AOCS-AACC Joint Short Course
French Lick, Indiana, July 13-16, 1969

Oilseed Proteins—Chemistry, Technology and Economics is the theme of the 1969 AOCS-AACC Short Course to be held next July 13–16 in French Lick, Indiana.

Thirteen papers will be presented during five sessions by some of the finest authorities in the field. Abstracts of these papers follow.

PROTEIN STRUCTURE AND PROPERTIES, by Dr. L. Butler, Department of Biochemistry, Purdue University.

With respect to their structure, properties and function, proteins are the most versatile of the biopolymers. This versatility is a consequence of the chemical diversity of their amino acid monomers and of the infinite number of ways in which the amino acid composition, linear sequence and 3-dimensional folding may be varied. The constituent amino acids include both hydrophobic (alkyl and aryl) forms and hydrophilic (acidic, basic and neutral) forms. These are connected in amine linkage, and the *trans*, planar nature of the peptide bond thus formed limits the conformational freedom of the resulting polypeptide chain. Irregular, but precise, folding of the chain is maintained by disulfide cross-links (covalent) and non-covalent forces such as hydrogen bonds and hydrophobic interactions. In many proteins, a portion of the chain is coiled into one of several regular forms such as helixes, stabilized by hydrogen bonds. The 3-dimensional conformation of the protein molecule is largely determined, under physiological conditions in solution, by the sequence of amino acids in the chain, but is readily interrupted by a variety of non-physiological chemical and physical agents, with concurrent loss of biological function. This rearrangement of the polypeptide chains, called denaturation, usually results in an alteration of the absorption spectra, solubility, sedimentation, viscosity, electrophoretic mobility, optical rotation, and other physical, as well as chemical properties of the protein molecule.

NEWER TECHNIQUES IN PROTEIN ISOLATION AND CHARACTERIZATION, by Dr. J. A. Rothfus, Northern Regional Laboratory, USDA.

For research workers and administrators whose duties or peripheral interests require a knowledge of means by which proteins are isolated and characterized, this lecture will summarize the theory, experimental techniques, and applications of contemporary research methodology with emphasis on methods that have potential for large-scale or industrial use. The isolation of proteins will be described from the initial disruption of seed structures to the final purification of individual protein components. Methods used in characterizing proteins will be introduced in terms of their utility in monitoring protein isolations or in predicting protein behavior. Specific topics to be considered include: the macrostructure of seeds as revealed by the electron microscope or scanning electron microscopy; properties of seed proteins, lipids, carbohydrates and conjugated proteins; the fragmentation of seed structures; particle fractionation by physical methods including density gradient centrifugation, ultrafiltration and continuous electrophoresis; macromolecular chemical structure; the importance of disulfide bonds and other forms of intermolecular bonding; controlled aggregation; the use of dissociating solvents and specific hydrolytic enzymes; the resolution of individual proteins; gel filtration; high pressure column chromatography; electrophoresis; electrofocusing; immunospecific adsorbents and special precipitating agents. Amino acid analysis, immunochemical techniques, ion- and dye-binding, flourescence spectroscopy, x-ray diffraction, optical rotatory dispersion, and other

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Oilseed Proteins . . .
Chemistry, Technology, Economics

Final Program

SUNDAY—

All day *Registration*

MONDAY MORNING—

9:00 *Welcome and Announcements*

MONDAY MORNING—

BASIC PROTEIN CHEMISTRY, Session Chairman, Dr. Edwin W. Meyer, Central Soya

9:15–10:15 *Protein Structure and Properties,* Dr. L. G. Butler, Department of Biochemistry, Purdue University

11:00–12:00 *Newer Techniques in Protein Isolation and Characterization,* Dr. John Rothfus, Northern Regional Labs., USDA

MONDAY AFTERNOON—

TECHNOLOGY—PROCESSES AND PRODUCTS, Session Chairmen, Dr. M. W. Formo, Cargill; Dr. K. J. Smith, NCPA

2:00– 2:45 *Processing of Oilseeds to Meal,* Mr. K. W. Becker, Mgr., Food Processing Dept., Blaw-Knox Company

3:00– 3:45 *Processing of Oilseed Proteins for Food Use,* Dr. K. F. Mattil, Dir., Food Products Research, College of Eng., Texas A&M University

4:30– 5:15 *Functional Properties of Oilseed Proteins,* Dr. D. W. Johnson, Executive Vice President, Crest Products, Inc.

