A.R. Baldwin Distinguished Service Award

"Thank you for this memorial, I mean, memorable, award," said Joe Endres in an unscripted moment of humor when he couldn't read his handwritten acceptance speech for the A.R. Baldwin Distinguished Service Award, given to him at the Annual Meeting & Expo in May.

His AOCS membership file is thick with news clippings detailing his distinguished career in fats and oils research as well as his innumerable contributions to AOCS. A carbon copy (remember carbon copies?) of a letter from then Vice President and Membership Committee Chairman A.E. MacGee dated September 18, 1961, invites Endres to upgrade his membership from Active Junior to Active.

"I was a graduate student when I attended my first meeting," Endres remembers, adding that his advisor at the University of Illinois steered him to ACOS as "the place to publish fats- and oils-related research." And publish he did, garnering several JAOCS papers out of his dissertation.

Endres joined AOCS after receiving his Ph.D. and joining Armour & Co. in Chicago, Illinois, as head of their research program and pilot plant.

"I was very active in the North Central Section," he says with typical understatement, having served as section president, vice president, treasurer, and board member. He remembers the sense of camaraderie among the section members with fondness.

Joe Endres, recipient of the A.R. Baldwin Distinguished Service Award.

As for his long and distinguished service to AOCS proper, he served as an officer "many times over," he says. "The only position I never held was secretary." He was treasurer in both the 1970s and 1980s, was president in 1992, and has served on countless committees. He also led Campaign AOCS, the fund-raising drive for the society's new headquarters, and has served on the AOCS Foundation board. He continues to function as the book review editor of *inform* and write a monthly column on information technology. A computer printout of his activities over only the past 10 years is three pages long and shows that in 2004 alone, he served on seven committees. The printout also shows he was named an AOCS Fellow in 2000 and edited *Soy Protein Products: Characteristics, Nutritional Aspects, and Utilization*, which was published by AOCS Press in 2001.

Somehow Endres finds time to volunteer for other groups as well. He teaches gardening and recently helped a variety of people with their state and federal income tax returns. Beyond that, reading, gardening and woodworking are his primary hobbies.

"Somebody needed to take the leadership role," he said of his decades of work. By giving Endres the Baldwin Award—which consists of a plaque, a $2,000 honorarium, and travel expenses provided by Cargill, Inc.—AOCS hopes to communicate the gratitude of AOCS members worldwide for his leadership over the years. ■

AOCS Fellows

Five new AOCS Fellows were installed at the AOCS Annual Meeting & Expo in May: Michael F. Cox, N.A. Michael Eskin, Ralph T. Holman, Johannes Nieuwenhuis, and Pamela J. White.

The award criteria stipulate that Fellows be veteran AOCS members whose achievements in science entitle them to "exceptionally important" recognition or who have rendered "unusually important" service to the society or to their profession. Candidates must have been members for a minimum of 15 years, and the body of AOCS Fellows cannot exceed 1% of the AOCS membership.

Following is a representative sampling of the sorts of efforts and achievements that earned this year's honorees the title of "Fellow."

The 2004 AOCS Fellows were recognized during the Awards Recognition Breakfast at the AOCS Annual Meeting in May. They are (from left to right) Ralph Holman, Michael Eskin, Michael Cox, Pamela White, and Hans Niewenhuis.

Michael Cox (member since 1983)
Cox was recognized as a valued and respected researcher in the field of surfactants and detergents and for his exceptional service to the AOCS, including his work establishing and serving as editor-in-chief of the *Journal of Surfactants and Detergents*. Cox also has been president of AOCS, a member of the Surfactants & Detergents Division Board, chairman of the World Conference on Detergents

(Montreux, 2002) and of the 1995 Annual Meeting & Expo in San Diego.

Michael Eskin (member since 1980)
Eskin was acknowledged as a distinguished scientist for his outstanding basic research on the chemistry and processing of fats and oils as well as for his service to AOCS. That service includes being an associate editor of *JAOCS*, a member of the *inform* Advisory Board, chair of the Division Council and of the LOQ Division. He also has organized and chaired many symposia and workshops concerned with lipid oxidation and frying fat quality.

Ralph Holman (member since 1946)
Holman was recognized for his stature as an internationally recognized biochemist and leader in AOCS. Specifically, he was instrumental in founding the journal *Lipids* and served as its editor-in-chief. He also served on the Governing Board as secretary, vice-president, and president.

Hans Niewenhuis (member since 1986)
Niewenhuis was commended for his distinguished career in the edible oils and fats field, and for advancing the activities of the AOCS. That career includes his stint as chairperson of the Dutch Chemical Society, as president of ISF, and as a member of the AOCS Governing Board.

Pamela White (member since 1981)
White was honored for her research accomplishments studying the properties of soybean oils produced by traditional breeding and genetic modification, as well as for her AOCS leadership activities. She served as vice-chair, secretary, member-at-large, and president of the AOCS Governing Board. She has also chaired many AOCS committees and functioned on the editorial advisory boards of many publications. ■

The complete list of AOCS Fellows

Distinguished Fellows:
Thomas Applewhite
Richard Baldwin
Karl Zilch

Fellows:
Joyce Beare-Rogers
Arno Cahn
Michael Cox
Harold Dupuy
Herbert Dutton
Edward Emken
Joseph Endres
David Erickson
Michael Eskin
David Firestone
Thomas Foglia
Edwin Frankel
Frank Gunstone
Earl Hammond
Tetsutaro Hashimoto
John Heilman
Ralph Holman
Yung-Shen (Vic) Huang
Peter Kalustian
R.G. Krishnamurthy
David Kritchevsky
Arnis Kuksis
Marcel Lie Ken Jie
Gary List
Gerhard Maerker
Ted Matson
Lincoln Metcalfe
David Min
Akira Mori
Hans Nieuwenhuis
Milton Rosen
Peter Wan
Pamela White
Richard Wilson
Randall Wood

Supelco/Nicholas Pelick Research Award

This year's recipient of the Supelco/Nicholas Pelick Research Award is George M. Carman, professor of food science at Rutgers University in New Brunswick, New Jersey. The award, which is sponsored by Supelco, Inc., a Division of Sigma-Aldrich, and Nicholas Pelick, a longtime member and past president of AOCS, recognizes outstanding original research in fats, oils, lipid chemistry, or biochemistry.

