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AOCS

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Departments and Information

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To be a global forum to promote the exchange of ideas, information, and experience, to enhance personal excellence, and to provide high standards of quality among those with a professional interest in the science and technology of fats, oils, surfactants, and related materials.

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Calendar

Bold type: *new listing*
For details on these and other upcoming meetings, visit www.aocs.org/meetings.

September

September 1–5, 2009. 50th International Conference on the Bioscience of Lipids, Regensburg, Germany. Information: e-mail: info.icbl@klinik.uni-regensburg.de; www.icbl2009.de.

September 8–10, 2009. 2nd Algae Biofuel Summit 2009, New Delhi, India. Information: www.algaebiofuelsummit.com.

September 9–10, 2009. Crude Oil to Biofuels: Trends Impacting Global Fuels, Hotel Sofitel, Rio de Janeiro, Brazil. Information: www.hartenergyconferences.com/index.php?area=details&confID=124.

September 9–15, 2009. FEBS Advanced Course: Lipid Signaling and Disease, Hotel Mara, Ortona, Italy. Information: www.negrisud.it/febs2009.

September 13–16, 2009. AACC International Annual Meeting 2009, Baltimore Convention Center, Baltimore, Maryland USA. Information: http://meeting.aaccnet.org.

September 13–16, 2009. 123rd AOAC Annual Meeting & Exposition, Philadelphia, Pennsylvania, USA. Information: www.aoac.org/meetings1/123rd_annual_mtg/main_2.htm.

September 15–17, 2009. HBA Expo, Jacob Javits Center, New York City, USA. Information: www.hbaexpo.com.

September 16–18, 2009. oils+fats, International Trade Fair for the Production and Processing of Oils and Fats Made from Renewable Resources, New Munich Trade Fair Centre, Munich-Riem, Germany. Information: e-mail: www.oils-and-fats.com.

September 21–23, 2009. Atlantic Bioenergy Conference 2009, Delta Beauséjour, Moncton, New Brunswick, Canada. Information: www.atlanticbioenergy.ca.

September 21, 2009. Short Course on Refining, Handling, and Applications of Palm Oil, Hilton Cartagena, Cartagena, Colombia. Information: www.aocs.org/Palma.

September 22–25, 2009. XVI Conferencía Internacíonal sobre Palma de Aceíte y Exopalma, Centro de Convenciones, Cartagena de Indias, Colombia. Information: www.fedepalma.org/conferencia2009.

September 23–25, 2009. International Forum on Emerging Technologies in Food Processing—Providing a Secure and Safe Food Supply, Campbell Alumni Center, University of Illinois, Urbana, USA. Information: William Artz, phone: +1-217-333-9337; fax: +1-217-333-9329; e-mail: wartz@illinois.edu; http://fshn.illinois.edu/food_processing_forum.

September 25–27, 2009. Globoil India 2009, Hilton Towers Mumbai, Mumbai, Maharashtra, India. Information: www.biztradeshows.com/organizers/tefla.html.

September 26–27, 2009. 6th International Symposium on Deep-Frying, Sydney, Australia. Information: www.eurofedlipid.org.

September 26–27, 2009. 9th AOCS Practical Edible Oil Refining Short Course, Process Optimization, Equipment and Technology Selection, and On-Line Process Control, Sydney, Australia. Information: www.aocs.org/meetings.

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AOCS Meeting Watch

September 21, 2009. Short Course on Refining, Handling, and Applications of Palm Oil, Hilton Cartagena, Cartagena, Colombia. Information: www.aocs.org/Palma.

September 26–27, 2009. 9th AOCS Practical Edible Oil Refining Short Course, Process Optimization, Equipment and Technology Selection, and On-Line Process Control, Sydney, Australia. Information: www.aocs.org/meetings.

September 26–27, 2009. Lipid Oxidation and Antioxidants Short Course, Sydney, Australia. Information: www.aocs.org/meetings.

October 2–3, 2009. Crystallization of Lipids Conference, Le Méridien King Edward Hotel, Toronto, Ontario, Canada. Information: www.aocs.org/meetings.

October 4–6, 2009. 23rd Meeting of the Canadian Section of the AOCS: Lipid Functionality in Processed Foods,·Le Méridien King Edward Hotel, Toronto, Ontario, Canada. Toronto, Ontario, Canada. Information: www.aocs.org/meetings.

November 14–15, 2009. 3rd Practical Short Course: Industrial Uses of Vegetable Oils: Biodiesel, Ink, Biobased Solvents, and Lubricants, Munich, Germany. Information: www.smartshortcourses.com or www.aocs.org/meetings/biodiesel09/index.cfm/2nd-International-Congress-on-Biodiesel-3rd-Practical-Short-Course.

November 15–17, 2009. 2nd International Congress on Biodiesel: The Science and the Technologies, The Westin Grand München Arabellapark Hotel, Munich, Germany. Information: www.aocs.org/meetings/biodiesel09.

May 16–19, 2010. 101st AOCS Annual Meeting and Expo, Phoenix Convention Center, Phoenix, Arizona, USA. Information: http://Annual_Mtg.aocs.org; phone: +1-217-359-2344; fax: +1-217-351-8091; e-mail: meetings@aocs.org.

For in-depth details on these and other upcoming meetings, visit www.aocs.org/meetings.

September 26–27, 2009. Lipid Oxidation and Antioxidants Short Course, Sydney, Australia. Information: www.aocs.org/meetings.

September 27–30, 2009. World Congress on Oils and Fats and 28th ISF Congress, Sydney Convention and Exhibition Centre, Darling Harbor, Sydney, Australia. Information: www.isfsydney2009.com.

September 28–30, 2009. Next Generation Biofuels, NH Grand Hotel Krasnapolsky, Amsterdam, Netherlands. Information: e-mail: info@greenconferences.com; www2.greenpowerconferences.co.uk/v8-12/Prospectus/Index.php?sEventCode=BF0909NL.

September 29–30, 2009. 2nd Algae World Asia, Kuala Lumpur, Malaysia. Information: www.cmtevents.com/aboutevent.aspx?ev=090914&.

September 30, 2009. Saturated Fat—Making Reduction a Reality, Leatherhead Food Research, Leatherhead, England. Information: www.leatherheadfood.com/satfat

October

October 2–3, 2009. Crystallization of Lipids Conference, Le Méridien King Edward Hotel, Toronto, Ontario, Canada. Information: www.aocs.org/meetings.

October 4–6, 2009. 23rd Meeting of the Canadian Section of the AOCS: Lipid Functionality in Processed Foods,·Le Méridien King Edward Hotel, Toronto, Ontario, Canada. Toronto, Ontario, Canada. Information: www.aocs.org/meetings.

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October 5–7, 2009. Food Processing Suppliers Association Process Expo, Las Vegas Convention Center, South Hall, Las Vegas, Nevada, USA. Information: www.iafis.org/processexpo/processexpo.

October 7–9, 2009. Congress of the International Federation of Societies of Cosmetic Chemists, Melbourne, Australia. Information: www.ifscc2009.com.au.

October 7–9, 2009. 3rd Annual Algae Biomass Summit, Marriot San Diego Hotel & Marina, San Diego, California, USA. Information: www.algalbiomass.org.

October 7–9, 2009. Biofuels Jatropha Markets Americas, Mexico City, Mexico. Information: www2.greenpowerconferences.co.uk/v8-12/Registration/Index.php?sEventCode=BN0907MX.

October 14–15, 2009. American Fats & Oils Association Annual Meeting. Information: www.afoaonline.org/events.html.

October 14–15, 2009. 4th Practical Short Course: Snack Food Processing and Product Formulation, "Het Pand" Ghent University, Ghent, Belgium. Information:http://home.scarlet.be/~tpm12374/smartshortcourses/snackfoods;www.bioactivesworld.com.

October 14–15, 2009. 2nd Jatropha World Africa, Brussels, Belgium. Information: www.cmtevents.com/aboutevent.aspx?ev=091021&.

October 17–18, 2009. 5th Practical Short Course on Functional Oils: Omega-3 Fatty Acids: Market Trends, Nutrition & Health, Utilization in Food Systems, Weitzer Hotel, Graz, Austria. Information: www.smartshortcourses.com; www.bioactivesworld.com.

October 18–21, 2009. 7th Euro Fed Lipid Congress: Lipids, Fats and Oils: From Knowledge to Application, Graz Convention Center, Graz, Austria. Information: e-mail: info@eurofedlipid.org; www.eurofedlipid.org/meetings/graz

October 18–22, 2009. Federation of Analytical Chemistry and Spectroscopy Societies Annual Conference, Marriott Hotel Downtown, Louisville, Kentucky, USA. Information: www.FACSS.org.

October 19–23, 2009. 76th National Renderers Association Annual Convention, Ritz-Carlton Hotel, San Francisco, California, USA. Information: http://convention.nationalrenderers.org.

October 19–24, 2009. Practical Short Course on Processing and Products of Vegetable Oils, Food Protein R&D Center, Texas A&M University, College Station, Texas, USA. Information: mslam@tamu.edu; http://foodprotein.tamu.edu/fatsoils/scvegoil.php.

October 21–22, 2009. !st Styrian Conference on Lipid Mass Spec, Hotel Weitzer, Graz, Austria. Information: www.meduni-graz.at/zmf/conference09.

October 21–22, 2009. OFI [Oils & Fats International] Asia, Balai Sidang Jakarta Convention Center, Jakarta, Indonesia. Information: www.oilsandfatsinternational.com/publication.asp?pubid=28&nav=3&exid=159.

October 25–28, 2009. Bioactive Lipids in Cancer, Inflammation and Related Diseases, CasaMagna Marriott Cancun Resort, Cancun, Mexico. Information: http://bioactivelipidsconf.wayne.edu.

October 26–28, 2009. 8th Annual World Food and Technology & Innovation 2009, World Trade Centre, Rotterdam, Netherlands. Information: www.foodinnovate.com/home.asp.

October 27–29, 2009. Biofuels 2009, 4th Annual Meeting, Budapest, Hungary. Information: www.wraconferences.com/2/4/articles/57.php?

October 28–29, 2009. 9th International Conference "OIL AND FAT INDUSTRY–2009," Azimuth Hotel St. Petersburg, Russia. Information: e-mail: market@vniig.org; www.vniifats.ru.

October 29–31, 2009. BioFuel Indonesia 2009, Griya Dome Convention Center, Medan, Indonesia. Information: www.biofuelindo.com.

October 31–November 1, 2009. International Antioxidant Forum/Short Course: Methodologies, Assessments, Applications and Health, Golden Gateway Holiday Inn, San Francisco, California, USA. Information: www.isnff.org.

October 31–November 1, 2009. Omega-3 and Beyond—Fundamentals, Applications and Health, Short Course of the International Society for Nutraceuticals & Functional Foods, Golden Gateway Holiday Inn, San Francisco, California, USA. Information: www.isnff.org.

November

November 1-4, 2009. Annual Conference and Exhibition of the International Society for Nutraceuticals and Functional Foods, San Francisco, California, USA. Information: www.isnff.org.

November 1–5, 2009. ASA-CSSA-SSSA (American Society of Agronomy-Crop Science Society of America-Soil Science Society of American) 2009 International Annual Meetings, Pittsburgh, Pennsylvania, USA. Information. www.acsmeetings.org.

November 1–6, 2009. XIII Congreso Latinoamericano de Grasas y Aceites (XIII Latin American Congress on Fats & Oils), Rosario Events and Convention Center, Rosario, Argentina. Information: e-mail: asaga@asaga.org.ar.

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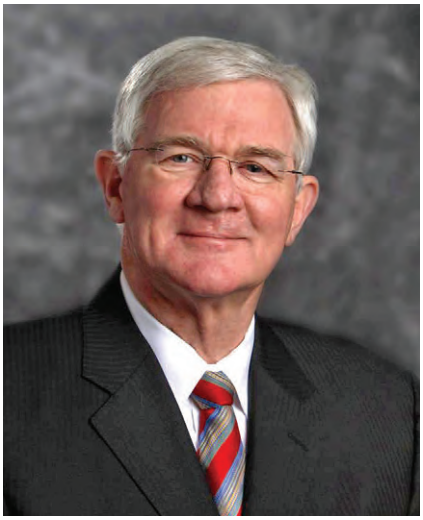
Message from the President



It is impossible to predict the future impact of the global financial crisis in which we find ourselves. What makes it more dramatic is the speed with which it occurred. Within nine months, the United States has gone from less than 4% unemployment to more than 10% unemployment. One of the world's largest companies, General Motors, entered bankruptcy. This financial crisis has affected all of us in one way or another.

In the midst of all of this doom and gloom, the good news is that the global banking system has been rescued. Good news, also, is that AOCS has weathered the financial storm very well because of the reserves that have been built up over the last four years, which were held in cash and cash equivalents.

Your Governing Board, at its May meeting, delegated to the AOCS Financial Steering Committee the responsibility to plan and implement a financial management plan that would help secure the long-term financial stability of AOCS. That plan has already been implemented, and it consists of three areas:

- An **Operating Account (OA)** that is managed by staff on a daily basis to receive revenue and pay expenses. The OA will be monitored by the Financial Steering Committee monthly. Twice yearly (January and July), funds in the OA will be adjusted to meet projected needs over the next six months. Normally, January and July are equilibrium points in the annual cashflow pattern.
- AOCS has established a significant **Buffer Account (BA)**. This BA is held in highly liquid assets (interest-bearing cash equivalents) that can be tapped in the event of an unforeseen crisis (e.g., 9/11 terrorist attack or H1N1 swine flu's shutdown of world travel), which might impact AOCS' revenues significantly. A substantial minimum has been established for this BA. This BA is managed by staff together with the Financial Steering Committee.
- Finally, AOCS has established a long-term **Investment Account (IA)** with a reputable (pressure-tested following the trying times of the financial crisis) investment advisory house to generate revenue for AOCS to advance its long-term interests and activities for its members and stakeholders. The IA is managed by the Financial Steering Committee.

With this sound financial structure now in place, the focus of the AOCS Board, with the support of staff, is to try to ensure that the financial result of each budget year is positive.

Your Board, for its 100th anniversary year, has budgeted for a negative outcome because of an anticipated revenue shortfall. This should not be a surprise in the current environment of corporate travel and expenditure restrictions. Staff headcount and salaries have been frozen as a result of the anticipated revenue reduction, along with our own travel restrictions and other cost-saving measures. I can assure you that everything feasible, consistent with continuing to provide excellent service, has been done to minimize our anticipated loss for this year.

Looking on the positive side, we anticipate that AOCS will be "back in the black" next fiscal year. In my next communiqué, I will lay out our vision for "Managing to the Future" of AOCS.

Ian C. Purtle
AOCS President, 2009–2010

Milk phospholipids—
A new ingredient for formulation of functional foods with bioactivity

Hans Burling, Åke Nilsson, and Lena Ohlsson

Phospholipids (PL) are common and important substances in the biological world. They make up the membranes of most cells in both plants and animals. These lipids are organized in double-layer structures serving as barriers between the various compartments and providing the proper environment for receptors, enzymes, and transport proteins. They also act as platforms for communication between cells and for hormones that regulate cell functions. Milk contains PL in the milkfat globule membrane (MFGM). This membrane is organized in ordered triple-layer structures together with special proteins, so-called MFGM proteins.

PL, or lecithins, are of great commercial use in the food and feed industry for emulsification purposes. They are also used in dietetic formulations and cosmetics, but in rather small quantities. Commercially, soybean is the greatest source for PL, with sales of about 200,000 metric tons (MT) per year, or 90% of the total market. Egg lecithin is a minor PL source with a production of around 300 MT per year, used mostly for dietetic purposes, in infant formulas and in parenteral nutrition.

Today, milk is seldom used as a source for PL even though it contains some very interesting bioactive PL, namely, phosphatidylserine (PS) and sphingomyelin (SM), which are the subject of this article.

STRUCTURES OF PHOSPHOLIPIDS (PL)

There are two kinds of PL: those that contain glycerol and those that contain sphingosine for binding of the phosphate group. In SM a single fatty acid is bound to sphingosine via an amide linkage; in the glycerophospholipids, the two fatty acids are bound via normal ester bonds.

PL compositions. Examples of PL compositions are presented in Table 1. It can be seen that milk PL has a different composition, with high proportions of the bioactive components SM and PS, compared with other major natural lecithins.

PROCESSING PROCEDURES FOR CONCENTRATION OF MILK PL

The normal content of PL in milk is about 250 mg per liter, equivalent to a content of 0.2% PL in whole milk powder. As a PL source, this content is too low to allow its use for functional food formulations. Because the PL are bound mainly to the milk fat globules, an obvious procedure for further concentration is to start from cream (40% fat). By using further centrifugation and emulsion-breaking procedures for making anhydrous milkfat, a serum phase can be collected that, after application of membrane filtration, gives a product that is over 20% PL in total solids. This procedure is patent pending WO 2006/128465 A1 (Arla Foods).

TABLE 1. *Relative phospholipid composition (%) in different commercial sources of lecithin products*[a]

	Soya	Egg	Milk
PC	34	75	27
PE	21	15	25
PI	18	0,4	8
SM	0	1.5	24
PS	0.5	0	12
PA	9	0	0
Others	17.5	8.1	4

[a] PC, phosphatidylcholine; PE, phosphatidylethanolamine; PI, phosphatidylinositol; SM, sphingomyelin; PS, phosphatidylserine; PA, phosphatidic acid.

The typical composition of a milk PL concentrate (Lacprodan PL-20) from Arla Foods is shown in Table 2. Glycoceramides in Table 2 include lactosyl ceramide and glucosyl ceramide, which structurally also belong to the sphingolipid (SL) family. The relatively high content of gangliosides also belonging to the SL group is of interest in the formulation of infant formulas for maintaining gut health.

For incorporating milk PL in cosmetics that need, for example, a protein-free ingredient, Lacprodan PL-20 can be subjected to ethanol extraction with no need of acetone precipitation to further reduce the triglycerides (TG) in the product. PL represents more than 80% of the total lipids, as shown in Table 2.

BIOACTIVE PROPERTIES OF PS

PS has lately aroused great interest as an active component in nutraceuticals for improved cognitive performance, as a counteractant against memory loss resulting from aging, and as a stress-release agent. Fifteen percent of the human brain PL pool

consists of PS. As the brain ages, part of the PL pool is lost and is replaced by inactive substances such as cholesterol.

More than 60 clinical studies have been performed over the years (McDaniel *et al.*, 2003), with results showing that the intake of PS has a positive effect on age-related memory decline, depression, stress, attention-deficit/hyperactivity disorder, and Alzheimer's disease. Using positron emission tomography, Klinkhammer *et al.* (1990) showed that PS intake stimulates brain glucose metabolism. Doses of an extra 100–300 mg of PS per day have been used tested in the published literature. This is equivalent to a dose of 5–15 g of Lacprodan PL-20 per day in a drink formulation of, say, 200 mL.

TABLE 2. *Typical composition (% of powder) of milk phospholipid concentrate (Lacprodan PL-20)*[a]

Protein		57
Lactose		7
Ash		6
Total lipids		24
Phospholipids thereof		20
	PC	5.4
	PE	5
	PI	1.6
	SM	4.8
	PS	2.4
	Others	0.8
Glycoceramides		1.3
Gangliosides		0.7

[a] For abbreviations see Table 1.

The normal intake of PS in the diet is about 130 mg, with large variations. Rich sources are fish and liver. Normal milk is a poor source. Vegetarians may get only about 50 mg per day.

The Diagnostic Assessment and Clinical Research Organization (DAACRO; Trier, Germany) conducted a clinical trial of Lacprodan PL-20 by adding about 15 g of Lacprodan PL-20 powder to a 250-mL drink (Hellhammer *et al.*, 2009). Consumption of this beverage on a daily basis would be equivalent to the intake of 300 mg PS. Their report concluded that the milk-derived PS had significant stress-dampening effects ($p = 0.02$), lowered perceived stress, dampened ACTH (stress hormone), and lowered serum and saliva cortisol levels. There was a trend for improved memory function, but it was not significant.

BIOLOGICAL PROPERTIES OF SM AND DERIVATIVES

Studies of potentially beneficial effects of SL in the diet have focused on lipid-lowering effects, anti-tumor effects, and the ability to counteract binding of pathogenic viruses and bacteria to glycosphingolipid receptors. Effects may be exerted via luminal

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information

For further reading:

- Duivenvoorden, I., P.J. Voshol, P.C. Rensen, W. van Duyvenvoorde, J.A. Romijn, J.J. Emeis, L.M. Havekes, and W.F. Nieuwenhuizen, Dietary sphingolipids lower plasma cholesterol and triacylglycerol and prevent liver steatosis in APOE*3Leiden mice, *Am. J. Clin. Nutr. 84*:312–321 (2006).
- Hellhammer, J., *et al.,* Three week intake of milk phosphatidylserine-Beneficial effects on memory and psychological stress response, presented at NutrEvent, Lille, France, June 17–18, 2009.
- Klinkhammer, P., B. Szelies, and W.-D. Heiss, Effect of phosphatidylserine on cerebral glucose metabolism in Alzheimer's disease, *Dement. Geriatr. Cogn. Disord. 1*:197–201 (1990).
- McDaniel, M.A., S.F. Maier, and G.O. Einstein, "Brain specific" nutrients: A memory cure? *Nutrition 19*:958–975 (2003).
- Nilsson, Å., and Duan, R.-D., Absorption and lipoprotein transport of sphingomyelin, *J. Lipid Res. 47*:154–171 (2006).
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- Slotte, J.P., Sphingomyelin-cholesterol interactions in biological and model membranes, *Chem. Phys. Lipids. 102*:13–27 (1999).
- Sprong, R.C., W.F. Hulstein, and R. Van der Meer, Bactericidal activities of milk lipids. *Antimicrob. AgentsCchemother. 45*:1298–1301 (2001).

interaction with sterols and bile salts and infectious agents, or via formation of bioactive metabolites that exert effects in the mucosa.

SM is co-localized with cholesterol in mammalian cells membranes. It interacts strongly with cholesterol and the regulation of SM and cholesterol metabolism (Slotte *et al*., 1999). In plasma lipoproteins, SM is the second-most abundant polar lipid after phosphatidylcholine in, for example, LDL (low-density lipoprotein) particles. A review paper on absorption and transport of sphingomyelin appeared rather recently in the *Journal of Lipid Research* (*47*:154–171, 2006).

The normal intake of SL in Western diets is about 0.3–0.4 g per day. Main sources are meat, milk, egg products, and fish.

Could increased intake of SL have a positive effect on serum cholesterol levels? Starting out from studies showing that SM inhibits cholesterol absorption (Nyberg *et al*., 2000), this topic has been studied in mouse models at TNO (Organisation for Applied Scientific Research) in the Netherlands using APOE*3 (apolipoprotein E ∗3)-Leiden mice (Duivenvoorden *et al.,* 2006). Results showed that dietary SL dose-dependently lowered plasma cholesterol and, surprisingly, also triglyceride.

Recently we performed two human studies in which we raised the question of whether SM-enriched food would have any effect on blood lipids postprandially (after a meal) or after long-term intake (abstract from Sphingolipid Club Meeting held November 14–16, 2008, published in *Naunyn-Schmiedeberg's Archives of Pharmacology* in advance of print, June 19, 2009; DOI 10.1007/s00210-009-0430-z). In an 8-hr postprandial crossover study and a 4-wk parallel group study we examined whether a SL-enriched buttermilk formulation affected concentrations of plasma cholesterol, TG (triglycerides), and apolipoproteins AI and B (apoAI/apoB). Healthy volunteers consumed a milk drink enriched in SM or a placebo formulation with an amount of PL corresponding to the amount of polar milk lipids in the test formulation, either with breakfast or daily for 4 wk. The postprandial study did not show any significant influence of the SL-enriched formulation on blood lipids. There was no difference at all in postprandial TG increase, but there was a trend toward an increased postprandial HDL (high-density lipoprotein) cholesterol/LDL cholesterol and apoAI/apoB ratio. Nor did the 4-wk study reveal any significant influence on fasting plasma lipids. Importantly, no adverse effects of the SL-rich formulation were observed, and further studies are warranted.