MONDAY NIGHT—

6:30 *Banquet,* speaker to be announced.

TUESDAY MORNING—

NUTRITION, Session Chairman, Mr. R. A. Reiners, Corn Products

8:30– 9:15 *Protein Metabolism,* Dr. Sanford A. Miller, Professor, Massachusetts Institute of Technology

9:30–10:15 *Assessment of the Nutritional Values of Novel Proteins,* Dr. Bernard L. Oser, Pres., Food and Drug Research Laboratories, Inc.

11:00–11:45 *Comparison of Nutritional Values of Oilseed Proteins,* Dr. Eldon E. Rice, Head, Biochemical & Nutrition Research Division, Swift & Company

TUESDAY AFTERNOON—

Recreation and Informal Discussions

TUESDAY EVENING—

PROTEINS FOR HUMAN FOODS, Session Chairman, Dr. Karl Mattil, Texas A&M

8:00– 8:45 *Present Utilization Patterns,* Dr. M. Dean Wilding, Head, Vegetable Products Research Division, Swift & Company

9:00– 9:45 *Possibilities & Probabilities,* Dr. Daniel Rosenfield, Deputy Director, High Protein Foods and Agribusiness Group, USDA

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WEDNESDAY MORNING—

ECONOMICS AND MARKETING, Session Chairmen, Dr. Dale W. Johnson, Crest Products; Dr. F. E. Horan, ADM

8:30– 9:15 *Practical Considerations in Commerical Utilization of Oilseeds,* Dr. Allan K. Smith, Oilseed Protein Consultant

9:30–10:15 *Economics of the Soybean Industry,* Mr. R. E. Fiedler, Vice President, ADM

11:00–11:45 *Marketing Considerations for New Protein Products in Food and Feed,* Dr. David L. Call, Graduate School of Nutrition, Cornell University

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Abstracts of Papers . . .

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methods that yield information about distinguishing features of proteins, or their behavior, will also be discussed.

PROCESSING OF OILSEEDS TO MEALS, by Mr. K. W. Becker, Food Processing Department, Blaw-Knox Company.

The prime consideration during processing of oilseeds to meals with respect to protein denaturation (i.e., cooking) is the time-temperature-moisture content relationship. Protein denaturation rate during the processing steps increases with an increase of any of these variables, but there is a threshold value for each variable below which the denaturation rate is very slow. In general, denaturation of protein is measured by its water dispersibility, i.e., denaturation increases as protein water solubility decreases. Choice of the extraction process for oilseeds depends primarily on the oil content of the seed and the allowable protein denaturation during preparation for extraction. Seeds with oil contents up to 30% may be extracted directly in percolation extractors, with minimum protein denaturation. Higher oil content seeds must be prepressed with some denaturation or they can be extracted by an immersion process such as centrifuge battery to minimize protein denaturation. The desolventizing operation is the most critical in mixing the degree of protein denaturation, since all three pertinent variables are near or above their threshold values. The selection of the proper processing units to completely desolventize the meal while maintaining desired limits will be discussed. Subsequent heat treatment after the desolventizing process may be used to further denature the protein or may be minimized to essentially prevent further denaturation. Prompt cooling is necessary before storage to preserve the required protein denaturation values. Classification and sizing may be required to meet the meal specifications.