Carman's research utilizes molecular genetic and biochemical approaches to study the regulation of phospholipid synthesis in baker's yeast *Saccharomyces cerevisiae*. Phospholipids are essential molecules that contribute to the structure of cell membranes, and participate in the regulation of cellular processes as signaling molecules and as reservoirs of lipid messengers.

The Carman laboratory has made significant contributions to the understanding of phospholipid synthesis in yeast through the purification and characterization of several enzymes and the isolation and characterization of key genes.

George M. Carman, recipient of the 2004 Supelco/Nicholas Pelick Research Award, is congratulated by Len Sidisky of Supelco (left) and Nicholas Pelick (right).

The research team played a key role in the discovery that expression of phospholipid biosynthetic enzymes is regulated by phospholipid precursors, and that key enzymes are regulated by membrane- and cytosolic-associated components and by covalent modification by protein kinases. These forms of enzyme

regulation have profound effects on membrane phospholipid composition and have important medical implications for understanding the molecular basis for various diseases.

In his award lecture, Carman presented his latest work showing that key enzymes responsible for the synthesis of phosphatidylcholine, the most abundant membrane phospholipid in eukaryotic cells, are repressed when yeast cells are depleted for the essential mineral zinc. This appears to be part of a general mechanism to reduce membrane synthesis and cell growth during nutritional stress. Carman acknowledged William Dowhan, who introduced him to the field of phospholipid metabolism, for continuous support in his professional career. Carman also expressed gratitude to the many postdoctoral associates (17), and graduate (44) and undergraduate (33) students who have worked in his laboratory during the past 26 years at Rutgers University.

Carman has authored 130 refereed publications on the regulation of phospholipid synthesis. He is a Fellow of the American Academy of Microbiology, and is the recipient of the Selman A. Waksman Honorary Lectureship Award, the Rutgers University Board of Trustees Award for Excellence in Research, and the New Jersey Agricultural Experiment Station Research Excellence Award. He is a former chair and organizer of the Gordon Research Conference on Lipid Metabolism and the Keystone Symposium on Lipid Second Messengers, and on the *Journal of Biological Chemistry* editorial board and Physiological Chemistry Study Section of the National Institutes of Health. Currently, he serves as an executive editor for analytical biochemistry of *Biochimica et Biophysica Acta*, and as associate editor of the *Journal of Lipid Research*.

Carman received his B.A. degree from William Paterson College, M.S. degree from Seton Hall University, and Ph.D. degree from the University of Massachusetts. His postdoctoral training was at the University of Texas Medical School in Houston. ■

The quest for healthful and functional lipids

Casimir C. Akoh received the 2004 Stephen S. Chang Award, which consists of $5,000 and a jade horse, at the AOCS Annual Meeting in Cincinnati in May. Akoh, who is a distinguished research professor in the Department of Food Science and Technology at The University of Georgia in Athens, AOCS Governing Board member, and past chair of the Lipid Oxidation Division, provided the following summary of his award lecture, which was given to a standing-room-only crowd at the meeting.

Casimir C. Akoh, recipient of the 2004 Stephen S. Chang Award, holds the award—a jade figurine of a horse—as Chang Award Trustee Joe Endres looks on.

We have been interested in improving the healthful and functional aspects of dietary lipids since 1985. Our work started with the concept of designing reduced-calorie and nondigestible zero-calorie fat substitutes such as olestra. The rationale behind this quest was that in the early 1980s, the Western diet contained approximately 35–37% calories from fat. As a result, many consumers were becoming overweight and prone to diseases such as obesity, cancers, diabetes, immune disorders, and cardiovascular and gall bladder problems.

The Procter & Gamble Co. (Cincinnati, Ohio) was already funding and conducting clinical research with the sucrose fatty acid polyester (Olestra, now Olean®) that they developed. We were able to reduce the synthesis time by using alkali metals or their soaps to catalyze the syntheses of a number of fat substitutes that could compete with olestra as fat substitutes. These include trahalose, sorbitol, raffinose, and stachyose fatty acid polyesters and alkyl glycoside polyesters such as methyl or octyl glucoside fatty acid polyesters. All these fat substitutes may be used to replace conventional fat in food formulations for functionality and to reduce weight gain. They are not digested or absorbed and hence contribute almost no calories to the diet. In fact, these molecules were more for functionality in foods than providing beneficial absorbable fatty acids to the diet. Numerous problems including physiological and nutritional effects have been reported after olestra consumption, such as loss of fat-soluble vitamins. We decided to shift focus toward the production of digestible and absorbable lipids with both functional and nutritional attributes using the tools of enzyme biotechnology that were coming of age in the late 1980s and early 1990s.

Lipids can be modified for nutrition, medical, and nutraceutical use, or for functionality in foods. Whether a lipid is considered functional or healthful, or both, will depend on its structure and component fatty acids. Structured or modified lipids can be designed for healthful applications such as better absorption, reduced calories, special disease conditions, immune function, cholesterol control, enteral and parenteral nutrition, and balanced n-3/n-6 ratios. For functionality, they can be designed to change the melting characteristics, rheology, plasticity, oxidative and frying stability, emulsification, or as a *trans*-free alternative for physical property attributes.