Apart from the chemical-physical action of SM on cholesterol uptake and metabolism, the digestion products derived from SM in the intestine, that is, ceramide and sphingosine, also have bioactive properties and impact on the developmental fate of many cell types. Alkaline sphingomyelinase activity has been observed in the entire intestinal tract of humans, with the highest activity in the small intestine. Ceramide is relatively poorly absorbed through the mucosa. It is estimated that 20–25% of the ingested SM reaches the colon, primarily as ceramide, which may be important for protection against colon cancer. This has been shown in animal experimental colon-cancer models (Schmelz *et al.,* 1998).

Ceramide is further degraded enzymatically in the intestinal wall by ceramidase to sphingosine, which is rapidly taken up by the enterocytes. Sphingosine is also reported to have antimicrobial effects in the gut, but when it is inside the cells, it can be phosphorylated or irreversibly degraded to palmitic acid and contributes to the fatty acid pool (Sprong *et al.*, 2001).

CONCLUSION

Milk PL in the form Lacprodan PL-20 with 20% PL offer new possibilities in the functional food area with promising bioactivities, especially as a source of phospatidylserine to ease memory decline and SL for maintaining balanced serum blood lipid levels. More clinical testing is needed to verify the results already published in the literature and the results of the pilot studies presented in this article. Selection of patients to participate in future studies is an important issue. Patients that are at risk for illness should be prioritized before normal healthy persons. The effects will most probably be more clear-cut doing so.

Hans Burling, senior scientist, Arla Foods AB (Lund, Sweden), can be reached via e-mail at hans.burling@arlafoods.com. Åke Nilsson and Lena Ohlsson are with the Department of Clinical Sciences, Medicine, Lund University Hospital.

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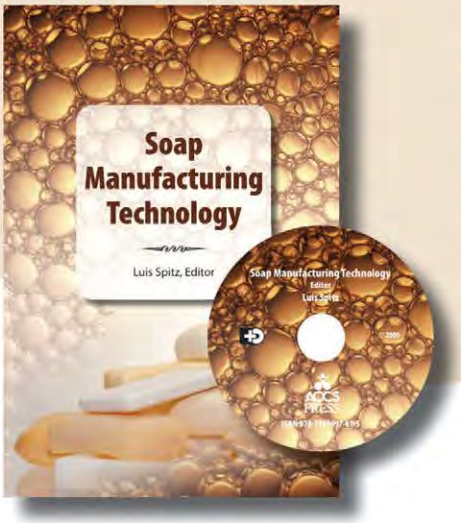

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Luis Spitz, Editor

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Global oil yields: Have we got it seriously wrong?

Denis J. Murphy

Up to now, most oilseed crop specialists have assumed that one metric ton (MT) per hectare (1MT/ha) was a pretty good ballpark figure for average oil yields from annual oilseed crops such as canola or sunflower. Of course the precise figure varies somewhat depending on the crop variety, climatic zone, and agronomy. Hence, spring-sown canola has quoted yields of about 0.6 MT/ha of oil in the Canadian prairies, whereas high-input, autumn-sown canola/rapeseed varieties in milder European climates average something closer to 1.4 MT/ha. Soybean has lower seed oil content, but it still manages about 0.5–0.6 MT/ha. Hence, the globally averaged oil yield from temperate crops is generally quoted at more or less 1 MT/ha. Thanks to improved varieties and agronomic practices, these estimated yields have increased slightly over recent decades but have not strayed too far from that magic figure of 1 MT/ha (see Table 1).

Over the last five years or so, these estimates of global vegetable oil yields have been used to calculate the expected efficiency of biofuel crops, especially in the biodiesel sector. Oil yields are the key to life-cycle analysis calculations of the net carbon or energy gain (or loss) from producing fuels from crops, compared with conventional fossil-derived petroleum feedstocks. These sorts of analyses have recently caused concern in some quarters when it was claimed that bioethanol made from US Midwestern cornstarch might be even worse than gasoline in its net greenhouse gas emissions. But thanks to that oil yield figure of 1 MT/ha, most observers would agree that oilseed-derived biodiesel fuels have fairly robust environmental credentials.

Table 1. *Estimated oil yields from selected crops*

Crop	Previous estimates, MT/ha[a]	New estimate[b], MT/ha
Canola (rapeseed)	1.2	0.49
Sunflower	1.0	0.42
Groundnut (peanut)	0.84	0.4
Soybean	0.56	0.36
Oil palm (includes kernel oil)	4.1	4.1
Maize (corn) ethanol	3.1	1.6

[a]MT/ha, metric tons per hectare.
[b]Johnston *et al.*, 2009.

Mature oil palms.

However, all those assumptions may need to be revised if the conclusions of a recent, carefully crafted survey of global energy crop yields are correct. The results were published in the journal *Environmental Research Letters* in January 2009 by a group led by Matt Johnston from the University of Wisconsin-Madison (USA). Their surprising conclusion is that for nearly all crops, we have got our oil yield figures seriously wrong. In most cases, they reckon that yields were overestimated by about 100%, while some crops like groundnut grown for biodiesel and wheat grown for bioethanol may have been overestimated by more than 150%. This means that our ballpark figure for oil yield from annual oilseed crops should be less than 0.5 MT/ha, instead of 1 MT/ha.

And there was another sting in the tail of the Wisconsin analysis. It seems that whereas annual oilseed yields may have been vastly overestimated, those of oil palm are more or less correct at about 4.1 MT/ha (made up of 3.68 MT/ha palm oil plus 0.44 MT/ha kernel oil). This means that the oil yield of oil palm per hectare may be as much as ninefold higher than that of temperate oilseed crops. Palm oil production costs are also lower because the crop is perennial, so it does not require annual sowing, and it is normally grown in lower wage regions of the world.

Moreover, whereas temperate oilseed crops may already be close to their maximum biological potential oil yield, oil palm breeders are developing varieties that yield in the region of 9–16 MT/ha, which is a massive 20- to 35-fold higher than canola or

sunflower. Perhaps now may be a good time to consider investing in the burgeoning oil palm industry in South America, where new high-yielding plantations are rapidly coming on-stream in countries such as Colombia and Ecuador. This is already happening in Africa, where China has reportedly secured rights to grow palm oil on 2.8 million ha in Congo and is now negotiating for a further 2 million ha in Zambia. The amount of oil that could be produced on 4.8 million palm-planted ha would require about 55 million ha of soybean, almost double the area of the entire US soybean crop (estimated at 31 million ha in 2009).

If these surprising results from the Wisconsin study are confirmed, they could fundamentally challenge our assumptions about the environmental case for biofuels as a major element in future strategies for sustainable energy provision. They could also affect sentiment about the wisdom of using food or feed crops as bioenergy feedstocks. This is especially topical at a time when the United Nations is dramatically increasing its estimates of the numbers of people suffering acute food shortages, and as the economic downturn and food price hikes disproportionately affect the poor in developing countries. Commenting on the significance of their study, Matt Johnston said:

"Our evaluation of crop yields shows the importance of place- and crop-specific data to inform decision-making on agricultural biofuels. Additional work would be required to evaluate the environmental benefits of specific biofuels produced at specific places, but it is clear that the life-cycle costs are highly dependent on where and how crops are produced."

information

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inform Contributing Editor Denis J. Murphy is professor of biotechnology at the University of Glamorgan (United Kingdom). He also works as an advisor with the United Nations Food and Agriculture Organization and as a consultant in the wider oil crops industry. Contact him at dmurphy2@glam.ac.uk.

Award Address

Omega-3 fatty acid profiling and dietary forensics

Editor's note: The following article is based on the address given by Ken D. Stark, the 2009 AOCS Young Scientist Research Award winner, at the 100th AOCS Annual Meeting & Expo, held in Orlando, Florida, USA, May 3–6.

Ken D. Stark

The quantity and type of dietary fat intake influence cellular membrane composition and lipid metabolism, which can impact cardiovascular disease (CVD), obesity, inflammation, and neurological development and function. Consumption of some types of fatty acids, such as omega-3 fatty acids, provides health benefits, while others, such as saturated and *trans* fatty acids, can potentially increase the risk of disease. Assessing individual dietary and cellular fatty acids, and determining their specific impact on biological processes, is becoming increasingly important. For example, whereas α-linolenic acid (ALA, 18:3n-3), eicosapentaenoic acid (EPA, 20:5n-3), n-3 docosapentaenoic acid (DPAn-3, 22:5n-3), and docosahexaenoic acid (DHA, 22:6n-3) are all omega-3 fatty acids, they accumulate in different lipids and tissues, and we are continually defining their distinct roles in health and disease.

Nutrient intakes including fatty acids can be estimated at the population level through aggregate methods such as food disappearance data, but for clinical utility, approaches that provide data specific to individuals are required. Estimates of an individual's dietary intake can be completed by average intake methods that involve food frequency questionnaires and surveys, and by daily food consumption methods that include recent intake recall and food diaries. Assessing nutrient intakes at the level of the individual is associated with a series of limitations that are spread throughout the process of estimating the actual intake. This includes the skill and consistency of the researcher during participant interviews, and the participant's ability to accurately report his or her intake and the ability to resist tendencies to change dietary habits during the observation process. There is also potential for errors and inconsistencies in handling the reports, both at the level of the researcher and in the software being used. Finally, the dietary assessment is limited by the actual food database being utilized. This includes potential errors in the accuracy and precision of the existing data, inconsistent methodological approaches to generate nutrient composition data, the completeness of the data, and the constantly changing food supply.

Determinations of fatty acids in human tissues and blood are biomarkers of dietary intake, but predicting fat intakes is difficult and dependent on the type(s) of fatty acid being examined.

Approximately 90% of dietary fatty acid intake in modernized countries (including Japan) is comprised of four fatty acids: 16:0, 18:0, 18:1n-9, and 18:2n-6 (palmitic, stearic, oleic, and linoleic acid, respectively). Endogenous fatty acid synthesis limits the utility of several biomarkers, especially saturated fatty acids. Fatty acid tissue-diet biomarkers with the most potential are those fatty acids exogenously obtained through the diet and include polyunsaturated fatty acids, *trans* fatty acids, and odd-numbered carbon-chain fatty acids. DHA in erythrocytes and plasma correlates highly with dietary DHA intake. Pentadecanoic (15:0) and heptadecanoic (17:0) fatty acids are associated primarily with dairy consumption, but they may help identify levels of saturated fat intake. Determining saturated fatty acid tissue biomarkers for the intake of individual dietary saturates is difficult, but the use of ratios and/or sums and aggregates of fatty acids can allow for the prediction of differences in polyunsaturated fat intake vs. saturated fat intake.

In addition, 16:1n-7 and 18:1n-7 are potential markers of low-fat/high-carbohydrate diets. Increased contents of n-7 fatty acids in tissues and blood reflect increased endogenous fatty acid production stimulated by excess carbohydrate intake. This

*inform*ation

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increased endogenous 16:0 production results in increased Δ-9 desaturation of 16:0 (at the n-7 position) with potential elongation to 18:1n-7. Low exogenous fat intake reduces the availability of 18:1n-9 and 18:2n-6 and results in greater incorporation of n-7 fatty acids into tissue lipids. The use of models combining four to five fatty acids measured in blood have been successful in differentiating between moderate- and low-fat diets. Empirical relationships developed by Bill Lands for determining the fatty acid compositions of human plasma phospholipids from dietary intake are available online (http://efaeducation.nih.gov/sig/dietbalance.html).

Blood-based biomarkers have a practical advantage over tissue-based biopsies. Adipose biopsies can provide very good, long-term dietary intake information, but they are far too invasive to be used at the level of routine clinical screening. Plasma and erythrocytes tend to be the blood fractions analyzed most often, although whole blood, platelets, and leukocytes have been analyzed as well. Plasma and erythrocyte measures tend to reflect shorter-term intakes, but they may be suitable for estimating long-term intake. The preparation of plasma-free erythrocytes and erythrocyte-lipid extraction requires specialized and time-consuming methodologies, but the fatty acid composition of the total lipid extract of erythrocytes is extremely similar to the fatty acid composition of erythrocyte phospholipids. Lipid class separation in erythrocytes prior to fatty acid determinations is unnecessary.

Plasma lipids, on the other hand, include triacylglycerols, cholesterol esters, and phospholipids. Fatty acid determinations of plasma total lipid extracts are often avoided because the fatty acids in the triacylglycerols component can be influenced by recent dietary intake and the triacyglyerol pool can be highly variable depending on whether the individual was in a fasted or fed state. Therefore, plasma-based fatty acid determinations are typically associated with prior lipid class separation such as thin-layer chromatography. A finger-tip-prick blood sample on chromatography paper is an extremely rapid blood collection technique that does not require trained phlebotomists and holds considerable potential for field studies and screening (Fig. 1). This technique does limit the results to the fatty acids composition of total lipids in whole blood, and it is very difficult to isolate specific blood fractions and individual lipid classes. However, it is important to point out that in the Physicians' Health Study, it was higher EPA + DHA levels in whole blood that were associated with lower risk of sudden cardiac death.

FIG. 1. *Fingertip-prick blood sampling on chromatography paper.*

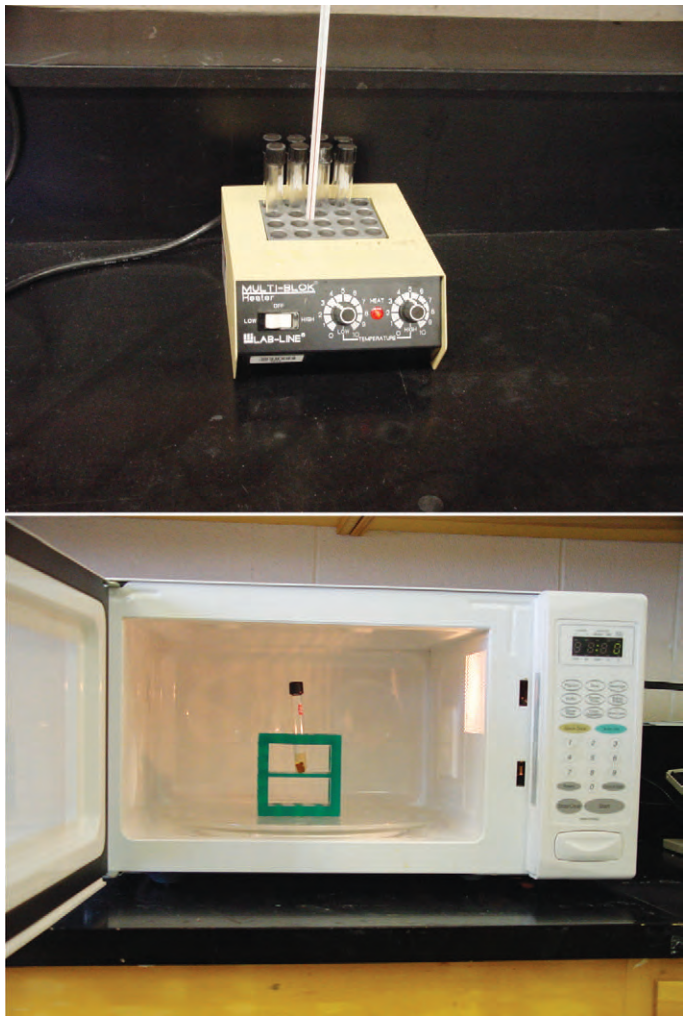

FIG. 2. *Direct transesterification of fatty acids in blood lipids using boron trifluoride in methanol by traditional convectional heat (approximately 60 min) as compared with microwave energy (approximately 45 s).*

The sum of the relative percentages of EPA and DHA in erythrocytes has been suggested as a potentially useful clinical risk factor, based largely on correlations to heart EPA + DHA status. An alternative method of examining omega-3 fatty acid status is to examine the percentage of omega-3 fatty acids in the highly unsaturated fatty acid pool (HUFA, ≥20 carbons and ≥3 double bonds). The HUFA pool is a surrogate marker of the fatty acids in the *sn*-2 position of cellular phospholipids. Focusing on the HUFA class of fatty acids allows estimation of cell membrane levels of omega-3 fatty acids from total lipid fatty acid determinations, without the necessity for blood fractionations and extensive isolation of lipid classes.

North Americans tend to have percentages of n-3 HUFA in total HUFA of about 20% in various blood measures, which is below the level of 50% that would provide significant cardio-

protection. Using the percentage of n-3 HUFA in total HUFA also increases the ability to predict the omega-3 fatty acid status of tissues such as liver, brain, and heart from blood omega-3 fatty acid status. By using the percentage of n-3 HUFA in total HUFA, we are also able to employ a variety of high throughput processing techniques such as direct transesterification of fatty acids with microwave energy without sacrificing the accuracy of the estimate of omega-3 fatty acid status (Fig. 2).

Combining these processing techniques with fast gas chromatography can result in tremendous gains in sample throughput and increased cost efficiency, and a lower cost per sample. It is estimated that more than 350,000 North Americans die each year from sudden cardiac death, while fish oil supplementation is associated with a 45% reduction in the risk of sudden cardiac death. Regular monitoring of omega-3 fatty acid intakes through blood analyses could prove highly effective for first-line prevention of sudden cardiac death. High throughput, cost-efficient analytical methods could enable fatty acid determinations in large-scale clinical trails and potentially lead to routine clinical fatty acid profiling by health care professionals.

Ken Stark received an undergraduate degree from the University of Toronto and he completed his graduate studies at the University of Guelph. While at Guelph, he was an AOCS honored student. He spent two years at the National Institutes of Health as a post-doctoral fellow examining dietary and behavioral influences on maternal-fetal metabolism of fatty acids. He is currently an assistant professor in the Department of Kinesiology at the University of Waterloo where he heads the Laboratory of Nutritional & Nutraceutical Research. Contact him at kstark@uwaterloo.ca.

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News & Noteworthy

Briefs

Pakistan will have to import more than 80% of its edible oil in 2009 following lower sunflower yields in the country, according to the Asia Pulse news service. In previous years, the country's annual consumption of edible oil was about 2.1 million metric tons, with 30% coming from local production and 70% from imports.

■■■

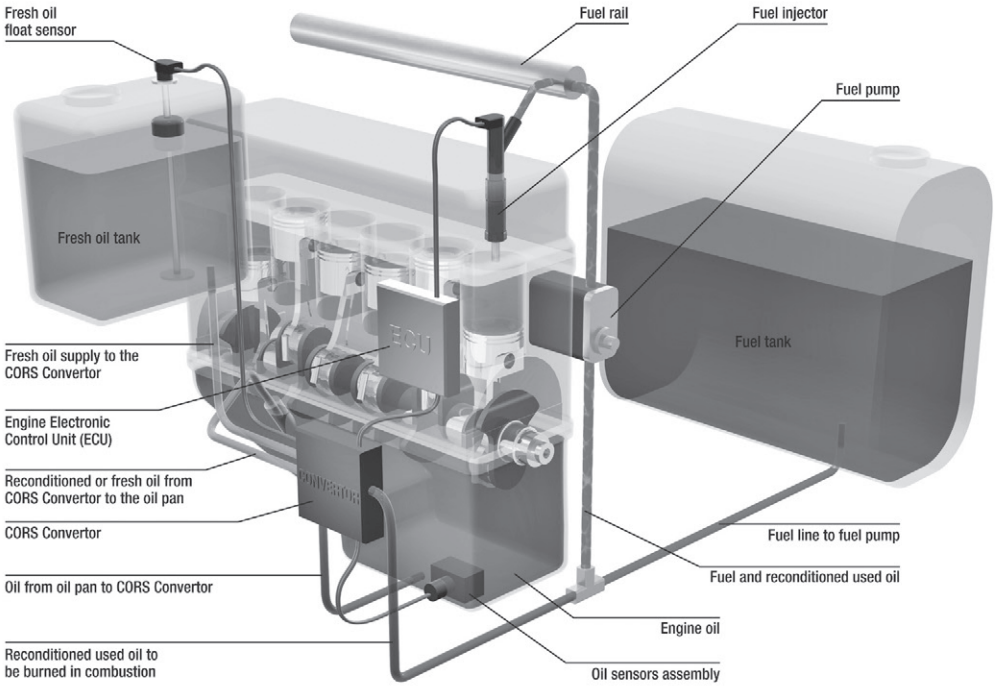
Retail sales of soy-food products in the United States have surpassed $4 billion for the first time, according to *Soyfoods: The U.S. Market 2009*, a report by Soyatech, LLC and SPINS, Inc. Leading categories driving this growth include soymilk, meat alternatives, tofu, and snack bars. Refrigerated soy-based entrees and sushi, tracked for the first time this year, also fared well and debuted in the top 25 largest soy foods categories, with $11.5 million in sales.

Soyatech, of Bar Harbor, Maine, USA, is a media, marketing, and event company that is wholly owned by High-Quest Partners. SPINS is a market research consultancy based in Schaumburg, Illinois, USA.

■■■

Honey bee colony losses in the United States were approximately 29% from all causes from September 2008 to April 2009, according to a survey conducted by the Apiary Inspectors of America (AIA) and the US Department of Agriculture. This is less than the overall losses of about 36% from 2007 to 2008, and about 32% from 2006 to 2007, that have been reported in similar surveys. An abstract of the data is available on line at: http://maarec.cas.psu.edu/pdfs/PrelimLosses2009.pdf.

"While the drop in losses is encouraging, losses of this magnitude are economically unsustainable for commercial beekeeping," said Jeff Pettis, research leader of the Agricultural Research Service (ARS) Bee Research Laboratory in Beltsville, Maryland, USA. ARS is USDA's principal intramural scientific research agency. The survey was conducted by Pettis; Dennis vanEngelsdorp, president of AIA; and Jerry Hayes, AIA past president. ■



Biobased engine oil in field testing phase

The University of Northern Iowa's National Ag-Based Lubricants (NABL; Cedar Falls, USA) Center has developed a technology that continuously recycles engine oil, overcoming the problem of oxidative stability and allowing biobased engine oil to be used in diesel engines.

The Continuous Oil Recycling System (CORS) developed by NABL is, in essence, like an on-board biodiesel manufacturing plant that removes small quantities of biobased engine oil from the crankcase, cleans and modifies it, and then feeds the oil into the engine fuel lines.

"We thought rather than forcing vegetable-based oil to last in an engine for 10,000 to 15,000 miles, we would change the oil before it breaks down and replace it with fresh oil," said UNI-NABL Center Director Lou Honary. "If soybean oil or other vegetable oil can safely perform for, say, 50 hours or 2,500 miles, the computerized recycling system would ensure the oil is consumed as diesel fuel before the 50 hours of performance."

Sensors on the CORS continuously monitor the physico-chemical properties of the oil and replace old oil with new at precisely the right time by feeding it into the fuel line in very small quantities. All that is needed is a small reservoir to store a fresh supply of oil.

"The CORS concept offers an opportunity for the earlier adoption of engine biolubricants," said Bill Mitchell, a retired agricultural machinery engineer who serves as a consultant on this project. "Features of the biobased engine lubricants in the CORS concept offer extraordinary natural lubricity, reduced petroleum dependency, and waste-oil elimination."

