 lire each. (Via Lauro 3, Milano, Italy)

Wilkens Instrument & Research, Inc. announces its new Gas Chromatography Catalog which includes the latest Aerograph Moduline instruments: Dual-column 1520 Series with choice of temperature programmer, Dual-column 200 Series with choice of temperature programmer, and Single-column 660 Series with choice of detectors programmers. (P.O. Box 313, Walnut Creek, Calif. 94597)

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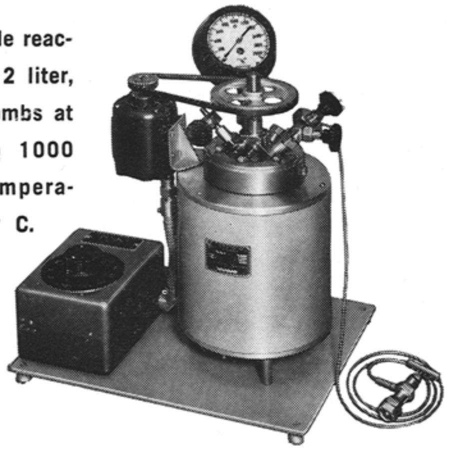


6th Annual Symposium on New Coatings and New Coating Raw Materials

The Polymers and Coatings Department of North Dakota State University is sponsoring the 6th Annual Symposium on New Coatings and New Coating Raw Materials, June 1–4, 1964, in Fargo, N. D.

The meeting will be held in the ballroom of Memorial Union; housing will be assigned in dormitories, hotels and motels. Food service will be available at Memorial Union. Registration fee is $30.00. A résumé of the program follows:

Symposium on High Temperature and Space-Related Coatings and Polymers

1. Equilibrium Between Molecules in Inorganic Polymer Systems. J. R. Van Wazer, Monsanto Chemical Co.
2. The Role of Organic Coatings in Spacecraft Design. J. E. Cowling, Naval Research Laboratory.
3. Comparison of the Effects of Ultraviolet Radiation on Optical Properties of Several Thermal-Control Surfaces. R. A. Jewell, National Aeronautics and Space Administration.
4. The Mechanism of Polystyrene Decomposiiton. L. A. Wall, National Bureau of Standards.

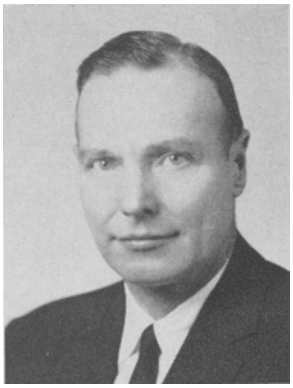
Panel Discussion.

General Papers

5. The Effect of Solvents Retention on the Properties of Poly (Methylmethacrylate) Films. D. R. Hays, General Motors Corp.
6. Photochemical Degradation of Wood. M. A. Kalnins, Forest Products Laboratory, USDA.
7. Vinyl-Cyclic-Acetals and Their Air Drying Properties. Seymore Hochberg, E. I. duPont de Nemours and Co., Inc.
8. Relationship of *cis* and *trans* Isomers to the Properties of Drying Oils. A. E. Rheineck and D. D. Zimmerman, NDSU.
9. Gelkotes: What the Paint Industry Contributed to the Plastics Industry. E. B. Euchner, Glidden Co.
10. Polyurethanes. M. E. Bailey, Allied Chemical Corp.
11. The Theory of Organosols. R. M. Fitch, NDSU.
12. Organosols for Metal Finishes. W. H. McKnight, Union Carbide Corp.
13. Post Forming Coated Metals. J. W. Baker, Butler Manufacturing Co.
14. Polyethylene as a Paint Additive. A. E. Rheineck and D. Falaas, NDSU.
15. Water-Resistant, Intumescent, Fire-Retardant Coatings. E. T. Rayner, USDA.
16. Linear Phenol-Formaldehyde Model Polymers. R. H. Peterson, NDSU.
17. Crosslinking Vinyl Condensation Polymers. F. T. Koehler, National Starch and Chemical Corp.
18. A New Functional Polymeric Suspension. C. F. Feldman, Jack Hurst and H. D. Anspon, Spencer Chemical Co.
19. The Principles and Effect of Ultra High Temperature Curing. D. F. Koenecke, Enjay Laboratories.

• Names in the News

R. P. Brandau



W. E. Thompson

W. E. Thompson (1961) has been elected vice president, research and development, for Archer Daniels Midland Co. He will be responsible for agricultural and chemical research, new product development, technical services and corporate engineering. He has served as director of research for ADM at the Thomas L. Daniels Research Center, Bloomington, Minn., since joining the firm in 1961.

H. B. Hayes (1961) has accepted a position as senior biochemist in Eli Lilly and Company's antibiotic purification development department, to work on the development of new and improved processes for their manufacture.

R. P. Brandau (1963) has been appointed technical service director for The Richardson Co., Melrose Park, Ill. He had formerly served as director of laboratories for Krystall Chemical Corp., owned by Richardson.

R. W. Matlack, of George D. Wetherill & Co., Philadelphia, Pa., has been appointed Executive Secretary of the Federation of Societies for Paint Technology. He will also carry the responsibility of Manager of the Paint Industries' Show and Editor of *Official Digest,* monthly journal of paint technology and engineering.

H. T. Iveson (1944) has been promoted to Product Manager for Central Soya's Chicago-based Chemurgy Div. He will be responsible for internal management of new and existing products in the line. Prior to his promotion, he served as Manager of Lecithin Products.

C. H. Hauber, AOCS Executive Secretary, was rushed to the DuPage County Hospital, Elmhurst, Ill., at midnight Feb. 29, and an emergency appendectomy was performed the next morning. As the Journal goes to press, he is recuperating nicely and expects to be back at his desk in the near future.

H. T. Iveson

R. W. Matlack

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• Obituary

C. A. Gerardi (1955), Secretary of the AOCS NE Section and member of the joint AOCS-ASTM Committee on Soap Analysis, passed away March 2 after an illness of several weeks. He had been associated with Colgate-Palmolive Co. Research Center, New Brunswick, N. J.

• New Products

Coleman Instruments, Inc., Maywood, Ill., announces an automated nitrogen analyzer, designed for use with unusually large samples. Model 29A Nitrogen Analyzer II may be used for determination of total nitrogen content of industrial and biological materials, organic and inorganic compounds. It yields results corresponding to theory within ± 0.2% nitrogen, with complete cycle requiring only 12 minutes.

Micro-Tek Instruments, Inc., Baton Rouge, La., has just released the second number in the series of research line of gas chromatographs. GC 2500R also has a companion model (GC 2000MR), provided with all-glass systems and a glass capillary introduction device for the bioanalytical research field.

E. H. Sargent & Co., Chicago, Ill., is now offering a new look and versatility in laboratory recorders for gas chromatographs. Model SR features: electrically switched 3-speed chart drive; full range attenuation; and elimination of undesirable A. C. signals.

Macrosonics Corp., Carteret, N. J., recently introduced a 2-megacycle immersible transducer for continuous production of dense sub-micronic aerosols. When immersed at proper height into a liquid, Type A-2000 creates a dry fog whose droplets are uniform and smaller than 1 micron. Average diameter of these droplets is about 1.4 microns. A small generator driving the equipment gives the possibility of producing between 75 and 250 cc aerosol per hour, using water and methanol.

Packard Instrument Co., Inc., LaGrange, Ill., is now producing and marketing a Computer-Memory Unit with 1024 and 4096 memory channels, under license from Intertechnique of France. Its capability gives the scientist and researcher almost unlimited flexibility and capacity in multiparameter analysis work.

Milton Roy Co., St. Petersburg, Fla., has developed two automatic industrial titrators for continuous or repetitive titration analysis of process streams. Both Titronic®R and Titronic C may be used solely for monitoring process streams or monitoring and controlling the concentration of their substances.

Armour Industrial Chemical Co., Chicago Ill., has introduced a series of amine oxides which will be marketed under the Aromax trade name: three methylated alkylamine oxides and three ethoxylated alkylamine oxides, The latter represents a new group of commercially available compounds, their major market expected in the area of detergents and shampoos because of their optimum biodegradability.

Corning Glass Works, Corning, N. Y., has introduced a moderately priced, high sensitive laboratory pH meter with advanced glass electrode design. Model 12 marks Corning's entry into the analytical instrument field.

Brooks Instrument Co., Inc., Hatfield, Pa., now has available a line of positive displacement meters capable of highly precise, continuous metering of extremely corrosive fluids such as sulfuric, hydrochloric and nitric acids. The Oval Super Acid-Proof Meter flows as low as 0.5 GPM with an accuracy of 99.5%, produced in a variety of materials and sizes.

Wm. Ainsworth & Son, Inc., Denver, Colo., has added a new model to its line of one-pan balances. The simplified design of Magni-Grad Type 21 provides a compact, space-saving unit—knob-operated, built-in weights and signals to facilitate weighing.

Central Scientific Co., Chicago, Ill., has introduced a cylindrical vacuum oven designed to be used for a variety of tasks requiring a combination of vacuum and constant temperature heat—especially useful for research, industrial or educational operations that require accelerated drying operations or drying of materials that decompose under normal atmosphere.

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1st International Congress of Agricultural and Food Industries in Tropical and Sub-Tropical Regions

The 1st International Congress of Agricultural and Food Industries of the Tropical and Sub-Tropical zones will meet at Abidjan, Ivory Coast, Africa in November 1964, under the high patronage of His Excellency M. Houphouet-Boigny, President of Ivory Coast.

The program will cover the study of the means for developing the transformation, preservation and distribution of local agricultural products—within the framework of a plan for general expansion of African countries. The task of scientifically and materially organizing this Congress was assigned to the International Commission of Agricultural Industries and the Permanent International Office of Analytical Chemisty, together with the Society for the Study and Development of Industry, Agriculture and Commerce. The latter society is engaged by their government in a permanent research mission.

Papers will be presented at the Congress in French, English, Spanish or German, and are categorized under the following: Research, technology and industrialization; problems of marketing, distribution and transportation; teaching, research and training; and consequences of industrialization.

Further information may be obtained from: Secretary of the Congress, 18, Avenue de Villars, Paris VII, France.

U. S. Government Grants for Latin America Exchange Program

University Lecturing and Advanced Research grants are now being offered by the U.S. Government, under P.L. 87-256, The Fulbright-Hays Act, on a competitive basis for participation in a program with Latin America. This extends for the academic year of March through November in 1965.

Requirements are: U.S. citizenship. For Lecturers, a minimum of one year of college teaching experience; for Research, a doctoral degree or recognized professional standing; a knowledge of the language of the host country.

Program announcements are available, and preference will be given to applications received by May 15, 1964. For application forms and additional information, write to: Committee on International Exchange of Persons, Conference Board of Associated Research Councils, 2101 Constitution Ave., Washington, D.C. 20418.

Glycerine Production Down

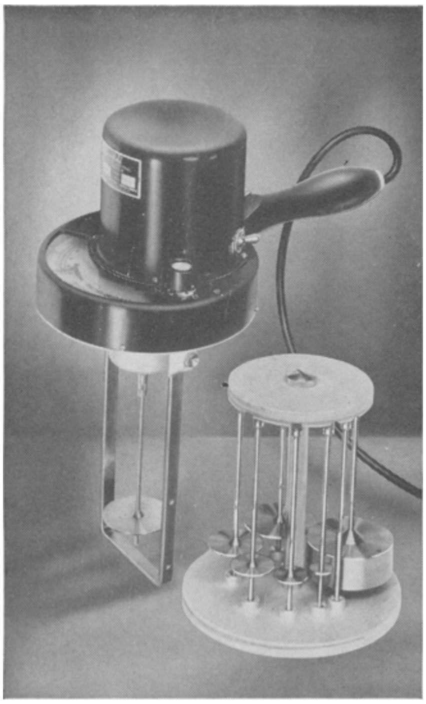
According to the U. S. Department of Commerce, production of crude glycerine (including synthetic) for the month of January was 28.3 million lb, down 0.7 million lb from December, but up 5.8 million lb from January last year.

At the end of January, producers' stocks of crude and refined glycerine totalled 38.5 million lb, down 2.2 million lb from the end of December, and down 17.3 million lb from January 1963.

JANUARY
(Million lb)
PRELIMINARY

Glycerine 100% basis	Factory production		Producers' stocks	
	Jan. 1964	% Change from Dec. 1963	End of Jan. 1964	% Change from Dec. 1963
Crude	28.3*	−2.4	16.2	−12.4
Refined, all grades	29.1	−3.0	22.3	+ 0.5
			38.5	− 5.4

* Includes synthetic glycerine.



Confectionery Fats . . .

(Continued from page 4)

for this property is obvious when shell goods and molded bars are being manufactured on automatic machinery. As will be shown later, contraction is a function of the types and proportions of the various triglycerides in the fat.

A confectionery fat should be compatible with other fats with which it might be used; i.e., mixing one with the other should not result in significant depression of the melting point or a large increase in the amt of liquid phase. Although standards cannot be set here, the melting point depression should probably be less than a degree centigrade and the increase in liquid content only a few per cent.

Relative impermeability of a fat to moisture has been claimed to be desirable for some purposes; e.g., to prevent loss of wt or to keep the soft centers of chocolate pieces from shrinking and cracking the coating.

Resistance to oxidative rancidity usually is not mentioned as a desirable characteristic because virtually all of the hard butters being marketed are resistant to such rancidity and normally do not present a problem on long storage. However, one should not expect confectionery fats containing sizable proportions of linoleoyl groups or very large proportions of monounsaturated acid groups to be entirely satisfactory. A final requirement which should be met if a confectionery fat is to be readily accepted by the industry is that the fat resemble cocoa butter closely in both its virtues and faults. Over a period of many years the manufacture of chocolate has been built around the unique properties of cocoa butter; enrobers, tempering kettles and cooling tunnels have been built and operated to cope with the special problems it presents. Persuading a large, well-established industry, and probably the consumer also, to adapt to a new fat having different properties will be difficult.

Under these conditions it is pertinent that the composition and properties of cocoa butter be examined more closely. The types and approximate mole percentages of the fatty acids occurring as triglycerides in cocoa butter are as follows: oleic, 37.3; stearic, 34.4; palmitic, 26.2; and linoleic, 2.1. The triglycerides are of the following types and approximate percentages:

	Mole, %
Trisaturated	3
Oleodipalmitin	4
2-Oleopalmitostearin	57
2-Oleodistearin	22
Palmitodiolein	7
Stearodiolein	6
Triolein	1

Cocoa butter is unique in that it contains about 83% monounsaturated triglycerides. The two major components (2-oleopalmitostearin and 2-oleodistearin) are present in such proportions that they form practically a eutectic mixture. Such a mixture behaves on dilatometric examination almost as a single compound.

The two major triglycerides of cocoa butter exhibit the same polymorphic behavior. Each has four distinct melting points, and ease of transformation from one melting point to the next higher is ca. equal for corresponding polymorphs. The sudden and dramatic contraction on solidification of properly seeded cocoa butter has been traced to the transformation of the next-to-highest melting polymorphs to the highest melting. Under the most favorable conditions linear contraction is ca. 2%.

Confectionery Fats from Lauric Acid Oils. Palm kernel stearine, palm kernel oil and coconut oil, the latter two usually after modification, have been used for many years in the confectionery industry and in general are good and desirable products. They have in common a low iodine value (usually below 10 for coconut oil and below 15 for palm kernel oils), which implies good resistance to oxidation. Their content of 40–50% lauric acid is conducive to a short melting range and a mp below 37C. Also, the oils are generally very light in color.

A palm kernel stearine made by fractionating palm kernel oil usually has a mp between 32 and 34C. The beginning of visible melting occurs 1.5–3 degrees below the point of complete melting. Content of solid fat at 20C usually is slightly above 80%.

Coconut oil melts at ca. 24.5C (76F). Although this is below the temp usually desired for a confectionery fat, it permits tailoring the oil for specific uses through hydrogenation. Commercial oils usually are hydrogenated to mp of 33.3, 37.8, and 43.3C (92, 100, and 110F). The completely hydrogenated oil has a mp of ca. 43.3C (110F). To obtain fats with higher melting points, the oil may be fractionated prior to hydrogenation, or other fats can be added to the hydrogenated oil.

The modified coconut oils are valuable for manufacturing chocolate-type products for summer use. At summer temp in most sections of the country, cocoa butter melts to a large extent and becomes soft.

Confectionery fats derived from the lauric acid oils do have some disadvantages. They are relatively incompatible with cocoa butter, which is usually present in confections because cocoa powder contains from 10–26% fat. A palm kernel stearine having ca. the same melting point and liquid content as cocoa butter, 33.2C and 20% liquid at 20C, has been found to yield with cocoa butter a 1:1 mixture melting at 29.0C and containing 30% liquid at 20C.

If the lauric acid oils in confections undergo a slight hydrolysis, a sharp, soapy flavor results. Also, when such confections are eaten, a burning sensa-

(Continued on page 30)

Safe Handling of LP-Gas

R. R. WELLINGTON, Skelly Oil Company, Kansas City, Missouri

In any relatively new industry, it takes time to develop safe operating procedures and safe working habits, particularly when the growth is as phenomenal as that of the liquefied petroleum gas (LP-Gas) industry. LP-Gas is a general term applied to light petroleum hydrocarbon fractions containing such compounds as propane, iso-butane and *n*-butane. Among the new uses of LP-Gas are heat treating, tractor fuel, weed burning, crop flaming and a host of other industrial applications.

Most full-time gas men learn how to handle LP-Gas safely; others with less contact have not been properly trained or instructed.

Industrial users of LP-Gas should have the following questions answered to their satisfaction:

1) How much effort must we expend to have a safe plant operation?

2) Can we afford to have an unsafe plant—or an accident?

Before answering these questions, let us review some of the physical properties of the product which have forced the development of safety standards.

1) The product is flammable. Thus, it must be stored away from sources of ignition. These include smoking, electrical sparks, open fires, etc.

2) The product has a vapor pressure of 108 lb at 60F and can have a 200-lb pressure at 100F. Storage containers must be built to Interstate Commerce Commission Regulations or the American Society of Mechanical Engineers Code for Unfired Pressure Vessels. They must be protected with safety relief valves against excessive presure.

3) One ft^3 liquid propane produces ca. 268 ft^3 vapor. Thus, relief valves must always communicate with the vapor space.

4) Liquid propane expands ca. 1% for each 6F. Consequently, containers cannot be filled completely.

5) The lower limit of flammability is 2.5%; the upper is 9.6%. This is one of the extremely desirable features of this product as it limits the chance of accidental ignition.

6) Specific gravity of the gas (air = 1) at 60F is 1.54. This is one of the less desirable properties we must recognize in planning installations, gas-consuming equipment and in locating storage. All LP-Gas containers should be purged to eliminate excessive pressures in the container and to eliminate the possibility of relief valves functioning prematurely.

A yardstick for the safe handling of LP-Gas can best be outlined as follows:

I. *Odorizing LP-Gases*: All liquid petroleum gases shall be effectively odorized by an approved agent of such character as to indicate positively, by distinct odor, the presence of gas down to concn in air of not over one-fifth the lower limit of flammability. Odorization, however, is not required if harmful in the use or further processing of the liquefied petroleum gas, or if odorization will serve no useful purpose as a warning agent in such use of further processing.

The lower limits of the more commonly used LP-Gases are:

Propane — 2.15%
Butane — 1.55%

These figures represent volumetric percentages of gas in gas-air mixtures.

The odorization requirement in various standards shall be considered to be met by the use of 1.0 lb ethyl mercaptan; 1.0 lb thiophane or 1.4 lb amyl mercaptan/10,000 gal LP-Gas. However, this listing of odorants and qualities shall not exclude the use of other odorants that meet the odorization requirements of the standards.

II. *Approval of Installation Plans*: It is important to have installation plans of plants consisting of over 2,000 gal water capacity approved by the city or county, if necessary, and by the State before construction begins.