Enzyme biotechnology as applied to lipids involves the use of lipases for the modification, synthesis, or hydrolysis of

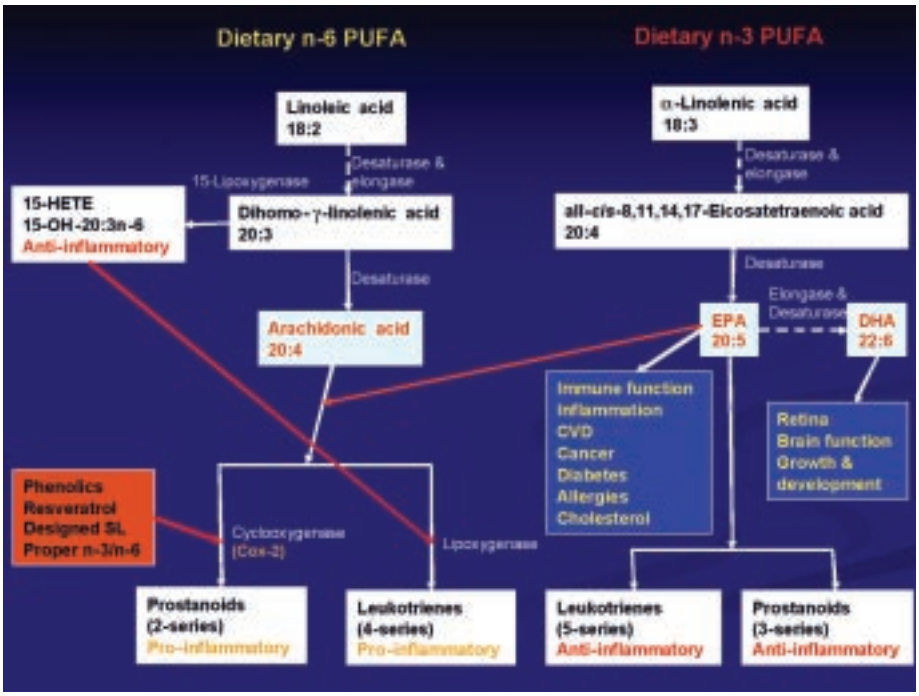

Figure 1. Metabolism of dietary n-6 and n-3 polyunsaturated fatty acids and possible role of designer lipids.

lipids and lipid-like molecules such as flavor/fragrance esters. Flavor compounds are important to the food industry, and fragrances are equally important for the fragrance and cosmetic industry where they command high premiums. Terpene esters of geraniol, citronellol, and menthol were synthesized using direct esterification, acidolysis, and interesterification reactions catalyzed by lipases. In addition, suitable lipases were used to resolve racemic mixtures of (±)-menthol to produce the desired (–)-menthol isomer.

(–)-Menthol is an important fragrance and flavor compound used largely in cosmetics, toothpastes, chewing gum, cigarettes, sweets, and even medicines. It also possesses the characteristic peppermint odor, which is lacking in the (+)-menthol isomer. We used phospholipases and lipases to modify or change the fatty acid composition of phospholipids, and lipases to modify vegetable and fish oils. Knowing the potential deleterious effects of certain fatty acids on the eicosanoid metabolism (Fig. 1), we designed digestible and absorbable structured lipids (SL) containing short- and/or medium-chain and

long-chain fatty acids that would antagonize the arachidonic acid metabolism and possibly improve human health.

Consumption of SL may help control or regulate the cyclooxygenase (Cox-2) and lipoxygenase enzymes involved in arachidonic metabolism and production of eicosanoids. In the Western diet, the ratio of n-3/n-6 is low as a result of consumption of more fats high in n-6 polyunsaturated fatty acids (PUFA) and fewer fats high in n-3 PUFA. Having adequate ratios of n-3/n-6 PUFA in the diet is vital to good health. Attempts were made to alter the n-3/n-6 fatty acid ratio of fats and oils in our laboratory using various lipases and substrates. Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) sources were used for this modification to achieve various n-3/n-6 ratios that may help ameliorate various human diseases such as improved immune function, diabetes, cardiovascular function, and reduced serum cholesterol levels. Other potentially beneficial healthful fatty acids for SL design include conjugated linoleic acid (CLA), γ-linolenic acid, arachidonic acid, and docosapentaenoic acid. Many of the structured lipids, depending on the nature and physiological function of the long-chain fatty acid component, may be desirable as nutraceutical lipids.

We also designed SL with better melting behavior and improved oxidative stability for functionality in foods such as in margarines, mayonnaises, spreads, cocoa butter substitutes, coating lipids, salad dressings, and beverages. SL containing palm oil as substrates were produced to add value to them and to replace *trans* fatty acids for use in spreads and other applications. These SL can be incorporated into our regular diets, supplemented in infant formula, sold in health food stores, or used in enteral and parenteral nutrition. We believe that SL can be designed to improve our overall health, change functionality in food applications, and enhance the absorption of certain fatty acids. Our further interest is in the oxidation of SL emulsions and the synthesis of zero-*trans* SL for food applications.

We found that oxidation of SL emulsions and their stabilization by natural antioxidants are slightly different. In some cases, under certain conditions, the natural antioxidants may serve as prooxidants. The molecular environment of the SL-based emulsion droplets also impacts their oxidative stability. Therefore, experimentation and care must be taken in choosing the suitable antioxidant for SL emulsions.