The amount of fresh oil used is as high as one-twentieth the amount of fuel used in the diesel engine. The on-board CORS computer processor constantly "communicates" with engine electronics to ensure optimum timing for burning small quantities of the engine oil. Using a 2% mixture of oil in diesel fuel for most stationary engines would provide all the benefits of biodiesel and result in an automatic oil

CONTINUED ON NEXT PAGE

change as desired. This technology eliminates the need for an actual oil change, but does require an infrequent change of the oil filter.

CORS has been successfully tested in the laboratory and is now entering the field test stage. The first target engines are being tested in utility companies' stationary diesel engines; they will then be tested in hospitals and other facilities that rely on their own electricity generated by diesel engines. Ships, shipyards, and other areas storing large volumes of fuels also will be tested.

Current tests use a special high-oleic soy oil, but research shows that other vegetable oils should work as well because "the sensors are blind to the type of oil being used," according to Honary.

"CORS is a smart technology that reacts to the variables in the motor oil and the engine," he said. "At the early stages of introduction, the CORS technology is suited for larger, stationary engines. The later versions will investigate use in off-highway construction and agricultural equipment, and eventually in on-road trucks and passenger cars."

EFSA on previous cargoes

The European Food Safety Authority (EFSA) reviewed the criteria for acceptable previous cargoes for edible fats and oils and issued an opinion on May 29, 2009. It is available at www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_1211902553518.htm.

The worldwide trade of edible fats and oils in bulk implies their transport by road, railroad, inland waterways, and sea. Industry asserts that it is not economically viable to operate a fleet of ships engaged only in the carriage of edible fats and oils as they would have to return empty to their original loading ports.

In 1996 and 2003, the Scientific Committee on Food (SCF) assessed the risk to human health arising from potential contamination of oils and fats shipped in tanks which may have been used to transport chemical substances, based on a set of five criteria. The Codex Committee for Fats and Oils (CCFO) has adopted the Recommended International Code of Practice for the Storage and Transport of Edible Oils and Fats in Bulk, including the Draft Codex List of Acceptable Previous Cargoes, which did not include criteria for the evaluation of substances.

For this purpose, in 2007, four criteria were developed by the Food and Agriculture Organization of the United Nations and the World Health Organization in collaboration with the Dutch National Institute for Public Health and the Environment. In 2009, these criteria were amended by CCFO at its 21st session and were forwarded for adoption by the 32nd session of the Codex Alimentarius Committee (CAC).

At the request of the European Commission, EFSA reviewed the criteria for acceptable previous cargoes for edible fats and oils set by the SCF. In doing so, the Panel on Contaminants in the Food Chain (CONTAM Panel) assessed the appropriateness of the four CCFO criteria, one by one, by comparing them with those set in 1996 by SCF for acceptable previous cargoes for edible fats and oils. The criteria for evaluation of acceptable previous cargoes for edible fats and oils as proposed by the CCFO are not in conflict with any of the five criteria developed by SCF. SCF criteria 1 to 4 are either explicitly or implicitly covered by the CCFO criteria. SCF criterion 5 dealing with the availability of analytical methods is not explicitly addressed in the CCFO criteria. The CONTAM Panel considers that SCF criterion 5 is still important. The CCFO criteria also cover food allergens and compounds that may react with oil and fats. The CONTAM Panel considers these additions relevant.

The CCFO criteria specifically apply to the immediate previous cargo. The CCFO criterion 1, which addresses documentation procedures, does not specify for how many previous cargoes records should be kept. This might be particularly important in the event that earlier previous cargoes consist of substances for which an acceptable daily intake (ADI) or tolerable daily intake (TDI) has not been established, EFSA noted.

"The CONTAM Panel is of the opinion that records of the three previous cargoes should be kept, in accordance with the Codex Recommended International Code of Practice for the Storage and Transport of Edible Oils and Fats in Bulk," the EFSA opinion states. "With respect to CCFO criterion 2, the CONTAM Panel agrees with the proposed threshold of an ADI (or TDI) of greater than or equal to 0.1 mg/kg body weight. The CONTAM Panel considered the situation of second and third previous cargoes and concludes that for nongenotoxic substances their transport as second and third previous cargoes is not of concern, taking into account their very limited carryover," the opinion continues. "Genotoxic substances, for which a threshold cannot be assumed, would not be acceptable as previous cargoes. Regarding the CCFO criterion 3 on known food allergens, the CONTAM Panel considers the scope of the CCFO criterion too narrow and should apply to all known allergens, not just to known food allergens, given the fact that the same cargo may be sold for cosmetic use. The CONTAM Panel also welcomes the inclusion of a criterion to evaluate the acceptability of substances reacting with the oils or fats," the EFSA opinion concludes.

EFSA meeting on health claims

Experts from the European Food Safety Authority's (EFSA) Panel on Dietetic products, Nutrition, and Allergies (NDA) met health claims applicants and

CONTINUED ON PAGE 508

Acquisitions/ mergers

Diehl Food Ingredients (DFI; Defiance, Ohio, USA), a unit of SensoryEffects, has acquired the emulsified powders and non-dairy creamer business of **ACH Food Companies** (Cordova, Tennessee, USA), a subsidiary of Associated British Foods.

■■■

Eurofins Scientific, Inc., has acquired **Strasburger & Siegel, Inc.**, a food-testing laboratory founded in 1926 and based in Hanover, Maryland, USA.

Commodities

CACAO/CHOCOLATE

Cargill has opened a new €16 million facility in the Netherlands for chocolate fillings and coatings, after investing €16 million. The investment doubled Cargill's capacity for coatings used by the bakery, biscuit, cereal, ice-cream, and confectionery industries, the company said.

■■■

Viterra Inc. of Regina, Saskatchewan, Canada, announced in June 2009 it will acquire a canola crushing plant owned by **Associated Proteins LP** (APLP) of Ste. Agathe, Manitoba, Canada, for $64 million. The APLP facility has a crushing capacity of 1,000 MT/day and is "well-situated to source raw materials and to supply North American markets," Viterra said. The transaction was expected to close on June 25.

CANOLA/RAPESEED OIL

Burcon NutraScience Corp. announced in June that it had raised approximately $16.9 million through a stock offering that will be used for "continued research and development of Burcon's soy protein isolate extraction and purification technology, further refining of Burcon's canola protein isolate extraction and purification technology, filing new patent applications, and expanding Burcon's intellectual property portfolio," according to a news release.

■■■

Cargill announced on June 1, 2009, that its Clear Valley® low-saturate canola oil will be available for customer testing in early 2010. The company says the oil has 4–4.5% saturated fat, which is 25% less saturated fat than in conventional canola oils.

■■■

Preol, a Czech producer of rapeseed oil, was scheduled to open a new rapeseed processing and methyl ester producing factory in Lovosice in late June 2009, according to the *Hospodářské Noviny* newspaper.

COCONUT

Copra exports in the first quarter of 2009 dropped by more than half to 233,525 metric tons (MT) from 2008 levels, according to the **Philippine Coconut Authority**. Shipments of coconut oil also dropped by almost 58% to just over 105,000 MT, while the value of coconut oil exports dropped by two-thirds to $78 million, without freight.

FISH OIL/MEAL

Neptune Technologies & Bioressources announced in June 2009 that it will work with **Bayer HealthCare** to develop pharmacological-grade products based on krill oil for sale in the United States. The company already is working with Nestlé and Yoplait on functional foods and Croda on supplements. Neptune is based in Laval, Québec, Canada.

OLIVE OIL

The **Australian olive oil industry** was dealt an apparent setback when two managed investment firms that, between them, reportedly account for 70% of the country's olive production collapsed in April. According to a report by *The Australian* newspaper, domestic output has grown from a total of 500 MT of olive oil in 2001 to an expected 16,000 MT in 2009. This year's crop will not be lost, thanks to agreements reached by the two companies with oil processors.

■■■

Chilean company **Somacor** has begun producing olive oil in Uruguay, where it has olive plantations in the Department of Lavalleja, according to the South American Business Information news service. To date, Somacor has invested $1 million and expects to reach an annual output of 450,000 liters of olive oil within 10 years, the report noted.

PALM OIL

Malaysia will intensify enforcement against oil palm seed swindles and theft of palm fruits and oil, which are costing the country billions in lost revenues, according to the *New Straits Times* newspaper. Plantation Industries and Commodities Minister Bernard Dompok reportedly told the Malaysian Palm Oil Board (MPOB) to begin licensing palm oil transporters and require them to install global positioning systems on their tankers to keep track of their movements.

SUNFLOWER

Ukraine has exported close to 1.3 MMT of sunflower oil over the first eight months of the current marketing year (September 2008–August 2009), which was a 28.7% increase, year-on-year, the Agricultural Ministry has reported to the *Ukraine Business Weekly* magazine. Ukraine's oil extracting enterprises have processed 3.9

CONTINUED ON PAGE 509

industry experts in Brussels on June 15, 2009, for an exchange of views on the presentation of applications for health claim authorizations.

The meeting was an opportunity to further explain the claims evaluation process to applicants and provide additional guidance in the light of experiences gained so far with the assessment of claim applications.

EFSA has decided to further develop procedures for communication with applicants while claims are being evaluated including greater use of the "stop the clock" procedure when NDA experts consider it necessary to request additional information regarding an application. "This will help ensure that there is a shared, mutual understanding between the panel and the applicant of the claim to be evaluated prior to adoption of the final opinion," EFSA said in a written statement. The NDA panel may request supplementary information from applicants to clarify in particular the object of the claim (e.g., whether it relates to a component of the foodstuff or the product itself) or the claimed health relationship.

Up to now, these issues would be addressed with applicants only before the application was accepted by EFSA and before evaluation started. Experience has shown that some of these questions only become apparent during the assessment of the application, and this can have a significant bearing on the evaluation.

Participants discussed various aspects of the process such as how the panel decides whether a claim is substantiated and how the evidence is weighted, what are the data requirements and pertinent studies to be included, and on what basis EFSA proposes the wordings of claims. EFSA will review and seek to improve transparency of the opinions with respect to these aspects.

EFSA aims to publish the revised version of the FAQ, an overview of comments received during the consultation, and a report of the technical meeting on its website in the third quarter of 2009.

Green Chemistry Awards announced

The 2009 Presidential Green Chemistry Challenge Awards winners were announced on Monday, June 22. The awards are given to recognize research that can make significant contributions to pollution prevention. The awards were presented at an awards ceremony at the Carnegie Institution for Science in Washington, DC, USA.

The Presidential Green Chemistry Challenge Awards program is administered by the US Environmental Protection Agency. Judging is by an independent panel of technical experts convened by the American Chemical Society and its ACS Green Chemistry Institute®.

The Presidential Green Chemistry Challenge Awards are given in five categories. The 2009 Award winners and their categories are:

ACADEMIC AWARD

Atom transfer radical polymerization: low-impact polymerization using a copper catalyst and environmentally friendly reducing agents—Hazardous chemicals are often required in the manufacture of important polymers such as lubricants, adhesives, and coatings. Krzysztof Matyjaszewski of Carnegie Mellon University (Pittsburgh, Pennsylvania, USA) developed an alternative process, called Atom Transfer Radical Polymerization (ATRP), for manufacturing polymers. The process uses chemicals that are environmentally friendly, such as ascorbic acid as a reducing agent, and requires less catalyst. ATRP has been licensed to manufacturers throughout the world, reducing risks from hazardous chemicals.

SMALL BUSINESS AWARD

BioForming® process: catalytic conversion of plant sugars into liquid hydrocarbon fuel: The award-winning process is a water-based, catalytic method to make gasoline, diesel, or jet fuel from the sugar, starch, or cellulose of plants that requires little external energy other than the plant biomass. The process was developed by Virent Energy Systems, Inc., Madison, Wisconsin, USA.

The process is flexible and can be modified to generate different fuels based on current market conditions. It can compete economically with current prices for conventionally produced petroleum-based fuels.

GREENER SYNTHETIC PATHWAYS

A solvent-free biocatalytic process for cosmetic and personal care ingredients—Esters are an important class of ingredients in cosmetics and personal care products. Usually,

they are manufactured by chemical methods that use strong acids and potentially hazardous solvents; these methods also require a great deal of energy. Eastman's new method uses immobilized enzymes to make esters, saving energy and avoiding both strong acids and organic solvents. "This method is so gentle that Eastman can use delicate, natural raw materials to make esters never before available," the EPA noted.

GREENER REACTION CONDITIONS

Innovative analyzer tags proteins for fast, accurate results without hazardous chemicals or high temperatures—Each year, laboratories test millions of samples of food for the presence of protein. Such tests generally use a large amount of hazardous substances and energy. CEM Corp. of Matthews, North Carolina, has developed a fast, automated process that uses fewer toxic reagents and less energy. The new system can eliminate 5.5 million pounds (2.5 million kg) of hazardous waste generated by traditional testing in the United States each year.

DESIGNING GREENER CHEMICALS

Chempol® MPS resins and Sefose® sucrose esters enable high-performance low-VOC

alkyd paints and coatings: Conventional oil-based alkyd paints provide durable, high-gloss coatings but use hazardous solvents. The Procter & Gamble Co. of Cincinnati, Ohio, USA, and Cook Composites and Polymers Co. of North Kansas City, Missouri, USA, are developing Chempol MPS paint formulations using biobased Sefose oils to replace petroleum-based solvents. Sefose oils, made from sugar and vegetable oil, enable new high-performance alkyd paints with less than half the solvent. Paints with less hazardous solvent will help improve worker safety, reduce fumes indoors as the paint dries, and improve air quality.

Dean Foods acquires Alpro

Dean Foods Co. (Dallas, Texas, USA) is acquiring the Alpro division of Vandemoortele N.V. (Ghent), Belgium's largest privately-held food company. The transaction's price is approximately €325 million (about $450 million) and is expected to be completed in the third quarter of 2009.

With its Alpro® soya and Provamel® brands, Alpro is the European leader in branded soy-based beverage and food products with net sales of approximately €260 million in 2008, according to Dean Foods. Alpro has five manufacturing sites in Belgium, the United Kingdom, France, and the Netherlands, and employs approximately 750 people.

"We think this is a great deal that establishes Dean Foods as a clear global leader in the soy beverages and related products category, with over $1 billion in combined annual retail sales," said Gregg Engles, Dean Foods chairman and chief executive officer (CEO).

Alpro CEO Bernard Deryckere will report to Joe Scalzo, CEO and president of Dean Foods' WhiteWave-Morningstar division. Alpro will be run as a separate European business.

Bunge to build export terminal

Bunge North America, the North American operating arm of Bunge Ltd. of White Plains, New York, announced that it has created a joint venture with ITOCHU and STX Pan Ocean to build and operate a state-of-the-art export grain terminal at the Port of Longview, Washington, USA. Called EGT Development, LLC, the project will be the first export terminal built in the United States in more than two decades.

The terminal will be capable of handling grain, oilseeds, and protein meals. It features a rail loop track unloading system capable of holding four 110-car unit trains at any given time. The facility will include a shuttle train unloading system as well as the capability to unload barges from the Columbia River. When it is fully operational, the facility will be able to handle more than eight million metric tons annually.

"The Pacific Northwest is already the second largest export corridor in North America but additional capacity will be needed to meet the growing demand for agricultural products in Asia," said Carl Hausmann, Bunge North America president and CEO.

ITOCHU is the second largest marketer of grain and food products in Japan, and STX Pan Ocean of Seoul, Korea, is one of the world's leading shipping companies of agricultural products. Bunge has oilseed processing assets in China, an ownership stake in the Phu My port in Vietnam, and is a significant seller into the Asian market. Bunge is the majority partner in the project.

MMT of sunflowerseed and produced 1.7 MMT of sunflower oil since the beginning of the marketing year, which was a 23.7% increase, year-on-year.

New ventures

Researchers at **Bayer MaterialScience** are using vegetable oils in the production of polyether polyols directly, without any need for further chemical transformation, according to a report in the June issue of *High Performance Plastics* (8, 2009). The resulting polyether polyols contain between 53% and 68% raw material from renewable sources.

■■■

A new **plant sterol-containing snack cracker**—claimed to be the first in the country—was introduced in June in the United States by nutritional food firm **Kashi**.

■■■

Russian company **AgroSib-Razdolye** will spend 700 million rubles worth of borrowed funds to upgrade a vegetable oil plant in the Altai Region, the press service of the regional government said in a statement in June. The company plans to complete the upgrade of the plant in February 2010.

■■■

A $30 million oilseed crushing plant has been built in Lira, Uganda, according to AllAfrica.com. **Mount Meru Millers** of Tanzania reportedly is the investor. The facility will have an annual capacity of 90,000 MT of oil, mainly from sunflower, simsim, and soy.

R&D

Archer Daniels Midland (ADM: Decatur, Illinois, USA) will provide $1.2 million, the **Kansas** (USA) **Bioscience Authority** will provide another $1.2 million, and the **University of Kansas** (Lawrence, USA) will provide in-kind support worth more than $300,000 for a three-year project aimed at converting vegetable oils into lubricants and other chemicals and at eliminating the need for petrochemicals in food packaging.

■■■

Nestlé S.A. has opened its first research unit in Japan. Based at the University of Tokyo, the unit will conduct fundamental research in nutrition and health, with a special focus on mobility and cognitive performance. ■

Construction was to begin in June 2009, with aim of opening the facility in time for the 2011 North American harvest.

Soy sustainability standards set

The Fourth General Assembly of the Round Table on Responsible Soy (RTRS), held May 26–27, 2009, in Campinas, Brazil, approved the "Principles and Criteria for Responsible Soy" that establish the basis for developing a standard for the production, trade, and processing of "responsible soy."

The soy industry has been criticized in recent years for causing deforestation, displacing indigenous peoples, and destroying natural habitats, particularly in South America. The RTRS aims to address these issues by establishing guidelines for good industry practice.

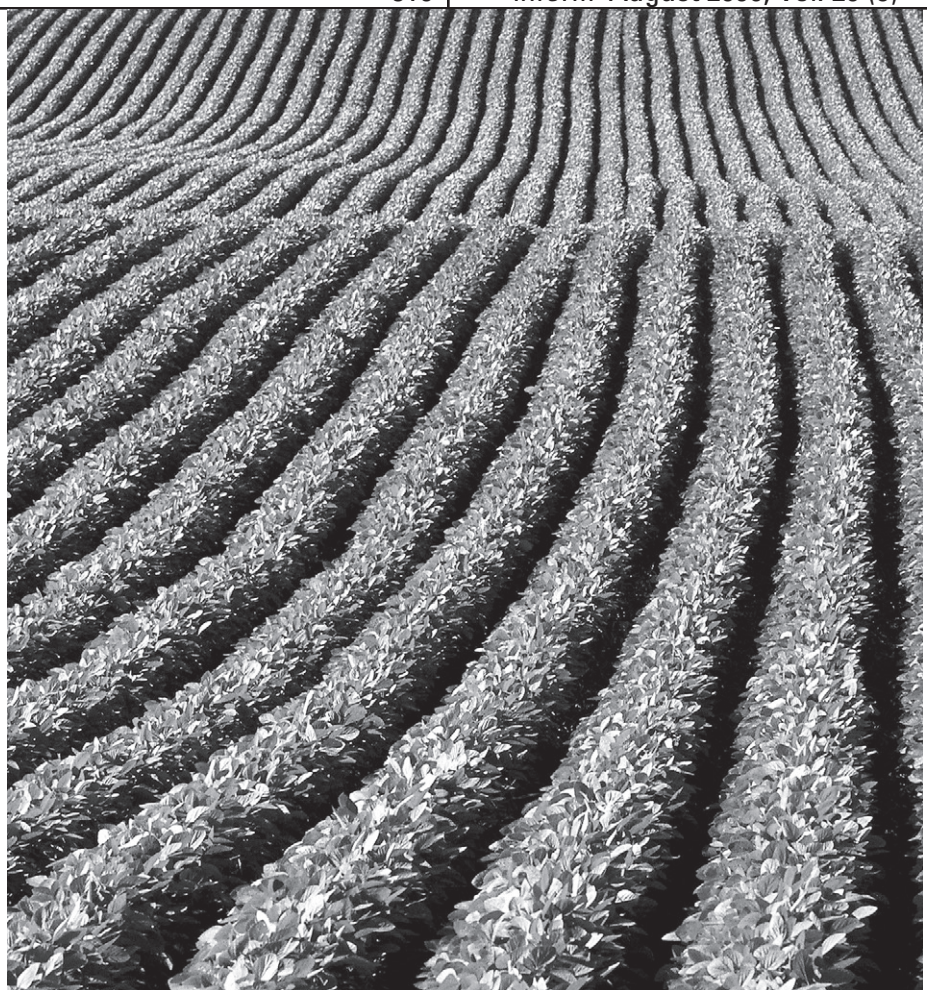
Point 4.4 of the principles and criteria states that "expansion for soy cultivation during field test period may not take place on land cleared of native habitat after May 2009." Further, "producers who want or plan to clear native habitat after the cut-off date of May 2009 must produce scientific evidence from a comprehensive and professional third-party assessment of the area concerned that identifies the absence of all primary forest, other high conservation value areas, and local peoples' lands."

Water utilization center opens

What Monsanto Co. billed as the world's first agricultural water utilization center opened June 16, 2009, at Gothenburg, Nebraska, USA.

The Water Utilization Learning Center is a $6 million facility designed for studying cropping systems in terms of genetics, agronomic practices, and biotech traits including water-use efficiency technologies such as drought-tolerant cropping systems. The center will help Monsanto advance research to help improve farmers' productivity in the Western Great Plains of the United States while gaining a better understanding of water use by crops.

Monsanto is based in St. Louis, Missouri, USA.



Canola meal imports affected

In May, two rail car shipments of canola meal from Bunge Ltd.'s Canadian crushing plants tested positive for *Salmonella* after inspection at the border by the US Food and Drug Administration (FDA), according to a Reuters news agency report in mid-June. Bunge person Deb Seidel reportedly said that one of the shipments could be traced back to the Bunge plant in Hamilton, Ontario. The second shipment tested positive in late May and came from Bunge's plant in Nipawin in the western province of Saskatchewan. Bunge immediately shut down the canola lines at each plant, according to the report.

A second Reuters story later in June reported that shipments by Cargill of Canadian canola meal into the United States are facing more FDA scrutiny after salmonella was found in a shipment in the first quarter of 2009. The Canadian Oilseed Processors Association is now studying Canadian plant procedures and the FDA's standards to prevent further *Salmonella* contamination, according to Reuters. ■

Biofuels News

Briefs

The European Commission (EC) proposal to impose anti-dumping duties on US biodiesel was adopted by EC finance ministers and took effect July 12, 2009 (see *inform 20*:420, 2009). Duties will range from $1.40 to $2.50 per gallon and may last up to five years. The European Biodiesel Board contended that US biodiesel marketed in Europe over the past two years had been sold at a discount, jeopardizing the European Union biodiesel industry.

■■■

At the inaugural meeting of the European Algae Biomass Association (EABA) held in June in Florence, Italy, Raffaello Garofalo, the executive director of the EABA, told Reuters news service that manufacture of biofuels from algae "will happen in the longer term, 10 to 15 years." He added, "There are still challenges and problems to resolve." He also indicated that at present biodiesel made from algae costs 10–30 times more than traditional biofuels. However, salable by-products could bring down the overall price.