III. *General Specifications*: To comply with regulations, it is necessary to use:

- A. Extra heavy pipe with threaded connections for pressure over 125 lb.
- B. Cast iron fittings are not permissible. Fittings should be designed for a min of 250 lb psig if the operating pressures are over 125 lb psig.
- C. Pumps, hose and other equipment should be designed for LP-Gas.
- D. There must be adequate relief valves in both container and piping.
- E. Containers used for LP-Gas either must comply with the Interstate Commerce Commission or the American Society of Mechanical Engineers Unfired Pressure Vessel Code.
- F. Containers should be installed in accordance with the standards as follows:
  - 1. Cylinder Systems—Location of Containers and Regulating Equipment:
    - a. Containers shall not be buried below ground. However, this shall not prohibit the installation in a compartment or recess below grade level, such as niche in a slope or terrace wall which is used for no other purpose, providing the container and regulating equipment are not in contact with the ground and the compartment or recess is drained and ventilated horizontally to the outside air from its lowest level, with the outlet at least three ft away from any building opening which is below the level of such outlet. Except as provided in the standards, the discharge from safety relief devices shall be located not less than three ft horizontally away from any building opening which is below the level of such discharge, shall not terminate beneath any building unless such space is well ventilated to the outside and is not enclosed on more than two sides.
    - b. Containers shall be set upon firm foundation or otherwise firmly secured; the possible effect on the outlet piping of settling shall be guarded against by a flexible connection or special fitting.
  - 2. Systems Utilizing Containers Other than ICC:
    - a. Each individual container shall be located with respect to nearest important building or group of buildings or line of adjoining property which may be built on in accordance with Table I.
    - b. No containers shall be stacked one above the other while installed for use.
    - c. In cases of bulk storage in heavily populated or congested areas, the authority having jurisdiction shall determine restrictions of individual tank capacity, total storage, and distance to line of adjoining property which

(Continued on page 41)

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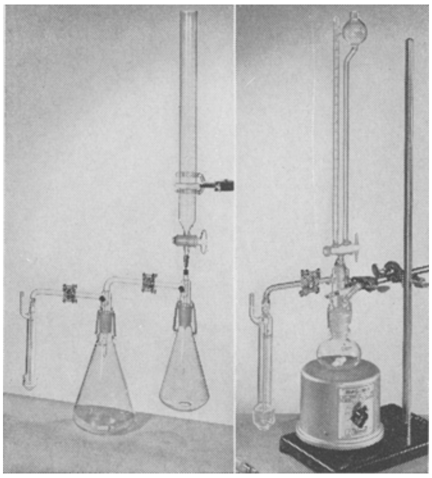
[1] Presented at the AOCS Meeting in Minneapolis, 1963.



Confectionery Fats . . .

(Continued from page 26)

tion is produced in the throat. Lauric acid oils also are subject to "ketone" rancidity, which is produced by the action of certain micro-organisms in the presence of moisture and nitrogenous nutrients.

Another disadvantage of the lauric acid oils is their price. Coconut oil is no longer the cheap product it was years ago; its cost now is above that of competitive domestic oils.

Confectionery Fats from Oleic-Palmitic-Stearic Acid Oils. Probably the best confectionery fats will be prepared from oils and fats containing the same fatty acid groups found in cocoa butter. Many individuals have been working over a long period of years toward such a development, but until recently no techniques for conducting the necessary processing operations economically on a large scale had been devised. Research and development work in this area still is not complete.

Hydrogenation, the widely used process for converting a liquid oil into a plastic fat, is by itself inadequate for making a good confectionery fat. During hydrogenation large proportions of positional and geometrical isomers of the oleoyl group are formed, and their triglycerides have a wide range of melting points. Furthermore, hydrogenation is essentially a random reaction with respect to the reduction of a given type of unsaturated acid group, and sufficiently large proportions of monounsaturated triglycerides cannot be obtained by present methods of operation.

Within the last few years, one oil processor has used a new approach to preparing a confectionery fat by way of hydrogenation. From compositional data on the fat it appears that a domestic oil is hydrogenated under highly selective conditions to obtain a large proportion of iso-oleic acid groups and that the hydrogenated oil is fractionated to obtain a cocoa butter-like product which has the desired melting point and is rich in iso-oleic acid groups. It is claimed that this cocoa butter-like fat has good compatibility with cocoa butter. The claim has merit from a physical-chemical standpoint. Iso-oleic acid groups in the *trans*-configuration not only resemble stearoyl groups in shape and length but also form relatively high-melting glycerides. The two groups, one in the confectionery fat and the other in cocoa butter, should be more or less equivalent, and some mixed crystal formation should be expected when the two fats are mixed.

At least one oil processor has used the fractional crystallization of a natural oil to solve the problem of making a confectionery fat of the type under discussion. Palm oil is fractionally crystallized from a solvent to obtain relatively concd oleodipalmitin. This fraction is either used as such, or a small portion of illipé butter is added to raise the melting point.

At the So. Utiliz. Res. and Dev. Div., a relatively good cocoa butter-like fat has been prepared on a pilot-plant scale from olive oil and completely hydrogenated cottonseed oil. The two products are randomly interesterified and a monounsaturated triglyceride fraction is isolated by fractional crystallization from solvents. This fraction not only contains sizable proportions of the triglycerides found in cocoa butter but also has similar melting characteristics, evident from the following data:

	Liquid content, %	
Temperature, °C.	Cocoa butter	Experimental fat
15	6.8	....
20	10.8	6.0
25	16.7	10.7
30	36.1	19.3
35	100.0	96.3
36.1	....	100.0

The experimental fat did not contract as cocoa butter did on solidification. This deficiency was attributed to the presence of a large proportion of 1-oleodisaturated glycerides which convert rapidly to their highest melting polymorphs during solidification. Hence, contraction by polymorphic transformation after solidification, as in cocoa butter, cannot occur.

Currently, work at the So. Utiliz. Res. and Dev. Div. is directed toward preparing cocoa butter-like fats by the direct esterification of the diglycerides of palmitic and stearic acids with oleic acid. Reaction conditions have been found for producing high yields of oleodisaturated glycerides.

Propylene Glycol Esters. Several investigators concerned with the development of confectionery fats have suggested that another good solution to the problem would be preparation of fatty products having most of the desired physical properties but consisting of compounds quite different from those found in ordinary fats and oils. At least three groups have conducted experiments with the fatty acid esters of propylene glycol. Because propylene glycol has only two hydroxyl groups, the variety of compounds possible with a given mixture of fatty acids is less than that with glycerol; this characteristic should result in a melting range shorter than that of the glycerides. The esterification of propylene glycol with a mixture of oleic, palmitic and stearic acids in which the oleic acid content ranges between ca. 10 and 20% is claimed to yield a product having the melting point, brittleness and mold release properties expected of a cocoa butter-like fat.

Summary and Conclusions. One can predict that the production and use of confectionery fats will expand. A po-

(Continued on page 63)

Gordon Research Conference on Lipid Metabolism June 15-19

Heading the list of 50 international conferences on developments in the most active areas of basic research in Lipid Metabolism, scheduled for June 15–19, 1964, at Kimball Union Academy, Meriden, N. H. David Kritchevesky (1959) is Chairman; Daniel Steinberg (1955) Vice-Chairman.

The complete program of conferences will continue through Sept. 4, with each meeting devoted exclusively to a single subject and lasting for one week. They will be held at five locations in New Hampshire: New London (Colby Junior College); New Hampton (New Hampton School); Meriden (Kimball Union Academy); Tilton (Tilton School); and Andover (Proctor Academy).

Founded 33 years ago, and originally only two in number, these Conferences are designed to promote the creative interchange of ideas and communications among research leaders in various scientific disciplines and in different scientific environments—academic, government and industrial.

We list below the complete Lipid Metabolism program, including speakers and titles. The complete schedule and attendance application forms may be obtained from W. G. Parks, Director, Gordon Research Conferences, University of Rhode Island, Kingston, R.I.

LIPID METABOLISM
15-19 June 1964
Kimball Union Academy
Meriden, New Hampshire

15 June

A. D. Bangham. Physical Structure and Behavior of Lipids and Lipid Enzymes.
J. A. Clements. The Role of Surface Active Lipids in Pulmonary Function.
F. A. Vandenheuvel. Structure of Myelin.
A. N. Davison. Some Aspects of Brain Lipid Metabolism.

16 June

N. S. Radin. The 2-Hydroxy Fatty Acids of Brain.
A. Fulco and J. F. Mead. The Metabolism of Long Chain α-Hydroxy Acids.
J. A. Olson. The Metabolism of β-Carotene and Retinol.
F. Chevallier. Turnover of Cholesterol in the Rat.

17 June

J. D. Wilson. Cholesterol Metabolism in the Isotopic Steady State in the Rat.
E. H. Ahrens, Jr. Sterol Balances in Man.
D. S. Goodman. Recent Studies on the Metabolism of Cholesterol Esters.
L. I. Gidez, P. S. Roheim, S. Switzer, H. A. Eder. Origin and Role of Plasma Cholesterol Esters.
J. A. Glomset. Recent Studies of the Plasma Cholesterol Esterification Reaction of Sperry.

18 June

J. N. Johnston. Recent Developments in Intestinal Absorption of Fats.
R. J. Havel. Transport and Metabolism of Triglycerides in Blood Plasma.
K. Folkers. New Aspects of Research on Coenzyme Q.
General Discussion Session.

19 June

M. Heimberg. Effects of Hormones, Diet and Drugs on Hepatic Triglyceride Metabolism.
P. D. Klein. Uses and Consequences of Dual Tracer Experiments in Lipid Metabolism.

ABSTRACTS

R. A. REINERS, Editor. ABSTRACTORS: J. G. Endres, 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

Formation of volatile components during the autoxidation of lipids. J. Hrdlicka and J. Pokorny (Inst. Chem. Tech., Prague). *Papers Inst. Chem. Tech. Prague* **6**, 161–9 (1962). Stearic, oleic, erucic and linoleic acids were oxidized at 180C and volatile carbonyl compounds were separated as 2,4-dinitrophenylhydrazones by paper chromatography, employing a 3:1 water-isopropanol solvent system. The method gave good separation and reproducibility. Individual carbonyl compounds were identified by comparison of R_f values and spectral absorption data. The volatile carbonyl compounds formed during oxidation consist mostly of saturated and monounsaturated aldehydes, their relative proportions varying with the initial degree of unsaturation. The total amount of carbonyl compounds was highest for stearic and oleic acids, probably because the aldehydes from erucic acid are less easily volatilized and those from linoleic tend to polymerize. The average number of C atoms of the aldehydes formed is approximately the same for high as for low temperature oxidation but a higher proportion of unsaturated aldehydes is formed at the higher temperatures. Only very small amounts of ketones and dicarbonyls are formed.

The effect of proteidic materials on the autoxidation of fatty acids and their derivatives. J. Pokorny, H. Daničkova and G. Janicek (Inst. Chem. Tech., Prague). *Papers Inst. Chem. Tech. Prague* **6**, 153–9 (1962). Glycerides, ethyl esters and free fatty acids from oils containing dienoic, trienoic and up to hexaenoic acids as the most unsaturated acids are rapidly autoxidized even at room temperature when mixed with a proteidic paste such as is obtained by treating hide parings with lime and hydrochloric acid. A part of the oxidation products, probably hydroperoxides, reacts with the proteidic material with formation of products insoluble in non-polar solvents. The extent of autoxidation and the proportions of individual types of end products (soluble in light petroleum fractions, soluble only after hydrolysis and insoluble) depend on the structure of the most unsaturated components present, on the I.V. and on the type of starting material used (glycerides, free fatty acids or ethyl esters).

Alkali treatment and countercurrent washing of vegetable oils with the Podbielniak extractor. L. S. Queirolo (Belotti Co., Milan, Italy). *Riv. Ital. Sostanze Grasse,* Sympos. Issue **1962**, 161–2. A description is given of the operating performance of the Podbielniak extractor.

Spectrophotometric studies on rancid olive oils. B. Foresti (Fats and Oils Exp. Stat., Catania, Italy). *Riv. Ital. Sostanze Grasse,* Sympos. Issue **1962**, 165–8. The spectrophotometric curves of the volatile substances stripped from olive oil samples of various degrees of rancidity exhibit two maxima: one at 225 mμ and one at 280 mμ. The first maximum is attributed to unsaturated carbonyls and the second to either saturated or unsaturated, non-conjugated carbonyls. A direct relationship exists between the optical density at 225 and 280 mμ and the organoleptic rancidity of the oil.

The Fitelson reaction and olive oil adulteration. A. Chindemi *et al.* (Prov. Chem. Lab., Terni, Italy). *Riv. Ital. Sostanze Grasse* **40**, 473–81 (1963). The Fitelson chromatic reaction has been used in the past to determine adulteration of olive oil by teaseed oil, but its accuracy has often been questioned. It is confirmed that contaminations of 20% or more teaseed oil can be detected by this method, although an accurate quantitative measurement of teaseed oil level is not possible. Strict adherence to the recommended experimental procedure is essential. The chromatic reaction becomes stronger when performed on the unsaponifiable fraction, however the oil's age and state of oxidation contribute to make it weaker.

Studies on the Fitelson reaction for olive oil. M. Vitagliano and A. Vodret (Univ. of Sassari, Italy). *Riv. Ital. Sostanze Grasse,* Sympos. Issue **1962**, 39–44. The validity of the Fitelson reaction for the qualitative identification of teaseed oil in olive oil was confirmed for levels of 10–15% or more teaseed oil. In the few cases where genuine olive oil gives a positive Fitelson reaction there appears to be a correlation with a late harvesting of the olives, after the winter season is over. The Fitelson reaction also becomes positive for olive oils after passage through an alumina column, while the same treatment on teaseed oil causes the chromatic reaction to disappear. This is interpreted to indicate that the substances responsible for the reaction are different for the two oils.

The use of the monomolecular film technique in the physico-chemical study of fatty substances. A. Nasini (Univ. of Turin, Italy). *Riv. Ital. Sostanze Grasse,* Sympos. Issue **1962**, 17–23. A review is given of the experimental techniques for obtaining monomolecular films, their characteristics and areas of application in the study of surfactants and lubricants.

Characteristics of the unsaponifiable fraction of olive oil. A. Montefredine and M. Iacone (Prov. Chem. Lab., Pescara, Italy). *Riv. Ital. Sostanze Grasse,* Sympos. Issue **1962**, 49–52. In a study of 136 samples of Italian olive oils, levels of unsaponifiable between 0.47 and 1.28% were found, with an iodine value between 182 and 306.

Olive oil production in the Italian economy. F. Zito (Univ. of Catania, Italy). *Riv. Ital. Sostanze Grasse,* Sympos. Issue **1962**, 103–8. The statistics of olive oil production in Italy and in the world are reviewed.

Identification of the presence of sesame oil in other oils by the Synodinos-Konstas reaction. G. Musurakis (State Chem. Lab., Athens, Greece). *Riv. Ital. Sostanze Grasse,* Sympos. Issue **1962**, 183–4. The application of the chromatic reaction of Synodinos and Konstas to the detection of sesame oil in olive oil, as well as in other vegetable oils, is discussed. Shaking together 30 cc's of oil and 10 cc's of conc. nitric acid, the acid layer assumes a yellow-green coloration when in the presence of sesame oil. As little as 5% sesame oil in olive, soybean, cottonseed or corn oil can be detected.

Research of foreign fats in lard, II. E. Pascucci and F. Paolini (Customs Chem. Lab., Rome, Italy). *Riv. Ital. Sostanze Grasse,* Sympos. Issue **1962**, 194–9. The presence of 10% or more tallow in lard can be revealed by a proposed modification of the Böhmer reaction, as well as by gas chromatography. The saturated: linoleic ratio in unadulterated lard is always lower than 5.5.

Technological aspects of the fats and oils industry. M. Lancin (Univ. of Charleroi). *Riv. Ital. Sostanze Grasse,* Sympos. Issue **1962**, 194–9. A review of basic engineering concepts in the fats and oils industry is given.

Identification of fatty acids by means of high efficiency capillary columns. M. Riva, F. Poy and P. Gagliardi (C. Erba Co., Milan, Italy). *Riv. Ital Sostanze Grasse,* Sympos. Issue **1962**, 66–68. The application of capillary columns to the identification of fatty acid composition of olive oils is described, especially in relation to the detection of positional and stereo isomers of oleic acid. Petroselinic acid was found at levels of approximately 1.5% and elaidic acid at the 0.5% level.

Chemical characteristics and nutritional value of margarine. A. Montefredine (Prov. Chem. Lab., Pescara, Italy). *Riv. Ital. Sostanze Grasse,* Sympos. Issue **1962**, 97–99. Data on margarines currently marketed in Italy is reviewed.

Continuous moisture determination in butter through measurement of dielectric constant. J. Fexa and Z. Burianec (Inst. Chem. Tech., Prague). *Papers Inst. Chem. Tech. Prague* **6**, 131–8 (1962). Details of a method are described for the continuous determination of butter moisture, in the 14–17% region, based on measurement of dielectric constant and capacitance of a cell through which the butter flows. The standard error of the method has been determined at 0.2% H_2O.

Gas chromatographic separation of cholesterol and desmosterol. R. Fumagalli and W. J. Vandenheuvel (Univ. of Milan, Italy). *Riv. Ital. Sostanze Grasse* **40**, 470–2 (1963). The conditions necessary to effect the gas-chromatographic separation of cholesterol from desmosterol, its immediate precursor, are discussed. Two polar stationary phases have been found effective: phenyl silicone and neopentyl glycol succinate. Some non-polar stationary phases can also be used, but require a higher number of theoretical plates.

Preparation of pure fatty acids. E. Fedeli *et al.* (Exp. Station Fats and Oils, Milan, Italy). *Riv. Ital. Sostanze Grasse* **40**, 459–62 (1963). A method for the preparation of pure methyl oleate (with less than 2% *trans* isomer) is described. *Trans* isomer formation is minimized by using a stereospecific hydroxylation method on methyl esters of natural fatty acids, leading to 9,10-methyl-dihydroxystearate. After chromatographic purification, this product is subjected to bromination and successive debromination, yielding the purified oleic methyl esters. Since both bromination and debromination involve a *cis-trans* transformation, the end product is almose pure *cis* isomer.

ECONOMIC EVALUATION OF OLIVE OIL EXTRACTION PLANTS. C. Cantarelli *et al.* (Univ. of Perugia, Italy). *Riv. Ital. Sostanze Grasse* **40**, 463–9 (1963). Economic factors connected with olive oil production are reported.

QUANTITATIVE ANALYSIS OF POLYGLYCEROLS BY PAPER CHROMATOGRAPHY. J. Zajic (Inst. Chem. Tech., Prague). *Papers Inst. Chem. Tech. Prague* **6**, 179–87 (1963). A paper chromatographic method for the quantitative analysis of polyglycerols is described. The R_f values for several glycerol polymers and regression equations correlating measured spot areas and polymer concentrations are given.

ACTIVITY OF OAT LIPASES. J. Pokorny *et al.* (Inst. Chem. Tech., Prague). *Papers Inst. Chem. Tech. Prague* **6**, 189–98 (1962). The activity of oat lipases was investigated using oat lipids as the substrate. The reaction takes place at 30C up to a maximum of 20% acidity after six days. A statistical study indicated an effect of crop year and an interaction effect between crop year and producing location as well as between oat variety and location. The activity of the enzyme does not change after up to 2 years' storage.

VARIABILITY OF PROPERTIES OF OAT LIPIDS. J. Pokorny *et al.* (Inst. Chem. Tech., Prague). *Papers Inst. Chem. Tech. Prague* **6**, 199–203 (1962). A statistical investigation on the variability of lipids from various Czech oat varieties is described.