The use of lipases as biocatalysts to produce *trans*-free or reduced-*trans* fats is a welcome idea given the recent attention by the industry and the U.S. Food and Drug Administration on *trans* fats and their reported negative health benefits. The time is ripe for the industry to invest in the enzymatic modification of lipids to produce healthful and functional lipids that will benefit the consumer. Structured lipids may also serve as a delivery mechanism for the introduction and absorption of physiologically important fatty acids in our diet. In addition, we attempted the recovery of used frying oils with different adsorbents to improve the quality of used frying oils and fried foods. Apparently, the type of adsorbent material and adsorbent combinations will affect the quality of recovered used frying oils. Antioxidant addition may also improve and extend the frying life of used oils. ■

Steroid research earns the Schroepfer Medal

The Schroepfer Medal was established to honor the memory of George J. Schroepfer Jr., a leader in the sterol and lipid field for more than 40 years. The award consists of a $5,000 honorarium and a medal, which were presented this year to Jan B. Sjövall of the Karolinska Institute in Stockholm, Sweden. Following is his summary of the work that gained him the medal.

In 1949, I became a student of Sune Bergström, a Nobel Laureate in 1982, and entered a project on the biosynthesis and metabolism of bile acids. Reversed-phase and paper chromatographic systems were developed and used to study metabolic conversions of bile acids. Intestinal bacteria were found to play an important role, producing secondary bile acids during the enterohepatic circulation. Bile acid composition was determined under different physiological and pathological conditions, and the feedback inhibition of bile acid formation was defined. Fifty years later, the mechanisms of this inhibition are now being clarified by several groups.

Following postdoc periods with E.C. Horning and D.A. Turner, I participated in the development, by R. Ryhage and the LKB Co., of the first commercial GC/MS instrument. GC/MS was then used to define the composition of bile acids and steroids in feces and urine from infants and adults. Analyses of feces from germfree and conventional rats revealed novel bacterial reactions, e.g., 16α- and 21-dehydroxylations. Analyses of steroid sulfates in human plasma gave the first information about gender and age dependence of the levels of dehydroepiandrosterone (DHEA) sulfate, a steroid presently receiving much attention.

New sample preparation methods were developed based on the synthesis and use of lipophilic neutral and ion-exchanging derivatives of Sephadex. These are still being used for purification and group separation of samples according to polarity and charge and are essential for analyses of metabolic profiles, "steroidomics," by electrospray mass spectrometry (ES-MS), and GC/MS.

Alcohol metabolism was found to be coupled to the reduction of certain steroids. In this way, inactive steroids could be converted to hormonally active steroids. It is now established that levels of estradiol in men and testosterone in women are increased after a small drink. Small doses of alcohol also affected bile acid biosynthesis from cholesterol at the level of cholesterol 7α-hydroxylase. It is not clear if this effect is related to the beneficial effect of alcohol on cardiovascular disease and if the alcohol-induced increase of the levels of 7α-hydroxycholes-

Jan B. Sjövall of the Karolinska Institute in Stockholm, Sweden, received the Schroepfer Medal at the AOCS Annual Meeting & Expo in May.

terol and 7α-hydroxycholest-4-ene-3-one results in formation of hepatotoxic oxysterols.

A complex mixture of steroid sulfates was found in the plasma of pregnant women and higher apes. They represent a late stage in the evolution of steroid metabolism and constitute about 50% of the progesterone metabolites in pregnancy. One pregnanediol sulfate isomer specifically undergoes 21-hydroxylation. Additional conjugation with *N*-acetylglucosamine is important for certain isomers. Patients with intrahepatic cholestasis of pregnancy have characteristic changes in the profiles of these steroids, indicating a defect in their biliary excretion, which can be treated with ursodeoxycholic acid. Several groups are investigating the possibility that mutations in transporter proteins predispose to the disease.

A combination of fast atom bombardment mass spectrometry (FAB-MS) and GC/MS of bile acids allowed the diagnosis of the first case of inherited deficiency of 3β-hydroxy-Δ^5-C_{27}-steroid dehydrogenase/isomerase. Other groups have recently determined the site of mutation of the gene. Treatment with chenodeoxycholic acid resulted in feedback suppression of the abnormal bile acid synthesis and was lifesaving. Acquired deficiency of Δ^4-3-oxosteroid 5β-reductase was present in many patients with cholestatic liver disease. The resulting bile acids inhibited hepatic bile acid transporters, explaining the cholestasis and aggravating the liver disease. Combination of lipophilic gel sample preparation with FAB-MS (now replaced by ES-MS) and GC/MS resulted in detection of novel conjugates of steroids and bile acids with *N*-acetylglucosamine and double conjugates, e.g., of oxysterols. These had not been previously detected or measured by conventional methods.

Evidence for the presence of an oxysterol 7α-hydroxylase was obtained with pig and human liver mitochondria and microsomes. Others have cloned the gene for this enzyme, which is now accepted as essential in the pathway starting with mitochondrial 27-hydroxylation of cholesterol and leading to bile acids. It was present in many extrahepatic cell types, e.g., in brain and thymus, also containing cholesterol 27-hydroxylase and 3β-hydroxy-Δ^5-C_{27}-steroid dehydrogenase. These cells made 7α,27-dihydroxycholest-4-en-3-one and 7α,27-dihydroxy-3-oxocholest-4-enoic acid as end products, which can be converted to normal bile acids in the liver. The former oxysterol was a strong inhibitor of HMG-CoA reductase activity. Thus, oxysterol 7α-hydroxylase may be important for cholesterol homeostasis in such cells both by providing a regulator of cholesterol synthesis and by catalyzing a step in a metabolic pathway for elimination of cholesterol from these cells.