PROCESSING OF OILSEED PROTEINS FOR FOOD USE, by Dr. K. F. Mattil, Food Products Research, College of Engineering, Texas A&M University.

Most processors of oilseeds are now producing protein only for animal feeds. Many of them are moving in the direction of the food markets; some are actively marketing food products. Any such transition requires new attitudes and new technologies. Among the new attitudes, one of the most important is that of a positive approach to sanitation and other aspects of food safety and esthetics; a recognition of the responsibilities associated with being in the food business. A number of new technologies have been developed for the conversion of oilseeds, particularly soybeans, into foods or food components. These include: controlled desolventization; production of protein isolates and several types of concentrates; production of fibers from soybean isolates and fibrous products from soybean flour; degossypolizing cottonseed products. Many technological problems remain to be solved, such as: practical means for eliminating mycotoxins from contaminated products; methods for effectively removing fiber (hull material) from several oilseeds; process for effecting the modification and control of the functional properties of the proteins in flours, concentrates and isolates.

FUNCTIONAL PROPERTIES OF OILSEED PROTEINS, by Dr. D. W. Johnson, Executive Vice President, Crest Products, Inc.

While there is a great deal of interest in proteins for foods abroad and in the United States, it is the functional and physical properties rather than nutritional values of proteins in protein-containing products which largely determine their acceptability for use as an ingredient in prepared foods or even if they are to be eaten as a food by itself. The nature of the protein per se, the presence of other constituents naturally present in protein containing products, the degree to which a protein is refined, the presence of other ingredients in a food system to which protein products are added, manufacturing conditions and a number of other factors working singly or together will influence the way proteins (as well as other ingredients) exert their functional characteristics. The discussion will cover the importance and desirability for proteins to have certain physical and functional characteristics, as well as the interest in non-functional properties, based on known facts and some theoretical considerations.

PROTEIN METABOLISM, by Dr. S. A. Miller, Professor, Massachusetts Institute of Technology.

The need of the body for protein is essentially the need for some 22 amino acids of which eight are considered essential. Thus, any method that attempts to define the quality of a food as a source of protein must take into account the manner in which these amino acids are utilized by the body. In this presentation the metabolism of protein will be discussed within the framework of methods used to determine the quality of protein. Starting with the process of digestion in which the amino acid polymer is broken down into simpler molecules, the metabolism of the amino acids will be followed through their active absorption by the intestinal mucosa to their transport through the circulation to the liver and then to the various pools and other compartments of the body. Their subsequent utilization in protein biosynthesis, urea metabolism and other pathways will be discussed in terms of the need for specific amino acid patterns and chronological sequences. The role of previous physiologic state, environmental interaction and nutritional status in regulating these events and their effect on protein requirements will also be discussed. The interdependence of protein metabolism with other components of the nutritional environment will be emphasized throughout these discussions as will be the implications of the dynamic state of metabolic activity.

ASSESSMENT OF THE NUTRITIONAL VALUE OF NOVEL PROTEINS, by Dr. B. L. Oser, President, Food and Drug Research Laboratories, Inc.

The concentration and refinement of food proteins of plant, marine or microbial origin involve processes which can significantly affect nutritive values predictable from a knowledge of the source or from the amino acid content as determined analytically. The actual animal tests generally involve short term feeding experiments with rats in which the proteinaceous material under test constitutes the sole source of protein, the total diet being approximately balanced with respect to all other nutrients. The results are expressed either in terms of the gain in body weight per unit weight of protein consumed, or as the per cent of ingested or absorbed nitrogen retained. Subsequent studies entail the use of other animal species and longer test periods in which other criteria (e.g., hematopoiesis, clinical and functional tests, reproduction and lactation) are investigated. The protein is evaluated not simply as the sole source of this nutrient, but as a supplement to other foods which may be low in protein quality or quantity. The final assessments of food proteins which have cleared the animal tests are made in human subjects. Acceptability of the

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product in various forms having been established, the nutritional evaluation is based on controlled feeding trials, such as nitrogen balance studies, in normal adults or children. If the protein appears to be of sufficiently high quality to have potential value in the prevention or treatment of malnutrition either alone or as a supplement, studies may be carried out with children in one or more centers in various parts of the world, some of which are WHO-approved for this purpose. The large scale field trial is finally undertaken when the results of this program of nutritional evaluation appear to justify clinical application in protein malnutrition.