■■■

The Donald Danforth Plant Science Center (St. Louis, Missouri, USA) and GeoSynFuels, LLC (GSF; Golden, Colorado, USA) have formed a joint venture called Agrius BioForms LLC (ABF) to produce low-cost proteins such as enzymes for cellulosic biofuels production. The advantage of ABF's technology resides in using soybean seed and other high-protein-content

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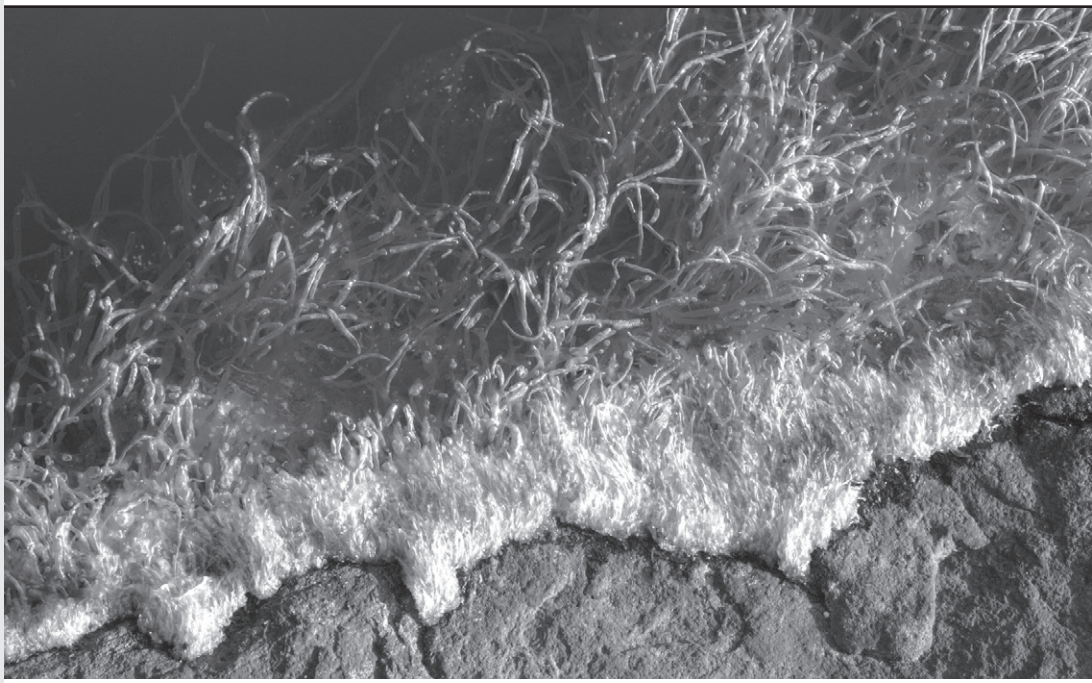

GENERAL

Economics of producing biofuels from algae

The US Department of Energy (DOE) released a Request for Information on June 3, 2009, regarding its National Algal Biofuels Technology Roadmap. In response, Phillip Brown, president and chief operating officer of Diversified Energy (Gilbert, Arizona, USA), placed on the company's website a document entitled "A Commercial Economics Perspective." According to Brown, priorities in developing and commercializing algal biofuels should be the following:

- Focus research and development activities on minimizing operations and maintenance (O&M) costs for algae production systems. His analysis showed that utilities (electricity, water, etc.), CO_2, maintenance of the algae growth system, labor, and nutrients have the greatest influence on operations costs. Utilities represent more than one-third of the total O&M expenses.
- Emphasize co-product capture and marketability to maximize revenue generation. Triacylglycerols represent a relatively small portion of algae-related revenue opportunities. Of the material produced in an algal biofuels system, 50–80% will be something other than oils used for biofuel.
- Aggressively develop technologies and processes that significantly improve total algae yields without dramatically increasing costs.
- Reduce total capital costs, through advanced technology, of algae production and harvesting. Components having the greatest impact on capital costs are the algae growth system, water management/harvesting/extraction, and CO_2 delivery infrastructure.

Brown's comments may be downloaded in a pdf format from www.diversified-energy.com/index.cfm?s_webAction=pressRoom, in a press release dated June 22, 2009.

Airlines need biofuels to survive

The New Straits Times Press (Kuala Lumpur, Malaysia) interviewed Paul Steele, director

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seeds as protein production platforms. The development of ABF's technology is projected to reduce further the low cost of GSF's cellulosic biofuels process and improve GSF's ability to compete in the $1.5 trillion global transportation fuel market.

■■■

In a June report entitled "Biofuels Markets and Technologies" Pike Research (Boulder, Colorado, USA) forecasts that the combined biodiesel and bioethanol markets will reach $247 billion in sales by 2020. The estimate for 2010 is $76 billion. Long-term commitment of national governments, technological advances, and economies of scale will bring about this increase. The 99-page report is available for $3,500 at www.pikeresearch.com.

■■■

Cargill (Frankfurt, Germany) started production at its new glycerine refinery in Germany in early June. Construction on the new plant, which is located adjacent to Cargill's existing biodiesel production facility in the Höchst Industrial Park, began in September 2008. By-product crude glycerine from the biodiesel plant will constitute the majority of the refinery's feedstock.

■■■

The US Environmental Protection Agency extended the comment period by 60 days on its proposed rule revising the national Renewable Fuel Standard program, commonly referred to as RFS2. The original comment period was to end on July 27, 2009, and will now end on September 25, 2009. The proposed rule would dramatically increase the volume requirements for renewable fuels, establish four categories of aviation environment for the International Air Transport Association (IATA), in June. Steele said that the development of biofuels is crucial to the sustainability of the airline industry. He also indicated, "[W]e have seen a lot of interest from new players, such as Honeywell . . . to develop the fuel."

Steele said companies are looking for technical certification of the fuels before making further investments. He expects such certification will be available by 2011. Certification is necessary because it indicates that methods of making the fuel have been clearly specified and criteria for acceptance of the fuel have been met.

IATA expects airline usage of biofuels to be 3–6% by 2020.

Biofuel production from algae expanding

Jim Lane, editor of BiofuelsDigest.com, projected on June 22 that algal biofuels capacity will expand from 1 million gallons (4 million liters) in 2009 to 1 billion gallons (4 billion liters) by 2014. He based his estimates on price and capacity projections for 2009–20014 by more than 30 algae biofuels companies. In 2014, 39% of the algal fuel capacity is expected to be in the United States; 33% of 2014 capacity is projected to use a photobioreactor process, and 67% open pond/raceway systems. No projection was included for fuel produced through fermentation processes (e.g., Solazyme, South San Francisco, California, USA; Bayer Technology, Leverkusen, Germany) or synthetic genes (e.g., Synthetic Genomics, La Jolla, California).

Lane also estimated that algae biomass yields for open pond systems would be 24–53 tons per acre (54–119 metric tons per hectare) per year.

RENEWABLE DIESEL

Neste Oil commits to certified palm oil

One of the feedstocks that Neste Oil (Espoo, Finland) uses in producing its NExBTL renewable diesel is palm oil. Neste announced in June that it is committed to

using only certified palm oil as and when sufficient volumes become available. The company predicts, on the basis of the current rate of certification, that this will be possible by 2015. The company recently received its first cargo of 5,000 metric tons (MT) of certified palm oil, and expects to use at least 50,000 MT in 2009.

Palm oil suppliers from whom Neste Oil buys are required to be members of the Roundtable on Sustainable Palm Oil (RSPO; www.rspo.org), an organization that brings together palm oil producers, users, and non-government organizations in the interest of promoting the production of sustainable palm oil.

According to a company press release, Executive Vice President Jarmo Honkamaa said, "Neste Oil has developed a system for the full traceability of the palm oil it uses, all the way from plantations to NExBTL plants."

BIODIESEL

California city drops biodiesel

In 2003, the city of Berkeley, California, USA, started burning biodiesel derived from recycled frying grease in its more than 100 cars and trucks that ran on diesel. Over the years, however, the feedstock for the city's biodiesel changed to soybean oil. Reflecting concerns of the citizenry that use of biodiesel derived from soybean oil is exacerbating world hunger, the city stopped receiving shipments of soybean-based biodiesel in May 2009. The City Council will consider formalizing this policy in September.

Deputy Public Works Director Andrew Clough indicated the city could revert to biodiesel from recycled frying grease, but

the supply is inadequate, and it is hard on engines (*Oakland Tribune*, June 4, 2009). In 2005 two of the city's diesel truck engines exploded when the city got a bad batch of biodiesel made from recycled grease.

PetroSun, Dalton Utilities to use wastewater to grow algae, produce biodiesel

The town of Gilbert, Arizona, USA, signed an agreement in mid-June with PetroSun Biofuels Inc. (Scottsdale, Arizona) to begin an algae-to-biofuels wastewater pilot program at the Neely Wastewater Reclamation Facility, operated by Severn Trent Services. The purpose of the program is to evaluate the feasibility of using wastewater as a source of nutrients and water for the cultivation of algae and their subsequent processing into feedstock for the production of biodiesel and other products. The Town of Gilbert will be offered all biodiesel produced from this pilot program at the actual cost of production and processing during the term of the program.

Dalton Utilities (Dalton, Georgia, USA) has been spraying the chlorinated effluent from the secondary treatment of community wastewater, representing about 34,000 people, onto a 9,000-acre (3,600-hectare) site to remove residual nutrients, such as phosphorus, before discharging the water to the Conasauga River. Recent tests indicated the soil is approaching its sorptive capacity with respect to phosphorus. The University of Georgia has contracted to work with Dalton Utilities to adapt the site for growing algae to remove these nutrients from the wastewater and to use the algae to produce biodiesel.

So far, six naturally occurring algae have been isolated from Dalton's wastewater and evaluated for their ability to remove phosphorus and to produce oil. A one-acre pilot facility will be built in the winter of 2009–2010 to field-test these organisms. The goal is to build a 20- to 40-acre facility on which algae would potentially produce 260,000 gallons (1 million liters) of biodiesel annually and remove phosphorus from the 25 million to 35 million gallons (94 million–130 million liters) of water processed each day. Carbon dioxide from the company's nearby power plant could be fed to the algae. The biodiesel would be enough to fuel the Dalton Utilities' diesel fleet.

Pennycress harvested in Illinois

Seventeen acres (6.9 hectares) of land sown to pennycress (*Thlaspi arvense*) near Peoria, Illinois, USA, were harvested June. The seeds of the plant contain about 36% oil, almost twice as much as soybeans, according to Terry Isbell, a researcher with the US Department of Agriculture National Center for Agricultural Research's New Crops Division (Peoria).

The crop was planted in September (see *inform 19*:673, 2008), and during the winter months it went dormant. The seed is harvested in late spring, using traditional farm equipment, allowing farmers to plant another crop after the pennycress has been removed.

The seed will be used to plant more acres in the fall of 2009. Biofuels Manufacturers of Illinois, LLC, is planning to break ground "as soon as August" if legislation is signed by Illinois Governor Pat Quinn supporting loan guarantees from the state, to construct a plant to convert pennycress seed oil into biodiesel.

Pennycress. Photo by Keith Weller; courtesy USDA-ARS.

Biofuels from diatoms

In an *Industrial & Engineering Chemistry Research* review paper (doi:10.1021/ie900044j), Ramachandra, Mahapatra, egories of renewable fuels, and require some renewable fuels to achieve greenhouse gas emission reductions compared to the gasoline and diesel fuels they displace. These revisions were mandated by the Energy Independence and Security Act of 2007.

■■■

Evonik (Essen, Germany) has dedicated a new production plant for sodium methylate in Mobile, Alabama, USA, just 9 months after laying the cornerstone. The plant has an annual capacity of 60,000 metric tons, and production is expected to support the production of biodiesel from canola and soybean oils. The company claims their catalyst offers customers consistently high biodiesel yields and especially high-purity crude glycerol.

■■■

Ethanol now fuels over 50% of the light vehicles in Brazil, according to Almir Barbassa, chief financial officer of Petrobras (São Paulo), the country's oil and energy company. Barassa told journalists in June, "Gasoline has become the alternative fuel. It is today what ethanol was before." In June gasoline cost about R$2.50 a liter, and alcohol was about R$1.50.

■■■

Indian Finance Minister Pranab Mukherjee cut the country's biodiesel import tax from 7.5% to 2.5% to help bring down prices and increase consumption, according to the government. A proposal was also made to exempt biodiesel blends from excise tax. Before this, biofuels were exempt, but blends were not.

■■■

According to *The Boston Globe* newspaper, General Motors is planning to make ethanol-fueled cars for Thailand. The company says the cars can run on either E20 (20% ethanol, 80% gasoline) or E85 fuel.

Volvo Thailand started marketing flex-fuel vehicles that can run on a range of alternative fuels, including E85, in December 2008.

The government of Thailand has been offering incentives such as lower excise taxes to companies and individuals that can help the nation cut its reliance on fossil fuels, making the country an attractive market for biofuel-powered vehicles. ■

Karthick B, and Gordon propose three ways to enhance the harvest of oil from microalgae called diatoms (Bacillariophyceae): (i) by using biochemical engineering, to extract the oil from the cells and process it into gasoline; (ii) by altering the cells so that they actively secrete their lipid content; (iii) by growing diatoms on tilted "solar panels" covered by at least a boundary layer of water from which secreted oil would rise to the top for skimming. The latter two are especially attractive because they do not require the cells to die in order to harvest the oil.

Cold-tolerant jatropha

SG Biofuels (Encinitas, California, USA) announced in June that it has identified several strains of cold-tolerant jatropha capable of thriving in climates previously thought to be outside of the crop's preferred subtropical habitat. Utilizing the strains, the company has initiated a breeding program to develop jatropha as an oil-producing crop in colder climates of the United States. After testing and cross-breeding, SG Biofuels could open the US Gulf Coast for jatropha cultivation. The region has been considered amenable for jatropha, because frosts occur only occasionally in the area.

These cold-tolerant strains are included among thousands of variants of *Jatropha curcas* the firm has collected from a range of climates and geographies around the world as part of its Genetic Resource Center, the company's collection of jatropha genetic material (see *inform 20*:360, 2009).

Shipping biodiesel commercially by pipeline

On June 30 Kinder Morgan Energy Partners, L.P. (KMP; Houston, Texas, USA) announced that its shipment of blended 5% biodiesel (B5) on a mainline segment of its pipeline was a first in the United States (see *inform 19*:803, 2008; *20*:218, 2009). The company injected B99 into ultra low sulfur diesel at the pump station and breakout tank farm of Plantation Pipe Line Company, Collins, Mississippi (USA), creating a 15,000-barrel (1.8 million liter) batch of B5 that was shipped to marketing terminals located in Athens, Georgia, USA, and Roanoke, Virginia, USA. Kinder Morgan performed testing on samples from the batch and found that the samples arrived on specification.

Tom Bannigan, KMP Products Pipeline president, said "We believe the blending and transportation of biodiesel by pipeline will have significant advantages for our customers when compared to the alternative of installing capital-intensive blending facilities at individual marketing terminals."

Bannigan added, "Kinder Morgan is initially focusing on moving blended biodiesel on segments of the Plantation system that transport only gasoline and diesel because of concerns about possible 'trailback' of biodiesel into subsequent jet fuel batches. If we can work through these issues, we will evaluate the possibility of moving blended biodiesel to every market on the Plantation system."

First draft of jatropha genome completed

Joint venture partners Synthetic Genomics Inc. (SGI), of La Jolla, California, USA, and the Asiatic Centre for Genome Technology, of Kuala Lumpur, Malaysia, announced completion of a first draft assembly of the jatropha genome in late May. (The joint venture had previously announced completion of the oil palm genome in 2008.)

The sequencing process revealed that the jatropha genome is approximately 400 million base pairs in size, similar to the size of the rice genome. Teams are now working to annotate the genome to identify particular genes of interest and to discover genetic variations for use in marker-assisted breeding. They are using both traditional breeding tools and modern plant molecular biology tools to improve plant yield, oil quality, and fertilizer requirements and to enhance stress and disease tolerance.

J. Craig Venter, of human genome fame, is the founder and chief executive officer of SGI.

ETHANOL

Colombia mandates E-85 vehicles

The US Department of Agriculture's Foreign Agriculture Service (FAS) confirmed in June that the Colombian government has mandated that, beginning in 2012, all new vehicles sold within the country must bear E85 flex-fuel technology. That is, vehicles must be operable on gasoline blended with 0–85% ethanol (E0 to E85). The government had already decreed that blends of E10 and B5 (5% biodiesel/95% petrodiesel blend) be achieved by 2010, and expectations are that this goal will be met.

Ethanol production in Colombia started in late 2005, and palm oil-based biodiesel in late 2007. Colombia is now the second-largest producer of biofuels in Central and South America, according to FAS. Brazil is the largest.

POET in the market to buy ethanol distilleries

The largest US producer of ethanol, POET LLC (Sioux Falls, South Dakota) is cautiously in the market to purchase additional ethanol distilleries, including ones from recently bankrupt companies. For example, Pacific Ethanol (Sacramento, California) filed for chapter 11 bankruptcy in May 2009, Aventine Renewable Energy Holdings Inc. (Pekin, Illinois), in April 2009, and VeraSun (Sioux Falls, South Dakota), in October 2008.

Reuters reported in early June that POET is considering several Aventine and Pacific Ethanol facilities. Criteria for consideration include location, design, markets, and price. POET claims to have "multiple trade secrets" that could make these

CONTINUED ON PAGE 530

Call for Nominations

Stephen S. Chang Award

The Stephen S. Chang Award recognition shall consist of a jade galloping horse symbolizing the award and an honorarium. The late Stephen S. Chang, an AOCS past president, and his wife, Lucy D. Chang, sponsor the award.

The Award

The Stephen S. Chang Award recognizes a scientist, technologist, or engineer who has made significant and distinguished accomplishments in basic research that must have been utilized by industries for the development or improvement of products related to lipids. The awardee may be recognized for either one major breakthrough or an accumulation of publications.

A prospective recipient must agree to be present for acceptance of the award and to deliver an award address at the 101st AOCS Annual Meeting & Expo. The award is made without regard for national origin, place of residence, race, color, creed, or gender.

Nomination Procedures

Nominations for the 2010 award must be submitted before October 15, 2009.

Candidate material should be sent to the AOCS Awards Program at awards@aocs.org.

The suggestions listed below may be helpful to nominators in addressing the mandatory criteria of industrial utilization.

1. Documentation of the application of research
   a. Patents received, licensing arrangements
   b. Specific examples of industrial use
2. Documentation for the development or improvement of products related to lipids
   a. Listing of new products, manufacturers, sales history
   b. Manufacturers' testimonials regarding product improvement resulting from their direct utilization of the basic research in specific products with comparative figures on sales or consumer acceptance

The nomination must include a letter from the nominator, at least three supporting letters, the nominee's curriculum vitae, and a list of major relevant publications, including patents.

www.aocs.org/member/awards

Briefs

The Indian health agency will study the levels of *trans* fatty acids in edible oils in the hope that levels eventually can be standardized, Health Secretary V. K. Subburaj told the *Times of India* newspaper in late May 2009. Previously, tests conducted by the Delhi-based Centre for Science and Environment on various products found that levels of TFA were several times higher in India compared to the recommended standards elsewhere. Testing has also found that edible oil from state-run ration shops have TFA levels as high as 50%, the report noted.

■■■

Smaller doses of plant sterols given frequently have a greater cholesterol-lowering impact (approximately 6% lower) than single doses, according to a study led by P.J.H. Jones of the Richardson Centre for Functional Foods and Nutraceuticals at the University of Manitoba in Winnipeg, Manitoba, Canada. The research appeared in the *European Journal of Clinical Nutrition* (*63*:747–755, 2009).

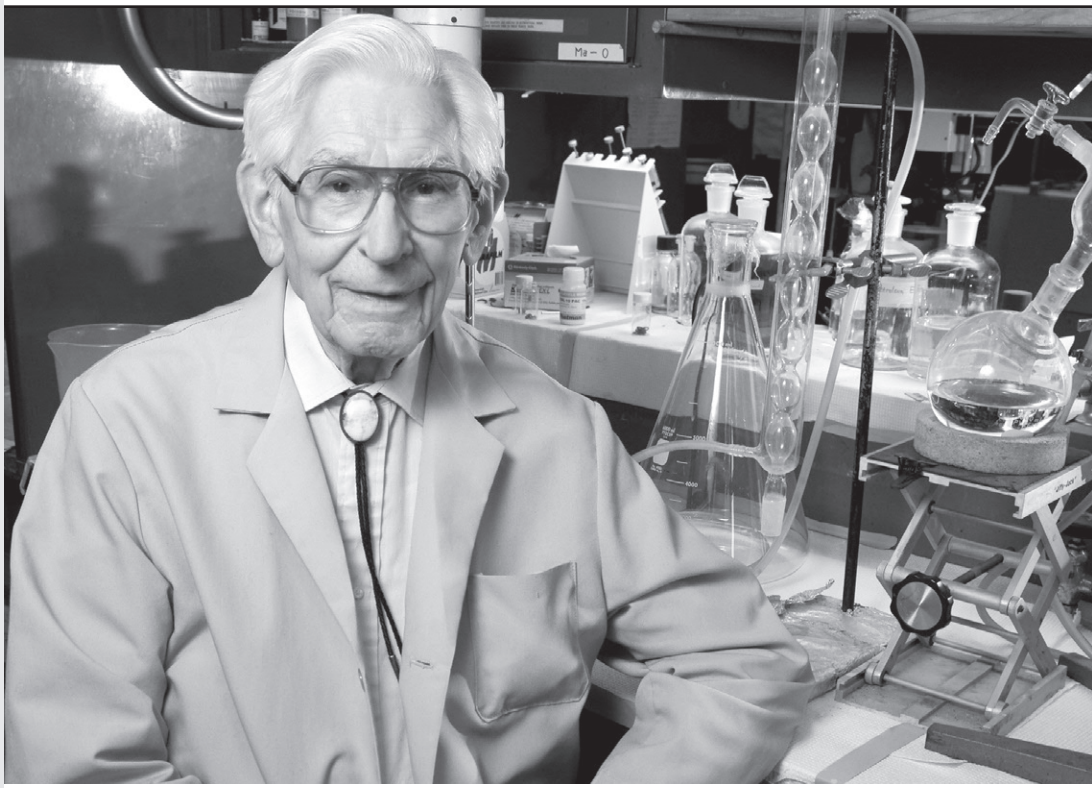
■■■

Scientists at the Institute of Food Research and the University of Nottingham (UK) led by Luca Marciani compared an acid-unstable emulsion with an acid-stable fat emulsion to find out if the acid-stable emulsion would be emptied from the stomach more slowly, cause more rapid lipid absorption, and lead to a greater feeling of satiety than the acid-unstable one.

The scientists found that the acid-unstable fat emulsion broke up to form layers on the watery phase of the meal with the fat floating on top. This resulted in the watery phase being emptied from the stomach before the fat layer. One hour after the meal the stomach volume of the acid-unstable emulsion was only half of that of the acid-stable emulsion. The researchers also found that compared to the acid-unstable emulsion, the acid-stable emulsion made participants feel fuller, less hungry and have less appetite.

The study appeared in the *British Journal of Nutrition* (*101*:919–928, 2009). ■

Health & Nutrition



U. of I. emeritus veterinary biosciences professor Fred Kummerow, who is 94, has spent nearly six decades studying lipid biochemistry, and is a longtime advocate for a ban on trans fats in food. Photo by L. Brian Stauffer, University of Illinois News Bureau.

Trans fats and blood flow

It isn't news that partially hydrogenated vegetable oils contain *trans* fatty acids (TFA), or that consumption of TFA has been deemed unhealthful. The negative health effects attributed to TFA include an increase in "bad" cholesterol (LDL, or low-density lipoprotein) and a decrease in "good" cholesterol (HDL, or high-density lipoprotein). Both of these effects are assumed to lead to hardening of the arteries (atherosclerosis).

A study by emeritus veterinary biosciences professor Fred Kummerow of the University of Illinois in Urbana-Champaign, USA, reveals a new way in which TFA gum up the cellular machinery that keeps blood moving through arteries and veins. The study, which appears in the August 2009 issue of *Atherosclerosis* (*205*:458–465, 2009; doi: 10.1016/j.atherosclerosis.2009.03.009), reports for the first time that TFA interfere with more than one key enzyme in the regulation of blood flow.