Recent and ongoing work concerns analysis of biologically active neurosteroids in brain by capillary HPLC/ES-MS/MS. The sample preparation is based on the use of lipophilic Sephadex derivatives, which separate steroid sulfates from free steroids. The former are analyzed directly, the latter are converted to oximes that are selectively sorbed on a cation exchanger and analyzed by multiple-reaction monitoring. Contrary to expectations from existing information, sulfates of pregnenolone and DHEA are not detected in rat brain. Previous reports on the presence of the sulfated forms are based on analyses of the free steroids released by solvolysis of presumed sulfate fractions. It appears that they have instead been released from another, as yet unidentified, form. Girard P derivatives of these steroids and of oxysterols are presently being investigated for high sensitivity analyses of their presence in the brain. ■

Students were honored at the Annual Meeting. The Ralph H. Potts Memorial Fellowship was awarded to Michael R. Stoner (back row, second from left). Ten students received the AOCS Honored Student Award. They are (front row, left to right): Linna Wang, Carolina Quintero, Jun Lin, Sylvia Gaysinsky, Elana M. Chapman, and Rahul Reddy Gangidi. Pictured in the back row are (left to right): Kerry Lyn Humphrey, Stoner, Monjur Hossen, Shigenobu Kishino, and Raina T. Gay. Not pictured is Hongmei Ren, recipient of the Thomas H. Smouse Memorial Fellowship.

Meeting memories

Robert Ackman
Professor emeritus, Dalhousie University
Halifax, Nova Scotia, Canada

Number of annual meetings attended: "I have never missed a meeting since joining in 1967."

Favorite AOCS meeting memory: "The best thing about these AOCS meetings is the people—seeing old friends and new scientists on the way up."

Thank you to the organizers of the 95th AOCS Annual Meeting & Expo:

- Local committee: Michael S. Showell, general chairperson; Manfred Biermann, technical program chairperson, Dave Casilio, exhibit chairperson.
- AOCS/JOCS Joint Symposium on Biosciences: Ching T. Hou, AOCS chairperson and Shun Wada, JOCS chairperson.
- View photos of the meeting on the internet at netlink: www.aocs.org/meetings/annual_mtg/photos/

Young Scientist Research Award

The 2004 Young Scientist Research Award, sponsored by Vijai K.S. Shukla and the International Food Science Centre A/S in Denmark, was awarded to John H. Coupland of The Pennsylvania State University at the AOCS Annual Meeting & Expo in May. The title of his award presentation was "Crystallization in Emulsions." His synopsis of the lecture follows.

John H. Coupland of The Pennsylvania State University receives the 2004 AOCS Young Scientist Research Award from outgoing AOCS President Mark Matlock at the Annual Meeting & Expo in May.

Much of the fat in food is present in fine droplets dispersed in an aqueous medium—an emulsion. The quality of foods such as milk, ice cream, and sauces depends on the stability of the emulsions that form part of their structure, and the phase transitions in the droplets can affect the quality of the products. However, the processes of lipid crystallization in emulsion droplets are subtly different from the crystallization of the same oil in bulk.

Because the oil is dispersed in fine droplets, there must be a nucleation event within each droplet for crystallization to occur, rather than the theoretical minimum of one nucleation event followed by extensive growth in bulk oil. This makes the process of crystallization in emulsions particularly interesting for studies on the fundamentals of nucleation. By measuring solid fat content as a function of time in a supercooled emulsion, it is possible to derive nucleation kinetics not convoluted with growth kinetics. In some simple fats, the crystals form spontaneously in each droplet (i.e., homogeneous nucleation), but in other cases other mechanisms become important, including crystals forming from the interfacial layer, from impurities in the droplets, or even from collisions with other droplets.

Dispersed-phase crystallization can lead to emulsion destabilization due to partial coalescence. The crystals from one droplet penetrate the surfactant layer and into a second droplet following collision. The fat crystals hold the droplets together as a pair yet prevent them from completely merging. This process is advantageous in whipped cream and ice cream and the agglomerated fat supports the air bubbles but can lead to oiling off in sauces undergoing temperature cycling. The situation is exacerbated when the water phase is frozen and thawed. The destabilized emulsion forms a soft cryogel after the water freezes and often completely breaks down on thawing. Protein-based surfactants, particularly in the presence of sugars, seem the best way to protect against freeze-thaw damage.

Phase transitions in the emulsion droplets have important effects on the small molecules present in the foods. Flavors, preservatives, and colors will partition between the aqueous and lipid phases of a food, and this will affect the overall flavor and stability. However, when the lipid droplets crystallize, the dissolved molecules can be squeezed out or trapped in the solid phase, changing their availability and the effectiveness of the food. Thus, controlling lipid phase transitions becomes then a powerful tool to control the taste and stability of foods. ■

Biotechnology Division Lifetime Achievement Award

Following his award presentation, Ramesh Patel (third from left) is congratulated by (left to right) award sponsor Brian McCormick of P&G Chemicals; Casimir Akoh, Biotechnology Division chairperson; and Ching Hou, Award Committee chairperson.

The 2004 Biotechnology Division Lifetime Achievement Award, which was developed in 1998 to honor outstanding performance over a lifetime of work, was given to Ramesh N. Patel at the AOCS Annual Meeting & Expo in May.

Patel's expertise in the microbial transformation and enzymatic syntheses of chemical and pharmaceutical products has spanned a 28-year career with the Exxon Research Co. (1975 to 1987) and the Bristol-Myers Squib Pharmaceutical Research Institute (1987 to present). He is recognized internationally as a leading authority in the stereoselective biocatalysis of chiral drug intermediates and structured lipids. His expertise encompasses the development of screening methods for finding the most suitable biocatalyst, the scale-up of the biotransformation processes, and the development of downstream methods for the recovery of target compounds. The enzymatic and microbial systems that he has created have had a significant impact on the manufacturing of various anticancer, antiviral, and antidiabetic agents. Patel holds more than 57 patents and has published in excess of 125 original papers.