COMPARISON OF NUTRITIONAL VALUES OF OIL SEED PROTEINS, Dr. E. E. Rice, Head, Biochemical and Nutrition Research Division, Swift & Co.

A protein seldom serves independently as a source of dietary amino acids—it works in concert with other proteins. Hence, the most important characteristic of each protein in the diet is its ability to fill gaps between the quantities of essential amino acids needed and those supplied by other foods. When examined from this viewpoint, oil seed proteins differ somewhat, but they all appear to be more valuable as supplementary proteins than their individual protein qualities imply. In general, feeding tests substantiate the theoretical supplementary values. Use of soybean, peanut, cottonseed and some other proteins for human or animal feeding will be discussed.

PRESENT UTILIZATION PATTERNS, by Dr. M. Dean Wilding, Head, Vegetable Products Research Division, Swift & Co.

Major emphasis will be given to the utilization of soy protein food concepts among the various potential oilseed proteins. Its growing importance in this new area of technology has resulted because of high protein yield per acre at a stable pricing structure, good protein quality, and functional characteristics of the protein. The defatted flour has limited use directly in food products because of certain dominant flavors. Most growing use potentials involve further processing. Various extraction techniques allow a 70% or 90% protein to be made from flour. High protein bread, beverages, imitation dairy products and meat products are effective uses for concentrates, or isolates, or both. They have the property of improving the nutritional value of many other proteins, particularly the cereals. Many of the present vegetable proteins lack the textural properties that are expected in many foods. Two major textural product concepts will be discussed with their advantages and limitations. Because of the relative blandness, the textural products are adapted to producing a wide variety of flavored simulations, such as imitation bacon, beef or chicken. The functional value that these textured products have in meat and other related foods will be discussed. Several new bland vegetable proteins are being evaluated in imitation milk and other dairy food concepts. Emphasis will be placed on the total acceptance of these protein sources in foods and not just in nutritional value alone. Many of these U.S. new food concepts are quite adaptable to the extensive need in other parts of the world. Some discussion will involve foreign feeding programs.

POSSIBILITIES AND PROBABILITIES, by Dr. D. Rosenfield, Deputy Director, High Protein Foods and Agribusiness Group, USDA

The interrelated factors of poverty and uncontrolled population expansion are and will continue to give major impetus to the increased utilization of oilseeds as human foods. These factors create an economic need which reinforces the nutritional need for more efficiently utilizing edible protein. As new technologies are developed to transform protein flours into food products of appealing organoleptic quality, uses could increase domestically as well as internationally. The functionality of the oilseed proteins will take in greater importance in the design of new foods. Economics and available technology will determine which protein sources will be utilized. Soy protein appears to have an assured place in the human market. There is a great potential for cottonseed and peanut protein, particularly in tropical areas. But if the technical problems of their usage are not solved, other sources such as sesame and coconuts could replace them. A source with great potential and competition for oilseeds is fish. The technology of fish protein concentrate production and use is improving rapidly. In addition to changes in processing technology, developments in agriculture including the livestock industry will affect the ultimate choice of protein sources. The food and poverty problem will continue to be of such magnitude that no one protein resource will solve the problem.

PRACTICAL CONSIDERATIONS IN COMMERCIAL UTILIZATION OF OILSEEDS, by Dr. A. K. Smith, Oilseed Protein Consultant.