THE COMPOSITION OF WAXY SUBSTANCES FROM OAT HULLS. I. Zeman, J. Pokorny and G. Janicek (Inst. Chem. Tech., Prague). *Papers Inst. Chem. Tech. Prague* **6**, 205–9 (1962). Oat lipids are not a homogeneous material, but consist of lipids of different polarities (as well as different fatty acid composition) and thus extractable with solvents of different polarities. The least soluble fractions contain increasingly high percentages of waxy substances. The fatty acid composition of these least soluble extracts differs appreciably from that of the more easily soluble fractions, containing much less palmitic, more stearic and higher fatty acids, as well as fatty acids with odd number of C atoms.

THE ISOMERIZATION PROCESS OF POLYUNSATURATED FATTY ACIDS, STUDIED BY GAS-CHROMATOGRAPHIC METHODS. G. Cartoni, A. Liberti and C. Ruggieri (Univ. of Naples, Italy). *Riv Ital. Sostanze Grasse* **60**, 482–6 (1963). The reaction of alkaline isomerization of polyunsaturated fatty acids leads to formation of geometric and positional isomers that can be detected by means of gas chromatographic capillary columns with high resolving power. Previously proposed theories, according to which the isomerization of natural linoleic acid (a 9 *cis*-12 *cis* isomer) results in 50% 9 *cis*-11 *trans* and 50% 10 *trans*-12 *cis* isomers, have been partially confirmed. However, a tendency to form a certain amount of *trans-trans* isomers, increasing with increasing reaction time, has been noted. Disappearance of the initial 9 *cis*-12 *cis* isomer is practically complete in 15-20 minutes at 180C.

FATTY ACID COMPOSITION OF THE OIL EXTRACTED FROM CORN MEALS. G. Kaderavek and G. Gay (Univ. of Milan, Italy). *Olearia* **17**, 145–7 (1963). Gas chromatographic analyses on samples of oil extracted from 36 different varieties of corn meal have given the following range of results: C-16:0, 11.5–16.4; C-18:0, 1.6–3.2; C-18:1, 26.9–33.3; C-18:2, 47.2–58.1; C-18:3, tr.–0.3%. These values are in good agreement with previously reported results and confirm the similarity of composition between this oil and the common corn oil, extracted from corn germs.

THE USE OF ALUMINA IN THE U.V. EXAMINATION OF OLIVE OIL. D. Corbi and L. Cicero. *Olearia* **17**, 148–55 (1963). The identification of olive oil adulteration by means of U.V. absorption measurements is greatly facilitated by previous passage of the oil through an alumina column, which eliminates the oxidation products of the oil that interfere in the U.V. readings. Unadulterated virgin olive oils are characterized by a value of K_{270} lower than 0.09.

KREIS REACTION AND PEROXIDE NUMBER OF RANCID OLIVE OILS. A. Montefredine and C. Testa (Prov. Chem. Lab., Pescara, Italy). *Riv. Ital. Sostanze Grasse*, Sympos. Issue **1962**, 169–73. Examination of a large number of olive oil samples at various levels of rancidity indicates poor correlation between the peroxide number determination and the Kreis reaction, with the peroxide number generally evidencing the onset of rancidity earlier than the Kreis reaction. This later reaction also, as modified by Watts and Major, is useful in providing a quantitative measure of rancidity.

STUDIES ON HIGH ACIDITY OLIVE HUSKS. V. Carrante and N. Tricarico (Exp. Agric. Stat., Bari, Italy). *Riv. Ital. Sostanze Grasse*, Sympos. Issue **1962**, 109–20. Olive husks undergo a process of lipase-catalyzed hydrolysis proceeding linearly with time during the first few days after expression of the oil. Among a large number of variables examined, the most favorable in slowing down the enzymatic degradation of the oil are: low moisture content and high temperatures; addition of ethyl alcohol; high pH (9–11), as given, for example, by calcium hydroxide. The optimum pH for enzymatic activity is 5–6. Sodium bisulfite, sodium benzoate and formaldehyde are all ineffective in slowing down the hydrolysis, while electrolytes, such as sodium chloride, have a definite retarding action.

THE MODIFICATIONS INDUCED BY INDUSTRIAL TREATMENTS IN SOME VEGETABLE OILS. U. Pallotta *et al.* (Univ. of Naples, Italy). *Riv. Ital. Sostanze Grasse*, Sympos. Issue **1962**, 154–60. It is possible to distinguish by analysis fats that have been refined by traditional methods from fats produced by esterification of distilled fatty acids. Esterification leads to formation of *trans* isomers which can be detected by I.R. spectroscopy as well as by chromatography. It is to be noted that the I.R. *trans* results are always higher than the ones obtained by chromatographic methods, presumably because only elaidic acid is determined chromatographically while all other isolated *trans* isomers contribute to the I.R. reading.

IDENTIFICATION OF TALLOW IN LARD BY GAS CHROMATOGRAPHY. D. Grieco (Grain Assoc. Lab., Milan, Italy). *Riv. Ital. Sostanze Grasse*, Sympos. Issue **1962**, 200–5. Gas chromatography with flame ionization detector has revealed the presence in tallow of two branched fatty acids, one with 14 and one with 16 C atoms, at levels of 0.1–0.2 and 0.3–0.7% respectively, that are absent from lard. Presence of 5–10% or more of tallow in lard can therefore be detected, even with the less sensitive thermal detectors.

EFFECT OF THE INHIBITOR CONCENTRATION ON THE OXIDATION RATE IN CERTAIN VEGETABLE OILS. C. Pietrzyk. *Roczn. Technol. Chem. Zywnosci* **9**, 81–98 (1962). Refined soyabean oil, I.V. 120.9, peroxides 0.015 mg. active O/g.; refined rapeseed (colza) oil, I.V. 101.9, peroxides 0.037 mg. active O/g. and partly oxidised linseed oil, I.V. 167.3, peroxides 0.930 mg. active O/g., were treated with various concentrations of commercial inhibitors. The latter included a mixture of 2- and 3-isomers of *t*-butyl-4-hydroxyanisole (BHA); 2,6-di-*t*-butyl-methylphenol (BHT) and nordihydroguaiaretic acid (NDGA). Optimal effect in the rapeseed oil was obtaingd with 0:06% concentration of either BHA or NDGA. Pro-oxidative effect was noted with higher concentration of these antioxidants. The BHT did not show pro-oxidative effects in the above three oils, even at concentrations as high as 5% by wt. and was classified as a "strong" antioxidant. Mixtures (1:1) of BHA and BHT in the rapeseed oil controlled the oxidation according to the BHT concentration but the pro-oxidative effect of BHA was eliminated. The pro-oxidative effect of the higher concentrations and the behaviour of anti-oxidant mixtures can be explained by the mechanism of the radical chain reactions. Equations relating oxidation rate to the concentration of antioxidant are presented and the "strength" and "efficiency" factors are calculated. (Rev. Current Lit. Paint Allied Ind.)

AQUEOUS DISPERSIONS OF PHOSPHATIDYLSERINE. IONIC PROPERTIES. M. B. Abramson, R. Katzman, and H. P. Gregor (Dept. of Chem., Polytechnic Inst. of Brooklyn, Brooklyn 1, N. Y.). *J. Biol. Chem.* **239**, 70–6 (1964). Optically clear, aqueous dispersions of phosphatidylserine were prepared by ultrasonication. Dispersions of the monosodium form in distilled water consisted of micelles with an average molecular weight of 4×10^6. The micelles were strongly acidic and had a high electrophoretic mobility; the isoelectric point was estimated at pH 1.2. All of the charged groups were readily accessible to titration. The infrared and titration data indicate that at the isoelectric point the molecule is a dipolar ion of phosphate and amino groups. As the isoelectric point is approached, coagulation occurs even in the absence of added salts. The pK_2 in 0.1 M NaCl is 3.35, and is attributed to ionization of the carboxyl group. The pK_3 at 10.0 corresponds to deprotonization of the amino group; as this pK is approached, the viscosity of the dispersions increases.

DIFFERENTIAL THERMAL ANALYSIS OF THE MELTING AND SOLIDIFICATION OF MILK FAT. F. Cantabrana and J. M. DeMan (Dept. of Dairy Sci., Univ. of Alberta, Edmonton, Alberta, Canada). *J. Dairy Sci.* **47**, 32–6 (1964). Differential thermal analysis (DTA) heating curves were recorded for milk fat cooled slowly, rapidly, and tempered; for the same fat from which 7% of HMG fraction was removed, and the same fat after randomization of the fatty acids on the glycerides. Thermal treatments led to differences in DTA curves that could be explained by the formation of mixed crystals of different glyceride groups. DTA cooling curves of milk fat, milk fat from which 7% of HMG was removed, and randomized milk fat are presented. DTA curves of conventionally churned and continuously made butters indicate that the latter type contains more mixed crystals, which may be an explanation for its different physical properties. Tributyrin was found to be a more satisfactory reference compound for DTA than was dioctylphthalate.

FLUOROMETRIC DETERMINATION OF LIPASE, ACYLASE, ALPHA- AND GAMMA-CHYMOTRYPSIN AND INHIBITORS OF THESE ENZYMES. G. G. Guilbault and D. N. Kramer (Defense Res. Div., U. S. Army Chemical Res. and Dev. Lab, Edgewood Arsenal, Md.). *Anal. Chem.* **36**, 409–12 (1964). A new, rapid method is described for the determination of steapsin, porcine pancreas, and wheat germ lipase, acylase, and chymotrypsin in the presence of other esterases. The method is based on the hydrolysis of nonfluorescent fluorescein esters by these enzymes. The rate of change in the fluorescence of the solution due to production of fluorescein, $\Delta F/\Delta t$, is measured and correlated with enzyme activity. The preparation of the substrate solution is relatively simple, and analysis requires only 3 to 5 minutes. Employing the method described, 0.0125 to 0.250 mg. per ml. of wheat germ or steapsin lipase, 0.00600 to 0.100 mg. per ml. of acylase, 0.0025 to 0.0500 mg. per ml. of porcine pancreas lipase, and 0.167 to 1.30 mg. per ml. of α- or γ-chymotrypsin may be determined with a relative standard deviation of about ± 1.5 to 2.0%.

NATURALLY OCCURRING TRIGLYCERIDES POSSESSING OPTICAL ACTIVITY IN THE GLYCEROL MOIETY. R. Maier and R. T. Holman (Hormel Inst., Univ. of Minnesota, Austin, Minn.). *Biochemistry* **3**, 270–74 (1964). Seed oils of the Chinese tallow tree, *Sapium sebiferum*, and of *Sebastiana lingustrina* were found to be optically active. By column chromatography, the light-absorbing and optically active triglyceride components of *Sapium sebiferum* were isolated and were found to have $[\alpha]_D^{20^\circ} = -21.5^\circ$ in 20% solution in chloroform. The comparable fraction from *Sebastiana lingustrina* exhibited $[\alpha]_D^{20^\circ} = -17.5^\circ$. The $E_{1\,cm}^{1\%}$ of the optically active fraction was 900 at 260 $m\mu$. The optically active fraction was separated into four subfractions by countercurrent distribution and these had rotations similar to the optically active fraction, suggesting that all the triglycerides in the optically active fraction are optically active. The unsaponifiable portion of the optically active fraction was demonstrated by thin-layer and gas-liquid chromatography to be glycerol. Fatty acid composition of the four subfractions, measured by gas-liquid chromatography, indicated the ratio of 1 mole unsaturated carboxyl-conjugated fatty acid per mole triglyceride. The unsaturated carboxyl-conjugated acids are considered to be on the α position of the glycerol.

EFFECTS OF ALIPHATIC ACIDS AND THEIR SALTS ON THE FLAME SPECTROMETRIC EMISSION OF CALCIUM. A. C. West (Thompson Chemical Lab, Williams College, Williamstown, Mass.). *Anal. Chem.* **36**, 310–14 (1964). Normal aliphatic acids from formic through caproic, isobutyric acid, and the sodium, potassium, and ammonium salts of formic through butyric have been studied. Results are discussed with respect to instrumental variables and possible mechanisms by which they can be explained. Dynamic solution surface tension (for the acids) and the dispersion of the analyte in the solid particles formed (for the salts) are concluded to be the most likely causes of the observed effects.

STUDY ON THE AUTOXIDATION OF FATS AND OILS. II. THE DISTILLED FATTY ACIDS FROM TALLOW. A. Yamajako and M. Loury (Lab. Jean Ripert, Inst. of Fats and Oils). *Rev. Franc. Corps Gras* **10**, 513–16 (1963). The advantage of using fatty acids in industrial synthesis is often counterbalanced by their ease of autoxidation in comparison to triglycerides. This fault is manifested by the appearance of undesirable color, in particular in soap-making (reversion of color during saponification). Color formation can be overcome with the use of antioxidants. BHT, BHA and hydroquinone were shown to be the most effective.

NEW METHOD FOR THE DEGUMMING OF LINSEED OIL BY A SIMPLE REFINING METHOD. R. Guillaumin and N. Drouhin (Lab. of Inst. of Fats and Oils, Paris, Fr.). *Rev. Franc. Corps Gras* **10**, 671–84 (1963). Linseed oil to be used for paints or to undergo chemical treatment must be as free as possible from gums. These gums are usually removed by water treatment, then neutralization with a solution of sodium hydroxide. Six methods were investigated for the removal of phosphatides from linseed oil. Degumming with the use of dilute hydrochloric acid was found to be the simplest and best. The procedure used to contact the oil with 0.05 to 0.3% hydrochloric acid for 15 minutes at 20–30C. The oil obtained by this treatment showed no increase in color after heating at 285C.

THE USE OF GLYCERINE AS A HEAT TRANSFER FLUID. G. Vernois (Ing.-Con. of Vanves, Seine, Fr.). *Rev. Franc. Corps Gras* **10**, 667–670 (1963). The author sets forth nine properties that an ideal heat transfer fluid should possess. These are (1) good heat transfer properties, (2) low volatility at high temperature, (3) chemical inertness to metals, (4) excellent thermal stability during service, (5) low congeal temperature, (6) low viscosity so that pumping will be easy, (7) high purity, (8) low vapor tension and (9) reasonable in cost. The author then categorically compares glycerine to a eutectic mixture of diphenol and diphenol oxide which is commercially known as Dowtherm A in the U.S.A. and by other trade names in foreign countries.

A METHOD TO OBTAIN BRASSIDIC ACID BY ISOMERIZATION OF COLZA OIL. A. Jakobowski (Inst. Przemyslu Tluszczowego, Varsovie). *Tluszczc i Srodki Piorace* **7**, 260–3 (1963). Colza oil was isomerized by refluxing it for 3 hours in an atmosphere of nitrogen with 0.5% of finely pulverized selenium using intense agitation. The isomerized colza oil was purified by partial crystallization at refrigerator temperatures. About 96% of the possible double bonds were isomerized. (Rev. Franc. Corps Gras)

DIRECTION OF RESEARCH ON COLZA AND CRAMBE ABYSSINICA OILS IN CANADA AND THE UNITED STATES. H. Niewiandomski. *Tluszczc i Srodki Piorace* **7**, 247–60 (1963). A brief review. (Rev. Franc. Corps Gras)

COMPONENT FATTY ACIDS OF THE MILK OF THE GREY (ATLANTIC) SEAL. R. G. Ackman and R. D. Burgher (Technological Res. Lab., Fisheries Res. Board of Canada, Halifax, Nova Scotia). *Can. J. Biochem. Biophys.* **41**, 2501–5 (1963). A gas-liquid chromatographic examination of the component fatty acids of the milk of the grey (Atlantic) seal confirms previous findings that in general composition the milk fats of marine mammals resemble the depot fat. An empirical correction system is suggested for argon ionization detectors.

COMPONENT FATTY ACIDS OF THE BLUBBER FAT FROM THE COMMON OR HARBOR SEAL PHOCA VITULINA CONCOLOR DE KAY. P. M. Jangaard, R. G. Ackman and R. D. Burgher (Technological Res. Lab., Fisheries Res. Board of Canada, Halifax, Nova Scotia). *Can. J. Biochem. Biophys.* **41**, 2543–46 (1963). GLC analysis revealed the presence of measurable amounts of 34 different fatty acids. Results agree fairly well with those obtained earlier by less sophisticated methods.

THE LONG SPACINGS OF POLYMORPHIC CRYSTALLINE FORMS OF LONG-CHAIN COMPOUNDS WITH SPECIAL REFERENCE TO TRIGLYCERIDES. F. D. Gunstone (The University, St. Andrews). *Chem. Ind. (London)* **1964**, 84–9. In some polymorphic forms of long-chain compounds the molecules lie vertically between the planes formed by their end groups while in others the chains are tilted. The author proposes that among *n*-saturated compounds, with their long polymethylene chains, there are certain preferred angles of tilt and that the various polymorphic modifications assume one of these. This hypothesis provides a consistent pattern for the long spacings observed with acids, salts, alcohols, esters, monoglycerides, and diglycerides. It also provides a new basis of understanding for the long spacings of simple and mixed triglycerides, and formulae have been derived from which the long spacings of saturated triglycerides can be calculated. Attempts to extend this to unsaturated compounds have not been successful.

THE OXIDATION OF A HIGHLY UNSATURATED HERRING OIL. H. Astrup (Agricultural College of Norway). *Chem. Ind. (London)* **1964**, 107. Small spring herrings containing 4% fat were processed to give an oil with an iodine value (Wijs) of 192. The ability of this oil to oxidize was tested and compared with oils of iodine value of 130 which had been prepared from winter herrings. The more highly unsaturated oil had a higher resistance towards oxidation than did the more saturated oils. Propyl gallate delayed but did not prevent oxidation. Apparently efficient antioxidants are present or have been formed in the oil from small herrings.

VEGETABLE OILS. XIII. THE COMPONENT ACIDS OF ISANO (BOLEKO) OIL. R. C. Badami and F. D. Gunstone (The University, St. Andrews). *J. Sci. Food Agr.* **14**, 863–6 (1963). Isano oil (the seed oil of the tree *Onguekoa gore* Engler) contains saturated acids (6%), oleic acid (14%), linoleic acid (5%), five C_{18} acetylenic acids (51%), four 8-hydroxy-C_{18} acetylenic acids (22%), and 9,10-dihydroxystearic acid (2%).

THE FREE FATTY ACID CONTENT OF SOME WHEAT FLOURS. W. R. Morrison (Univ. of California, Davis). *J. Sci. Food Agr.* **14**, 870–3 (1963). The amount and composition of the free fatty acids (FFA) in wheat flours from 0 to 476 weeks of age was studied. FFA content increased with age. While there was a tendency for FFA from spring flours to contain less palmitic acid and more linoleic acid than those from winter and biscuit flours, there was no apparent relationship between FFA composition and flour strength. The course of liberation of FFA in some flours was studied over a limited period. While no measurable amount of stearic acid was liberated, all other acids were liberated at a steady rate.

LIQUID SHORTENING EMULSIONS. A. S. Geisler (Atlas Chemical Industries, Inc.). *U.S. 3,117,010.* A liquid shortening emulsion consists of (1) 30–55% by weight of a fat base selected from the group consisting of liquid vegetable oils, plastic vegetable or animal fats and mixtures thereof; (2) 40–65% of water; (3) 1.5–6% of a monoglyceride having an iodine value of at least 40; and (4) 1–7% of an emulsifier composition consisting of a lipophile emulsifier (sorbitan- or isosorbide-fatty acid ester) and a hydrophile emulsifier (polyoxyethylene sorbitan- or polyoxyethylene isosorbide-fatty acid esters). The lipophile emulsifier and the hydrophile emulsifier are present in a ratio by weight of about 0 to 100 to 80 to 20, respectively. The over-all hydrophile-lipaphile balance of the monoglyceride and emulsifier composition in the emulsion has a value within the range of 5.5 to 11.5.

(Continued on page 42)

Safe Handling of LP Gas . .