95th AOCS ANNUAL MEETING & EXPO

Three awards given at IOP luncheon

Three awards were given at the Industrial Oil Products (IOP) luncheon during the AOCS Annual Meeting & Expo in May. They included the SDA Glycerine Innovation Research Award, the USB Industrial Uses of Soybean Oil Award, and the IOP Division Student Award, which was given to Merve Çetinkaya of Istanbul Technical University in Turkey for her work on biodiesel-run generators.

The Glycerine Innovation Award is sponsored by The Soap and Detergent Association, whose president, Ernie Rosenberg, was on hand to present the award to Kuzuhiro Akama, president of NOF America Corp. (White Plains, New York). Akama accepted the award on behalf of Masahiko Fukayama and Noriko Fujio of NOF Corp., Japan.

Zoran Petrovic receives the USB Industrial Uses of Soybean Oil Award from outgoing Industrial Oil Products Division Chairperson Dharma Kodali at the AOCS Annual Meeting & Expo in May.

The two scientists, who were unable to attend the meeting, developed an environmentally friendly antifreeze agent from a glycerine derivative. The new application was designed for use on roadways and has been found to be efficient at low temperatures, durable, fast-acting, water-soluble, and harmless to grass and trees.

Also receiving an award at the luncheon was Zoran Petrovic of the Kansas Polymer Research Center at Pittsburg State University in Kansas. Petrovic was the first recipient of the USB (United Soybean Board) Industrial Uses of Soybean Oil Award.

In accepting the award, Petrovic noted that without initial funding for USB, "we probably wouldn't be here now [accepting the new award]." Whereas his laboratory team consisted of two people when he received the first grant, he now heads a team of 11 researchers, two consultants, and a number of students.

His method for transforming vegetable oils to plastics will be commercialized by Cargill Inc., he said, with the first products expected by the end of the year.

The roughly 60 luncheon attendees also listened to a keynote speech by Jürgen Metzger of the Institute of Pure and Applied Chemistry at the University of Oldenburg in Germany. Metzger spoke about the need for and feasibility of sustainable development. ■

Samuel Rosen Memorial Award

This award is sponsored by Milton Rosen to recognize his father, Samuel Rosen, who worked as an industrial chemist on the formulation of printing inks for more than 40 years. The 2004 recipient is Daniel S. Connor of The Procter & Gamble Co. (P&G; Cincinnati, Ohio), whose summary of his award presentation on highly soluble surfactants follows.

Daniel S. Connor of The Procter & Gamble Co. (left) accepts the Samuel Rosen Memorial Award from Milton Rosen.

Most existing mainframe surfactants, which were introduced in the 1960s, were made as linear as possible in order to achieve high biodegradability. While these surfactants performed well in hot water with phosphate builders, it has become increasingly difficult to achieve good performance with non-phosphate formulas as wash temperatures have decreased, particularly in high water hardness. Original mainframe synthetic surfactants (1947) generally had highly branched tails, which performed satisfactorily in hot water but were too slowly biodegradable. We were able to break the linear surfactant paradigm for biodegradability by controlling the type, amount, and location of branching.

Highly soluble surfactants improve laundry detergents by increasing their performance in cold, hard water. This improves laundry performance for the consumer while saving energy. Two large-volume surfactants, linear alkyl sulfates (AS) and linear alkylbenzene sulfonates (LAS), have been improved by modification of their hydrophobic chains. The molecular approach is to lengthen the average distance from the anionic head groups to the furthest terminal methyl groups to enhance oily cleaning while maintaining solubility. Cold, hard water solubility is gained by addition of single methyl groups roughly mid-chain on largely terminally substituted hydrophobes. Actual degrees of branch-

ing are somewhat above 1 in the alcohol and somewhat below 1 in the alkylbenzene. These are made from somewhat different methyl-substituted olefins in each case.

Shell Chemical Co. has worked out a skeletal isomerization of their Neodene® internal olefins to produce a mixture of largely monomethyl branched C_{15}–C_{16} olefins. They add carbon monoxide and two moles of hydrogen utilizing their Neodol Process® to give solely primary alcohols. Shell's catalyst converts the internal olefins to terminal olefins prior to hydroformylation. Thus, most of the addition of $–CH_2OH$ occurs on the terminal carbon atoms of the backbone chain of the olefin. Solubility improvement in cold, hard water is enough that it allows a hydophobe increase to C_{16}–C_{17} from the current C_{14}–C_{15} in these alcohol sulfates. Oily soil removal at room temperature with these modified alcohol sulfates is dramatically improved.

Linear alkylbenzene (LAB) was modified by alkylation with a methyl-substituted olefin. This occurs on an acidic site within the pore of zeolite catalyst. The catalyst skeletally isomerizes the methyl group as well as the double bond. Conditions in the catalyst are so constrained that the benzene alkylates almost exclusively at the 2- and some at the 3-positions. Also, the methyl and phenyl groups are effectively separated from each other. UOP has worked out a commercial process to make modified linear alkylbenzene (MLAB) by sieving methyl paraffins out of kerosene followed by dehydrogenation, cleanup, and alkylation in the zeolite. These modified alkylbenzene sulfonates show marked oily soil improvement over LAS using comparable detergent formulas in cold, hard water. Again, the effective hydrophobe length was increased over that of LAS this time by maximizing 2-phenyl substitution. Cold, hard water solubility was attained by mid-chain methyl substitution on about one-half of the hydrophobe chains.