In the past 40 years oilseeds have gained a dominant position in the U.S. agriculture. Soybeans have made more rapid progress in the feed and food industries than other oilseeds because of the low cost in their production, easy adaptability to solvent processing, and importance to the feed and food industries. Foreign markets have been a great asset to the soybean industry. However, each oilseed is finding its special place in the industry through plant breeding, the development of new techniques in oil mill processing and other technical modifications. The discussion will be concerned with both the favorable and unfavorable factors involved in production, composition, processing and conversion of the protein concentrates into acceptable foods. The recent oilseed research and development which holds promise for increasing utilization of oilseed in foods will be discussed. This will include progress in the breeding of high protein soybeans, new centrifugal techniques for reducing the gossypol in cottonseed meal, progress in the development and production of glandless cottonseed, processing new varieties of sunflower seed, the potential for new and improved oil solvents, the advantages of extrusion processing of oilseed meals, and other techniques which might be expected to improve the color, flavor, texture and other properties of oilseed proteins for foods.

ECONOMICS OF THE SOYBEAN INDUSTRY, by Mr. R. E. Fiedler, Vice President, ADM.

The soybean, an immigrant from China, has risen from the bottom of the U.S. agricultural crop ladder over the past 40 years to its position today of being number two. Only mighty corn is still ahead of the soybean cash value to the American farmer. Behind this unprecedented growth of an agricultural crop were two attributes of the soybean seed: a high content of excellent protein and a moderate content of oil useful for both edible and industrial uses. Although soybean oil does not quite measure up in quality to peanut, cotton, corn and some other vegetable oils, research has modified these deficiencies to such an extent that over 60% of all the fats and oils consumed in the U.S.A. are soy based. The soybean has resulted in the development of a world-wide marketing and processing technology covering the seeds and its two main products. Today, soybean and its products are the most exported agricultural goods with exports from the U.S.A. alone reaching the billion dollar level in recent years. So important has the soybean become to the American scene that it receives the active attention of almost every facet of private and public agribusiness. And the end is not in sight as the meal and oil fractions are finding their way into more and more highly sophisticated applications for human food use.

MARKETING CONSIDERATIONS FOR NEW PROTEIN PRODUCTS, by Dr. D. L. Call, Graduate School of Nutrition, Cornell University.

This session will explore the alternatives available to those who desire to market new protein products. Alternatives such as fortification, extension of existing products,

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are compatible with a possible association between the regulation of synthesis *de novo* of 3-*sn*-phosphatidylcholine and the assembly and release of lipoproteins from the liver. Methods for the chemical synthesis of phosphorylcholine and palmityl coenzyme A are described which are suitable for preparation of radioactively labeled substrates.

HYPOCHOLESTEROLEMIC EFFECT OF POLYSACCHARIDES AND POLYSACCHARIDE-RICH FOODSTUFFS IN CHOLESTEROL-FED RATS. S. Kiriuama, Y. Okagaki and A. Yoshida (Dept. of Nutr., School of Med., Tokusjima Univ., Tokushima, Japan). *J. Nutr.* 97, 382–88 (1969). The hypocholesterolemic effect of cellulose, sodium carboxymethylcellulose (CMC), pectin, alginic acid (free) agar-agar, gum arabic, konnyaku powder (prepared from the tubers of *Amorphophalus konjac*), konbu (*Laminaria japonica*), hijki (*Hijikia fusiformis*) and aonori (*Enteromorpha prolifera*) was examined in rat fed hypercholesterolemic diets. The hypocholesterolemic effect was reconfirmed for pectin and a new demonstration of the plasma- and liver cholesterol-depressing activity was achieved for CMC and konnyaku powder. Absorption of cholesterol was significantly depressed in rats fed pectina and konnyaku powder, but rats fed CMC showed no alteration in cholesterol absorption as compared with the control group. The activity of konnyaku powder, which is known to be hydrolyzed by intestinal microorganisms, did not increase by the combined administration of antibiotics. From these facts, it appears that the mechanisms depressing plasma cholesterol differ appreciably in these three substances.