(Continued from page 28)

TABLE I

Regulations for Container Locations

Water capacity/ container	Minimum distances		
	Containers		Between aboveground containers
	Underground	Aboveground	
Less than 125 gal	10 ft	None	None
125–500 gal	10 ft	10 ft	3 ft
501–2000 gal	25 ft	25 ft	3 ft
2001–30,000 gal	50 ft	50 ft	5 ft
30,001–70,000 gal	50 ft	50 ft	0.25 of sum of diam of adjacent containers
70,001–90,000 gal	50 ft	100 ft	

may be built on—plus other reasonable protective measures.

G. Vaporizers or vaporizer house installations must comply with standards.

H. Containers should be well painted and preferably with a light color.

I. Fire protection. In a regular industrial LP-Gas plant a 10-lb dry chemical extinguisher (12 B.C. rated) should be supplied and maintained in good condition. In larger plants with storage of 150,000 gal W.C. or more, provision should be made for an adequate supply of water unless other means for fire control are provided. It is suggested the plant operator contact the local fire marshal to acquaint him with the plant fire protection.

J. Lighting. Lights and switches in the hazardous area should be Group D, Class 1, explosion proof.

K. Fence. If fence is used it should be 6-ft industrial type with at least two means of emergency access.

L. Container charging room. If containers are filled in a building, it should be 10 ft from storage containers and 25 ft from adjoining property which may be built upon. Scales used for weighing containers should be equipped with automatic filling devices or indicators to assure accuracy in charging the containers. Scales should be checked daily with dead weights to insure proper wt. It is extremely important that all containers, large and small, be filled according to standards and *never overfilled.* (Table II).

M. Unloading points: operation and location.

1. Tank car or transport truck unloading points and operation:
   a. The track or tank car siding shall be relatively level.
   b. *A tank car connected* sign, as covered by ICC rules, shall be installed at the active end or ends of the siding while the tank car is connected for unloading.
   c. While cars are on sidetrack for unloading, wheels at both ends shall be blocked on the rails. Chock blocks shall be used while transport units are being unloaded.
   d. A man shall be in attendance at all times while the tank car, cars or trucks are being unloaded.
   e. The pipeline to which the unloading hoses are connected shall be equipped with a back flow check valve to prevent discharge of the LP-Gas from the receiving container and line in case of line hose or fitting rupture.
2. The tank car or transport truck unloading point shall be located with due consideration to the following:
   a. Proximity to railroads and highway traffic.
   b. The distance of such unloading point from adjacent property.
   c. With respect to buildings or installer's property.
   d. Nature of occupancy.
   e. Typography.
   f. Type of construction of building.
   g. Number of tank cars or transports that may safely be unloaded at a time.
   h. Frequency of unloading.

TABLE II

Maximum Permitted Filling Density

Specific gravity at 60F	Aboveground containers		Underground containers
	0–1200 gal total water cap.	Over 1200 gal total water cap.	All capacities
	%	%	%
0.496–0.503	41	44	45
0.504–0.510	42	45	46

N. It is very important that each person working with LP-Gas is properly trained and familiar with the standards. They should also wear leather gloves and long sleeved shirts in a plant area. All smoking materials should be left in a safe area and not carried by anyone around an LP-Gas plant.

The above is a brief sketch taken from the Standards for the Storage and Handling of Liquefied Petroleum Gases adopted by the National Fire Protection Assoc. It is suggested that anyone involved in any phase of LP-Gas use become familiar with these standards. Your local state regulations on LP-Gas, as well as N.F.P.A. Pamphlet No. 58, "Standards for Storage and Handling of LP-Gas at Utility Gas Plants," should be consulted.

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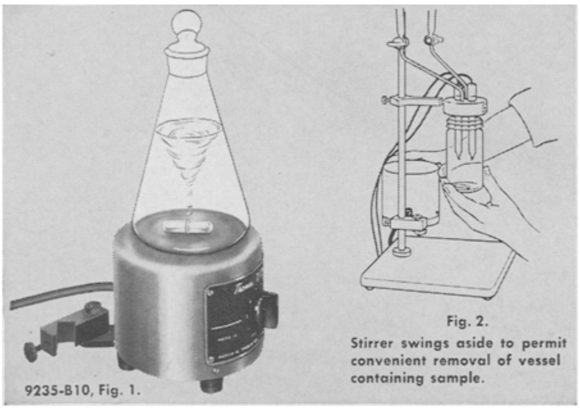

9235-B10, Fig. 1.

Fig. 2. Stirrer swings aside to permit convenient removal of vessel containing sample.

(Continued from page 40)

QUICK TEMPERING OF SHORTENINGS. C. W. Hoerr and R. J. Vander Wal (Armour & Co.). *U.S. 3,117,011.* A process for treating shortening triglycerides to improve their physical properties comprises the following steps: cooling a mass of melted triglycerides from a molten state to effect crystallization and then uniformly heating the triglycerides under quiescent conditions to a temperature of 90–110F and maintaining the triglycerides at that temperature for a period no greater than 6 hours.

FAT-CONTAINING DRIED DAIRY PRODUCT AND METHOD OF MANUFACTURE. J. M. McIntire and C. C. Loo (Dairy Foods, Inc.). *U.S. 3,120,438.* A process for the manufacture of a fat-containing dried dairy product which is a free-flowing granular material characterized by high wettability and dispersibility in cold water comprises the following steps: introducing malted milk powder into a treatment zone; moistening the individual particles of the milk powder with an emulsion consisting of water and lecithin and a strongly hydrophilic surfactant, the ratio of water to lecithin in the emulsion being so calculated that the final product will contain from 0.2% to 1.5% by weight of lecithin. The emulsion causes the moistened particles to be sticky and to adhere together to form random shaped aggregates while dispersed in the treatment zone. Excess moisture from the aggregates is then removed outside the treatment zone.

• Fatty Acid Derivatives

INFRARED ABSORPTION SPECTRA OF HYDROXYL AND CARBONYL DERIVATIVES OF OCTADECANOIC ACID. R. Guillaumin (Lab. of Inst. of Fats and Oils, Paris, Fr.). *Rev. Franc. Corps Gras* **10**, 541–47 (1963). The infrared characteristic absorption was studied in the 2 to 15 micron range of a number of mono- and polyhydroxy derivatives of stearic acid as well as the carbonyl derivatives.

EFFECT OF THE DEGREE OF ACETYLATION ON THE CONSISTENCY OF ACETYLATED FATS. J. Pokorny and I. Tomankova (Inst. Chem. Tech., Prague). *Papers Inst. Chem. Tech. Prague* **6**, 171–7 (1962). Mixtures of mono- and diglycerides of stearic acids and fatty acids from hardened fats were acetylated in different degrees by means of acetic anhydride. The heat resistance of the resulting acetylated fats varies as a function of the degree of acetylation since melting point and dilatation are linear functions of the percentage of unreacted hydroxyl groups.

PARTICULATE NITROCELLULOSE COATED WITH SORBITAN TRIOLEATE. R. E. Coffee (Olin Mathieson Chemical Corp.). *U.S. 3,118,797.* Nitrocellulose particles are coated with sorbitan trioleate in a proportion equivalent to between 0.02 and 0.5% by weight of the nitrocellulose. The coating of sorbitan trioleate is substantially complete and of substantially uniform thickness.

• Biology and Nutrition

STUDIES ON THE METABOLISM OF CIS,TRANS ISOMERS OF METHYL LINOLEATE AND LINOLENATE. M. L. Blank and O. S. Privett (Hormel Inst., Univ. of Minnesota, Austin, Minn.). *J. Lipid Res.* **4**, 470–476 (1963). Studies were made of the group composition of the lipids and of the fatty acid components in each class of lipids in the livers of rats fed a fat-free diet or diets supplemented with methyl linoleate (*cis*-9,*cis*-12-octadecadienoate); methyl *cis*-9,*trans*-12-octadecadienoate; and methyl linoleate, which contained 30% of the double bonds in the *trans* configuration. The conversion of methyl *cis*-9,*trans*-12-octadecadienoate to an isomer of archidonic acid, believed to be *cis*-5, *cis*-8,*cis*-11,*trans*-14-eicosatetraenoic acid, and of "*cis,trans*"-methyl linolenate to polyenoic acids containing *trans* unsaturation in rats is reported. The metabolism of *trans* acids in relation to the nutritional requirements of the rat for essential fatty acids is discussed. 4,7,10,13-Eicosatetraenoic acid was found in the liver phospholipids of rats fed a fat-free diet and, to a lesser extent, in the liver phospholipids of a group of rats receiving a supplement of methyl linoleate.

THE INTESTINAL ABSORPTION OF FATTY ACID: A BIOCHEMICAL AND ELECTRON MICROSCOPIC STUDY. C. T. Ashworth and J. M. Johnston (Depts. of Pathology and Biochem., Univ. of Texas Southwestern Med. School, Dallas, Texas). *J. Lipid Res.* **4**, 454–460 (1963). Following the administration of 2 ml of C^{14}-labeled oleic acid to rats by stomach tube, osmiophilic droplets and particles, from 10 to 300 $m\mu$ in diameter, were demonstrated in the intestinal lumen. The smaller droplets of fatty acid were frequently found between the microvilli of intestinal epithelial cells and were of the same size range as has been proposed for lipid micelles (10 mμ). The radiochemical examination of the lumen contents revealed that the activity was still present in free fatty acids. Larger osmiophilic droplets, averaging 150 mμ in diameter, were found in cytoplasmic vesicles within the epithelial cells. These findings suggest that electron microscopic visualization of lipid droplets cannot distinguish between fatty acid and mono-, di-, and triglycerides. Chemical and radiochemical findings in the absorption of fatty acid indicate that the fatty acid enters the chyle primarily as triglyceride, that the triglyceride content of the intestinal wall is increased, and that there is a significant transfer of the C^{14} label from fatty acid to triglyceride at some stage during absorption. These observations mean that at least some of the osmiophilic droplets seen with electron microscopy in the intestinal epithelial cells in fatty acid absorption must be triglycerides.

Structures of the normal unsaturated fatty acids of brain sphingolipids. Y. Kishimoto and N. S. Radin (Mental Health Research Inst., Univ. of Michigan, Ann Arbor). *J. Lipid Res.* 4, 437–443 (1963). A description is presented of the structural characterization of the normal unsaturated fatty acids of pig brain sphingolipids. The acids were isolated with the use of silver nitrate-impregnated silica gel and gas-liquid chromatography, and the positions of the double bonds were determined by a simplified ozonolysis procedure. In this method, the methyl esters were treated consecutively with ozone, performic acid, and diazomethane. Gas-liquid chromatography with a temperature program permitted analysis of the degradation products without preliminary separation of the mono- and dicarboxylic acids. Twenty-seven chemically-defined unsaturated acids were found, 25 of which have not been previously reported. These include the odd- and even-numbered monoenoic acids 22–26 carbon atoms long, as well as C$_{24}$, C$_{25}$, and C$_{26}$ dienes. Each acid consisted of 2–4 positional isomers, which appear to have been derived from oleic, palmitoleic, linoleic, or an odd-numbered acid by chain elongation.

Biosynthesis of nervonic acid and its homologues from carboxyl-labeled oleic acid. *Ibid.*, 444–447. An emulsion of carboxyl-labeled potassium oleate was injected directly into the brains of a group of rats, and 24 hours later the rats were sacrificed. The brain sphingolipids were isolated, and from these, the individual normal unsaturated acids. The major acid, nervonic, was cleaved by ozonolysis and also by decarboxylation. Virtually no activity was found in the chain portion from the ω-end, while 74% of the activity was found in the carboxyl group. It would appear that very little oleate entered the cells that make the sphingolipid acids and that much of it was degraded to acetate. The labeled acetate thus formed was used to lengthen shorter acids.

In vivo conversion of labeled fatty acids to the sphingolipid fatty acids in rat brain. A K. Hajra and N. C. Radin. *Ibid.*, 448–453. Emulsions of carboxyl-labeled palmitate, stearate, lignocerate, and DL-cerebronate were injected into the brains of weanling rats. After various time intervals, the rats were sacrificed, and the saturated fatty acids of the brain sphingolipids were isolated and decarboxylated. All four acids had been incorporated into the sphingolipids. The palmitate and stearate gave rise to radioactive lignocerate and cerebronate in which the carboxyl groups were relatively nonradioactive. The lignocerate-C^{14} gave rise to labeled cerebronate in which the carboxyl group contained nearly all the activity. The injected cerebronate-C^{14} underwent little or no conversion to normal acids.

Measurement of serum triglycerides by thin-layer chromatography and infrared spectrophotometry. K. Krell and S. A. Hashim (Dept. of Med., St. Luke's Hosp. and Inst. of Nutrition Sciences, Columbia Univ., New York, N. Y.). *J. Lipid Res.* 4, 407–412 (1963). A direct and nondestructive method for the quantitative determination of serum or plasma triglycerides has been developed. The lipid extract of 1 ml of serum is chromatographed on 1-mm wet-thickness silicic acid layers prepared from a water-acetone slurry. Following elution, triglycerides are quantified by infrared spectrophotometry. For both synthetic and naturally occurring triglycerides, a nonlinear relationship of absorptivity as a function of concentration has been characterized. Precision of the method is 2% and accuracy 4%. Recoveries average 96%. The method is sensitive to serum concentrations as low as 20 mg/100 ml.

The substrate specificity of phospholipase A. L. L. M. Van Deenen and G. H. De Haas (Dept. of Biochem., Lab. of Organic Chemistry, State Univ. of Utrecht, Utrecht, Netherlands). *Biochim. Biophys. Acta* 70, 538–553 (1963). Investigations on variously modified analogues of phospholipids elucidated the following substrate characteristics for phospholipase A (*Crotalus adamanteus*). Within the class of α-phosphoglycerides L-isomers are readily hydrolysed, while D-α-phospholipids appeared not to be attacked. L-α-lecithins containing fatty acids with greatly varying chain length are susceptible to phospholipase A action; however, certain water-soluble short-chain compounds are hydrolysed at a very slow rate only. Glycol analogues were demonstrated to exhibit substrate activity. Phospholipase A catalyses the hydrolysis of a symmetric β-lecithin into an optical-active lysolecithin.

The effect of biotin deficiency on the synthesis of fatty acids by yeast. H. Suomalainen and A. J. A. Keranen [Research Lab. of the State Alcohol Monopoly (Alko), Helsinki, Finland]. *Biochim. Biophys. Acta* 70, 493–503 (1963). Biotin was replaceable by the unsaturated long-chain fatty acids, oleic and palmitoleic, when added with aspartic acid to biotin-deficient baker's yeast under aerobic conditions. Baker's yeast grew normally with ethyl stearate and palmitate under similar conditions. This is explained by the ability of the esters to penetrate into the yeast cells, where the saturated acids were converted into unsaturated ones. When baker's yeast grew in the absence of biotin under aerobic conditions, the content of C$_{18}$ fatty acids, including oleic acid, decreased, and the content of C$_{16}$ fatty acids, particularly palmitoleic acid, and of acids with less than 16 carbons atoms, increased.

Effect of triparanol on atherosclerosis and on sterol composition and concentration in serum and aorta of the chicken. H. Y. C. Wong, J. Avigan, R. L. Raiford, A. Butler, and H. E. Vroman (Dept. of Physiology, College of Med., Howard Univ., Washington, D. C.). *J. Lipid Res.* 4, 477–480 (1963). The administration of triparanol resulted in an increase in serum total sterols and desmosterol in both cockerels and egg-laying pullets. In all cases, the administration of triparanol caused a cessation of egg production. It appears that triparanol enchances the degree and incidence of atherosclerosis of the aorta of the chicken.

Fate of palmitate and of linoleate perfused through the isolated rat liver at high concentrations. P. J. Nestel and D. Steinberg (Lab. of Metabolism, Nat'l Heart Inst., NIH, Bethesda 14, Md.). *J. Lipid Res.* 4, 461–469 (1963). When rat livers were perfused with red cell-albumin solutions containing high concentrations of free fatty acids (FFA), the FFA were very rapidly taken up. The net increase in liver glyceride content was independent of whether palmitate, linoleate, or a combination of the two was used to raise the FFA concentration of the perfusate. The changes in the fatty acid pattern of the glycerides in the liver and in the perfusate indicated that the fatty acid added to the perfusate to raise the FFA concentration to high levels was being preferentially utilized for formation of the new glycerides. Perfusion with palmitate markedly increased the percentage of palmitate in the perfusate glycerides. Linoleate had less effect on the fatty acid pattern of the liver glycerides and a greater effect on that of the perfusate glycerides. Studies of utilization of labeled FFA by liver slices showed that relatively more labeled palmitate was incorporated into glycerides and relatively more linoleate into phospholipids. Livers were perfused with palmitate at low and at high concentration adding palmitate-1-C^{14} as a tracer. It was shown that high FFA concentrations strongly stimulated conversion to C^{14}O$_2$ and incorporation into glycerides but had a less marked effect on incorporation into phospholipids.

Genetic variations in plasma lipid content in mice. R. S. Yamamoto, L. B. Crittenden, L. Sokoloff, and G. E. Jay, Jr. (Nat'l Inst. of Arthritis and Metabolic Diseases and Nat'l Cancer Inst., NIH, Bethesda 14, Md.). *J. Lipid Res.* 4, 413–418 (1963). Large genetic variations in plasma concentrations of total lipids, cholesterol + cholesterol ester, and phospholipids were found in STR/1N, DBA/2JN, and A/LN mice and their crosses. The concentrations were constant from 2 to 16 months of age and were independent of sex.

THE ROLE OF MICROSOMES IN FATTY ACID SYNTHESIS FROM ACETATE BY CELL-FREE PREPARATIONS OF RAT LIVER AND MAMMARY GLAND. S. Abraham, K. J. Matthes and I. L. Chaikoff (Dept. of Physiology, Univ. of Calif., Berkeley). *Biochim. Biophys. Acta* 70, 357–369 (1963). The conversion of acetate to fatty acids by particle-free supernatant and microsomal fractions of rat livers and of lactating and non-lactating rat-mammary glands was studied. Stimulation of fatty acid synthesis by addition of microsomes to the supernatant fraction was related to the amounts of microsomal protein and ATP added to the incubation mixtures. Excessive amounts of either one depressed the level of synthesis, which could be reversed by addition of larger amounts of the other.

METABOLISM OF 1-C^{14} LIGNOCERIC ACID IN THE RAT. S. Gatt (Dept. of Biochem., Hebrew Univ. Hadassah Med. School, Jerusalem, Israel). *Biochim. Biophys. Acta* 70, 370–380 (1963). 1-C^{14} Lignoceric (tetracosanoic) acid was synthesized and administered to rats. Following intravenous injection, the fatty acid accumulated in the liver, was slowly oxidized to $C^{14}O_2$ and incorporated into sphingolipids, cholesterol esters and glycerides; a large portion of the administered acid was found as free fatty acid for periods of 24 hours or more. After intracerebral administration to young rats, lignoceric acid was incorporated into the brain sphingolipids and glycerides.

LIPID METABOLISM AND THE LAYING HEN. I. PLASMA-FREE FATTY ACIDS AND THE ONSET OF LAYING IN THE DOMESTIC FOWL. P. J. Heald and H. G. Badman (Twyford Laboratories Ltd., London N. W. 10, Great Britain). *Biochim. Biophys. Acta* 70, 381–388 (1963). It has been found that the onset of laying in the domestic fowl is preceded by large increases in the plasma-free fatty acids, total lipids and phosphoproteins, the quantities of these components decreasing markedly when laying commences. No such changes were detected in the cockerel on coming to maturity. When intermittent egg laying was induced by decreasing the duration of exposure to light, a cyclical rise and fall of the plasma component was found to be associated with oviposition. The clearance rates of C^{14}-palmitate from the plasma of the laying hen were not markedly different from those of the immature pullet; the flux was related to concentration of free fatty acids in the plasma.