To get our new technologies into the market as soon as possible, P&G's research utilized the two specific sources of olefins described above. We view this just as the beginning of what will be possible in the future. Changes in the petroleum industry will lead to many paths toward controlled methyl branched olefins. These include olefin dimerization or oligomerization, isomerization, hydroisomerization, cracked wax, and dehydrogenation. One particularly fruitful source of suitable paraffinic and olefinic feedstocks is the Fischer–Tropsch process. This is the focus of extensive research in the petroleum industry toward high-quality transportation fuels (jet/diesel). ■

Adlof shares 30 years of fats and oils research

The Herbert J. Dutton Award is sponsored by the Analytical Division and presented to a scientist who has made significant contributions to the analysis of fats and oils or for work that has resulted in major advances in the understanding of processes utilized in the fats and oils industry. This year's recipient is Richard Adlof, a research chemist at the U.S. Department of Agriculture's (USDA's) National Center for Agricultural Utilization Research in Peoria, Illinois. What follows is an excerpt from his award presentation, "Fats: The Good, The Bad, and The Ugly."

Richard Adlof (left) receives the Dutton Award from Analytical Division Vice Chairperson Craig Byrdwell.

Since 1992, I've worked to develop silver ion HPLC as a standard method for analysis of isomeric fatty acids and triglycerides and, in the late 1990s, I became interested in the synthesis, analysis, and biochemistry of conjugated linoleic acids. Today, I'm part of a research group studying the functionality, stability, and safety of structurally modified (low-*trans*/low-saturated) edible oils. I'm also currently editor of the *Advances in Lipid Methodology* book series. My research has resulted in some 100 publications, one patent, and the 1989 USDA Unit Award for Distinguished Service for "Substantiating the safety of hydrogenated soybean oil in human diets through pioneering research techniques presently used to identify fatty acids best meeting nutritional needs." And now the Dutton Award. I appreciate this one most because it is recognition by my peers.

Silver success

Under the heading of analytical chemistry, I always found the lining of my cloud to be silver, as in silver ion chromatography, as in synthesis/isolation/purification/analysis of isomeric fatty acid methyl esters (FAME; *cis/trans*), phospholipids, triglycerides—unlabeled or labeled with deuterium atoms.

Silvered XN1010 resin formed the basis for silver resin chromatography. In the mid-1970s I began working with XN1010, an ion-exchange resin (sulfonic acid form) made by Rohm and Haas, but we discovered we could use it (in the silver form) to separate unsaturated fats. The resin arrived as large, spherical (16- to 50-mesh) particles that we subsequently (1) ground in a burr mill, (2) wet-sieved into different-sized fractions, (3) added silver ions to, and (4) packed into glass columns. Great capacity! I could, for example, separate 30 g of deuterium-labeled fats on a 5 × 25 cm glass column packed with *ca.* 60–120 mesh resin (with methanol as solvent) or, by only silvering a percentage of the resin (partial argentation resin chromatography; PARC), I could readily separate highly unsaturated fats. Sadly, XN1010 production ceased after 1987 or so. But I continue to look for another source of XN1010.

Why deuterium-labeled fats? Since deuterium is non-radioactive, these fats were fed to humans to study such things as *trans* fat incorporation, metabolic pathways, and fat/cholesterol interactions and to study fat absorption/utilization in individuals (infant to adult) afflicted with metabolic disorders such as multiple sclerosis. Over my career I've synthesized perhaps 35 different deuterium-labeled fats (*cis/trans* isomers, with different numbers and locations of double bonds), in 2- to 30-g batches, containing 2, 4, 6, or 8 deuterium atoms. Many of the syntheses contained 7 or 8 steps (Wilkinson reductions, Grignard and Wittig coupling reactions), often requiring 6–8 weeks per synthesis.

Useful, since the fats could be fed in mixtures (-d_2, -d_4, and -d_6, for example) and their incorporation, metabolism, and interactions studied by gas chromatography/mass spectrometry. Since not all the *d*-labeled fats were used, I still keep and maintain quantities of these fats (30+ synthesized over a 20-year period), and they continue to be used in cooperative studies with researchers around the world, in cell cultures, mice, rats, insects, and amoebic parasites, and from pheromone precursor studies (development of biological pest controls) to lipid oxidation rate studies and membrane fluidity studies (using broadband nuclear magnetic resonance) in plants as a function of external temperature.

I recognized the potential of silver ion HPLC and have since then used and, I hope, have helped expand the uses of this powerful, analytical tool. (Not just powerful but, for some applications, *the* most powerful analytical method available.) And formation of standard methods using silver ion HPLC is underway in the United States and in Europe.

Recently, we studied temperature effects on silver ion HPLC for the analysis of structured and/or isomeric lipids. Whereas with most chromatographic techniques (liquid or gas), samples tend to elute more rapidly at higher temperatures, we found just the opposite effect with our silver ion chromatography system. For the first time, we can apply temperature programming to silver ion chromatography.

Two fat facts

So what else have I learned from more than 30 years of fats-related research? Analytically speaking, that the "cloud" I spoke of earlier continues to have a silver lining—as in silver ion chromatography studies of structured fats and column temperature effects. This is certainly reflected in terms of my total number of publications. I also learned two "fat" facts.

Fact 1: The human body is very efficient at digesting/breaking down fats—all fats—whether *trans*, saturated, or whatever. So you are what you eat. For more than 90% of the population, the terms "*trans*" and "saturated" fats mean nothing . . . ***if*** you eat a balanced diet and don't live off hamburgers and French fries.

Fact 2: Much of the nutrition-related information in the literature is—well, is wrong! Some examples (dogma vs. reality):

(a) Dogma: Results from animal studies can be readily applied to humans. Reality: Sometimes.
  (1) Linoleic acid is readily converted to arachidonic acid in the mouse, but only 1–2% in humans. (Note: these data are for males only—no actual data for females have been reported; our unpublished data suggest conversion in women is much lower than in men.)
  (2) Stearic acid (a saturated fat) is not a health problem because it is not absorbed (data from animal and early human studies). In truth, we found that stearic acid is readily absorbed (>90%) in humans but, like all fats, it is readily broken down and used. (Note again: You are what you eat.)