STEREOSPECIFIC HYDROXYLATION OF LONG CHAIN COMPOUNDS BY A SPECIES OF TORULOPSIS. E. Heinz, A. P. Tulloch and J. F. T. Spencer (Nat. Res. Council of Canada, Prairie Regional Lab., Saskatoon, Saskatchewan, Canada). *J. Biol. Chem.* 224, 882–88 (1969). A species of yeast of the genus *Torulopsis* hydroxylates long chain C_{18} compounds and then converts them to glycosides of 17-L-hydroxy C_{18} fatty acids. Incubation of methyl (17-^{18}O)hydroxyoleate with whole cells and of methyl oleate in the presence of $^{18}O_2$ or $H_2{}^{18}O$ showed that the oxygen atom, introduced on hydroxylation, is not lost on glycoside formation and that it is derived from molecular oxygen and not from water. Esters of (18-$^2H_3$), (16,18-$^2H_5$), (17-$^2H_2$), (17-D-^{2}H), and (17-L-^{2}H)octadecanoates have been synthesized. On incubation of these compounds no deuterium atoms at C-16 and C-18 are removed by the 17-L-deuterium atoms is lost. Unsaturated intermediates are, therefore, most probably not involved and 17-L-hydroxy acid is produced by displacement of and L-hydrogen atom (retention of configuration). The rate of formation of glycoside from L-deuterostearate was less than half of that from D-deuterostearate or from unlabeled stearate, suggesting the operation of primary isotope effect.

PLASMA LEVELS OF FFA, GLYCEROL, β-HYDROXYBUTYRATE AND BLOOD GLUCOSE DURING THE POSTNATAL DEVELOPMENT OF THE PIG. G. Bengtsson, J. Gentz, J. Hakkarainen, R. Hellstrom and B. Persson (Dept. of Pediatrics, Karolinska Inst., Kronprinsessam Lovisas Barnsjakhus, Stockholm). *J. Nutr.* 97, 311–15 (1969). Levels of plasma free fatty acids (FFA), glycerol, β-hydroxybutyrate and blood glucose were determined in 175 sow-nursed piglets ranging in age from newborn to 9 weeks old, and in 22 newborn piglets starved up to 24 hours after birth. At birth, the concentrations of FFA and glycerol are very low. Animals starved for 6 to 24 hours from birth show a very moderate increase in FFA and unchanged or decreased concentrations of glycerol and β-hydroxybutyrate. These results are probably related to the low content of body fat in the newborn pig. During the first hours of suckling there is a significant rise in FFA and glycerol. A significant positive correlation between these parameters was found in two groups, aged 16 to 24 hours and 9 weeks. β-Hydroxybutyrate is extremely low in cord blood. A slight but significant increase is seen after birth with the peak value occurring between 8 and 12 hours. The blood glucose level is low at birth and there is a significant increase after the first nursing. The same glucose level persists throughout the first weeks of life. No correlation was found between glucose and FFA levels.

BIOCHEMISTRY OF THE SPHINGOLIPIDS. XVIII. COMPLETE STRUCTURE OF TETRASACCHARIDE PHYTOGLYCOLIPID. H. E. Carter, D. R. Strobach and J. N. Hawthorne (Div. of Biochem., Dept. of Chem., Univ. of Illinois, Urbana, Ill.). *Biochemistry* 8, 383–388 (1969). The tetrasaccharide (2-mannosido-6-(D-glucosamido-(1–4)-D-glucuronido) inositrol (obtained from the hydrolysis of phytoglycolipid has been oxidized with periodate and the products reduced with sodium borohydride. Isolation of D-arabitol as one of the polyol products shows that in the tetrasaccharide the inositol is 2,6-disubstituted. Proton magnetic resonance studies on the derived glucosylinositol and carboxyl-reduced N-acetyl trisaccharide showed that the glucuronic acid moiety was attached to the 6 position of inositol. The mannose, therefore, must be attached to the 2 position of inositol. Also deduced from proton magnetic resonance spectra was the all-D-configuration of the tetrasaccharide. Confirmation of this came from the time of half-hydrolysis of the N-acetyl trisaccharide. The point of attachment of the phosphate to the inositol in phytoglycolipid was shown to be through the 1 position by oxidation studies on the intact phytoglycolipid. The latter point was substantiated by mild acid hydrolysis of phosphorylated oligosaccharide to afford only inositol 1-phosphate.