FURTHER STUDIES OF THE MECHANISM OF THE PLASMA CHOLESTEROL ESTERIFICATION REACTION. J. A. Glomset (Div. of Endocrinology and Metabolism, Dept. of Med., Univ. of Washington, Seattle). *Biochim. Biophys. Acta* 70, 389–395 (1963). The role of the major plasma lipoprotein fractions in the plasma cholesterol esterification reaction has been studied. Human plasma was incubated at 37C for 24 hr, and the lipoproteins were subsequently fractionated by ultracentrifugal flotation. Each fraction was compared to the corresponding non-incubated control with respect to content of total and unesterified cholesterol, lecithin, and lysolecithin. Although the total cholesterol content of the individual fractions did not change as a result of the incubation, the unesterified cholesterol of each decreased, the greatest decrement being associated with the low-density lipoproteins. In contrast, the greatest decrement in lecithin was in the high-density fraction, and the greatest increment in lysolecithin was in the "very high-density" fraction. When lipoprotein fractions obtained by precipitation with ethanol were incubated separately, it was found that the relative decrease in α-lipoprotein unesterified cholesterol was much greater than that in β-lipoprotein unesterified cholesterol, and comparaable results were obtained with lipoproteins prepared by differential flotation.

ENHANCEMENT OF CHOLESTEROL ESTERIFICATION IN SERUM BY AN EXTRACT OF GROUP-A STREPTOCOCCUS. R. Rowen and J. Martin (Dept. of Microbiology and Immunology, Albert Einstein College of Med., New York, N. Y.). *Biochim. Biophys. Acta* 70, 396–405 (1963). Extracts of certain Group-A streptococci, in minute amounts, markedly increase the rate and extent of cholesterol esterification occurring in human serum held at 37C. The direct transfer of a single fatty acid from lecithin to cholesterol constitutes the major mechanism of cholesterol esterification *in vitro* in human serum; the rate and extent of ester formation being limited by the availability of lipoprotein-bound lecithin. The streptococcal factor, in promoting the degradation of high-density serum lipoprotein, evidently enhances esterification by making bound lecithin more accessible to the serum enzyme involved in fatty acid transfer.

THE PHOSPHOLIPIDS OF LIVER-CELL FRACTIONS. I. THE PHOSPHOLIPID COMPOSITION OF THE LIVER-CELL NUCLEUS. M. I. Gurr, J. B. Finean and J. N. Hawthorne (Dept. of Medical Biochemistry and Pharmacology, Medical School, Birmingham, Great Britain). *Biochim. Biophys. Acta* 70, 406–416 (1963). Nuclei have been isolated from rat liver and their purity investigated by electron microscopy. Nuclear phospholipid, cholesterol, DNA and protein have been determined. The phospholipid composition of the nuclei has been investigated by hydrolysis and two-dimensional paper chromatography and compared with the phospholipid composition of whole liver. The amount of lipid in the nucleus is small, but the pattern of lipids is similar to that in the whole cell with the exception that cardiolipin is absent from the nucleus.

SEPARATION OF THE LIPIDS OF PHOTOSYNTHETIC TISSUES: IMPROVEMENTS IN ANALYSIS BY THIN-LAYER CHROMATOGRAPHY. B. W. Nichols (Brunet College, London, Great Britain). *Biochim. Biophys. Acta* **70**, 417–422 (1963). Thin-layer chromatography on silicic acid, using solvents of carefully controlled water content, has permitted the separation of the total lipids of lettuce and cabbage into at least 19 components. Only a small proportion (chiefly phosphatidyl glycerol) of the leaf phospholipids was present in the chloroplast fraction, which contained a novel, unidentified lipid in addition to mono- and di-galactolipids. Free sterols, sterol esters and triglycerides were detected in extracts from the whole leaf, but were absent from the corresponding chloroplast preparation. Sterol glycosides were abundant both in the whole leaf and in the stalk, but the other glycolipids were concentrated mainly in the photosynthetic tissue.

THE DETERMINATION OF THE FATTY ACID COMPOSITION OF SERUM LIPIDS SEPARATED BY THIN-LAYER CHROMATOGRAPHY; AND A COMPARISON WITH COLUMN CHROMATOGRAPHY. D. T. Bowyer, W. M. F. Leat, A. N. Howard and G. A. Gresham (Depts. of Pathology and Agriculture, Univ. of Cambridge, Great Britain). *Biochim. Biophys. Acta* **70**, 423–431 (1963). A method is described for the determination of fatty acid patterns of individual phospholipids (viz. lecithin, lysolecithin and sphingomyelin) and neutral lipids (viz. sterol esters, free fatty acids and triglycerides) of serum by gas-liquid chromatography, after their separation by thin-layer chromatography. Replicate determinations indicate that the method gives highly reproducible results, and there is no evidence of loss of unsaturated fatty acids by oxidation. In a comparison between thin-layer and column chromatographic methods, values for the fatty acid composition of cholesterol esters, triglycerides and free fatty acids were in good agreement. With phospholipids agreement for values of lecithin and lysolecithin was moderately good but with sphingomyelin agreement was poor.

THE SEPARATION OF NEUTRAL BLOOD-SERUM GLYCOLIPIDS BY THIN-LAYER CHROMATOGRAPHY. E. Svennerholm and L. Svennerholm (Dept. of Medical Biochem., Univ. of Gothenburg, Gothenburg, Sweden). *Biochim. Biophys. Acta* **70**, 432–441 (1963). A method is described for the quantitative isolation of neutral glycolipids of blood serum on thin-layer plates of silica gel. Four different glycolipids have been isolated and characterized: ceramide-monohexoside, -dihexoside, -trihexoside and -trihexoside-N-acetylgalactosamine. The ceramide-monohexoside is a glucocerebroside. All the hexosides, except the amino sugar containing one, contained both normal and hydroxy fatty acids. The glucocerebroside and the ceramide-dihexoside constitute more than ⅘ of total neutral serum glycolipids.

THE STRUCTURE OF MYCOSIDE B. H. Demarteau-Ginsburg and E. Lederer (Institut de Chimie des Substances Naturelles, C.N.R.S., Gif-sur-Yvette, Seine-et-Oise, France). *Biochim. Biophys. Acta* **70**, 442–451 (1963). Mycoside B, a specific glycolipid found in bovine strains of *Mycobacterium tuberculosis* is shown to be a mixture of homologous compounds differing by the nature of the fatty acids. The principal constituent of this mixture is a mycoside B having the molecular formula $C_{84}H_{156}O_{10}$; it contains one molecule of 2-O-methyl-D-rhamnose bound in B linkage to the phenolic hydroxyl of a phenolic, methoxylated glycol $C_{32}H_{58}O_4$, the two aliphatic hydroxyls of which are esterified with one molecule of palmitic acid and with one molecule of C_{29}-mycocerosic acid. A provisional formula for mycoside B is presented.

STUDIES ON THE MUCOLIPIDS AND THE CEREBROSIDES OF CHICKEN BRAIN DURING EMBRYONIC DEVELOPMENT. O. W. Garrigan and E. Chargaff (Dept. of Biochem., College of Physicians and Surgeons, Columbia Univ., New York, N. Y.). *Biochim. Biophys. Acta* **70**, 452–464 (1963). The formation of mucolipids, cerebrosides, and other brain constituents has been examined in the developing chick embryo. Mucolipids were isolated from adult chicken brain and a corresponding fraction from 10 developmental stages (starting at 4.5 days) of the chick-embryo brain. These fractions are compared with regard to amount per cell, composition, and several physical properties.

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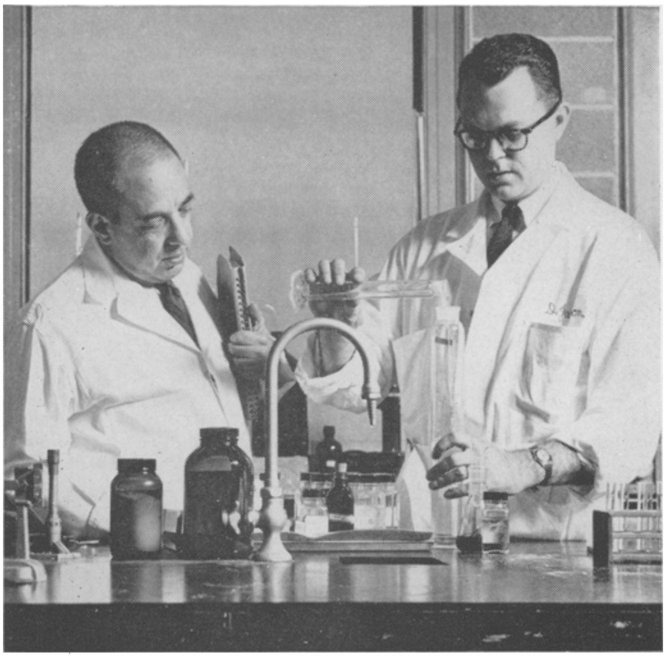

The Rendering Industry . . .

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One of their first research projects was initiated in 1950, in cooperation with the American Meat Institute Foundation and the U. S. Department of Agriculture. Starting with meat meal and tankage, this cooperative program was soon expanded to include animal fats and other animal and poultry by-products. It also developed the initial findings from which a totally new market was born . . . the addition of animal fats to feeds.

When the first estimates of this market were announced in 1952, predictions were made that the annual usage would be about 250 million pounds a year. These were to prove conservative. Recent figures show that the U. S. feed industry now uses more than 500 million pounds of tallow and grease alone, along with substantial amounts of meat and bone meal, feather meal and poultry by-products meal. Growth in the use of fats in feeds from the present level to a high of 1.4 billion pounds annually over the next decade does not appear unreasonable.

Today, fat is added to practically all commercial dry dog food and to most chicken feeds, particularly to broiler and layer rations. Many turkey and calf feeds, as well as some hog and beef cattle feeds, also contain added fat. Much of the reason for this is that animal fats contain approximately 2.5 times as much energy as corn, the most common feed ingredient. The high-efficiency, high-protein rations commonly used today require this energy boost and in most cases tallow and grease can provide it more economically than any other ingredient.

Even when corn prices are low, feed manufacturers favor the use of tallow in their rations for many other reasons. Added fat contributes many nutritional benefits to feeds and acts as an aid in processing as well. In addition to its caloric or energy value, fat increases feed efficiency, reduces dustiness, makes for easier handling; it increases palatability, reduces wear on handling, mixing and other machinery; it aids in homogenizing and stabilizing the mixture of fine particled feed additives, supplies an added growth factor and gives feed a better appearance. Adding fat to pelleted feeds leads to an increase in pelleting rate, longer service life for pelleting dies and less wear on pelleting machinery. It also enables manufacturers to make pellets with feeds that otherwise could not be pelleted.

These "plus" factors cause feed formulators to use fats even when the energy-cost ratio for fats is above other energy sources. In a recent year, for example, use of fats continued to expand though their cost averaged 34% above corn on an equivalent energy basis.

A wide range in kinds and grades of fats and oils is incorporated into livestock feeds. As long as a fat is not rancid or becoming rancid, does not have an objectionable odor, is clean, has a stability of at least 20 hours (A.O.M.), and is low in moisture, it should make a satisfactory feed ingredient. Recent studies indicate that, of the total volume of fats and oils used in formula feeds, fancy tallow accounted for about 26% of the total, prime tallow 29%, other tallows 18%, white grease 2%, yellow grease 13%, other greases 4%, and fats and oils other than tallow and grease 8%.

Another growing market for our ever-mounting stockpile of inedible tallow is the fatty acid industry. Here animal fat, principally in the form of inedible tallow, is the largest single source material for fatty acids.

Fortunately, the prospects of tallow as a chemical raw material are limited only by the chemists' imagination. It furnishes straight-chain carbon compounds not obtainable from petroleum, for example. It furnishes structures at a cost at which they could not be synthesized from other sources. Some are materials rarely found or not at all present in natural products. In 1960 about 50% of the

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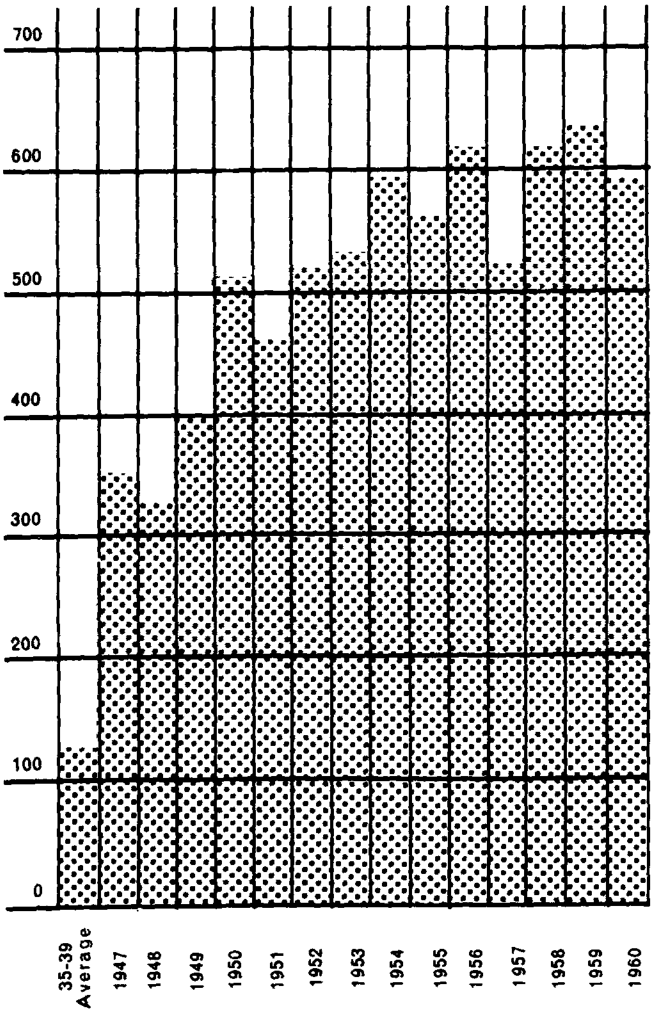
THE GROWTH OF FATS IN INDUSTRY
Million Pounds



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Specificities of lipases. P. Desnuelle and P. Savary (Institut de Chimie Biologique, Faculté des Sciences, Marseilles, France). *J. Lipid Res.* 4, 369–384 (1963). This review is devoted to the specificities displayed by the best characterized lipases, mainly pancreatic lipase. 174 references.

Purification and partial characterization of sphingomyelin from human plasma. C. C. Sweeley (Dept. of Biochem. and Nutrition, Univ. of Pittsburgh, Pittsburgh 13, Pa.). *J. Lipid Res.* 4, 402–406 (1963). Isolation of pure sphingomyelin from human plasma on a preparative scale is described. Analyses of fatty acids by gas-liquid chromatography on two polar polyester columns indicate the presence of all even- and odd-carbon, saturated fatty acids from C_{14} to C_{25} and most of the corresponding monoenoic acids as well. Palmitic acid is the predominant component; seven of the acids constitute over 90% of the total fraction. A previously unassigned trace constituent of the fatty acid fraction has been tentatively identified as a C_{24} dienoic acid on the basis of relative retention times, microhydrogenation, and reaction with mercuric acetate.

The incorporation of dimethylaminoethanol and dimethylaminoisopropyl alcohol into Phormia regina phospholipids. L. L. Bieber and R. W. Newburgh (Dept. of Chemistry, Oregon State Univ., Corvallis, Oregon). *J. Lipid Res.* 4, 397–401 (1963). The effect of replacing dietary choline with dimethylaminoethanol and dimethylaminoisopropyl alcohol on the larval phospholipids of the blowfly *Phormia regina* was investigated. It was found that these compounds were incorporated into the phospholipids to the extent of approximately 30% of the total phospholipids when dimethylaminoethanol was used and approximately 18% when dimethylaminoisopropyl alcohol was added to the diet. The separation of these phospholipids by silicic acid chromatography followed by chromatography on DEAE-cellulose is described.

The uptake from the blood of triglyceride fatty acids of chylomicra and low-density lipoproteins by the mammary gland of the goat. J. M. Barry (University of Oxford), W. Bartley, J. L. Linzell, and D. S. Robinson. *Biochem. J.* 89, 6–11 (1963). Arteriovenous measurements were made across the mammary glands of lactating goats to discover which fractions of the plasma lipids provide fatty acids for the formation of milk fat. It was concluded that a large part, and possibly all, of the fatty acids of milk that come from the blood lipids are derived from the triglycerides of the chylomicra and d <1.019 low-density lipoproteins.

The phospholipids of the housefly, Musca domestica. H. D. Crone and R. G. Bridges (Pest Infestation Lab., Slough, Bucks). *Biochem. J.* 89, 11–21 (1963). The major components of the phospholipid fraction of the housefly are: phosphatidylethanolamine (65% of the total lipid phosphorus), phosphatidylcholine (17%), phosphatidylserine (3.5%), phosphoinositide (3%), a material believed to be a polyglycerophosphatide (5%), plasmalogens (1.3%), a glycerol ether phosphatide (1%), and a sphingolipid containing phosphorus and ethanolamine (3.5%).

Fatty acid composition of the serum lipids of pigs given different amounts of linoleic acid. W. M. F. Leat (Univ. of Cambridge). *Biochem. J.* 89, 44–51 (1963). The fatty acid compositions of the serum lipids of 6 pigs fed with olive oil to supply from 0.1 to 3.7% of the calories as linoleic acid have been determined. The major changes in fatty acid composition occurred when dietary linoleate supplied less than 1% of the calories. In the phospholipid fraction decreasing dietary linoleate resulted in a decrease in the percentage of linoleic acid and arachidonic acid and an increase in that of eicosatrienoic acid. Of the total eicosatrienoic acid and arachidonic acid in serum, 70–75% was associated with the phospholipids. In the sterol esters a decrease in dietary linoleate resulted in a fall in the percentage of linoleic acid, which was compensated for by a rise in that of oleic and palmitoleic acids. Of the total linoleic acid in serum, 60–70% was associated with the sterol esters. The fatty acid composition of the triglycerides and non-esterified fatty acids were least affected by changes in dietary linoleate.

Fatty acids of different tissue lipids in rats fed on diets qualitatively different in lipid composition. E. Turchetto, M. Proja and M. G. Gandolfi (Universita di Bologna). *Biochem. J.* 89, 22P (1963). The diets contained 10% of the following fats: hydrogenated coconut oil, tallow, olive oil, peanut oil, or corn oil. Statistical evaluation of analytical results showed a clear influence of dietary lipids on total lipids and especially on the neutral fat of the different tissues; phospholipids were modified to a lesser extent. Dietary lipids influenced to a decreasing extent the depot lipids, the neutral fat of liver, serum, muscle and heart; phospholipids of heart were least modified. Tallow and hydrogenated coconut oil increased the saturated fatty acid content; olive oil did not produce appreciable modifications; peanut and corn oils induced a general increase of unsaturated acids and in particular of linoleic and arachidonic acids.

FATTY ACIDS IN HOSPITAL MENUS. Margaret O. Osborn and Margaret A. Ohlson (State University of Iowa). *J. Am. Dietet. Assoc.* 43, 533–6 (1963). Fatty acids in the food served during 84 days in the cafeteria for the professional staff of a university hospital were calculated from values in food tables and also were determined by gas chromatography. Comparison of calculated and analyzed values showed close agreement. The diet averaged 2800 calories per day with 41.2% calories as fat and had a P/S ratio of 0.2. An average of 3.4% of calories was from linoleic acid. Daily averages of fatty acids (as % of total fatty acids) were: saturated 46.1, oleic 40.8, linoleic 9.0, linolenic 0.6, and unidentified unsaturated fatty acids 3.5.

TOTAL LIPIDS AND FATTY ACIDS IN BREAD. A. I. Fleischman, Gertrude Eastwood, and Marilyn Davis (St. Vincent's Hospital, Montclair, N.J.). *J. Am. Dietet. Assoc.* 43, 537–40 (1963). Total lipids and fatty acid composition of 26 commercial breads (white, dietetic white, wheat, rye) were determined by gas liquid chromatography. The reported results indicate wide variations in both total lipid and P/S ratio within each class of bread and between different varieties of bread produced in one bakery. The authors point out the necessity for knowing both the type and brand name of bread in computing diets.