Kummerow begins by describing the two main causes of heart disease: sudden blood clots in the coronary arteries, and atherosclerosis, the buildup of plaque in the arteries to the point where it interferes with blood flow. TFA contribute to both of these causes of heart disease, he says.

"The arteries of someone who dies from atherosclerosis look like old scrub boards as a result of the formation of plaques," Kummerow notes. "They look corrugated, and this plaque buildup continues to the point where it will stop blood flow."

The body can use TFA as a source of energy for maintenance and growth, he says, but TFA interfere with the body's ability to perform certain tasks critical to good health. Because these effects are less obvious, many researchers have missed the underlying pathologies that result from a diet that includes *trans* fats, Kummerow suggests.

CONTINUED ON NEXT PAGE

TFA displace—but cannot replace—the essential fatty acids linoleic acid (omega-6) and linolenic acid (omega-3), which the body needs for a variety of functions, including blood flow regulation.

TFA have previously been shown to interfere with an enzyme that converts the essential fatty acid linoleic acid into arachidonic acid, which is needed for the production of prostacyclin (a blood-flow enhancer) and thromboxane (which regulates the formation of blood clots needed for wound healing). Simply adding more linoleic acid to partially hydrogenated fats is not enough; in 2007, Kummerow's team reported that extra linoleic acid did not overcome the problem.

"*Trans* fats inhibited the synthesis of arachidonic acid from linoleic acid, even when there was plenty of linoleic acid available," Kumerrow said.

The new study reports that in addition to interfering with the production of arachidonic acid from linoleic acid, TFA also reduce the amount of prostacyclin. Thus, blood clots may more easily develop, and sudden death is possible.

"This is the first time that *trans* fatty acids have been shown to interfere with yet another part of the blood-flow process," Kummerow said.

In other recent work on TFA, investigators led by Gülhan Samur looked at the fatty acid composition of mature breast milk in 50 Turkish women and the association with the women's diets. Samur and colleagues are with the Department of Nutrition and Dietetics at Hacettepe University in Ankara.

"Total milk lipid extracts were transmethylated and analyzed by using gas liquid chromatography to determine fatty acid contents," they write. "A questionnaire was applied to observe eating habits and three days of dietary records from mothers were obtained. Daily dietary intake of total energy and nutrients was estimated by using a nutrient database. The mean total *trans* fatty acid content was 2.13 ± 1.03%. The major sources of *trans* fatty acids in mothers' diets were margarines/butter (37.0%) and bakery products and confectionery (29.6%). Mothers who had a high level of *trans* isomers in their milk consumed significantly higher amounts of these products. Saturated fatty acids, polyunsaturated fatty acids, and monounsaturated fatty acids of human milk constituted 40.7 ± 4.7%, 26.9 ± 4.2%, and 30.8 ± 0.6% of the total fatty acids, respectively. The levels of fatty acids in human milk may reflect the current diet of the mother as well as the diet consumed early in pregnancy," they conclude.

The research appeared in *Lipids* (*44*:405–413, 2009).

US consumers still confused about fat

Sixty-seven percent of US consumers are concerned with the amount of fat they consume, and 69% say they are concerned with the type of fat they consume. That's according to the annual *Food and Health Survey* conducted by IFIC (International Food Information Council), a trade group based in Washington, DC, USA.

Consumers continue to pay particular attention to *trans* fat, IFIC reports. Awareness of *trans* fat remains high at 90%. Fifty-seven percent of consumers who say they look at the Nutrition Facts panel on packaged foods say they use *trans* fat information on it, and of those who are aware of *trans* fat, 64% say they are trying to reduce *trans* fat in their diet. Consumers' understanding of healthful fats, such as unsaturated fats, still appears to be lacking.

PERCEIVED HEALTHFULNESS

Similar to 2008, the majority of respondents rated olive oil (74% in 2009) as being "somewhat healthful" or "extremely healthful." The following oils show a significant decrease in the percentage of respondents who rated them as being "healthful": soybean (54% in 2009 vs. 60% in 2008), canola (52% in 2009 vs. 59% in 2008), and sunflower (49% in 2009 vs. 58% in 2008). The percentage of Americans who perceive corn oil as "healthful" remained steady this year (34% vs. 37% in 2008). Overall, the percentage of respondents who report they were "unaware" of the healthfulness of all the vegetable oils mentioned increased significantly from 2008.

Some questions regarding dietary fats and food information were asked for the first time in 2009. Of those who have heard of the general term "unsaturated fats" and/or any of the specific unsaturated fats, 70% of respondents stated that they would find it either "somewhat helpful" or "extremely helpful" to list the types of unsaturated fats on the Nutrition Facts panel on the food label. All survey participants were asked to characterize the overall messages they have heard or read in the media (TV, Internet, magazines, newspapers, etc.) with regard to fats. Thirty-eight percent reported hearing or reading that "fats can be part of a healthful diet"; 34% reported hearing that "fats cannot be part of a healthful diet"; and 28% of respondents reported that they "have not heard or read about fats in a healthful diet."

Isoflavones and breast cancer risk

The question over whether soy isoflavones, which have functional similarity to human estrogens, protect against breast cancer as a result of their anti-estrogenic activity or increase risk as a result of their estrogen-like properties, remains an issue of debate. New work by researchers in the United States examines the relationship between isoflavone supplementation and mammographic density, a strong marker for breast cancer risk, among postmenopausal women.

Led by Gertraud Maskarinec at the Cancer Research Center Hawaii in Honolulu (USA), the Osteoporosis Prevention Using Soy (OPUS) study is a multisite, randomized, double-blinded, and placebo-controlled trial. Researchers assigned 406 postmenopausal women to 80 or 120 milligrams/day of isoflavones each or a placebo for two years. Percent densities were assessed in digitized mammograms using a computer-assisted method. The mammogram reader did not know the treatment status at the time of the mammograms.

"We applied mixed models to compare breast density by treatment while considering the repeated measures. The mammographic density analysis included 358 women, 88.2% of the OPUS participants; 303 had a complete set of three mammograms, 49 had two, and six had only one mammogram. At baseline, the groups were similar in age, BMI, and percent density, but

mean breast density differed by study site (P = 0.02). A model with all mammograms did not show a treatment effect on any mammographic measure, but the change over time was significant; breast density decreased by 1.6%/year across groups ($P < 0.001$). Stratification by age and BMI did not reveal any effects in subgroups. In this randomized two-year trial, isoflavone supplements did not modify breast density in postmenopausal women," the authors write in the *Journal of Nutrition* (*139*: 981–986, 2009).

CLA and LC-PUFA combination tested

The results of a recent study did not support beneficial effects of combined therapy with conjugated linoleic acid (CLA) and omega-3 long-chain polyunsaturated fatty acids (omega-3 LC-PUFA) for beta-cell dysfunction or insulin resistance in humans, but suggested that insulin sensitivity in older obese subjects may be reduced.

Dietary supplementation with either CLA or LC-PUFA has been shown to alter adiposity and circulating lipids, both presumed risk markers of cardiovascular diseases. "However, CLA may decrease insulin sensitivity, an effect that may be reversed by omega-3 LC-PUFA," the scientists noted. Thus, the researchers tested the potential of CLA plus omega-3 LC-PUFA to affect insulin secretion and sensitivity in nondiabetic young and old, lean and obese subjects.

Led by Bo Ahrén of Lund University in Sweden, the researchers gave CLA at 3 grams (g)/day (d) plus omega-3 LC-PUFA at 3 g/d or a control oil at 6 g/d to lean or obese young (20 to 37 years old) or lean or obese older men (50–65 years) for 12 weeks. The study had a double-blind, placebo-controlled, randomized, crossover design, and primary end points were insulin secretion and sensitivity during a standardized meal test, evaluated by modeling glucose, insulin, and C-peptide data.

"There was no significant difference in fasting levels of glucose, insulin, or C-peptide after CLA/omega-3 LC-PUFA treatment compared with the control oil," the researchers write. "Neither insulin secretion nor estimated sensitivity was affected by CLA/omega-3 LC-PUFA in lean or obese young subjects or in older lean subjects. However, in older obese subjects, estimated insulin sensitivity was reduced with CLA/omega-3 LC-PUFA compared with control ($P = 0.024$)," they concluded.

"Shunt" enhances fat burning

It sounds like a dieter's dream: a genetic alteration that allows mice to convert fat to carbon dioxide and remain lean while eating a high-fat diet.

By inserting a molecular shunt into the livers of mice, researchers have shown they can make the animals burn more fat. The so-called glycoxylate shunt consists of two metabolic enzymes normally found in bacteria and plants, but not in mammals, according to a report in *Cell Metabolism* (*9*:525–536, 2009).

"It's an additional channel for burning fat to control obesity," said James Liao of the University of California, Los Angeles (UCLA; USA).

"This creates a shortcut through [the normal pathway]," added Katrina Dipple, also of UCLA. "It's like putting in a toll road."

In the beginning, the researchers really didn't know what the enzymes taken from *E. coli* bacteria would do when placed in mammalian cells. In fact, the glycoxylate shunt actually prevents the complete oxidation of fat in the organisms in which it is normally found.

Remarkably, they found that human liver cells expressing the enzymes burn more fat. Likewise, mice with the shunt resist becoming obese despite eating a high-fat diet.

Liao and Dipple's team traced those effects to lower levels of a fat metabolite called malonyl-CoA and an additional fat oxidation pathway.

"By perturbing the system, we were able to find how it's controlled," Dipple said.

The findings suggest that malonyl-CoA may be a good target for therapies aimed at ramping up fat breakdown. While the delivery of these genes into humans via gene therapy might someday be an option, Dipple emphasized it is not their intent to suggest such a strategy in the case of obesity. The study does offer proof-of-principle for a new way to study metabolism, however.

"Usually, we study metabolism by knocking out a gene or replenishing one that is missing," Liao said. "In this case, we introduced a new pathway to see the response." ■

The Schroepfer Medal

Call for Nominations

Candidate material should be submitted by e-mail to awards@aocs.org.
Deadline for nominations: October 15, 2009

The AOCS is accepting nominations for the 2010 Schroepfer Medal. The Schroepfer Medal is sponsored by the American Oil Chemists' Society and will be presented every two years at the AOCS Annual Meeting & Expo. The award, which consists of an honorarium and a 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 aims to foster Schroepfer's ideals of personal integrity, high scientific standards, perseverance, and a strong spirit of survival, tempered by charm and wit.

The purpose of this award is to recognize scientists who have made significant and distinguished advances in the steroid field. The work may represent a single major achievement or a cumulative body of work. Preference will be given to accomplishments in biochemistry and physiology with biomedical applications and to interdisciplinary research in which rigorous chemical and analytical methods were applied to elucidate the physiological roles of steroids in animals, plants, or microorganisms. However, fundamental advances that are primarily chemical, pharmacological, or analytical will also be considered.

Call for nominations

1. A prospective recipient must agree to be present for the acceptance of the award and must agree to deliver an award address at the 101st AOCS Annual Meeting & Expo.

2. The award shall be made without regard for national origin, place of residence, race, color, creed, sexual orientation, gender, or religion. Failure of a nominee to receive the award in one year shall not bar him or her from consideration for the award in a subsequent year.

3. Completed nominations should include a 300- to 1000-word summary describing the significance of the nominee's accomplishments in the steroid field, a current curriculum vitae including a full list of publications, and two supporting letters from individuals who are familiar with the nominee's accomplishments. Optionally, the nomination package may also include copies of three publications illustrating the nominee's most important work in the steroid field.

www.aocs.org/member/awards

Briefs

Research published online in *The FASEB Journal* (doi: 10.1096/fj.09-131995) describes a new protein that can kill the HIV virus when used as a microbicide and shows how it might be possible to manufacture this protein in quantities large enough to make it affordable for people in developing countries.

In this paper, Ma and colleagues describe how they combined two protein microbicides (b12 monoclonal antibody and cyanovirin-N) into a single "fusion" molecule and showed that this molecule is more active against HIV than either of its individual components. They designed synthetic DNA for producing this molecule and introduced this DNA into plant cells. After regenerating transgenic plants that produce the fusion molecule, they prepared the microbicide from a plant extract made by grinding the leaves.

■■■

Monsanto Co. (St. Louis, Missouri, USA) and BASF (Ludwigshafen, Germany) scientists recently reported that a naturally occurring gene can help corn plants combat drought conditions and confer yield stability during periods of inadequate water supplies. The companies stated that they will use the gene in their first-generation drought-tolerant corn product, which is designed to provide yield stability and will be the first biotechnology-derived drought-tolerant crop in the world.

The companies said that the drought-tolerant corn contains the *cspB* gene, from *Bacillus subtilis*. This gene codes for an RNA chaperone, a commonly occurring protein molecule that binds to RNA and facilitates its function.

■■■

Bayer CropScience AG (Monheim, Germany) and Monsanto have agreed to cross-license their respective herbicide tolerance traits in rapeseed/canola on a nonexclusive basis for commercialization within their respective branded canola seed businesses.

Biotechnology News

Courtesy Cognis.

Reports examine biotech in Germany, Mexico, Czech Republic

The US Department of Agriculture's Foreign Agricultural Service recently released a series of biotech-related reports covering the response to, and practices surrounding, biotech throughout the world. They include GAIN report nos. GM9026 (Germany), MX9041 (Mexico), and EZ9007 (Czech Republic).

GM PLOT DESTRUCTION IN GERMANY

Anti-biotech groups continued their destruction of research plots in Germany in 2009. By the end of May 2009, the German Plant Breeders Association (BDP) reported six cases of research plot destructions and occupations in Germany. Since there is no commercial cultivation allowed in Germany activists are concentrating their destructive work on research fields and research installations.

In the most recent case, a research project with 274 apple trees was destroyed at the Federal Research Institute for Horticulture, the Julius Kuehn Institute, near Dresden. The trees were housed in a plastic greenhouse. In reaction to this, Minister of Agriculture of the State of Sachsen Lothar Kupfer put out a press release stating that this "criminal" action caused damage of about $1 million. Kupfer argued that a number of facts call for support of green biotechnology: bigger yields, improved plant health, and lesser need for pesticides and fertilizers. Kupfer also pointed out that biotechnology is present in modern life, in different vaccines, in detergents, and in many foods.

In 2008, BDP reported 26 cases of field destructions and six cases of field occupations.

GMO TECHNICAL COMMITTEE CREATED IN MEXICO

On June 22, the Secretariat of Agriculture, Livestock, Rural Development, Fishery and Food (SAGARPA) published in Mexico's *Diario Oficial* an agreement to create the Technical and Scientific Committee for Genetically Modified Organisms.

Under the terms of this global agreement, Monsanto will grant Bayer CropScience access to Monsanto's Genuity™ Roundup Ready® canola trait and Bayer CropScience will grant Monsanto access to its LibertyLink® tolerance trait for use in canola.

■■■

Dow AgroSciences Canada Inc. (Calgary) announced in June that it had renewed its strategic alliance with the National Research Council Plant Biotechnology Institute of Saskatoon, Saskatchewan, for an additional five-year term. The research goals of the strategic alliance include the development of enabling technologies and the development and production of new oil profiles for industry and health. The agreement also includes research into improvements in agronomic productivity and increased yield.

■■■

Syngenta (Wilmington, Delaware, USA) recently announced that it had acquired Georgia-based Circle One Global Inc., to add an antitoxin crop protection technology to the company's portfolio. Circle One Global markets the product Afla-Guard, which is aimed at reducing aflatoxin, a toxin that can develop in crops such as corn and peanuts, particularly during heat and drought stress. ■

According to the agreement, the main objective of this committee is to support SAGARPA in the analysis of petitions and notices related to genetically modified organisms (GMO) in accordance with the Bio-safety Law. The specific objectives of this committee include:

(i) Review, assess, and issue technical opinions on the potential risks that GMO could have on animal, plant, and aquaculture health based on the risk analysis and the results submitted by developers and administrative bodies;

(ii) Analyze the cases and situations that are submitted for consideration in order to state a technical opinion on the issuance of permits and notices for activities with GMO under the support of scientific, legal, or technical studies;

(iii) Understand, discuss, and issue technical opinions on safety measures for implementation, based on technical, legal, and/or scientistific studies;

(iv) Monitor, review, analyze, and issue technical opinions on the actions or omissions that warrant the imposition of administrative penalties in accordance with the current legislation.

Members of the Technical Committee will be representatives of several SAGARPA areas: the Fisheries and Aquaculture Scientific Commission; the coordinator of International Affairs; the National Institute of Forest, Agriculture and Livestock Research; the National Institute of Fisheries; the National Service of Seed Inspection and Certification; the National Service of Agro Alimentary Health, Safety and Quality; and the Undersecretary of Agriculture.

CZECH RECOMMENDATIONS FOR EU BIOTECH POLICY

According to the Czech Academy of Sciences, many European scientists are disturbed by the fact that political factors and ideology prevent unbiased assessments of biotechnology in some EU (European Union) countries, negatively affecting the whole community. Being aware of the responsibility their country bears during the EU Presidency, Czech scientists working with biotech crops prepared a White Book summarizing their experience and analyzing relevant EU legislation. (The book is available as a pdf file at www.bc.cas.cz/en/MOBITAG.html.)

The White Book makes the following recommendations:

(i) Decisions concerning genetic modifications should not contradict scientific evidence;

(ii) Breeding techniques, including GM, should primarily be evaluated with respect to the outcome rather than the process itself;

(iii)The precautionary principle should be replaced by serious and robust risk/benefit assessment applied to all innovations in agriculture;

(iv) Risk assessments should always include the benefits and comparison of parallel technologies with all their components (e.g., GM crop deployment, standard agriculture with pesticides, and organic farming with permitted plant protection measures, since pesticides and even mycotoxins in organic foods present risks);

(v) Economic assessments should also be done by comparison with parallel technologies;

(vi) If EU member states are allowed to ban technology permitted elsewhere in the EU, they should also be allowed to use a technology that has not yet been approved by the EU, provided that it does not impinge on other member states.

EFSA evaluates antibiotic resistance marker genes

An EFSA (European Food Safety Authority) statement was published in June that provided a consolidated overview of the use of antibiotic resistance marker genes (ARMG) in GM plants, including a joint scientific opinion of the GMO and BIOHAZ Panels. The Panels concluded that, according to information currently available, adverse effects on human health and the environment resulting from the transfer of the two antibiotic resistance marker genes (*nptII* and *aadA*) from GM plants to bacteria, associated with use of GM plants, are unlikely. Uncertainties in this opinion are due to limitations related, among others, to sampling and detection, as well as challenges in estimating exposure levels and the inability to assign transferable resistance genes to a defined source. Two members of the BIOHAZ Panel expressed minority opinions concerning the possibility of adverse effects of antibiotic resistance

marker genes on human health and the environment.

In another opinion, the GMO Panel reviewed its previous assessments of individual GM plants containing ARMG, taking into account the findings and conclusions of the joint opinion of the GMO and BIOHAZ Panels. The GMO Panel concluded that its previous risk assessments on the use of the *nptII* marker gene in GM plants are consistent with the risk assessment strategy described in the joint opinion and that no new scientific evidence has become available that would prompt it to change its previous opinions on these GM plants.

In their joint opinion, the GMO and BIOHAZ Panels concluded that transfers of ARMG from GM plants to bacteria have not been shown to occur either in natural conditions or in the laboratory. The key barrier to stable uptake of antibiotic resistance marker genes from GM plants to bacteria is the lack of DNA sequence identity between plants and bacteria.

In related news, EFSA also evaluated information in relation to the safeguard clause invoked by Austria on oilseed rape (GT73), concluding that "in terms of risk to human and animal health and the environment, no new scientific evidence was presented that would invalidate the previous risk assessment of oilseed rape GT73. The EFSA GMO Panel also concludes that no new scientific data or information was provided in support of adverse effects of oilseed rape GT73 on the environment and on human and animal health in Austria. Therefore, no specific scientific evidence, in terms of risk to human and animal health and the environment, were provided that would justify the invocation of a safeguard clause."

For the same reason, EFSA also concluded that Austria's invocation of the safeguard clause in relation to maize (MON 863) and oilseed rape varieties MS8, RF3, and MS8×RF3 was unjustified.

Oil palm genome sequencing, assembly announced

Recently, a team of researchers announced that they had completed the sequencing, assembly, and annotation of the oil palm genome. Officiated by the Prime Minister of Malaysia, Najib Tun Razak, the announcement detailed the partnership between Sime Darby (Kuala Lumpur, Malaysia), Synamatix Sdn Bhd (Selangor, Malaysia), and 454 Life Sciences (Branford, Connecticut, USA) to fully characterize the genome of this tropical plant.

Although the completion of the 1.7 billion-base-pair oil palm genome is an important agricultural milestone, it also signals a fundamental shift in the technological approach used for sequencing large complex plant genomes. The genome was sequenced using only the Genome Sequencer FLX Titanium system and then assembled and analyzed by Synamatix. This was the first *de novo* genome assembly of a large and highly complex plant to be completed without the addition of conventional Sanger sequencing data. This fast and economical approach opens new doors to understanding the genetic makeup of a wide range of economically important plants, where sequencing has traditionally been prohibitively expensive.

"By using the combination of long 454 reads and our own assembly pipeline, we were able to achieve a very high quality assembly in spite of the genome's very high repeat content. The approach we have taken for sequencing and assembly of the oil palm offers a significantly faster and more economical way to characterize large, highly complex genomes," said Robert Hercus, Synamatix managing director.

454 Life Sciences, a center of excellence of Roche Applied Science, developed and commercialized the 454 Sequencing System for ultra-high-throughput DNA sequencing.

Cracking the problem of pod shatter in brassicas

An international team of scientists has cracked the problem of pod shatter in brassica crops such as oilseed rape. Just before harvest, oilseed rape pods are prone to shatter, causing a 10–25% loss of seeds and up to 70% in some cases.

"By artificially producing a hormone in a specific region of the fruit, we have stopped the fruit opening in the related model plant *Arabidopsis*, completely sealing the seeds inside," says Lars Østergaard from the John Innes Centre (Norwich, Norfolk, England). "We need to refine the process for use in agriculture to reduce seed loss but still allowing them to be easily harvested."

The scientists discovered that the absence of the hormone auxin in a layer of cells in the fruit is necessary for the fruit to open. Two stripes of tissue form where no auxin is present, and these separate to open the pod. It is already known that proper plant development, such as organ growth and patterning, requires specific hormones to accumulate in specific regions. This is the first time that removal of a hormone has been found to be important for cell fate and growth.

Brassica plants normally disperse their seeds by a pod-shattering mechanism. Although this mechanism is an advantage in nature, it is one of the biggest problems in farming oilseed rape. As well as losing valuable seeds, it results in runaway "volunteer" seedlings that contaminate the next crop in the rotation cycle. If rape seeds are harvested early to get around the problem, immature seeds may be collected that are of inferior quality. The research was published in *Nature 459* (583–586, 2009). ■

2009

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AOCS Code of Ethics • Chemistry and its application by scientists, engineers, and technologists have for their prime objective the advancement of science and benefit of mankind. Accordingly, the Society expects each member: 1) to be familiar with the purpose and objectives of the Society as expressed in its Articles of Incorporation; to promote its aim actively; and to strive for self-improvement in said member's profession; 2) to present conduct that at all times reflects dignity upon the profession of chemistry and engineering; 3) to use every honorable means to elevate the standards of the profession and extend its sphere of usefulness; 4) to keep inviolate any confidence that may be entrusted to said member in such member's professional capacity; 5) to refuse participation in questionable enterprises and to refuse to engage in any occupation that is contrary to law or the public welfare; 6) to guard against unwarranted insinuations that reflect upon the character or integrity of other chemists and engineers.