XIX. STUDIES ON AN EPIMERIZATION PHENOMENON IN THE OLIGOSACCHARIDE OF PHYTOGLYCOLIPID. H. E. Carter, A. Kisic, J. L. Koob and J. A. Martin. *Ibid.*, 389–393. Phytoglycolipids from various plant seeds yield on alkaline hydrolysis a mixture of oligosaccharides which on further acid hydrolysis give a common trisaccharide, glucosamidoglucuronidoinositol. In a more detailed study of the trisaccharide fraction from corn a relatively water-insoluble material was isolated amounting to 15% of the total. This material has now been identified as glucosamidoiduronidoinositol. In a study of the possible origin of the insoluble trisaccharide it was discovered that glucosamidoglucuronidoinositol and glucuronidoinositol are partially epimerized to the corresponding iduronido derivatives in yields of 15 and 27%, respectively, by treatment with hot $Ba(OH)_2$ solution. These findings are in accord with the facile 50% epimerization of unsubstituted glucuronic acid to iduronic acid. Phytoglycolipid (tri- and tetrasaccharide mixture) was esterified and reduced thus converting the hexuronic acid moiety to hexose. Hydrolysis of the reduced material yielded glucose but no idosan. Nitrous acid degradation of the tri- and tetrasaccharide mixture (obtained by alkaline hydrolysis) gave glucosylinositol but no idosylinositol was obtained. Therefore it can be concluded that iduronic acid is not present in phytoglycolipids but is an artifact produced by the alkaline treatment used in hydrolysis of the glycolipid. The facile eperimization of glucuronido derivatives under alkaline conditions is a matter of concern in dealing with various glucuronic acid containing polymers.

BILE ACIDS. XXVI. THE METABOLISM OF 12α-HYDROXYCHOLANOIC ACID-24-^{14}C IN THE RAT. R. C. Sonders, S. L. Hsia, E. A. Doisy, Jr., J. T. Matschiner and W. H. Elliott (Dept. of Biochem., St. Louis Univ., School of Med., St. Louis, Mo. 63104). *Biochemistry* 8, 405–413 (1969). 12α-Hydroxycholanoic acid-24-^{14}C was administered intraperitoneally to each of three rats with bile fistulas. Within 24 hr most of the administered ^{14}C was recovered in bile. After alkaline hydrolysis of the conjugated bile acids, the free bile acids were separated

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production of imitations and production of new food products and others will be examined. The potential marketing problems for each alternate and the relative costs of gaining consumer acceptance will be discussed. In conclusion, the potential market for new protein products will be analyzed.

Registration forms have been sent to all society (association) members in a separate mailing. If you have misplaced the forms or need extras, send your requests to: Oilseed Protein Short Course, American Oil Chemists Society, 35 E. Wacker Drive, Chicago, Illinois 60601.

The Short Course is being offered at a complete cost of $160. Students will be charged $80. Accompanying spouse will be charged $65. Lodging for three nights and nine meals are included.

Ample facilities will be available to keep your family entertained while you are learning about proteins. Then too, you will have an afternoon free to join your family or friends in a game of golf or other recreation, if you do not choose to attend informal sessions on the short course subject matter which will also be scheduled during this "free" afternoon.

To be certain of a confirmed reservation, your completed registration form and check covering the full cost of the Short Course should be in the AOCS office by June 27.