YIELD AND COMPOSITION OF BROILER-FRYERS FRIED BY THREE METHODS. Ann Abbott Smith and Gladys E. Vail (Purdue University). *J. Am. Dietet. Assoc.* 43, 541–4 (1963). Broiler-fryer chickens, each divided into 10 parts, were fried by 3 methods. The effect of method on yield and composition was determined. In general, skillet-frying gave a higher yield than deep-fat or oven-frying. Deep-fat-fried birds contained the highest percentage of fat. The back, ribs, and heart contained higher percentages of fat than other muscles, and the breast contained the lowest. For all cooking methods, percentages of fat in the skin were high compared with that in the meat.

EFFECT OF OLEIC AND LINOLEIC ACIDS ON THE ABSORPTION OF SATURATED FATTY ACIDS IN THE CHICK. R. J. Young and R. L. Garrett (Dept. of Poultry Husbandry, Cornell Univ., Ithaca, N. Y.). *J. Nutr.* 81, 321–29 (1963). Palmitic and stearic acids, which are utilized very poorly by the chick when fed singly, are absorbed to a significant degree when fed in a mixture of fatty acids such as hydrolyzed lard. Oleic acid appears to play a direct role in facilitating the absorption of the saturated fatty acids. It is not known whether this effect is exerted in the lumen or in the mucosal cells of the intestine.

GROWTH HORMONE EFFECTS ON BOVINE BLOOD PLASMA FATTY ACID CONCENTRATION AND METABOLISM. W. F. Williams, S. D. Lee, H. H. Head, and J. Lynch (Dept. of Dairy Sci., Univ. of Maryland, College Park). *J. Dairy Sci.* 46, 1405–08 (1963). Blood plasma FFA concentrations have been determined in 22 dairy cows. Plasma FFA concentration averaged 0.34 ± 0.08 meq/liter. Treatment with growth hormone resulted in an average 50% increase in plasma FFA concentration 6 hr after administration. Four experiments indicated that growth hormone treatment probably resulted in increased acetate turnover.

INFLUENCE OF FATTY ACIDS ON APPEARANCE OF BACTERIAL PHOSPHOLIPASE D IN INCUBATED PLASMA. W. C. Vogel and L. Zieve (Lab. for Cancer Res., Minneapolis Veterans Hosp., Univ. of Minn.). *Proc. Soc. Exp. Biol. Med.* 114, 805–08 (1963). The role of fatty acids in the elaboration of bacterial phospholipase D in incubations of fresh human plasma has been studied. An optimal amount of fatty acid could be specified, dependent on the amount and type of protein present. Enzyme activity was greater in the presence of cephalin (PE) than lecithin, oleic acid than palmitic acid, and globulin than albumin.

GROSS AND MICROSCOPIC PATHOLOGY OF TOCOPHEROL-DEFICIENT MINK. H. D. Stowe and C. K. Whitehair (Dept. of Veterinary Pathology, Michigan State Univ., East Lansing, Mich.). *J. Nutr.* 81, 287–300 (1963). Experimental tocopherol deficiency was produced in young male mink to study the subsequent gross and microscopic lesions and the extent to which they were

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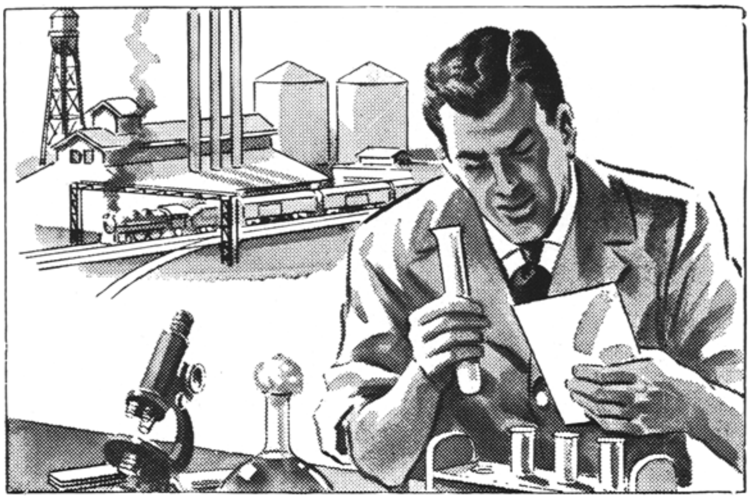

The Rendering Industry . . .

(Continued from page 48)

raw material used in the production of our commercial fatty acids originated from this source. Prior to World War II, production of animal fatty acids took a relatively insignificant part of the tallow market . . . some 100 million pounds . . . as compared to 2 billion pounds for soap.

During the war, regulations were put into effect limiting the use of fat in soapmaking processes in which glycerine, needed in high volume for the war effort, was not recovered. This opened up new markets for fatty acids as a starting point for the specialty soap manufacturer. The greasemaker, too, found that fatty acids were more uniform than the glycerides then available. The result was a rise in annual fatty acids production from about 100 million to over 300 million pounds from 1941–1951.

Fatty acids are processed in many ways to create a wide diversity of products. For example, the process of oxidation is used to oxidize oleic acid through the use of ozone to form azelaic and pelargonic acids. Esters of both azelaic acid and pelargonic acid are well known for their utility in synthetic lubricants for jet aircraft and plasticizers for vinyl chloride, rubber and other polymer systems. Additionally, azelaic acid is finding use in polyamides, and polyurethanes in the form of "Spandex" fibers. Pelargonic acid has been used to prepare high gloss, hard finish alkyd resins. Approximately 4 pounds of tallow are necessary for the manufacture of one pound of azelaic acid.

The unit process of amidation is used to react fatty acids with ammonia or amines to form amides. Oleic amide and the diamide of stearic acid and ethylene diamine are used as anti-blocking agents in polyethylene film. Other amides are used as detergents and foam boosters or stabilizers. Stearamids and stearanilide are used as waxes and buffing compounds.

In the process of amination, both nitriles and fatty amines are prepared. Nitriles are used as solvents and chemical intermediates; but of the fatty nitrogen family, it is the amines (primary, secondary and tertiary) that produce the largest volume of sales. The end use of these compounds has a wide range and includes detergents and hair control agents for shampoos, use in foam boosters, santicizers, oil well chemicals, epoxy resin hardeners, etc.

Two especially growing fields are the use of the quaternary ammonium salts in the manufacture of "Bentone" type lubricants, and the very rapidly expanding use of quaternaries in home fabric softeners.

The polymerization of unsaturated fatty acids has also been a field of special activity. The growth curve for dimer acids is still a very healthy one, and an increasing expansion of uses for this family of products is anticipated. Corrosion inhibitors, oil well additives, polyamid resins, paints, epoxy curing agents, urethane elastomers and coatings, lubricant and gasoline additives, printing inks and adhesives are only a few of the products made today from these versatile chemicals.

Epoxidation of unsaturated fatty acid derivatives produces materials which are marketed in the vinyl stabilizer-plasticizer field. Alternates can be cured with anhydrides and other agents to produce novel resin systems. If epoxidation as a unit process could be substantially lowered in cost, a whole new family of fatty-based products probably would be put on the market.

Fatty acids of glycerides can be saturated for sale as waxes or can be reduced by further hydrogenation to fatty alcohols. Fatty alcohols have found wide use in detergents as anionic types such as sulfated alcohols or non-ionic ethoxylated types or combinations of the two. Certain fatty alcohols are being used as water evaporation controllers when used as mono-molecular layers. Other fatty alcohols are used as wax bodies in cosmetics.

Esterification is one of the best known and oldest of the unit processes used in oleochemistry. Glyceryl monostearate and other mono-, di-, and tri-esters of glycerine and other polyols are finding increasing use in surfactant, emulsifier or emollient field. These materials as a group were consumed at a rate of 12% higher in 1962 than in 1961. Furthermore, additional increase of usage is projected for the next several years. Meanwhile, gradual growth is occurring in some of the old stand-bys such as glyceryl tri-oleate and methyl oleate.

Ketonization of fatty acids has produced stearone and methyl ketones which have found modest use as waxes, solvents, chemical intermediates and as anti-slip agents in polyethylene and polypropylene film. Isomerization of oleic acid reportedly has produced products which can be advantageously used in the detergent field. Saponification of fats or fatty acids produces soaps. The alkali metal soaps are used as detergents except the lithium soaps which, along with soda soaps, can be used in specialty lubricating greases as thickeners. Heavy metal soaps can be used in lubricating greases, in rubber compounding, flattening agents for paint and as stabilizers for vinyl chloride systems.

For the future, products made from tallow are expected to find increasing utility in automotive and industrial lubricants, in oil additives and oil well chemicals. In the plastics and rubber field, fatty derived products will be used as plasticizers, as process control additives, as emulsifiers and processing aids as well as being parts of new polymer systems. Growth in the surfactant-detergent-emulsifier-emollient field should increase as newer specialty products are produced.

Legislation requiring biodegradable products should accelerate rather than retard this area of growth. Increased need for water evaporation control and other conservation processes, along with other monomolecular layer applications such as in adhesives, should provide interesting markets for fat derived products. The fields of cosmetics, shampoos, home fabric softeners and other personal grooming specialties will provide increasing markets for these oleochemicals.

Bright Outlook

All in all, the outlook for tallow and other products of the rendering industry has gradually been changed from gloomy to bright. Even so, the renderers, through the National Renderers Assoc., are currently redoubling their efforts to expand their market for their products still further. In early 1962, the Association opened its first overseas office in Europe for education and promotion of U.S. animal and poultry by-products on behalf of its members. This year, the second office was opened in Tokyo, Japan. NRA is thus recognizing the great opportunity to expand domestic uses for tallow, grease and proteins to overseas markets. These markets have caused exports of inedible tallow and grease to expand over 300% since 1950.

To add more weight behind research efforts, the members of National Renderers Assoc. have recently formed the Fats and Proteins Research Foundation. Stated simply, the purpose of the Foundation is to pool research resources of the industry in order to accomplish collectively what would be impossible on an individual basis.

Its goal is to initiate and conduct research activities that will develop new and better uses of fats, proteins and related materials throughout the world. This will be not only the research arm of the rendering industry and the NRA, it will also seek expanded research funds from companies in the meat packing, poultry processing, meat distribution, livestock and poultry breeding and feeding and associated service industries.

No doubt about it, animal fats and proteins are important and valuable commodities. Although their role has changed tremendously within the past few years, research may soon prove that we've only scratched the surface.

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altered or prevented by the addition of cod liver oil, selenium or α-tocopherol to the basal ration. The major gross lesions consisted of internal intercostal, adductor and cardiac myopathy, hepatic peripherolobular fatty infiltration and, in the cod liver oil-supplemented mink, yellow fat.

TOXICITY OF FATTY ACID ESTER HYDROPEROXIDES. H. S. Olcott and A. Dolev (Dept. of Nutritional Sciences, Inst. of Marine Resources, Univ. of Calif., Berkeley). *Proc. Soc. Exp. Biol. Med.* 114, 820–22 (1963). Intraperitoneal injection of concentrates of methyl linoleate hydroperoxide into adult rats was lethal at a level of about 150 μM per 100 g. Previous injection of equal amounts of tocopherol or ethoxyquin did not change the LD_{50} level. Sixteen hundred but not 800 μM per 100 g were lethal when administered by stomach tube.

LIPID ALTERATIONS IN EUGLENA GRACILIS CELLS DURING LIGHT-INDUCED GREENING. A. Rosenberg and M. Pecker (Dept. of Biochem. and Med., Columbia Univ. and The Columbia Univ. Res. Svc., Goldwater Memorial Hosp., N. Y. City). *Biochemistry* 3, 254–58 (1964). Etiolated cells of *Euglena gracilis* were subjected to constant illumination in a mineral medium. After a short lag period the cells produced chlorophyll in three successive stages. Sulfolipids accumulated before measurable amounts of chlorophyll. Sulfolipid synthesis occurred in stages corresponding to those of chlorophyll synthesis. In contrast, the cellular galactolipid level increased at a linear rate with the onset of illumination, independently of chlorophyll level. Upon illumination of the cells, the major fatty acids of the well-nourished etiolated cell, C_{13} and C_{14}, rapidly disappeared. The green cell replenished its fatty acid complement by the synthesis of unsaturated fatty acids mainly of the 16- and 18-carbon series.

INHIBITION OF CHOLESTEROL SYNTHESIS IN VIVO BY A CONVULSANT, METRAZOL. G. J. Alexander and R. B. Alexander (Dept. of Biochem., N. Y. Psychiatric Inst. and Columbia Univ. College of Physicians and Surgeons, N. Y. City). *Proc. Soc. Exp. Biol. Med.* 115, 229–32 (1964). Pentamethylene tetrazol inhibited the incorporation of acetate-1-C^{14} into sterols in intact mice even after a single injection. Prolonged treatment of mice with very low, subconvulsive, doses of the drug resulted in a 20% decrease in plasma cholesterol level, as well as a pronounced decrease in the amount of radioactivity found in liver sterols synthesized from acetate-1-C^{14} or mevalonate-2-C^{14} but not from squalene-C^{14} or lanosterol-T. Metrazol treatment also resulted in almost complete absence of radioactivity in carbon dioxide exhaled by treated animals injected with mevalonate-2-C^{14}. These findings indicate that the site of action of Metrazol along the acetate-cholesterol pathway lies between mevalonate and squalene.

THE EFFECT OF DIABETES AND INSULIN ON THE BIOSYNTHESIS OF INDIVIDUAL FATTY ACIDS IN ADIPOSE TISSUE. W. Benjamin and A. Gellhorn (Dept. of Med. and the Inst. of Cancer Res., College of Physicians and Surgeons, Columbia Univ., New York 32, N. Y.). *J. Biol. Chem.* 239, 64–9 (1964). The synthesis of individual fatty acids from acetate and stearate and the composition of the epididymal fat pad from normal and diabetic male rats was studied. It was found that in the epididymal fat pad of normal rats oxygen was an absolute requirement for the synthesis of oleic acid from stearic acid, whereas glucose deprivation had no effect. Triglyceride synthesis from stearate was only moderately affected in the absence of glucose or oxygen. Monoenoic fatty acid synthesis from acetate was severely depressed in the adipose tissue from diabetic rats. This depression was far greater than the decrease in total fatty acid synthesis that occurs in diabetes. Oleic acid synthesis from stearic acid was essentially halted in the fat pad from the diabetic although the esterification of stearic acid into the triglyceride fraction was not depressed.

CHARACTERIZATION OF LIPID CONSTITUENTS OF HUMAN "FIBROBLASTS" CULTIVATED IN VITRO. G. G. Bole, Jr. and C. W. Castor (Rackham Arthritis Res. Unit, Dept. of Internal Med., Univ. of Michigan, Ann Arbor, Mich.). *Proc. Soc. Exp. Biol. Med.* 115, 174–79 (1964). Lipids from connective tissue cells cultivated *in vitro* were identified by silicic acid column and paper chromatography, and by Dawson's hydrolysis procedures. Phospholipids constituted 64–84% of the total lipid with the remainder approximately equally distributed between cholesterol and the glycerides. Total lipid concentration ranged from 9.1 to 17.2 mg per 100 mg of dry cell solids. Phosphatidyl choline,-ethanolamine,-myoinositol, sphingomyelin, and plasmalogens were identified in all cells examined. Phosphatidyl serine was undetected in one, and "phosphatidic acid" undetected in several of the cell lines. No unusual intracellular concentration of lipid or definite correlation with mucopolysaccharide production was demonstrated.

EFFECT OF SOURCE OF NUTRIENTS AND NUTRITIONAL LEVEL OF THE COW ON DEVELOPMENT OF HYDROLYTIC RANCIDITY IN THE MILK. R. Y. Cannon and G. H. Rollins (Dept. of Dairy Sci., Auburn Univ., Auburn, Alabama). *J. Dairy Sci.* **47**, 41–5 (1964). Long-term continuous and short-term change-over feeding trials were used to determine the effects of the nutritional level of the cow and the inclusion of green feed in the ration on the susceptibility of the milk to spontaneous and agitation-induced lipolysis. In all trials, no effect of green feed or of nutritional level was found. Rather, the susceptibility of the milk to both types of lipolysis was a characteristic of the individual cow.

FATTY ACID COMPOSITION OF THE PHOSPHATIDE AND TRIGLYCERIDE FRACTIONS OF HUMAN EPIDERMIS. C. Carruthers (Dept. of Biochemistry Res., Roswell Park Memorial Inst., N. Y. State Dept. of Health, Buffalo). *Proc. Soc. Exp. Biol. Med.* **115**, 215–18 (1964). In a limited number of analyses the lipid composition of human male and female epidermis of extremities shows differences in that female epidermis has much more triglycerides than does the male epidermis while the latter has more cholesterol, ether eluate and phosphatides than does female epidermis. The fatty acid composition of the triglyceride fraction is characterized in part by containing about 73% unsaturated fatty acids while this figure for the phosphatides is 50%. The phosphatides contain 2 unsaturated acids with 20 carbons and small amounts of pentadecanoic, heptadecanoic, behenic, lignoceric acids as well as the more common fatty acids.

COMPARISON OF FATTY ACIDS FROM LIPID CLASSES OF SERUM LIPOPROTEINS AND OTHER LIPIDS IN THE BISON. L. Evans (Dept. of Dairy Husbandry, Univ. of Minnesota, St. Paul). *J. Dairy Sci.* **47**, 46–53 (1964). High- ($D > 1.063$) and low-density ($D < 1.063$) lipoproteins, comprised 64 and 36%, respectively, of bison serum total lipids. Protein-bound non-esterified fatty acids accounted for less than 1%. High-density lipoproteins (HDL) contained comparatively greater concentrations of sterol esters, non-esterified fatty acids, and phospholipids. Liver lipids showed 53% triglycerides and 37% phospholipids. Rumen content lipids contained 4, 16, 17, 22, and 33%, respectively, of monoglycerides, sterols, phospholipids, and non-esterified fatty acids. Lipids in abomasal fluid showed 2% monoglycerides, 50% phospholipids, and 12% non-esterified fatty acids. HDL lipid classes resembled those of the low-density lipoproteins (LDL) in fatty acid composition, but triglycerides were more saturated and sterol esters more unsaturated in the latter. Oleate was the predominant unsaturated fatty acid in most of the lipid classes.

TRANSFORMATION OF CHOLIC ACID IN VITRO BY CORYNEBACTERIUM SIMPLEX. BILE ACIDS AND STEROIDS 132. S. Hayakawa and B. Samuelsson (Dept. of Chem., Karolinska Institutet, Stockholm 60, Sweden). *J. Biol. Chem.* **239**, 94–97 (1964). The transformation of cholic acid by *Corynebacterium simplex* has been investigated. This microorganism effects both elimination of the hydroxyl group at C-7 and dehydrogenations in ring A. The following metabolites were isolated and identified: 7α,12α-dihydroxy-3-keto-5β-cholanoic acid, 7α,12α-dihydroxy-3-ketochol-4-enoic acid, 12α-hydroxy-3-ketochola-4,6-dienoic acid, 12α-hydroxy-3-ketochol-4-enoic acid, and 12α-hydroxy-3-ketochola-1,4-dienoic acid. A synthesis of methyl 12α-hydroxy-3-ketochola-1,4-dienoate is described. The observed reactions of cholic acid are discussed in relation to those occurring normally during the metabolism of bile acids *in vivo*.

STUDIES ON THE STRUCTURE OF THE PRIMARY OXIDATION PRODUCT FORMED FROM TETRAHYDROPTERIDINES DURING PHENYLALANINE HYDROXYLATION. S. Kaufman (Lab. of Cellular Pharmacology, Nat'l Inst. of Mental Health, NIH, Bethesda 14, Md.). *J. Biol. Chem.* **239**, 332–38 (1964). The structure of the primary oxidation product formed from tetrahydropteridines during both the nonenzymatic and the phenylalanine hydroxylase-catalyzed oxidation has been re-examined. Results are not consistent with a 5,6-dihydro structure for the primary oxidation product, and they strongly support a quinonoid structure.