I hereby subscribe to the above Code of Ethics. Signature of Applicant _____

S&D News

Briefs

The Procter & Gamble Co. (Cincinnati, Ohio, USA) has acquired the Zirh skincare brand from Zirh International Corp. (New York, New York, USA). Zirh is a premium male grooming brand available in high-end department stores, specialty outlets, and online. Like P&G's recent acquisition of The Art of Shaving, the acquisition of Zirh "supports P&G Beauty & Grooming's strategy to build the world's premier male grooming company," said the company in a news release.

■■■

Bradford Soap Works (West Warwick, Rhode Island, USA) acquired custom soap manufacturer Stahl Soap (Hoboken, New Jersey, USA) for an undisclosed sum on June 9, 2009. A Bradford spokesperson told *HAPPI* magazine the company intends to "bring the majority, if not all, of the manufacturing of these products into our West Warwick facility."

■■■

Oregon was set to be the 13th US state to regulate the amount of phosphorus allowed in residential automatic dishwashing detergent after the state legislature passed a bill to that effect in late May 2009. As of June 15, the governor had not yet signed the bill into law, but was expected to do so. The bill bans the sale of residential dishwasher detergents in Oregon with more than 0.5% phosphorous content by July 1, 2010. Commercial products are exempt from the ban.

■■■

Consumer products publicized as the "world's first and only line of house products that are both eco-certi-

Laffans and Huntsman collaborate

Laffans Petrochemicals Ltd., which is based in Mumbai, India, and Huntsman Corp. Singapore Pte Ltd., a unit of the US-based chemicals manufacturer, have signed a letter of intent "to share knowhow, expertise, and resources for specialty chemicals." A report in the *Hindu Business Line* newspaper suggests the companies "intend to leverage each other's capabilities and resources for surfactants and amines manufacturing in India." Laffans' responsibilities reportedly will include manufacturing and raw material sourcing, whereas Huntsman's role would include commercial infrastructure, branding, product range, global approvals, technology, and manufacturing processes.

According to the newspaper, "the planned technology transfer will include specialty nonionic surfactants, glycol ethers, and amines for a wide range of markets, including agrochemicals, household, personal care, oil and gas, and automotive brake fluids."

This will be the first surfactants manufacturing plant for Huntsman outside of the United States, the report noted.

Market report on biocides

The average growth rate of specialty biocides used in disinfectants and sanitizers in household, industrial, and institutional cleaners was 2.9% in 2008, which exceeded the 1% growth of the overall biocide industry in the United States, according to S*pecialty Biocides 2008: A Global Series of Regional Market Analyses* from consulting and research firm Kline & Co. of Little Falls, New Jersey, USA.

In 2008, the US specialty biocide market was valued at just under $2.0 billion, with market volumes approaching 272,155 metric tons. Water treatment is the leading application group in the United States, with halogenated biocides the leading category owing to significant consumption within water treatment. By contrast, the household, industrial, and institutional cleaning products industry consumed around $130 million of specialty biocides in 2008.

fied and carbon neutral" has been introduced in Canada. Manufactured by Montreal-based Bio Spectra, the Attitude® line-up of products includes laundry detergents, autodish detergents, and fabric softener. The products are certified by the EcoLogo program administered by Terrachoice, a marketing firm based in Ottawa, Ontario, Canada.

■■■

LS9, Inc., an industrial biotechnology company based in South San Francisco, California, USA, has announced a strategic partnership with The Procter & Gamble Co. The partnership includes a multiyear collaboration to accelerate the adoption of LS9's proprietary technology in the production of a broad portfolio of products, including sustainable chemicals and renewable transportation fuels.

■■■

UK's Technology Strategy Board, a unit of the British government, will fund research on skin- and haircare products from seaweed, the group announced in May. The aim of the Board is "to develop new or improved sustainable materials, processes, and products"; a total of 18 projects will benefit from an investment totaling over £20 million (almost $37 million). ■

The green trend is affecting customers of specialty biocides within the household, industrial, and institutional cleaning products sector, Kline says. The importance of this trend has been acknowledged not only by such specialty companies as Method Home Products and Seventh Generation, Inc., but by major companies in the industry, signified, for example, by Clorox's introduction in January 2008 of its new product line, Green Works. Similarly, consumer products manufacturers are using more environmentally friendly biocides in disinfectants and sanitizers rather than other biocide formulations.

"Although green cleaning products only comprise a small percentage of the total household, industrial, and institutional cleaning products market, sustainability and environmental responsibility is where the industry is focused," says Anna Ibbotson, industry manager at Kline's Chemicals and Materials practice. "As there is currently no uniform industry definition for green, it creates a huge challenge for chemical suppliers to develop and then position their products to address this market movement."

More information about the report is available at www.KlineGroup.com.

P&G names new head

The Procter & Gamble Co. (P&G) has a new leader: Robert McDonald—formerly chief operating officer of the Cincinnati, Ohio-based multinational—replaced CEO A.G. Lafley on July 1, 2009. Lafley, 61, who took over as CEO in 2000, remains as chairman of the P&G board.

Lafley is widely credited with reinventing and reinvigorating P&G by speeding the time-to-market of new products and selling off underperforming brands. "A.G. is the top CEO of my generation," Amgen CEO Kevin Sharer told *BusinessWeek* in late 2007. "He's a role model for all of us."

McDonald, 55, not only will have to follow a business icon, he will also need to revive P&G's declining sales and profits as consumers move from name brands to economy labels. In his 29-year tenure with P&G, McDonald has held positions in Canada, the Philippines, Japan, Korea, Belgium, and the United States, including a stint as president of Global Fabric & Home Care.

CED: Call for papers

The CED (Comité Español de la Detergencia Tensidactivos y Afines) has issued a call for paper proposals for its annual meeting, April 14–15, 2010, in Barcelona.

The topics to be covered include raw materials, synthesis and analysis, new developments and applications, physico-chemistry, environment, legislation, markets, and consumption/distribution. The submission deadline is September 30, 2009; paper proposals should be submitted via www.cedmeeting.com (e-mail: ced@jornadasced.com).

Chemrez to expand

Oleochemicals producer Chemrez Technologies Inc. of the Philippines is expanding its business abroad, according to the *Manila Times* newspaper. A publicly listed firm, ChemrezTech manufactures biodiesel, powder coatings, resins, and other specialty chemicals. Last year, Chemrez's exports to Thailand, Japan, Australia, Turkey, and the United States accounted for 15% of its total revenues of P4.66 billion (roughly $96 million).

The company's chief finance officer, Alvin Lao, told the newspaper that Chemrez plans to develop new products in order to build its coco methyl ester export markets. Additional oleochemicals manufactured by the company include glycerine and other methyl ester derivatives.

Degradation of alkylbenzene sulfonates

A new study led by Tsutomu Tasaki and colleagues at the Miyazaki Prefecture Industrial Technology Center in Japan examines a water and wastewater treatment technique for eliminating alkylbenzene sulfonate surfactants from aqueous systems.

The technique uses an eight-watt low-pressure mercury lamp in the presence of nanobubbles (diameter = 720 nm) for the decomposition of sodium dodecylbenzenesulfonate (SDBS), as a model compound in aqueous solution.

"Degradation experiments were conducted with an ozone lamp (185–254 nm), both with and without nanobubbles," the researchers write. "The result shows that

the oxidation and mineralization rate of SDBS were significantly enhanced under 185–254 nm irradiation by oxygen nanobubbles. Although a high concentration of surfactant was used in this study, SDBS removal is effective in the integrated nanobubbles/vacuum ultraviolet system, via the observation of 99.8% SDBS oxidation and 76.8% total organic compound removal after 24 hours of irradiation," they continue.

"The current study investigates the effect of [the] size of bubble on the mineralization rate of SDBS. Furthermore, the rates of surfactant degradation were compared with those of nonsurfactants such as benzene sulfonate. It was found that the mineralization of SDBS surfactants with nanobubbles was observed to be more effective than that with microbubbles (diameter = 75.8 μm). The comparative results show that the mineralization rate of surfactants was much faster than the nonsurfactants in the presence of nanobubbles under 185–254 nm irradiation," they note.

The researchers concluded: "Based on the experimental results and kinetic degradation model, we concluded that the enhancement on the mineralization of surfactants is attributed to the high adsorption capability of nanobubbles, because of the small particle size offering a large surface area to facilitate the reaction."

The study appeared in *Industrial & Engineering Chemistry Research* (*48*:4237–4244, 2009).

Personal care market remains promising

Anna Ibbotson

Despite the economic downturn, the personal care industry remains an attractive market for suppliers of performance ingredients aimed at delivering the results consumers demand from hair and skin products. The market is ripe for savvy suppliers who can find the right niche and the right buyers for their innovative products to capitalize on the demand for anti-aging, anti-wrinkle, and other products that offer pharmaceutical-quality results without the prescription or the high price.

For chemical suppliers geared toward the construction and automotive industries, the last 18 months have been tough as the housing, finance, and automobile markets crawled to a near halt amid the worst recession in recent history. However, suppliers in the personal care space enjoyed solid gains in 2008 as personal care specialty chemicals have been able to maintain their specialty status and healthy margins, while other classes of polymers, additives, and engineered plastics, once considered specialty products, have been commoditized (see Fig. 1).

Specialty products represent about 40% of the $10 billion-plus personal care ingredients industry, with an array of performance products, including actives, delivery systems, film formers, sensorial agents, rheology-control agents, and specialty surfactants, among others. As consumers demand better performance at lower costs, there remains ample opportunity for specialty suppliers to leverage the current economic and technological developments

to remain competitive, and even thrive, in an otherwise dismal industry.

ECONOMIC WOES GOOD FOR THE INDUSTRY

Personal care remains an attractive industry partly as a result of the poor economy. As laid-off workers and those struggling financially learn to adjust their spending habits to compensate for the reduction in disposable income, they begin to seek alternatives to costly hair and skincare treatments. To make up for cutting back on physician or salon treatments, consumers are demanding better performance from off-the-shelf products and exploring mass retail distribution channels as a cost-effective source for their products. Products in this space, particularly those with anti-aging and anti-wrinkle qualities, are thriving.

In addition, unemployed or underemployed consumers who once enjoyed employer-sponsored healthcare benefits are now doing more to take better care of themselves in an effort to avoid costly out-of-pocket medical expenses. This trend, coupled with a desire to maintain personal appearance in a bid to improve their employment prospects, will likely buoy the personal care industry right through the worst of the recession and beyond.

COMPLACENCY IS BAD FOR BUSINESS

Even given these positive trends, innovation remains a crucial component to success for suppliers of specialty actives and delivery systems for the personal care industry. Staying ahead of the curve will remain critical: developing exciting new products, working with customers to devise strategic packaging and marketing initiatives, as well as leveraging the at-home-treatment trend, can all help to drive growth for companies with the right approach to the market.

Products that promise specific results—especially those for which claims can be scientifically substantiated—will continue to be a boon to the industry. Synthetic peptides, for example, have revolutionized the anti-aging industry by bringing pharmaceutical strength to off-the-shelf products in nearly all distribution channels. To take a lesson from history, continued investment in research and development to develop new actives with heightened and specific efficacy will pay off for future growth.

Similarly, delivery systems that offer longer staying power or improved penetration give consumers a better return on their investment, helping to drive sales, and foster repeat customers. There has been a great deal of buzz surrounding the use of microcapsules to deliver skincare actives, such as retinol, retinyl palmitate, and vitamin E acetate for anti-aging. Particularly in the wake of negative publicity surrounding nanoparticles and their perceived danger of allowing the absorption of actives into the body through the skin, microcapsules are considered a safer alternative.

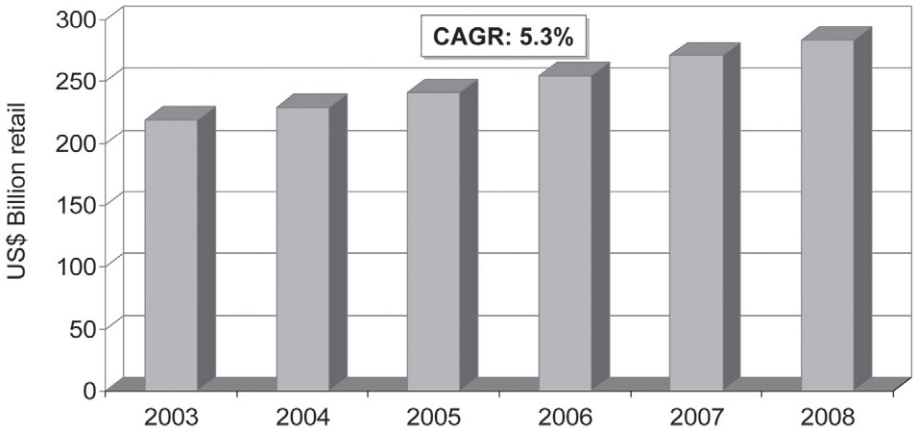

FIG. 1. *Global personal care market growth at retail level, 2008. Abbreviation: CAGR—compound annual growth rate. © 2009 Kline & Company*

NATURAL INFUSION SPURS GROWTH

The naturals trend continues to infuse growth into the industry as botanical ingredients such as grapeseed extract for anti-aging, green tea for anti-wrinkle, and other organic sources garner proof of efficacy. The opportunity here is for chemical suppliers to devise the most efficient method to extract the specifically-desired molecule for the activity desired. An efficient harvesting and extraction process would reduce manufacturing costs and help boost the appeal of botanicals-based products for both formulators and consumers.

The "packaging" of synthetic actives with botanical ingredients could also provide a powerful strategy for suppliers whose individual products are unable to withstand the current economic forces. A combination of actives, such as a synthetic peptide-green tea mix, could leverage the combined benefits of both actives and help hold down the cost of the final product.

In addition to product innovation, specialty actives suppliers might consider an innovative channel marketing approach to reach a wider audience. While products at the luxury end of the scale have suffered a bit in the weak economy, mass products are holding their own. For suppliers whose customers' lines include brands at both ends of the spectrum, like L'Oréal and The Procter & Gamble Co., there could be opportunity to infuse lower-cost brands with higher-value actives in a cost-effective way by leveraging existing formulation lines and economies of scale.

CONVERGENT MARKETS = DIVERSIFIED CUSTOMER BASE

The recent convergence of the personal care, pharmaceutical, and nutrition industries to form new markets in cosmeceuticals, nutraceuticals, and nutricosmetics bodes well for specialty actives suppliers who can market innovative ingredients designed to provide specific benefits in these areas. By combining the power of pharmaceutical-grade actives with the perceived safety of natural ingredients and sound nutritional overtones, actives suppliers could diversify their sales across the various end-use industries for personal care, nutrition, and pharmaceutical applications.

Consumers' interest over the past six to seven years in environmental protection and healthier living has helped to carry the nutrition market well through the recession; raw materials suppliers in the personal care industry might take a lesson from this success to stay ahead of the tide in difficult times.

Anna Ibbotson is an industry manager for chemicals and materials at Kline & Company's office in Oxford, UK. She can be reached at Anna.Ibbotson@klinegroup.com.

People News/ Inside AOCS

Next annual meeting program shaping up

Catherine Watkins

Each year at the AOCS Annual Meeting & Expo (AM&E), division representatives play a vital role in creating the program for the next year's meeting. They use a simple but effective process honed over the years to make program creation a virtually painless operation.

First, each division holds a roundtable session—usually an hour in length—during the opening days of the meeting. The roundtable groups discuss broad program areas and emerging science that are of particular interest to each division's members. Then, armed with the session titles developed during the roundtable meetings, division representatives attend the Program Committee meeting on the afternoon of the last day of the AM&E. (Jim Kenar of the US Department of Agriculture-Agricultural Research Service's National Center for Agricultural Utilization in Peoria, Illinois, USA, currently is chairperson of the committee.)

Once the Program Committee meeting begins, the division representatives jot down their session titles on rectangular pieces of paper supplied by the AOCS Meetings Department staff, who have also laid out a grid on a wall of the meeting room with the 12 AOCS divisions listed vertically and the days and day parts listed horizontally at the top.

The division representatives next post their topics under the proper day/day part, and discussion begins. The group can easily see where topics overlap, at which point divisions often choose to co-sponsor a session. Some good-natured negotiation often occurs as the work of program development continues. By the end of the 90-minute meeting, the bare bones of the following year's program are in place, proving that low-tech solutions sometimes are the most efficient.

MEETING DETAILS

The 101st AOCS AM&E will be held May 16–19, 2010, in Phoenix, Arizona, USA; the general chairperson is Douglas M. Bibus, Lipid Technologies LLC, University of Minnesota, Austin, Minnesota, USA. The tentative topic list, by division, includes:

- **Agricultural Microscopy:** Aquafeeds; agricultural microscopy; food, feed, and fertilizer safety; minerals
- **Analytical:** Nutraceuticals; rapid technologies; trace contaminants; mass spectrometry; general analytical topics
- **Biotechnology:** Biocatalysis; sterols; processing technologies; oilseed biotechnology and genomics; utilization of co-product streams; biobased surfactants and ingredients; general biotechnology topics
- **Edible Applications Technology:** Lipid crystals and structural properties in foods; baking fats (formulating based on nutrition and economics); food emulsions; confectionery fats (formulating based on nutrition and economics); general edible applications technology topics
- **Food Structure & Functionality:** Food-body interactions; design of successful performing interfaces; phase transitions and rheology of food structures; new processing approaches for the creation of novel food structures; structuring at nano level for food applications
- **Health and Nutrition:** Lipids and inflammation and lipid signaling molecules; bioactivity of short- and medium-chain fatty acids and their health effects; omega-3 and -6 benefits/liabilities—interactions, competition; general health and nutrition topics
- **Industrial Oil Products:** Alternative fuels; processing technologies; biobased lubricants; new glycerol uses; industrial applications; oleochemicals and polymers; general industrial oil products
- **Lipid Oxidation and Quality:** Emulsions and interfaces—omega-3 oils and stability; specialty antioxidants; shelf-life stability and sensory properties (cereals and whole grains); frying oils; general lipid oxidation and quality
- **Phospholipid:** Nutritional and biological functions of polar lipids; lipids in nanotechnology; analytical characterization and quantification in phospholipids; industrial and feed applications of phospholipids; general phospholipids

The AOCS Program Committee met on May 6, 2009, to develop session topics for the 101st Annual Meeting & Expo, May 16–19, 2010, in Phoenix, Arizona, USA.

*inform*ation

At a glance

- 101st AOCS Annual Meeting & Expo
- May 16–19, 2010
- Phoenix Convention Center, Phoenix, Arizona, USA
- Online submission of declarations of intent (i.e., a proposal to present at the meeting) at http://AnnualMeeting.aocs.org ends on October 5, 2009; the deadline for abstract submissions is January 11, 2010.

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101st AOCS Annual Meeting & Expo

- **Processing:** Processing hot topics (sustainability, energy, new technology); food/feed safety and quality; exhibitor presentations; personnel and facility safety; general processing
- **Protein and Co-Products:** Protein and co-products from biofuel production; corn meal utilization; from peptides to macromolecules; novel technologies for isolation and extraction of proteins and co-products; general protein and co-products
- **Surfactants and Detergents:** General surfactants; extended-chain surfactants; dynamic properties of surfactants; industrial applications; green ingredients and labeling; general cleaning—new surfaces; biobased surfactants/ingredients

HOW TO PRESENT

Persons wishing to make either oral or poster presentations should complete the Declaration of Intent form at http://AnnualMeeting.aocs.org no later than October 5, 2009. Required information includes the paper title, authors, affiliations, and keywords for the proposed presentation. Authors can access their online account anytime before the January 11, 2010, deadline to complete and/or edit their abstract submissions. However, authors are strongly encouraged to add abstracts sooner, rather than later, to help session chairs organize their sessions.

Catherine Watkins is associate editor of inform *and can be reached at cwatkins@aocs.org.*

BIOFUELS NEWS (CONTINUED FROM PAGE 515)

facilities profitable, and POET itself has remained profitable, on average, even during the economic crisis of the past year.

Shell sells cellulosic ethanol through retail outlet

As of June 10, 2009, customers at a Royal Dutch Shell service station in Ottawa, Ontario, Canada, became the first in the world to fill their tanks with gasoline containing 10% cellulosic ethanol that had been derived from wheat straw. The biofuel was produced locally from non-food raw materials at Iogen Energy Corporation's demonstration plant (Ottawa), using advanced conversion processes. Iogen and Shell are partners in the plant, which now produces 40,000 liters of fuel per month.

Graeme Sweeney, Shell executive vice president Future Fuels and CO_2, said, "I am excited we are leading the pack in cellulosic ethanol production technology and, with this event, showing what is possible in the future." He added, "While it will be some time before general customers can buy this product at local service stations, we are working with governments to make large-scale production economic."

Ethanol pipelines in Brazil

Operators of three separate ethanol pipeline projects in Brazil are considering coordinating their efforts to transport ethanol from remote areas of the country to the main areas of consumption and export terminals (see *inform 19*:674, 2009), according to Reuters. Participants include Cosan, Sao Martinho, and Crystalsev, which have joined to form Uniduto, an organization whose purpose is take care of technical and viability studies as well as environmental clearance for the pipeline.

Petrobras, the state-run oil company, is also entering the ethanol market in Brazil, and expects to produce 3.5 billion liters of fuel annually by 2013 through partnerships in mills and projects, as reported by Reuters. Its pipeline project, PMCC, expects to begin operations in 2010

Ethanol produced from sugar in Brazil goes for export as well as internal markets, where about one-third of the fuel used in vehicles is ethanol (*inform 19*:159, 2009). Reuters said Brazil could export 25 billion liters of ethanol annually by 2025. ■

CALENDAR (CONTINUED FROM PAGE 492)

November 2–4, 2009. BIO-Europe, 15th Annual International Partnering Conference, Messe Wien Exhibition & Congress Center, Vienna, Austria. Information: www.ebdgroup.com/bioeurope.

November 2–5, 2009. Soya & Oilseed Summit 2009/Global Soybean & Grain Transport 2009, The Roosevelt Hotel, New Orleans, Louisiana. Information: www.soyatechevents.com.

November 9–12, 2009. Malaysian Palm Oil Board International Palm Oil Congress 2009 (PIPOC 2009), Kuala Lumpur, Malaysia. Information: e-mail: pipoc2009@mpob.gov.my; www.mpob.gov.my or www.conferencealerts.com/seeconf.mv?q=ca1xmhs3.

November 10–11, 2009. 4th European Bioplastics Conference, Ritz Carlton Hotel, Berlin, Germany. Information: e-mail: info@european-bioplastics.org; www.european-bioplastics.org.

November 14–15, 2009. 3rd Practical Short Course: Industrial Uses of Vegetable Oils: Biodiesel, Ink, Biobased Solvents, and Lubricants, Munich, Germany. Information: www.smartshortcourses.com or www.aocs.org/meetings/biodiesel09/index.cfm/2nd-International-Congress-on-Biodiesel-3rd-Practical-Short-Course.

November 14–19, 2009. Association for the Advancement of Industrial Crops 21st Annual Meeting: The Next Generation of Industrial Crops, Processes, and Products, Termas de Chillán, Chillán, Chile. Information: www.aaic.org/2009_meeting.htm.

Minutes for the 2009 AOCS business meeting

The 100th AOCS annual business meeting was called to order by AOCS Past President and Centennial Celebration Committee Chairperson Robert Hastert at 7:20 A.M., Tuesday, May 5, 2009, at the Rosen Shingle Creek in Orlando, Florida, USA.