(b) Dogma: The cholesterol content of animal fats is responsible for their hypercholesterolemic (cholesterol-raising) effects. Reality: The effect of the cholesterol in a person's diet on one's plasma cholesterol is minor. An increase of 100 mg cholesterol per day in most humans only increases their serum cholesterol 2–3 mg/dL, an insignificant amount.

(c) Dogma: Randomized (scrambled) vs. native fats: Belief that 16:0 (a saturated fat found in the 2-position of animal fat triglycerides) results in increased serum cholesterol levels (from studies in rats). Reality: We found ingestion of randomized vs. native lard had the same effect on total blood fats and cholesterol levels. Why? The fats are randomized (scrambled; 35–50%) when absorbed in your body, then reassembled for storage use as energy and tissue-building. So the structure of the fat is less important than the total fatty acid composition. Again, note: You are what you eat!

(d) Dogma: The suggestion that dietary supplementation with fish oil capsules is necessary to meet requirements for n-3 fatty acids. Reality: Actually, linolenic acid (an 18-carbon n-3 acid) is converted at *ca.* 14% to n-3 fatty acids in a balanced diet, an amount that appears to be sufficient to meet the daily n-3 requirements for humans (useful information for producers of soybean oil, which is *ca.* 7% 18:3n-3).

So, do "ugly" fats really exist? For most of us the answer is, in my opinion, no. Just eat sensibly from all the food groups.

A third thing I've learned in my more than 30 years of fats and oils research is that good luck (or "fortune") has more to do with things than I would like to admit. And I have been fortunate to have: good research leaders, co-workers, and technicians such as Lynne Copes, Sandy Duval, and Erin Walter; good research projects; and the flexibility to explore related research areas.

Future of analytical chemistry

What do I see in the future for analytical chemistry? On the plus side, I feel recent developments in analytical technology—improved separation(s), sensitivity, speed, and data handling—have allowed analytical chemists to better view and understand the world around them. Methodologies such as "fast GC," APCI-MS, and 2D-GC, which, in the past, were the exclusive domains of a few "experts," are today—due to the assistance of computers—available to more and more laboratories and researchers. In this respect, the future for analytical chemistry looks bright. And I look forward to being a part of it. ■

Timothy L. Mounts Award

Named after Timothy L. Mounts, a distinguished scientist and leader in AOCS, this award recognizes research accomplishments relating to the science, technology, or applications of edible oils or derivatives in food products. The 2004 Mounts Award was given to Alejandro G. Marangoni of the Department of Food Science at the University of Guelph in Ontario, Canada. Marangoni received the award at the dinner held by the Edible Applications Technology Division during the AOCS Annual Meeting & Expo and also served as the keynote speaker. A synopsis of the award presentation, "The Yield Stress of Fats and Its Relationship to Structure," prepared by Marangoni follows.

From an engineering perspective, the yield stress is an extremely useful parameter in the characterization of the rheological behavior of soft solids such as foods, hydrogels, paints, and mud. The apparent yield stress of a plastic solid, such as a fat, is usually defined as the point at which, when the stress is increased, the deforming solid first begins to show liquid-like behavior. Even though much controversy has recently arisen regarding the existence of a "true" yield stress, it still remains as one of the most widely used rheological characteristics of plastic solids.

Of particular interest to our research effort is the relationship between microstructure and mechanical properties in fat crystal networks. Many economically important food products such as chocolate, butter, margarines, and spreads are structured in this fashion.

The yield stress is one of the most important macroscopic properties of fats, since it is strongly correlated to sensory perception of hardness and spreadability, as well as to material stability. Existing rheological models that include the concept of a yield stress do not take into consideration the material's structure—the structural basis for a yield stress has not been proposed in mathematical terms. Work in our laboratory has focused on establishing this relationship using fractal scaling relationships. We have established that the yield stress can be calculated from a mathematical formula, and the Young's modulus of the material can easily be obtained using that equation. Agreement between experiment and theory was also shown to be very good.

In our work, we have also proposed a structural definition for the yield stress of a plastic solid structured as a network of aggregated crystalline particles: The yield stress corresponds to the force required to move an ensemble of network structural elements from their equilibrium separation distance, characterized by a finite interaction energy, to a critical separation distance, where the interaction energy equals zero.

Future challenges in this field include the incorporation of crystallization kinetics into our model. Preliminary work has shown that the nucleation rate is related to the fractal dimension of the fat crystal network in cocoa butter. The ultimate aim of this work is to be able to predict the mechanical properties of a fat from knowledge of key structural features, and to be able to ultimately engineer the hardness of a fat by constructing crystal networks with defined characteristics.

Our work has received financial assistance from the Natural Sciences and Engineering Research Council of Canada and the Ontario Ministry of Agriculture and Food. ■

Alejandro Marangoni of The University of Guelph received the 2004 Timothy L. Mounts Award at the AOCS Annual Meeting & Expo in May.

Meeting memories

Gary List
Lead scientist, National Center for Agricultural Utilization Research
Peoria, Illinois

Number of annual meetings attended: 27

Favorite AOCS meeting memory: "My favorite annual meeting memory involves my first meeting in 1967. I was supposed to leave for Chicago on Saturday, but instead I took my wife to the hospital, where our first child was born. She was born at 2 AM, after which I got two hours of sleep and then I went to my first AOCS meeting where I delivered my first paper as a new dad."

Firouz Madadnoee
Consultant and lecturer, AIVOM Co.
Tehran, Iran

Number of annual meetings attended: 5 or 6

Favorite AOCS meeting memory: "I like to come to this meeting to see my many friends and to show my appreciation for the knowledge I got when I studied in the United States and Malaysia. I am combining that knowledge with my region's knowledge to produce better products, which is good for everybody!"