EFFECT OF BUTTER FAT AND BODY WEIGHT ON EXPERIMENTAL ATHEROSCLEROSIS IN RABBITS. S. D. Kobernick, E. Melman and M. T. Lo (Div. of Lab, Sinai Hosp. of Detroit, and Dept. of Pathology, Wayne State Univ. College of Med., Detroit, Mich.). *Proc. Soc. Exp. Biol. Med.* **115**, 160–64 (1964). Rabbits were fed cholesterol, butter, and *ad libitum* Purina chow diets in various amounts and combinations to evaluate the effect of butter fat and body weight on serum lipids and experimental atherosclerosis. A quarter of a gram of butter per day had no effect on serum lipid levels nor did it produce aortic atheromata, whereas an equal amount of cholesterol produced definite increases in serum lipids and atheromatous plaques. When 10 g of butter were given per day, there was a small but significant rise in all lipid fractions. On the group level, a close correlation was found between severity of aortic lesions and degree of hyperlipemia, which in turn was related to total cholesterol intake. In individual animals considerable variation was encountered. No differences were observed in initial weights or average weight gains. It was concluded from this study that saturated fats in the diet are not a major factor in the pathogenesis of experimental atherosclerosis in rabbits.

INFLUENCE OF NICOTINIC, PICOLINIC AND PYRIDINE-3-SULFONIC ACIDS ON CHOLESTEROL METABOLISM IN THE RAT. D. Kritchevsky and S. A. Tepper (The Wistar Inst., Philadelphia, Pa.). *J. Nutr.* **82**, 157–61 (1964). The addition of 1% of nicotinic, picolinic or pyridine-3-sulfonic acid to a cholesterol-free rat diet for 3 weeks did not affect serum cholesterol levels. Liver cholesterol levels of the nicotinic acid-fed rats were lower than those of the controls. When these compounds were fed at 1% of the diet to rats also receiving 2% cholesterol and 0.5% cholic acid, all test groups displayed elevated serum cholesterol levels and the nicotinic acid group also had a higher liver cholesterol content than did the controls.

• Drying Oils and Paints

REACTION OF CYCLOPENTADIENE POLYMERS WITH VEGETABLE OILS. A. V. Chernobai. *Zh. Prikl. Khim.* **35**, No. 10, 2346–7 (1962). The thermal combination of the above compounds under CO_2 was studied, in an effort to improve the elastic properties of polycyclopentadiene films and make the latter suitable for use

(Continued on page 63)

Some Aspects of the Edible Fat Industry in the United Kingdom

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Introduction

Shortening and margarine manufacture in the United States, and possibly in Canada, is in many ways different from that in Britain. This is due largely to differences in availability of component oils and fats in the two commercial spheres. The U.S. is an oils and fats producer, and large supplies of soybean and cottonseed oil, lard and tallow are available, particularly soybean oil and lard. Consequently, the questions in the U.S. are likely to be, "How can we consume more and more soybean oil and lard?"; "What new products can be developed based upon them?"; and "How can we use them to the best advantage in existing products?"

In Britain the situation is quite different. We are not producers of oils and fats, except for tallows and lard on a small scale. Therefore, we are customers for the cheapest food oils and fats available in world markets. We must be ready to replace oils in our formulations if their price rises precipitously, as has been true with some fats in recent years, and we must be ready to take advantage of any source of fats offered at low prices. This necessitates using a variety of available oils and fats and leads to formulations containing several ingredient fats—blended shortenings, rather than the simpler and more straightforward formulations of all-hydrogenated fats or rearranged lard, usually produced in America.

There has also been a reduction in production of crude oils and fats by means of crushing or extraction in the United Kingdom. Several countries, like India, which exported large quantities of oilseeds before World War II, have undergone such changes in their economy that most of the oilseeds are consumed at home. With the technical development of these producer-countries, more and more oil is being extracted in the country of origin and offered in world markets as crude oil. It may, therefore, be cheaper in the United Kingdom to buy crude oil rather than buy the seeds and crush them. The seed crushing industry in the United Kingdom worked at about two-thirds capacity in 1960–1961. The relative fluctuations in the price and availability of different oilseeds, and the severity of the competition, make necessary versatile plants and increased experience capable of handling a variety of oilseeds as they become available. Only those producers who are sufficiently flexible and capable of utilizing the lowest cost raw materials without loss of quality are going to survive in this severe modern competition.

Consumption of Edible Fats in the United Kingdom

A general picture of the baking industry in the United Kingdom will probably help towards a better understanding of the position. Several marked changes have taken place over the last 10 years. The baked goods market has expanded by some £30–£130 million sterling, but the number of bakeries has rapidly decreased from about 35,000 in 1939 to 12,000 now; five large groups control over half of the total market. In biscuit (crakers and cookies) manufacture, three main groups have expanded and now also produce cakes with long shelf lives. The small local bakers who manage to hold their own, do so by offering freshly baked goods and specialties, such as fresh cream cakes, but competition is increasing from the frozen food firms. As far as retail sales are concerned, about 40% of the cake business is done through bakers' shops, 36% through grocers' shops and 18% through chainstores and supermarkets. These figures should be considered in relation to the English customs. Although the standard of confectionery is high in the United Kingdom, 87% of housewives bake most of their cakes at home, and they do not use cake mixes.

The present state of the cake mix business in Britain is one factor which could alter the pattern of fat usage. The British housewife has not taken to cake mixes very enthusiastically, probably because there is a tradition of home baking and she can still buy high quality confectionery from the baker's shop round the corner. Most popular mixes consist of a plain sponge for little individual cakes, which can be baked on the spur of the moment. Cakes are not eaten as a dessert in Britain, but as part of a traditional meal, late in the afternoon when, following bread and spreads of a savoury type, cakes are eaten with tea. These cakes are much less sweet and less aerated than the American types and are not eaten with elaborate fillings and toppings. The peak year for cake mixes was 1955 when 37½ million packets were sold. Since then the sales have declined to 32 million in 1960. The comparison of ca. 38 oz cake mix consumed annually per head in the U.S. with 6 oz per head in Britain makes for interesting speculation. Two firms with American backing and "know-how" are actively engaged in the field, but the outcome of their efforts remains doubtful. (Since this paper was read, one of the firms has withdrawn from Britain, whereas another American Company has tentatively entered the field.) Currently, it would appear that cake sales are more likely to increase in the near future in the form of prepacked cakes sold through the chain stores and supermarkets.

Some impression of the pattern of edible fat sales and consumption can be obtained from the figures shown in Table I. While it is difficult to obtain precise figures, the quantities quoted are sufficiently accurate to indicate the overall picture.

The last column is found by difference and consists of all consumption other than that sold through retail channels.

Butter is still consumed in the largest quantity for all purposes and this figure would probably rise at the expense of margarine, if the price of butter dropped. Butter is at present retailing at about 40–50¢/lb, margarine from 20–35¢/lb and lard at 18–19¢/lb. More margarine is consumed than shortenings and lard together, a considerable quantity being used domestically and in the catering trade as a spread as well as for baking. Domestically, butter and margarine retain a large lead, and approximately three times as much lard as shortening is used, mainly in pastry making and frying. This lard is still partly sold in bulk, usually in 28-lb cartons (about 40%) but packaged lard, 0.5-lb wrapped blocks, is increasing in importance. Lard is sold as prime steam lard (not washed, bleached and deodorised) and is mainly American lard shipped in bulk tanks.

Much of the butter and margarine included in the industrial and catering figures will have been used as spreads in the catering trade (i.e. hotels, restaurants, canteens, hospitals, schools and institutions). However, quite a considerable proportion of margarine is used in the United Kingdom for bakery purposes, probably a higher proportion than in the States, and some large bakeries utilize the sales prestige of butter by producing all butter cakes and

TABLE I

Consumption of Edible Fats in the United Kingdom in 1961[a]
Metric Tons

	Total	Domestic	Industrial & Catering
Butter	469	260	209
Margarine	330	200	130
Shortenings	136	30	106
Lard	134	94	40
Other edible oils & fats	233	....	....

[a] Figures quoted at the National Seed Crushers' Assn. Annual Conference, May 1962.

biscuits (cookies) particularly for prepacked sale through the large multiples and supermarkets. Over the last 15 years, an increasing proportion of bakery shortenings have been high ratio, superglycerinated types, particularly for slab and layer cakes and gateaux, but the highly aerated, sweet dessert type of cake popular in America has not yet caught the fancy of the majority of the British housewives. Our high ratio cakes tend to be lower in sugar and liquid than their American counterparts.

The use of lard for bakery purposes is very much a matter of price. When lard is at its cheapest, it is economic to use it in bread or to rearrange it and use it in shortenings. When the price of lard rises (over 11¢/lb) it tends to be dropped from the better shortenings but is still not cheap enough to be used in the cheaper baking fats, and it tends to lose its place as a bread fat to the cheaper shortenings. In general, to be used in any quantity, lard must take its place as an ingredient and compete with the lowest priced fats available, i.e. animal tallows and hardened fish oils.

Severe competition has resulted in considerable pressure being applied towards the manufacture of lower cost shortenings without sacrificing quality, and the comparatively rapid turnover of baked goods in Britain permits shortenings of relatively limited keeping properties to be used successfully (20–50 hr AOM). This competition in the United Kingdom (and probably also in the States) has reduced the gap in performance between low cost shortenings and those made from more expensive fats. Thus a drift has occurred towards those shortenings which command a low profit margin away from those traditional quality fats from which a reasonable profit can be made. This change in emphasis has resulted in attempts to produce "specialty" fats, designed for use in a specific product or to meet rigid production specifications. Examples are ice-cream (or 'mellorine') fats, special long-life frying fats, fats for cream fillings, and confectionery fats such as cocoa butter substitutes. These fats can command a good profit margin and often some slight relaxation from the most rigorous competition. It is noticeable that more and more special fats are being produced and are striving to establish themselves as brand leaders for specific lines.

Price Structure of Oils and Fats in the United Kingdom

Although some of our problems which have been discussed have their parallels on the American continent, other conditions are quite different. One of the major differences is the availability of ingredient fats, which in the United Kingdom are bought on the world market and imported.

Table II will serve as a reminder of the oils used in the manufacture of margarine in the U.S., and it is very apparent that the market is dominated by soybean oil and to a lesser extent cottonseed oil, with soybean oil increasing its proportion of the market. Probably one of the significant figures in the Table is the increased consumption of corn oil, for reasons which will be well appreciated.

TABLE II

Oils and Fats Used in the Production of Margarine in the United States

	1954	1955	1956	1957	1958	1959	1960
	Thousand tons						
Vegetable							
Soybean	297	333	335	390	476	488	493
Cottonseed	177	124	126	106	65	55	61
Groundnut	1	1	1	1	2	2	2
Coconut	2	3	4	2	2	..	..
Maize	..	..	..	..	..	8	22
Others[a]	10	9	13	14	11	4	2
Total	487	470	479	513	556	557	580
Animal							
Oleo Beef fats	4	4	3	4	4	4	3
Lard	3	6	14	11	7	16	26
Total	7	10	17	15	11	20	29
Total	494	480	496	528	567	577	609

[a] Mainly vegetable stearine prior to 1959; stearine since has been included in the oils from which it is derived.

Source: Commonwealth Economic Committee, "Review of Vegetable Oils & Oilseeds," Her Majesty's Stationery Office, London, 1962.

TABLE III

Oils and Fats Used in the Production of Margarine in the United Kingdom

	1954	1955	1956	1957	1958	1959	1960	1961[a]
	Thousand tons							
Vegetable								
Groundnut	79	92	67	38	35	37	22	19
Cottonseed	19	11	9	9	5	4	11	9
Soybean	2	....	1	4	9	17	24	17
Sunflower	....	[b]	....	....	[b]	[b]	[b]	[b]
Sesame	1	2	....	....	[b]	[b]	[b]	[b]
Coconut	47	55	62	56	40	20	19	27
Palm kernel	45	35	30	28	13	9	8	7
Palm	58	56	75	64	73	82	67	61
Others	15	11	16	21	11	13	18	5
Total	266	262	260	220	186	182	169	155
Animal								
Lard	2	2	2	2	2	14	32	17
Others						3	3	2
Total	2	2	2	2	2	17	35	19
Marine	51	45	43	67	80	91	97	97[c]
Total	319	309	305	289	268	290	301	271

[a] Provisional.

[b] Included, if any, in "Others."

[c] Whale oil 56, fish oil 41.

Source: Commonwealth Economic Committee, "Review of Vegetable Oils & Oilseeds," Her Majesty's Stationery Office, London, 1962.

Table III shows a very different picture of the consumption of oils used in margarine in the United Kingdom. The most noticeable features are:

1) The decline in consumption of coconut and palm kernel oils commencing in 1958 from which these oils have not recovered.
2) The increased use of lard and marine oils since 1958.
3) The over all decline in the use of vegetable oils.
4) The steady high consumption of palm oil.
5) The maintained high level of marine oil consumption which in 1961 consisted for the first time of nearly equal quantities of whale oil and fish oil. Prior to this, whale oil had made up virtually the whole tonnage.

If we now look at the figures for shortenings, several of the same factors are apparent. In the United States, the increased use of tallow and the absence of marine oils can be noted. In the United Kingdom we also see the decline in the use of vegetable oils, the increased use of animal fats, mainly lard, and the constant high figures for marine oils, which in 1961, consisted as in margarine, of about 50/50 whale oil/fish oil.

These changes are directly attributable to the availability and price of the individual fats. The outstanding example is the fluctuation of coconut and palm kernel oils. These lauric-acid-rich oils have a clean quick melt which make them very suitable for margarine blends. Until the end of

TABLE IV

Oils and Fats Used in the Production of Compound Cooking Fat in the United States

	1954	1955	1956	1957	1958	1959	1960
	Thousand tons						
Vegetable							
Soybean	410	415	349	355	471	509	521
Cottonseed	286	196	144	121	107	143	163
Groundnut	2	3	3	3	3	1	1
Coconut	7	2	2	4	5	6	5
Palm	7	8	5	3	1	5	8
Others	3						
Vegetable oil stearine	44	44	40	42	38	[a]	[a]
Total	759	668	543	528	625	664	698
Animal							
Lard	63	149	204	168	142	220	214
Tallow	36	50	61	98	111	114	120
Stearine	4	3	2	3	2	..	..
Total	103	202	267	269	255	334	334
Glycerides	..	17	18	17	17	[a]	[a]
Total	879	888	827	814	897	998	1032

[a] In 1959 and 1960, vegetable oil stearine and glycerides were reported with the individual oils from which they had been derived.
Source: Commonwealth Economic Committee, "Review of Vegetable Oils & Oilseeds," Her Majesty's Stationery Office, London, 1962.

TABLE V

Oils and Fats Used in the Production of Compound Cooking Fat in the United Kingdom

	1954	1955	1956	1957	1958	1959	1960	1961[b]
	Thousand tons							
Vegetable								
Groundnut	38	39	33	24	25	24	11	12
Cottonseed	19	10	6	5	3	5	4	4
Soybean	4	3	5	6	8	9	14	8
Sesame	2	1	..	..	[a]	[a]	[a]	[a]
Coconut	2	2	3	3	2	1	1	2
Palm	46	35	37	33	35	33	28	35
Palm kernel	7	7	8	7	8	3	4	2
Others	4	2	5	6	6	4	5	3
Total	122	99	97	84	87	79	67	66
Animal	2	4	4	7	8	15[c]	27[d]	20[e]
Marine	47	55	48	44	47	45	45	53[f]
Total	171	158	149	135	142	139	139	139

[a] Included, if any, in "Others."
[b] Provisional.
[c] Lard 12.
[d] Lard 21.
[e] Lard 15.
[f] Whale oil 25, fish oil 28.
Source: Commonwealth Economic Committee. "Review of Vegetable Oils and Oilseeds," Her Majesty's Stationery Office, London, 1962.

1957 they were comparatively cheap (£90–100/ton); 11–12¢/lb. By July 1959, the coconut oil price reached £145/ton (18¢/lb) and palm kernel oil rose with it. Consequently, it was necessary to experiment with alternatives and the result can be seen in the increased consumption of soybean oil, lard, and whale oil that were priced low at that time. During 1960, fish oil (principally from Peru) began to be offered in large quantities at a very low price (about £60/ton washed—7.5¢/lb; it is now about £40/ton) which made it imperative to find means to use hydrogenated fish oil to as great an extent as possible. The consumption of fish oil has increased until it appears likely that more fish oil will be used than whale oil. The experience gained as a result of the pressure to use these cheaper materials is a permanent gain and it is doubtful whether fats displaced in this way will necessarily regain their place of pre-eminence even when prices drop again. It is, however, true that the consumption of coconut and palm kernel oils is increasing again now that the price has fallen; but the net result has been a gain in our experience and flexibility with respect to margarine and shortening ingredients.

Another factor which has influenced the formulation of margarines and shortenings in the United Kingdom has been relative high price, and the fluctuations in price, of liquid oils. Soybean oil, which has often been cheapest, has gained in acceptance; but when profit margins have been tight, it has been necessary to try to formulate blends with as little vegetable oil, either liquid or hydrogenated, as possible. Therefore, there has been an increase in the use of low-melting solid fats such as palm oil and lard (when the latter has been cheap), tallow in recent months, and low melting hydrogenated marine oils in the 30–37C mr (open tube or slip point).

Ingredient Fats Used in the United Kingdom

As we have seen, the oils and fats available for consumption in the United Kingdom include the liquid vegetable oils, notably groundnut oil, cottonseed oil and soybean oil (both as liquids and hydrogenated), palm oil from West Africa or Malaya, lard from various sources but predominantly America, tallow and hydrogenated whale and fish oils. Shortening blends in the United Kingdom contain hydrogenated fats of a number of standard mp, normally 54–56C, 46–48C, 40–42C and latterly 30–37C, (these melting points are "open tube" as specified by the British Standards Institution) and the dilatometric characteristics are given in Table VI. The estimate of solid glycerides has been obtained by the method of Jasperson & McKerrigan (1) and will tend to be higher than the solid fat indexes used in America, particularly at temperatures below 25C.

Fats in the 54–56C and 46–48C ranges are used to provide the stability and long mr to shortenings. To a very large extent the fats at these high mp can be interchanged with only minor adjustments.

The fats of mp 40–42C are used mainly in margarine blends, where the higher melting point fats would tend to cause poor melting properties and palate-cling. Here again, it is possible to interchange one fat with the other, except perhaps palm oil, which requires only a small degree of hardening to reach this mp and consequently has a lower content of *iso*-acids and, therefore, a lower solid glycerides content. Fish oil can be hardened to this mp to give a fat similar to hardened whale oil.

Hydrogenated fats in the 30–38C mr have become more and more important as a result initially of the high price of liquid vegetable oils. Hardened vegetable oils of 33–36C mp can be obtained with relatively high solids contents at 20C (ca. 40%), together with complete melting at body temperatures (Samples 1) by hydrogenation conditions which produce a high *iso*-acid content (high temperature—spent catalyst).

Whale oils also can be hydrogenated to give high solid glyceride contents and rapid melting and, if carefully hardened, fish oil is interchangeable with whale oil. When the lauric-rich oils were at their highest prices, means were devised to use large quantities of these hydrogenated vegetable and whale oils in margarine blends and their usage remains considerable today. Lately the low price of Peruvian fish oil gave rise to attempts to use it in the same way as whale oil, despite the disadvantages of its higher iodine value (180–200), and we have seen that the consumption of hardened fish oil is now comparable with that of whale oil.