AOCS President Casimir Akoh welcomed the participants and extended a special thank you to the Centennial Celebration Committee. Akoh also recognized AOCS Past President Dick Baldwin, the longest-standing member present at this meeting. Baldwin is a living link to AOCS founding President Felix Paquin, having met Paquin at the 1950 Annual Meeting in Atlanta, Georgia, USA.

Akoh thanked the AOCS Past Presidents and recognized their contribution to the Society. Akoh noted that Oliver Fiala, who was not in attendance, has been a member for 74 years (our longest-standing member) and that two of AOCS' corporate members had held that status for 50 years. Akoh stated, "AOCS wouldn't be here after 100 years without the individuals who found value in being part of the AOCS network, companies that found the AOCS an important source of technical information and networking, and without the support of allied associations worldwide." For more information on the rich history of AOCS, President Akoh directed the participants to visit the Hall of Presidents in the Expo Hall.

Akoh thanked and invited Annual Meeting General and Technical Chairperson Pamela White to the podium. White opened by recounting that AOCS Past President David Wesson had once expressed that AOCS' history of collaboration and information sharing was established during informal discussions following technical sessions. It was during these less-formal discussions that participants found they were pursuing similar goals and could work together to achieve them. White said these informal discussions are probably occurring even today at bars and restaurants following the technical sessions. White hoped that the participants found value in attending the technical sessions and enjoyed reading about and seeing images of the history of the Society in the special exhibit area. White thanked the Annual Meeting Committee and everyone else who contributed to the outstanding technical program for this meeting.

President Akoh called AOCS Secretary Steve Hill to the podium to present the minutes from the 2008 business meeting—unless someone made a motion to approve the minutes as published in the October 2008 issue of *inform*. The motion to approve the minutes as published was made, seconded, and approved by a voice vote.

AOCS Foundation Chairperson Mike Boyer took the podium to discuss the success of the Foundation's Campaign for Technology, which comes to a conclusion in 2009. Boyer explained that more than $318,000 had already been raised, with a goal of $500,000 by the end of the year. Boyer went on to discuss the Foundation's plans for the future, including its focus on the issue of sustainability.

Past President Philip Bollheimer presented the Governing Board election results and reported that the officers elected for 2009–2010 are: Ian Purtle, President; Keith Grime, Vice President; Timothy Kemper, Treasurer; Christopher Dayton, Sevim Erhan, William Hausmann, and Andrew Proctor, Members-at-Large.

Continuing in their current terms are Secretary Steve Hill; Members-at-Large Erich Dumelin, Alejandro Marangoni, Tom McKeon, and Neil Widlak; Education and Meetings Steering Committee Chairperson Deland Myers; and Publications Steering Committee Chairperson Robert Moreau.

Akoh gave his retiring president's address highlighting key events during his presidency. He stated that while the global economy is in crisis, AOCS continues to prudently manage its resources and plan for growth. Once the economic conditions improve, AOCS will be ready with new products and services to benefit the people and industries AOCS serves. Akoh was pleased to report that AOCS Membership continues to grow, as does member retention. Akoh considers communication with Society members and constituents to be a top priority and has endeavored over the past year to keep them updated with regular articles in *inform*. Akoh recognized the efforts of the AOCS Foundation through the current Campaign for Technology and in its upcoming new initiative. Akoh stated that in AOCS' second century, it will be critical that our leaders think strategically, stay relevant, and continue to build on our global presence. He thanked the membership for their support during his term and offered his congratulations on AOCS's 100th anniversary.

Akoh also thanked retiring Board members Rick Della Porta and Carlos Molina for their dedicated years of service on the AOCS Governing Board.

As his final action, Akoh passed the AOCS gavel to incoming President Ian Purtle.

In the incoming president's address, Purtle emphasized that although times have changed, AOCS' aspirations have remained the same. On the occasion of AOCS' 100th anniversary, Purtle urged the participants to consider what the Society has meant to them personally and to the fields served by AOCS members. Purtle stated that those of us who continue to benefit from the contributions made through the AOCS organization owe a debt of gratitude to the nine founding members who gathered in Memphis, Tennessee, in 1909, as well as those who have carried forward the original vision of this Society. Purtle spoke about the growth of AOCS and the industry over the past century and reminded participants that it is our task to "continue this stewardship, following the vision and example of those nine young men in Memphis 100 years ago."

AOCS Award winners were recognized.

AOCS Executive Vice President Jean Wills Hinton thanked the members, both new and long-time, for their participation and the major role they have played in AOCS' growth, success, and longevity. She noted that the responsibility for carrying the work of AOCS into the future is now ours. She expressed confidence that AOCS' members and constituents would be successful in living up to the standards that our founding members so diligently established. She expressed gratitude on behalf of the AOCS staff for the opportunity to work with the organization and the individuals who are affiliated with it.

With no further business, President Purtle adjourned the meeting at 8:15 A.M. and introduced the Keynote Speaker, Daniel Burrus.

Book Review

Fats are Good for You and Other Secrets: How Saturated Fat and Cholesterol Actually Benefit the Body

John J. Kabara, North Atlantic Books, 2008
242 pages
ISBN: 978-1-55643-690-1, $16.95.

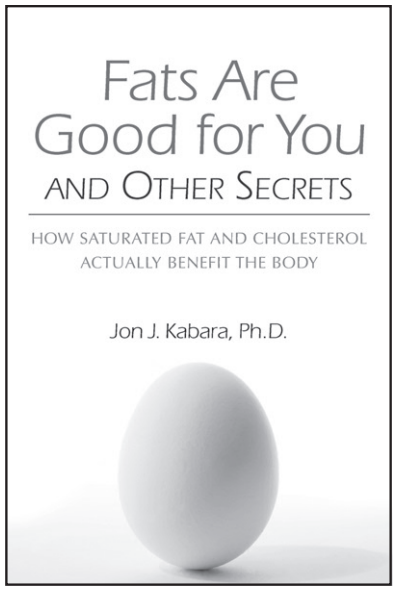
Jane Mara Block

John J. Kabara has written an easy-to-read book that can be understood by professionals and researchers involved in the subject area as well as by any interested layperson. The author's writing style did not happen by chance: The intention is to present and publicize a product, monolaurin, or glyceryl monolaurate, or, as it was registered commercially, Lauricidin.

Kabara, a researcher in this area for around 50 years, has made a major contribution to the study of saturated fat and cholesterol metabolism, and he presents this in the book from an unusual angle. In the majority of papers and books published on saturated fats, these compounds are treated negatively, and the approach normally takes the form of describing the detrimental effects of their consumption on health. In contrast, this book describes the beneficial effects of medium-chain monoglyceride fatty acids (C8, C10, and, particularly, C12, or Lauricidin). According to Kabara, the different types of fat (saturated, mono- and polyunsaturated) have different caloric and pharmacological effects, although these are not always recognized. As a result, he suggests that the term "saturated fat" should be differentiated and always preceded by the adjective "short-, medium- or long-chain."

After an introduction to oils and fats, the author presents a history of the use of natural medicines and a summary of fat metabolism. Later chapters cover the beneficial effects of fats on health, such as the antimicrobial action of saturated fats, antimicrobial and antiviral effects of fatty acids and monoglycerides present in maternal milk, and the effect of lipids on oral health. The actions of fats as modulators of the immune system, as well as their effect on the increased risk of cancer, atherosclerosis, infections, benign prostatic hyperplasia, and gastric ulcers, are also presented, although the author emphasizes that these effects depend mainly on the concentration and type of fat present in the diet. Some of the effects presented are well-established, while others remain scientifically unproven. Since this book comes under the category of "popular science," much of the information is unsupported by references or, in some cases, supported by an insufficient number of references. Additional references really should be included to support the recommendations based on the effects described.

The author's reflections on over five decades of research on saturated fats and cholesterol are presented before the final chapter, which consists of positive testimony given by consumers concerning the effects of Lauricidin in the diet on a remarkably varied range of pathological conditions.



In this book, in which he promotes Lauricidin, Kabara provides us a kind of "redemption" of saturated fats and cholesterol. He also takes the opportunity to examine the situation from another point of view: the positive side of fat consumption and how consumption of certain saturated fats and cholesterol are necessary to maintain health.

The last 60 years have witnessed a change in the diet of the population, with an excessive consumption of saturated and *trans* fats, and a major imbalance in the omega-6/omega-3 fatty acid ratio in the diet. This dietary pattern has brought about a rise in the incidence of a number of chronic diseases among the population (cardiovascular diseases, stroke, cancer, inflammatory disease, and obesity, among others). The essential fatty acids, like vitamins and minerals, are necessary in the diet. However, the excessive intake of any type of fat (including mono- and polyunsaturates) can have negative effects on health, such as sexual and immune system dysfunction, cardiovascular disease, and increased risk for the development of cancer.

In this context, attempts to find fats "guilty" or "innocent" seem pointless. The main message that should be broadcast to the population is that balanced diets, not only in caloric terms but also in relation to quality, are best. From this point of view, the message of the book is very clear and opportune: there are no good or bad fats; it is their inappropriate intake that leads to metabolic disorders. The key words to ensure that dietary fats have positive effects on our health are variety and moderation, together with the correct balance in terms of the quantity of saturated, mono-, and polyunsaturated fats. As the author says: "It is time for an oil change, both in our thinking and in our diet."

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Patents

Patent Applications

Modifications of solid 3-*sn*-phosphoglycerides

Yesair, D., *et al*., Biomolecular Products Inc., January 15, 2009, US20090017119A1

Methods for hydrolyzing solid ungranulated lysophosphatidylcholine with phospholipase A2 are provided. Also disclosed are methods for making a lipid matrix of lysophosphatidylcholine, monoglyceride, and fatty acid, and lipid matrices of having a particular structure.

Shortening system

Doucet, J., c/o Frommer, Lawrence, Haug, January 15, 2009, US20090017181A1

A shortening system, such as a spray shortening system; for instance, a shortening system containing unhydrogenated or non-hydrogenated vegetable oil, such as a highly unsaturated, nonhydrogenated or unhydrogenated vegetable oil, e.g., soybean oil or canola oil and a minimum or minor amount (e.g., by weight about 3–10%, advantageously about 3–7%, more advantageously about 3–6%, or about 3–5% or less than about 6% or less than about 8%) of conserved *trans* monoglyceride and/or diglyceride, advantageously a monoglyceride or a mono- and diglyceride that is mostly monoglyceride, based on a highly unsaturated oil, such as a highly unsaturated vegetable oil, e.g., canola or soybean oil, which has been selectively and partially hydrogenated so as to result in conservation of the geometric isomer of the C18:1 ester, namely the C18:1*t* or elaidic ester, as well as to methods for making and using such a shortening system, products from the use of such a shortening system, and the monoglyceride and/or diglyceride constituent of the shortening system, and methods for making and uses thereof.

Polyol refining

Soest, H.-K., *et al*., LANXESS Deutschland GmbH, January 29, 2009, US20090030243A1

The subject of the present invention is a method for refining of polyols, preferably glycerol, by means of monodispersed ion exchangers in a purification unit of ion exclusion process and a mixed bed.

Novel microorganism, lipid-modifying agent, and the method of manufacturing 2-acyl lysophospholipids

Nishihara, M., *et al*., Tokyo University of Marine Science and Technology, January 29, 2009, US20090029428A1

The present invention provides a new supply source of phospholipase A1, which is useful for phospholipid modification and lipid biochemical research, and offers a method capable of efficiently manufacturing a large amount of high-DHA (docosahexaenoic acid)-content phospholipids and lysophospholipids. A novel microorganism HFKI-0020 (FERM AP-20545) of the genus *Pseudomonas* that produces enzymes with phospholipase A1 activity can be used as a new supply source of enzymes with the phospholipase A1 activity. A lipid-modifying agent containing an effective dose of enzymes with the phospholipase A1 activity produced by those novel microorganisms allows the efficient mass-production of lysophospholipids.

Stable beverage products comprising polyunsaturated fatty acid emulsions

Chen, Y., *et al*., Coca Cola Co., January 15, 2009, US20090018186A1

A beverage product comprising at least one beverage base and at least one polyunsaturated fatty acid emulsion, said emulsion comprising a continuous liquid phase; an emulsifier; and a discontinuous liquid phase comprising a blend including a polyunsaturated fatty acid source and a dispersing agent, the polyunsaturated fatty acid source comprising at least one polyunsaturated fatty acid, wherein the weight ratio of the fatty acid source to the dispersing agent in the blend ranges from about 9:1 to about 1:10.

Hydrotreating and catalytic dewaxing process for making diesel from oils and/or fats

Ghonasgi, D., *et al*., ConocoPhillips Co., January 22, 2009, US20090019763A1

Methods for producing C_{10}–C_{30} hydrocarbons from fatty materials, such as triglyceride compounds, are provided. Hydrocarbon compounds, particularly those boiling in the temperature range of between about 80°F to about 1,000°F [27–540°C], are produced by contacting a fatty material with at least one catalyst comprising cobalt and molybdenum on a zeolite support under hydrotreating conditions. Additional hydrotreating catalysts also may be used to further improve the properties of the hydrocarbon product.

Nonhydrogenated fat composition and its use

Van Den Bremt, K., and B. Kleenewerck, c/o Scully, Scott, Murphy, & Presser PC, January 22, 2009, US20090022868A1

The present invention relates to a nonhydrogenated vegetable fat composition suitable for use in confectionery fats. The nonhydrogenated vegetable fat composition consists of an interesterified fat obtained by subjecting a blend of an amount of at least one lauric fat and an amount of at least one nonlauric fat to an interesterification. The nonhydrogenated vegetable fat composition has an SFC [solid fat content] that is at least 50 wt% at 20°C and less than 15 wt% at 35°C, a content of $C_{12} + C_{16}$ fatty acids of at least 55 wt% with respect to the total weight of the fat composition, and a ratio of C_{12}/C_{16} fatty acids of at least 1.

System and method for heating viscous fuel supplied to diesel engines

Samanta, I., and S. Gallagher, General Electric Co., January 29, 2009, US20090025908A1

A heat transfer system is used for heating a viscous fuel supplied to a diesel engine. The heat transfer system includes a heat exchanger provided at a predetermined location within the heat transfer system. A hot fluid and viscous fuel are circulated in a heat-exchanging relationship within the heat exchanger to heat the viscous fuel supplied to the engine from a first temperature to a second temperature.

Process for the production of phospholipids

Schneider, M., and E. Loveaas, ProBio Group AS, January 29, 2009, US20090028989A1

The present invention provides a phospholipid composition obtainable by a process comprising contacting a fish meal with an organic solvent to produce a lipid-containing liquid, and subjecting said liquid to microfiltration optionally followed by solvent stripping.

Soy-based aqueous food concentrate

Niederreiter, C., *et al.*, Nestec S.A., January 29, 2009, US20090029007A1

The present invention relates to soy-based aqueous concentrated food compositions that are stable to cooking conditions, i.e., do not undergo decomposition or separation upon prolonged heat and/or acid treatment. The invention also relates to the use of partially hydrolyzed soy protein to improve the stability of said compositions and to a method for preparing a stable soy-based concentrated food composition.

Composition suitable for use in baking

McNeill, G., *et al.*, Loders Croklaan USA LLC, January 29, 2009, US20090029024A1

A composition comprising: (i) from about 20% to about 80% by weight of an interesterified palm oil olein; (ii) from about 5% to about 25% by weight of a liquid oil; and (iii) from about 15% to about 75% by weight of a fat selected from the group consisting of palm oil stearins, interesterified palm oil stearins, palm oil oleins, fully hydrogenated oils, and mixtures thereof may be used as a bakery fat, particularly a laminating fat for products such as puff pastry.

Low fat spread with ambient stability

Pernetti, M., Conopco Inc. d/b/a Unilever, January 29, 2009, US20090029025A1

Fat-continuous spreadable food product that comprises a dispersed aqueous phase, a primary emulsifier, polyglycerol polyricinoleate, 5–30 wt% of fat, and less than 1 wt% of hardstock and wherein the fat phase comprises at least 70 wt% of palm oil on fat phase, which is storage stable at ambient temperature and up to 40°C. The invention also provides for a method of making a spread without an inversion step.

Fatty acid hydroxylases and uses thereof

Meesapyodsuk, D., and Qiu, X., Bioriginal Food & Science Corp., January 29, 2009, US20090031454A1

The invention provides isolated nucleic acid molecules that encode novel fatty acid hydroxylases. The invention also provides recombinant expression vectors including hydroxylase nucleic acid molecules, host cells into which the expression vectors have been introduced, and methods for the production of hydroxyl fatty acids such as 12-hydroxyoctadec-9-enoic acid (ricinoleic acid).

Glycerol derivatives and methods of making same

Kodali, D., c/o Dorsey & Whitney LLP, November 27, 2008, US20080293602A1

Symmetrical polyols, polyol esters, polyesters, polyurethanes, triazoles, and polyvinylethers derived from glycerol and methods of making the symmetrical polyols, polyesters, polyurethanes, polyhydroxyvinylethers, and triazoles are discussed. Also provided is a method of making serinol [2-amino-1,3-propanediol].

Patent information is compiled by Scott Bloomer, a registered US patent agent with Archer Daniels Midland Co., Decatur, Illinois, USA. Contact him at scott_bloomer@admworld.com.

Extracts & Distillates

Effect of unsaturated acyl chains on structural transformations in triacylglycerols

Mykhaylyk, O.O., and C.M. Martin, *Eur. J. Lipid Sci. Technol. 111*:227–235, 2009.

Simultaneous time-resolved small-angle and wide-angle X-ray scattering has been used in the study of the isothermal crystallization behavior, after quenching, of triacylglycerols (TAG) with 18 carbons in the hydrocarbon chains. Saturated, unsaturated TAG, their blends, and mixed saturated/unsaturated TAG were studied. The mixed saturated/unsaturated TAG and their blends form an α_2-phase with a longitudinal packing different from two-chain and three-chain packings, which distinguishes them from the other fats. The unstable α_2-phase, observed at the initial stage of crystallization of mixed saturated/unsaturated TAG, is classified as a transient mesophase. Two dimeric units proposed for a structural model of the α_2-phase have been used to describe the structural organization of TAG molecules in the liquid state.

Fatty acid composition in tissues of mice fed diets containing conjugated linolenic acid and conjugated linoleic acid

Yuan, G.-F., A.J. Sinclair, H.-Y. Sun, and D. Li, *J. Food Lipids 16*:148–163, 2009.

The influence of 1% alpha-eleostearic acid (α-ESA, *cis*9,*trans*11,*trans* 13-18:3) and 1% punicic acid (PA, *cis*9,*trans*11,*cis*13-18:3) on fatty acid composition in mouse tissues was compared with conjugated linoleic acid (CLA, mixture of primarily *cis*9,*trans*11- and *trans*10,*cis*12-18:2) in the present study. The content (% total fatty acids) of 18:2n-6 was significantly reduced in the heart and adipose tissues, and total polyunsaturated fatty acids (PUFA) and n-6 PUFA were significantly reduced in adipose tissue by α-ESA, PA, and CLA feeding. The contents of 22:6n-3 and total n-3 PUFA were significantly increased in the liver, kidney, and heart by PA feeding, but not by α-ESA. In contrast to PA, supplementation with CLA significantly decreased 22:6n-3 in the liver, kidney and heart. The content of 20:4n-6 was significantly decreased in the liver and kidney by CLA feeding, but not by α-ESA and PA. The present results indicate that α-ESA, PA, and CLA have differential effects on 22:6n-3 and 20:4n-6 contents in mouse tissues. Conjugated linolenic acid (CLnA), a group of octadecatrienoic acid isomers with a conjugated triene system, has been reported to exhibit favorable physiological effects, including anticancer properties and regulation of lipid metabolism. Punicic acid and α-ESA, two isomers of CLnA, have been shown to convert into *cis*9,*trans*11-18:2 *in vivo*. The effect of CLnA on fatty acid composition in mouse tissues was investigated in comparison with CLA mixtures in the present study. The data obtained here could provide information for the potential application of CLnA-containing seeds as functional food ingredients, a natural source of endogenously formed *cis*9,*trans*11-18:2, and a dietary feeding strategy to beneficially modify the fatty acid composition of animal tissues.

Plant sterol consumption frequency affects plasma lipid levels and cholesterol kinetics in humans

AbuMweis, S.S., C.A. Vanstone, A.H. Lichtenstein, and P.J.H. Jones, *Eur. J. Clin. Nutr. 63*:747–755, 2009.

The objective of the study was to compare the efficacy of single versus multiple doses of plant sterols on circulating lipid level and cholesterol trafficking. A randomized, placebo-controlled, three-phase (six days/phase) crossover, supervised feeding trial was conducted in 19 subjects. Subjects were provided (i) control margarine with each meal; (ii) 1.8 g/day plant sterols in margarine with breakfast (single-BF) and control margarine with lunch and supper; or (iii) 1.8 g/day plant sterols in margarine divided equally at each of the three daily meals (three times per day). Relative to control, end-point plasma low-density lipoprotein (LDL) cholesterol concentrations were lower ($P < 0.05$) after consuming plant sterols three times per day but were not different when consumed once per day (3.43 ± 0.62, 3.22 ± 0.58, and 3.30 ± 0.65 mmol/L: control, three times per day, and single-BF, respectively). Relative to the control, end-point LDL level was 0.21 ± 0.27 mmol/L (6%) lower ($P < 0.05$) at the end of the three-times-per-day phase. Cholesterol fractional synthesis rate was highest ($P < 0.05$) after the three-times-per-day-phase (0.0827 ± 0.0278, 0.0834 ± 0.0245, and 0.0913 ± 0.0221 pool/day, control, single-BF and three times per day, respectively). Cholesterol-absorption efficiency decreased ($P < 0.05$) by 36 and 39% after the three times-per-day and single-BF phase, respectively, relative to control. Present data indicate that to obtain optimal cholesterol-lowering impact, plant sterols should be consumed as smaller doses given more often, rather than one large dose.

Delivery of lycopene to physiologically relevant vascular cells

Lorenz, M., V. Stangl, C. Jacob, K. Daemen, V. Böhm, K. Fröhlich, G. Baumann, K. Stangl, R. Simone, and P. Palozza, *J. Food Lipids 16*:259–272, 2009.

Lycopene most likely contributes to the positive health effects of tomatoes on the cardiovascular system. However, elucidation of underlying cellular mechanisms is hampered by the intricate solubility of lycopene in aqueous solutions. Cells relevant to the cardiovascular system, including bovine aortic endothelial cells (BAEC), the monocytic cell line THP-1, and RAT-1 fibroblasts, were treated for various time periods (0–72 h) with different concentrations of lycopene (1, 5, and 10 μM), solubilized either in tetrahydrofuran (THF) or micelles as solvents. Incubation of all three cell types led to a concentration- and time-dependent increase in cellular lycopene content. Both vehicles tested, THF and micelles, proved equally effective in the delivery of lycopene to cells. A marked difference in the amount of lycopene incorporated was observed among the various cell types. Compared with THP-1 cells, the uptake of lycopene using both solvents was higher in BAEC and RAT-1 fibroblasts for all concentrations and time points tested. Epidemiological data indicate a beneficial effect for consumption of tomato products in the prevention of cardiovascular diseases. Only limited data are available

on the cellular uptake of lycopene in vascular cells. Lycopene was successfully delivered to different cells relevant for the cardiovascular system. These results represent an important prerequisite for the study of molecular and cellular mechanisms by which lycopene may exert its beneficial effects on the cardiovascular system.

Current advances in sunflower oil and its applications

Garcés, R., E. Martínez-Force, J.J. Salas, and M. Venegas-Calerón, *Lipid Technol. 21*:79–82, 2009.