All of these low mp fats can be used in shortening blends as major components to reduce the consumption of liquid oils when they are expensive. Low-melting hardened whale and fish oils have been particularly useful in the lowest priced blends. Fish oils of this mp must be carefully handled in storage and refining if troubles with reversion

TABLE VI

Dilatometric Characteristic of Ingredient Fats Used in the United Kingdom

Temperature C	% solid glycerides							
	Melting point 54–56C			Melting point 46–48C				
	Palm	Soybean	Whale	Palm	Peanut	Soybean	Whale	Fish
10	87	80	85	70	68	72	74	75
20	85	75	83	62	62	65	73	73
30	83	65	80	56	53	56	69	67
40	79	57	77	36	35	42	45	44
50	43	33	40	3	2	4	4	3
60	....	....	....	....	....	....	....	....

	Melting point 40–42C				Melting points between 30–37C					
	Palm	Soybean	Whale	Fish	Soybean		Peanut		Whale	Fish
					1	2	1	2		
10	47	58	58	60	45	30	55	37	50	45
20	37	52	55	53	36	21	42	21	40	37
30	20	37	38	36	14	8	17	7	13	15
40	7	8	7	10	2	....	....	....	....	....

flavours are to be avoided. Certainly these cheaper fats have established themselves as acceptable alternative ingredients in both margarine and shortening blends. It is likely that they will continue to be used in future when the price of vegetable oils makes it advantageous economically.

Specification and Quality Control

In general, fats are sold on performance, except where prejudices may exist between animal and all-vegetable blends. Consequently, methods whereby specifications can be established and agreed upon are essential. In the United Kingdom, individual firms set up their own test methods to maintain the highest quality, but, unfortunately, standard methods whereby specifications can be agreed upon between manufacturer and consumer are frequently not available. One of the most useful services of the AOCS is the establishment of standard chemical and physical techniques throughout the trade, whereby specifications can be drawn up and understood by both parties in the States.

As far as taste and shelf life are concerned, peroxide values and some form of induction period are often used in the United Kingdom, but several different methods are quoted for the induction period, usually variations of the Active Oxygen Method (AOM). Despite the large amount of painstaking work which has been carried out on the causes of flavour deterioration in fats, it is still necessary to rely upon the decision of a tasting panel. However, like all subjective tests, it can lead to disagreements which are difficult to resolve.

For colour measurements, the Lovibond readings are generally accepted, but a measure of the appearance of a plasticised fat is much more difficult to achieve. The comparison of off-white colours of surfaces which are soft and easily disturbed and which set with a slightly glossy appearance, involves not only some means of measuring small differences in reflectance but, initially, the difficulty of obtaining a sample with a standard surface. Apart from selling-specifications, it is often necessary to give a plant operative a pattern for work, so that he can make small adjustments to processing conditions to produce fats identical in appearance from batch to batch. After trials with several empirical techniques, our most successful method is to give the operative a set of numbered, standard plates made by dispersing a selected range of paint pigments in a styrene polyester resin. By this means it is possible to mix exactly the required range of colour. A set of these standard plates has been adopted which can be standardised by reflectance, are stable over a considerable period, can be reproduced when required, and have proved satisfactory in the hands of intelligent plant operatives under manufacturing conditions.

Difficulties also still exist in the United Kingdom in specifying the texture or plasticity of fats. For many years the formulation of fat blends, and their texture and plasticity had to be controlled by mp determinations. The most general methods are the "incipient and complete fusions" and the "open tube" mp or "slip point." The latter is the only mp specified by the British Standards Institution (2), but a "flow" or "drop" point, carried out in a Ubbelhode type of apparatus also is used.

It is not necessary to elaborate upon the limitations of these and dilatometric methods, such as the dilation number devised some years ago by Unilever to standardise fat hydrogenations. They are being used to an increasing extent by hydrogenators and shortening manufacturers to specify blends. Unfortunately, there is no accepted standard method in the United Kingdom now and agreement is difficult. I imagine that the standard AOCS method for "solid fat index" has made life a lot easier for fat manufacturers in the States and it is to be hoped that we will not be long in agreeing to a similar standard procedure.

The rheology of fats, and the use of different instruments for measuring it, have been the subject of several investigations in the United Kingdom. Several instruments including a sectilometer, an extruder and a penetrometer have been compared (3), but there is no standard technique and it is probable that some form of penetrometer is most generally used. Despite all the scientific work which has been done in the rheology of fats, the test most generally used and quoted by bakery operatives is the "thumb" test, and frequently no amount of scientific results can shake an opinion based upon this most practical and empirical test!

There remain performance tests for shortenings. Most manufacturers and some large bakeries perform a creaming test, but there is little uniformity. Some use a simple sugar/fat cream and others perform a complete cake-making test in which the ingredients sugar, egg and flour are added to the fat in stages, with the specific volume of the batter measured at each stage. Finally, a cake may be baked and its volume recorded. We favour a complete test, in which the proportion of fat is lower than in a balanced recipe so that strain is thrown on the shortening. Any weakness, such as lack of basic aerating power, lack of dispersion with egg or liquid or instability of batter on addition of flour are found. There is no standard procedure throughout the trade and different procedures involving different quantities and different machines are used by different firms.

From what I have said concerning the need for standardizing methods for specifying fats in the United Kingdom and the difficulties involved, it will be realised that we envy you the excellent work undertaken by the AOCS on behalf of the trade in the U.S.A., in devising and standardizing methods. These must assist greatly in reaching agreement between manufacturer and consumer. I hope that we will soon be in a similar position in the United Kingdom where the need is, if anything, greater on account of our greater multiplicity of ingredients.

Recent Legislation

As in the States, the British Government has recently been considering food additives' regulations and two concern manufacturers of edible oils and fats.

The Antioxidants in Food Regulations (4) were introduced in September 1958, and have remained unchanged since then. They are very much in line with the regulations in other countries which permit the use of antioxidants, and are based upon U.S. experience. In Britain, the gallates, butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT), may be added to anhydrous oils and fats. Fats may contain up to 100 ppm propyl, octyl and dodecyl gallates, and 200 ppm BHA and/or BHT, and mixtures of the latter with gallates up to 300 ppm.

Antioxidants have not been used to a great extent in the United Kingdom for a number of reasons. Many of our blends have contained comparatively large quantities of vegetable oils; the turnover of fats is fairly rapid; the temp is moderate, and we do not have to contend with the extremes of temp which are possible in the U.S.A. Most of the domestic and bakery fats still contain no added antioxidants. The greatest use is in biscuit (cracker and cookie) fats, frying fats, and fats for manufacturing prepacked cooked foods. We have had indications that the British housewife may react unfavourably to the slight phenolic smell of BHA from fats used for frying, but evidence is not extensive. The efficacy of antioxidants upon the prerancidity flavour deterioration of vegetable oils remains in some doubt, as shown by papers published recently from the United Kingdom (5) and it is likely that the answer to this problem must await the solution of the wider general problem of flavour deterioration in edible fats.

The second recent regulations which have affected fat manufacturers are the Emulsifiers and Stabilisers in Food Regulations, 1962 (6). Prior to their final publication, the Ministry had issued two previous publications, one in 1956 consisting of a report and recommendations of the Food Standards committee as to the use of emulsifying agents and stabilizing agents in foods, and then in 1961 specific proposals for regulations were circulated. These proposals did not include lactoglycerides, polyglycerol esters or polyoxyethylene derivatives of the sorbitan esters of fatty acids, but did include sugar esters of fatty acids. Representations were immediately made to the Ministry by several firms and

Research Associations, with the result that when the final regulations appeared, the above emulsifiers which had previously been omitted were included and sugar esters were excluded. Only stearyl tartrate and partial glycerol esters were permitted in bread, but the latter classification is thought to include lactoglycerides and diacetyl tartaric acid esters of monoglycerides (TEM). The permitted list is, therefore, fairly wide and it will be interesting to see whether lactoglycerides in shortenings and diacetyl tartaric esters of monoglycerides in bread now make any progress under British conditions. It must be remembered that the traditional British cake is not the American high-volume type, and, with the present rather static phase of cake mixes, the position of emulsifiers like lactoglycerides remains speculative.

One "storm in a teacup" caused unexpectedly by these emulsifier regulations occurred because the regulations limited the proportion of soap in partial glycerol esters to 2%. It had previously been usual to sell to bread bakers a self-emulsifying type of glyceryl monostearate (ca. 40% mono-ester) which contained 5–6% soap. The bakers used this GMS in the form of an emulsion made with five times its weight of hot water, the emulsion being sometimes used alone and sometimes with fat added. It was necessary to have the tolerance given by 5–6% soap to ensure that it was possible to make a suitable emulsion, or at least a smooth dispersion, under the wide variety of conditions used in different bakeries. These conditions included water which varied in hardness up to 400 ppm $CaCO_3$, the use of a variety of bakery machines to make the emulsions, depending upon what happened to be available, and water temperatures ranging from tepid to hot. As there appeared to be no specific reason why this restriction had been included, representations have been made to the Ministry. Meanwhile, the bakery trade does not have the tolerance that it had formerly and has suffered some difficulty, but it is hoped that the regulations will be amended.

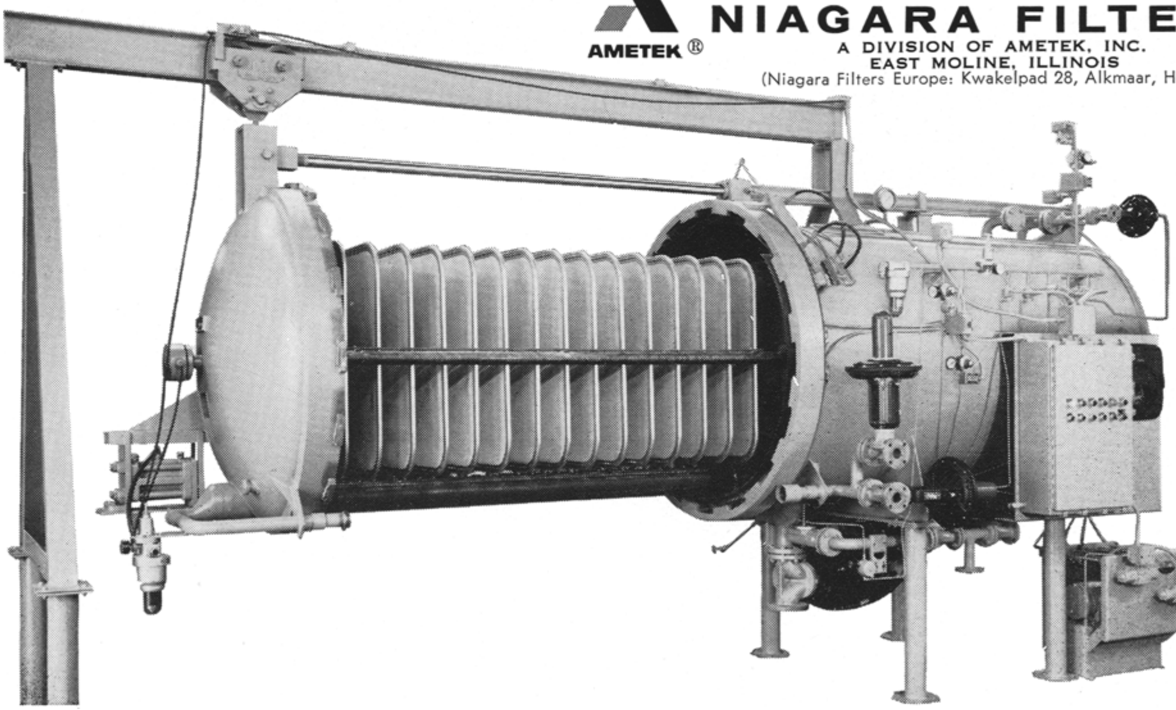
Future Trends

On the domestic side, cake mixes remain an enigma, and their sudden development could revolutionise the position very quickly. At present this does not appear very likely.

There are factors that could increase the usage of liquid oils provided prices permit. There is an increasing interest in liquid cooking oils for many reasons: these include a new appreciation of European cooking oils, probably as a result of more holidays spent on the Continent of Europe; a belief that less fat is ingested if foods are fried in oils rather than fats, which may influence those on slimming diets; and health reasons which are probably two-fold, i.e. a belief that foods cooked in vegetable oils are more digestible, and a slowly awakening interest by the general public in the possible relationship between dietary fats and arterial diseases. Much will depend upon the outcome of the worldwide research on this last subject. One leading brand of domestic cooking fat has for years been formulated with sufficient liquid oil to provide at least 25% linoleic acid and others may follow suit.

With bakery fats, there is likely to be more call for specialty fats of all types. In the larger bakeries there is an increased use of continuous production, particularly in the biscuit factories and those cake bakeries which produce large quantities of a few lines. This results in a growing interest in liquid or pumpable shortenings which can be metered directly with the other ingredients into the continuous system. Shortenings of this type can be made predominantly of liquid oil, but the recent high prices of liquid oils has tended to make these blends uneconomic. Efforts, therefore, are being directed towards the production of pumpable shortenings using blends of less expensive fats, but which are flowable under specific conditions.

The future development of emulsifiers, now that the regulations have given the all clear on many of them, also appears to be bound up with the development of specialty fats, which can command a premium, and the advance of



the cake mix business, both of which may depend to a certain extent upon whether the British palate will be attracted to American-type cakes.

Summary

Certain aspects of the edible fat industry in the United Kingdom are reviewed and compared with the same aspects in the United States: production, consumption, prices, effect of prices on changes in use, specification, quality control, legislation, and future trends.

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3. Prentice, J. H., British Food Manufacturing Industries Research Association Research Report No. 69, April 1956.
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5. Paul, S., and A. Roylance, JAOCS *39*, 163–165 (1962); Crossley, A., A. C. Davies and J. H. Pierce, *Ibid. 39*, 165–168 (1962).
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[Received June 24, 1963—Accepted October 23, 1963]

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Abstracts . . .

(Continued from page 55)

as a varnish base, using polymer solutions in benzene or xylol and tung, dehydrated castor and linseed oils. Full solution was observed only with linseed oil, the optimum temperatures of interaction being 260–280C. The product may contain 30-35% of the polymer; contents >40% give rise to insoluble, three-dimensional products. The products containing 10–30% polymer were tested for (*a*) rate of film formation by drying, (*b*) hardness and (*c*) water resistance. It was found that the films formed faster and were stronger and more water-resisting when the polymer contents were higher (optimum 30%); the water resistance was also higher for films dried at an elevated temperature. The interaction is believed to proceed by an addition of the polymers to the conjugated double bonds of the fatty acid radicals, by a diene synthesis mechanism. (Rev. Current Lit. Paint Allied Ind.)

DRYING OIL IMPREGNATION OF CARBON ELECTRODES. B. L. Bailey and B. Best (Great Lakes Carbon Corp.). *U.S. 3,120,454.* In a method of impregnating a porous carbon electrode with a drying oil, the improvement comprises subjecting the impregnated electrode at least once to steam at a pressure of at least 300 p.s.i. and then quickly releasing the pressure.

• Detergents

FATTY ACID COMPOSITION OF SUCROGLYCERIDES OF COCONUT OIL AND LINSEED OIL. R. Tudisco and D. A. Turner (Ledoga Co., Milan, Italy). *Riv. Ital. Sostanze Grasse* 40, 528–30 (1963). Sucroglycerides were prepared by reacting sucrose with two different oils (coconut and linseed) in various molecular ratios, at 95–98C, in a slightly alkaline medium. Vapor phase chromatography of the fatty acid methyl esters of the sucroglycerides indicated no change from the initial fatty acid composition of the two oils.

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4th International Congress on Surface Active Substances

AOCS Member Heads Section

The 4th International Congress on Surface Active Substances will be held in Brussels, Beglium, Sept. 7-12, 1964, presided over by H.R.H. Prince Albert of Belgium.

The works of the Congress are divided into three parts: Chemistry of Surface Active Substances, consisting of some 50 papers; Physics of Surface Active Substances, 150 papers; and the Use of Surface Active Substances, 100 papers. This latter Section is under the direction of Charles Paquot (1952), Director, Du Laboratoire de Lipochimie, National de la Recherche Scientifique, Paris, France.

Program and final registration forms may be had on application to: General Secretariat, 4th International Congress on Surface Active Substances, 49, Square Marie-Louise, Brussels 4, Belgium.

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Classified Advertising

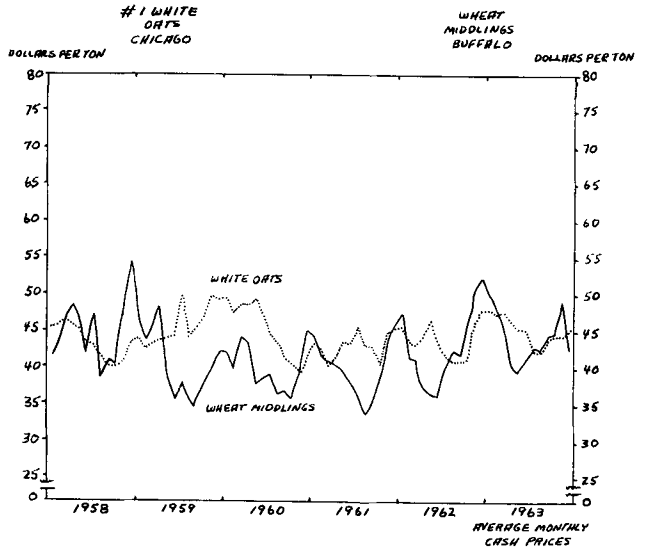
Confectionery Fats . . .

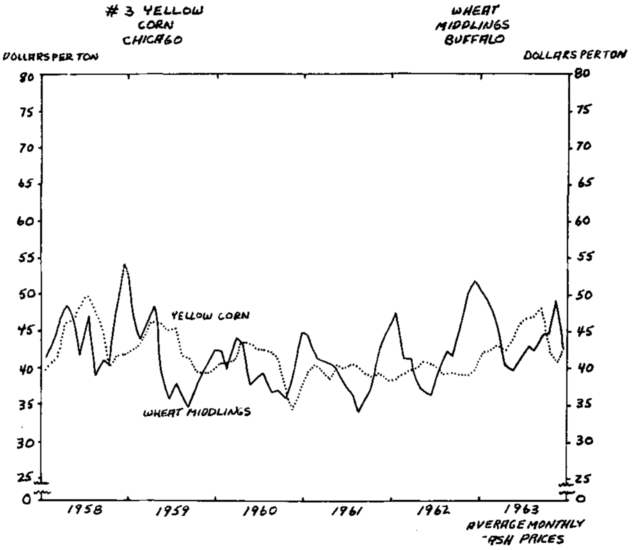
(Continued from page 30)

tential market of 100 million lb/year is not overly optimistic, especially considering the fact that potential utilization in so-called pastel coatings, which have not been discussed, are not included in this amt. The preferred physical characteristics of confectionery fats have been well established, and in their most important respects are the characteristics of cocoa butter. Fats made from lauric acid oils can be prepared readily and have a number of the preferred characteristics; therefore, their use will continue for many years. Fats made from oleic-palmitic-stearic acid oils have been produced up to now in relatively small quantities because of more involved processes and resulting higher cost; but eventually the utilization of large quantities of very good products of this type can be expected. The future role of fatty products which resembled confectionery fats in physical properties but differ in not being glycerides is uncertain but probably will not be great.

Gladly the Cross . . .

(Continued from page 10)





wheat millfeeds are intermediate protein feeds. No futures markets are available in either one. It is not surprising that their prices are not well related to soymeal, which as a high protein feed has a good constant demand for broilers and as a balancer of all other ration items. Both have the peculiarly strong seasonal characteristic of feeds influenced by the enormous spring-summer increases in the availability of hay, pasture, and dehydrated alfalfa. They are on occasions, however, usefully related to moves in oats and corn. It would seem likely that some key hedge-no hedge relationships could be developed in the corn-oats complex, at some times of year and at some differences. This is not surprising since it is probably always correct that grain can be substituted for middlings and/or gluten feed, but the reverse is not true. What is needed is further investigation. What is always needed is an open mind as to the possibilities of cross hedging.

James McHale
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1964 Cumulative Index to Advertisers

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