The fatty acid and triacylglycerol compositions of a vegetable oil determine its physical, chemical, and nutritional properties. The applications of a specific oil depend mainly on its fatty acid composition and the way in which fatty acids are arranged on the glycerol backbone. Minor components, e.g., tocopherols, also modify oil properties such as thermo-oxidative resistance. Sunflowerseed commodity oils predominantly contain linoleic and oleic fatty acids, with lower contents of palmitic and stearic acids. High-oleic sunflower oil, which can be considered as a commodity oil, has oleic acid up to around 90%. Additionally, new sunflower varieties with different fatty acid and tocopherol compositions have been selected. Owing to these modifications, sunflower oils possess new properties and are better adapted for direct home consumption, for the food industry, and for nonfood applications such as biolubricants and biodiesel production.

Fast gas chromatography: Applications in milk fat analysis

Povolo, M., and G. Contarini, *Lipid Technol. 21*:88–90, 2009.

In our society, saving time is important because time is money. For this reason the development of instrumentation able to perform high-speed analytical determinations is an ongoing matter, particularly regarding routine control analyses. In the last few years the possibility of performing gas chromatographic analysis in a very short time has been increasing. In this paper a general overview of fast chromatography and our experience in its application to the analysis of milk fat triacylglycerols is reported.

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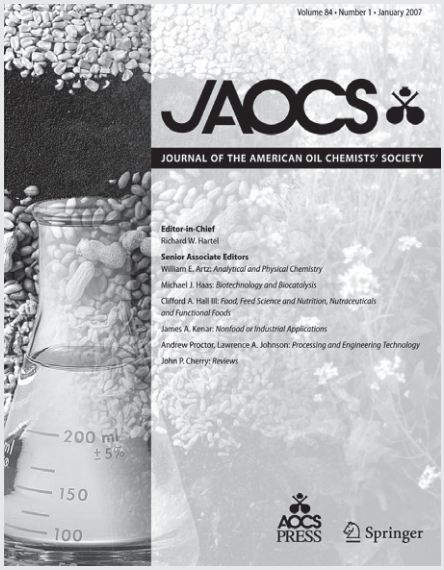
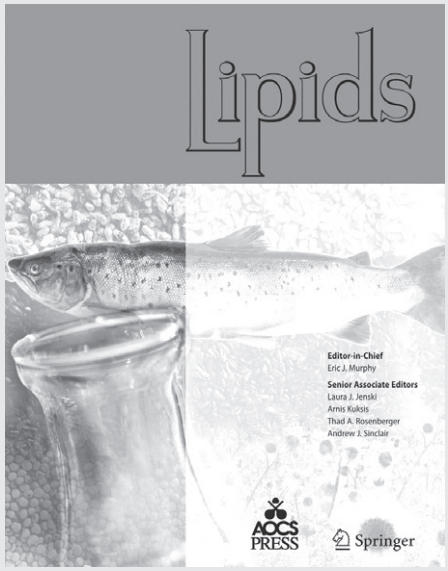


Journal of the American Oil Chemists' Society (July)

- Purification of GLA-triglycerides from evening primrose oil by gravimetric column chromatography, Rincón-Cervera, M.A., I. Rodríguez-García, J.L. Guil-Guerrero
- Characterization of oil extracted from buriti fruit (*Mauritia flexuosa*) grown in the Brazilian Amazon region, Silva, S.M., K.A. Sampaio, T. Taham, S.A. Rocco, R. Ceriani, and A.J.A. Meirelles
- Profiling of phytosterols, tocopherols, and tocotrienols in selected seed oils from Botswana by GC–MS and HPLC, Mitei, Y.C., J.C. Ngila, S.O. Yeboah, L. Wessjohann, and J. Schmidt
- Color measurements in blue-tinted cups for virgin-olive-oil tasting, Melgosa, M., L. Gómez-Robledo, R. Huertas, L.F. Capitán-Vallvey, M.J. Moyano, and F.J. Heredia
- Characterization of cross-linked lipase aggregates, Prabhavathi Devi, B.L.A., Z. Guo, and X. Xu
- Milk thistle seed oil constituents from different varieties grown in Iran, Fathi-Achachlouei, B., and S. Azadmard-Damirchi
- Products formed during thermo-oxidative degradation of phytosterols, Rudzińska, M., R. Przybylski, and E. Wąsowicz
- Characterization of Turkish virgin olive oils produced from early harvest olives, Dıraman, H., and H. Dibeklio lu
- Synthesis of sodium (+)-(12*S*,13*R*)-epoxy-*cis*-9-octadecenyl sulfonate from vernonia oil, Sutton, D.C., N.S. Johnson, C. Hlongwane, and F.O. Ayorinde
- Chemical and enzymatic interesterification of a blend of palm stearin: soybean oil for low *trans*-margarine formulation, Costales-Rodríguez, R., V. Gibon, R. Verhé, and W. De Greyt
- Comparative oxidative stability of fatty acid alkyl esters by accelerated methods, Moser, B.R.
- Plant sterol and policosanol characterization of hexane extracts from grain sorghum, corn, and their DDGS, Leguizamón, C., C.L. Weller, V.L. Schlegel, and T.P. Carr



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- Low and high fat diets inconsistently induce obesity in C57BL/6J mice and obesity compromises n-3 fatty acid status, Tallman, D.L., A.D. Noto, and C.G. Taylor
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- Effects of dietary coconut oil on the biochemical and anthropometric profiles of women presenting abdominal obesity, Assunção, M.L., H.S. Ferreira, A.F. dos

Santos, C.R. Cabral, and T.M.M.T. Florêncio

- Effect of ALA-enriched food supply on cardiovascular risk factors in males, Sioen, I., M. Hacquebard, G. Hick, V. Maindiaux, Y. Larondelle, Y.A. Carpentier, and S. De Henauw
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- Characterization of both polyunsaturated fatty acid biosynthetic pathways in *Schizochytrium* sp., Lippmeier, J.C., K.S. Crawford, C.B. Owen, A.A. Rivas, J.G. Metz, and K.E. Apt
- Effect of bilayer phospholipid composition and curvature on ligand transfer by the α-tocopherol transfer protein, Zhang, W.X., G. Frahm, S. Morley, D. Manor, and J. Atkinson
- Dietary lipid level induced antioxidant response in Manchurian trout, *Brachymystax lenok* (Pallas) larvae, Zhang, H., Z. Mu, L. Xu, G. Xu, M. Liu, and A. Shan
- New 17-methyl-13-octadecenoic and 3,16-docosadienoic acids from the sponge *Polymastia penicillus*, Denis, C., G. Wielgosz-Collin, A. Bretéché, N. Ruiz, V. Rabesaotra, N. Boury-Esnault, J.-M. Kornprobst, and G. Barnathan
- Differences in sterol composition between male and female gonads of dominant limpet species, Kawashima, H., M. Ohnishi, and S. Ogawa
- Effect of ALA-enriched food supply on cardiovascular risk factors in males, Sioen, I., M. Hacquebard, G. Hick, V. Maindiaux, Y. Larondelle, Y.A. Carpentier, and S. De Henauw

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Comparison of two gas-liquid chromatograph columns for the analysis of fatty acids in ruminant meat

Alves, S.P., and R.J. Bessa, *J. Chromatogr. A 1216*:5130–5139, 2009.

Two gas-liquid chromatograph capillary columns for the analysis of fatty acids (FA) in ruminant fat are compared. Those columns are the CP-Sil 88 having a length of 100 m and a highly polar stationary phase and the Omegawax 250 having a length of 30 m and a stationary phase of intermediate polarity. Fatty acid methyl ester (FAME) patterns of branched-chain, *cis* and *trans* octadecenoate isomers as well as conjugated and nonconjugated 18:2 and 18:3 isomers are fairly different between columns, even though most of the FAME could be separated on either column. However, the CP-Sil 88 showed better resolution of 18:1 isomers than Omegawax 250. The analysis of 96 samples of ruminant meat fat in both chromatographic systems showed that averages obtained for total FA content and for most of the individual FA did not differ between columns. Moreover, regression analysis of Omegawax and CP-Sil 88 data is highly correlated. Quantitative differences between chromatographic systems were detected for samples containing more than 66 mg fatty acids per gram of muscle dry matter.

Feasibility for improving phytonutrient content in vegetable crops using conventional breeding strategies: Case study with carotenoids and tocopherols in sweet corn and broccoli

Ibrahim, K.E., and J.A. Juvik, *J. Agric. Food Chem. 57*:4636–4644, 2009.

Among vegetables, sweet corn (*Zea mays* L.) and broccoli (*Brassica oleracea* L. ssp. *italica*) are important sources of dietary carotenoids and tocopherols. Because medical evidence suggests that carotenoid and tocopherol health-promoting activity acts in a dose-dependent manner, conventional breeding to develop elite sweet corn and broccoli germplasm with enhanced levels of these phytochemicals will potentially promote health among the consuming public. This investigation includes the quantitative analysis of carotenoid and tocopherol contents of 41 corn and 24 broccoli genotypes grown in multiple environments (years and seasons in one location) to partition the variation into genetic, environment, and genotype by environment interaction (G × E) components and measure the phenotypic stability of genotypes for these phytochemicals. The primary carotenoids and tocopherols in corn were lutein and γ-tocopherol (65 and 73% of total carotenoid and tocopherol, respectively), whereas β-carotene and α-tocopherol were dominant in broccoli (65 and 79% of total carotenoid and tocopherol, respectively). Partitioning of the variance indicated that genetic differences among the genotypes averaged for the primary compounds in corn (lutein, zeaxanthin, and α- and γ-tocopherol) and broccoli (β-carotene, lutein, and α- and γ-tocopherol) accounted for the largest proportion of the variation (67 and 55% of total phenotypic variation averaged across the phytochemicals in sweet corn and broccoli, respectively). Stability analysis identified several corn (IL451b sh2 and IL2027-8 sh2) and broccoli ("Pirate" and "Baccus") genotypes with relatively high mean concentrations for the various carotenoids and tocopherols that were comparatively stable across seasons and years. The results of this investigation suggest that sweet corn and broccoli germplasm with enhanced concentrations of carotenoids and tocopherols can be developed using conventional breeding protocols.

Enrichment of amaranth oil with ethyl palmitate at the *sn*-2 position by chemical and enzymatic synthesis

Pina-Rodriguez, A.M., and C.C. Akoh, *J. Agric. Food Chem. 57*:4657–4662, 2009.

Amaranth oil is rich in linoleic, oleic, and palmitic acids. Structured lipids (SL) with specific functional and nutritional characteristics can be prepared through chemical or enzymatic interesterification. The aim of this study was to increase the palmitic acid content at the *sn*-2 position in amaranth oil triacylglycerols for possible use in infant formula. Chemical and enzymatic interesterification techniques were assessed before selecting the latter for further optimization modeling. Enzymatic interesterification of ethyl palmitate and amaranth oil significantly increased the total content of

palmitic acid, reduced linoleic acid content, and increased the amount of palmitic acid at the *sn*-2 position of the SL product. Even though amaranth oil content of palmitic acid (18.3%) was originally similar to that in breast milk (18.3–25.9%), the structural changes induced through enzymatic modification resulted in a SL closely resembling breast milk fat and hence its possible application as a fat substitute for infant nutrition. A second-order polynomial model was developed to predict the amount of total palmitic acid incorporated when reaction time and substrate level were manipulated, and to optimize the combination of parameters to achieve specific palmitic acid contents in amaranth oil. The resulting model is useful to develop an SL from amaranth oil enriched with palmitic acid specifically at the *sn*-2 position for possible application in infant formulas

Physical characterization of lard partial acylglycerols and their effects on melting and crystallization properties of blends with rapeseed oil

Cheong, L.-Z., H. Zhang, Y. Xu, and X. Xu, *J. Agric. Food Chem. 57*:5020–5027, 2009.

This work attempted to examine the effects of lard partial acylglycerols on the melting and crystallization properties of blends with lard and rapeseed oil (LR). Partial acylglycerols [lard-monoacylglycerols (lard-MAG) and lard-diacylglycerols (lard-DAG)] were found to result in different melting and crystallization properties of LR. Lard-MAG exerted a slight inhibitory effect on crystallization of LR. Nevertheless, it was not statistically significant ($P > 0.05$). In fact, the presence of lard-MAG did not change the solid fat content (SFC) of LR. Lard-DAG, on the other hand, exerted different effects on the crystallization of LR depending on its concentration and degree of supercooling. The presence of a low concentration of lard-DAG was found to significantly ($P < 0.05$) delay nucleation and crystal growth velocity of LR at low degree of supercooling, which was reflected by a reduced Avrami constant (k) and SFC and increased half-time of crystallization ($t_{1/2}$). Meanwhile, a high concentration of lard-DAG was found to promote nucleation and crystal growth in LR at low degrees of supercooling with increased k and SFC and decreased $t_{1/2}$. The characteristics of the blends may have correlations with their properties in potential meat applications.

Increase of cholesterol oxidation and decrease of PUFA as a result of thermal processing and storage in eggs enriched with n-3 fatty acids

Mazalli, M.R., and N. Bragagnolo, *J. Agric. Food Chem. 57*:5028–5034, 2009.

In this work, cholesterol oxide formation and alteration of fatty acid composition were analyzed in n-3 enriched eggs under different storage periods and two temperatures. The eggs enriched with n-3 fatty acids were stored at 5 or 25°C for 45 days and subsequently boiled or fried. For each treatment, 12 yolks were analyzed every 15 days including time zero. The concentrations of the cholesterol oxides 7-ketocholesterol, 7β-hydroxycholesterol, and 7α-hydroxycholesterol increased during the storage period and were higher in fried eggs. Only the 7-ketocholesterol was affected by the storage temperature, and its concentration was highest in eggs stored at 25°C. There was no significant difference in the contents of cholesterol and vitamin E at the different storage periods; however, the concentration of vitamin E decreased with thermal treatment. In addition, the n-3 polyunsaturated fatty acids, especially 18:3, 20:5, and 22:6, were reduced throughout the storage at 5 and 25°C.

Fate of fat: The role of adipose triglyceride lipase in lipolysis

Zimmermann, R., A. Lass, G. Haemmerle, and R. Zechner, *Biochim. Biophys. Acta, Mol. Cell Biol. Lipids 1791*:494–500, 2009.

Lipolysis, the coordinated catabolism of triacylglycerol (TG) stored in cellular lipid droplets, provides fatty acids, di-, and monoglycerides. These products are important energy substrates, precursors for other lipids, or lipid-signaling molecules. Following their discovery by C.H. Hollenberg, M.S. Raben, and E.B. Astwood (1961) and M. Vaughan, J.E. Berger, and D. Steinberg (1964), hormone-sensitive lipase (HSL) and monoacylglycerol lipase stayed in the focus of research for three decades. Within the last decade, however, it became evident that the lipolytic pathway is incompletely understood. Studies on the regulation of lipolysis and the characterization of HSL-deficient mice indicated that additional previously unrecognized factors that contribute to fat catabolism must exist. This led to the discovery of the perilipin, adipophilin, Tip47 (PAT) family of lipid droplet-binding proteins and the identification of a novel TAG hydrolase named adipose triglyceride lipase (ATGL). This review focuses on the importance of ATGL as TG lipase within the "lipolytic machinery" and the current knowledge of molecular mechanisms that regulate ATGL activity.

Fast method for monitoring phospholipase A_2 activity by liquid chromatography–electrospray ionization mass spectrometry

Schebb, N.H., D. Falck, H. Faber, E.-M. Hein, U. Karst, and H. Hayen, *J. Chromatogr. A 1216*:5249–5255, 2009.

A new liquid chromatography–electrospray ionization mass spectrometry (LC–ESI-MS) method for the fast determination of phospholipase A_2 (PLA_2) activity has been developed. For the first time, the method allows the parallel detection of glycerophosphatidylcholine (GroPCho) as PLA_2 substrate as well as of its products fatty acid (FA) and lyso-GroPCho. ESI-MS was carried out in negative ion mode, detecting the FA as $[M - H]^-$ ions and the lyso-GroPCho and GroPCho as acetate adducts $[M + Ac]^-$. Utilizing a fast gradient on a short C_5-modified silica gel column with 3 μm particles, five GroPCho, five FA, and six lyso-GroPCho could be separated according to their chain length in less than 3 min. A very high average chromatographic efficiency of 41,200 theoretical plates (plate height 0.5 μm) was achieved for the separation of the GroPCho. The method was applied for monitoring the release of arachidonic acid (20:4 FA) and 1-stearoyl-lyso-*sn*-GroPCho (18:0 GroPCho) from unilamellar vesicles of 1-stearoyl-2-arachidonoyl-*sn*-GroPCho (18:0/20:4 GroPCho). With a limit of detection of 0.5 pmol (total amount injected on column) for the FA and lyso-GroPCho and 1.5 pmol for the GroPCho as well as a

linear range of 1.5 decades, the method has proven to be suitable for the monitoring of different secretory PLA_2 ($sPLA_2$) conversions. Furthermore, it was applied to screen a small library of PLA_2 inhibitors for their activity toward $sPLA_2$ type V and snake venom of *Bothrops moojeni*. In both cases, active samples could be directly identified. With its short analysis time, its high chromatographic efficiency, and the parallel detection of substrate and all products, the developed LC–ESI-MS method is well suited for the analysis of PLA_2 activity.

Automated lipid identification and quantification by multidimensional mass spectrometry-based shotgun lipidomics

Yang, K., H. Cheng, R.W. Gross, and X. Han, *Anal. Chem. 81*:4356–4368, 2009.

This article presents the strategies underlying the automated identification and quantification of individual lipid molecular species through array analysis of multidimensional mass spectrometry-based shotgun lipidomics (MDMS-SL) data, which are acquired directly from lipid extracts after direct infusion and intrasource separation. The automated analyses of individual lipid molecular species in the program use a strategy in which MDMS-SL data from building block analyses employing precursor ion scans, neutral loss scans, or both are used to identify individual molecular species, followed by quantification. Through this strategy, the program screens and identifies species in a high-throughput fashion from a built-in database of over 36,000 potential lipid molecular species constructed employing known building blocks. The program then uses a two-step procedure for quantification of the identified species possessing a linear dynamic range over three orders of magnitude and re-verifies the results when necessary through redundant quantification of multidimensional mass spectra. This program is designed to be easily adaptable for other shotgun lipidomics approaches that are currently used for mass spectrometric analysis of lipids. Accordingly, the development of this program should greatly accelerate high-throughput analysis of lipids using MDMS-SL. ■

Meet Rivka Efrat

Honored Student Rivka Efrat expects to receive her Ph.D. from The Hebrew University of Jerusalem by the end of 2009. What will come next? "I hope to continue investigations in surface chemistry either at a university or in industry," she told *inform*.

Efrat remembers her first meeting with her Ph.D. supervisors, Nissim Garti and Abraham Aserin. "They suggested I work on several different subjects. One of them was 'cubic liquid crystalline phases and their soft dispersed particles.' The possibility of designing and creating nanoparticles with sophisticated inner structures drew my curiosity," she said.

The first part of her study examines the influence of an added third component to a lyotropic liquid crystal of cubic structure with the purpose of lowering its viscosity. "The second part focuses on the structure of a low-viscosity cubic phase—the new cubic phase that results from the addition of guest molecules of biological value at increasing concentrations to its maximum solubilization capacity," she noted. "The guest molecules that were studied included an ionic drug, insoluble in water, and hydrophobic molecules with added health benefits," she added. "The third part of the project focuses on researching and producing nano-particulated structures with internal cubic organization (cubosomes or micellosomes)," she concluded.

In her time away from the laboratory, Efrat likes trekking, gymnastics, reading books, and exploring new software. Assuming she has free time, that is: She is the mother of three children and reports that her husband and children all "are very supportive of my love of science." ■

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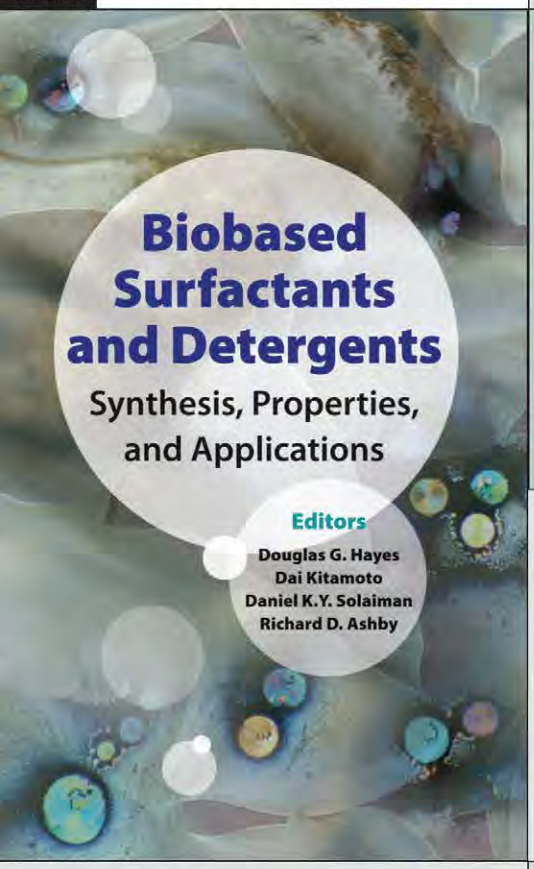

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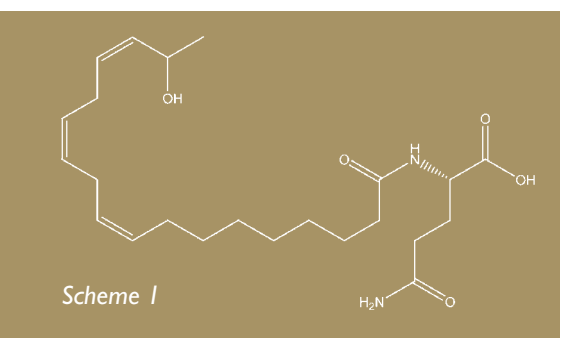
Brent Sørensen

Emerging research in insect lipids

Although insects represent over half of all known living species, there has been relatively little focus placed on the study of lipids in this highly diverse group of animals. Aside from universal functions such as energy storage (for flight and metamorphosis), signaling, and structural components of membranes, fatty acids (FA) serve as precursors for pheromones that are used for communication. They are also major components of cuticular wax, which prevents moisture loss and protects the insect against fungal and bacterial infection. In certain cultures, the potential uses of insect oils have long been recognized.

FA PROFILES

FA are stored in the form of triacylglycerol (TAG) in the fat body, but they are transferred in the form of *sn*-1,2 diacylglycerol bound to lipophorin (a lipoprotein). The FA profile of each insect varies with lipid class and tissue, as well as the developmental stage and sex of the insect. In generalist insects (those that are able to use a wide array of food sources), the FA composition of the insect largely reflects that of the diet. FA patterns in parasitic insects also are similar to those in their hosts. The major FA in insects are usually linoleic acid (18:2) and α-linolenic acid (18:3). Diptera, an order that includes flies and mosquitoes, can be distinguished by relatively high levels of 16:1, while Hemiptera (sucking insects) have high levels of myristic acid (14:0). In species of Lepidoptera (butterflies and moths), odd-numbered carbon-chain FA including 15:0, 15:1, 17:0, and 17:1 were found, suggesting that there was a different oxidation mechanism, or that these FA were synthesized from propanoate (3:0) instead of acetate (2:0).



Scheme 1

A number of hydroxy FA are found in insects including 9,10,16-trihydroxy-hexadecanoic acid (aleuritic acid), which is found in substantial amounts in the secretion of the tac bug, *Tacharadia lacca,* and is a major component of shellac. Beeswax and royal jelly contain a number of hydroxy FA, including 17-hydroxy-octadecanoic acid. Branched-chain FA have been found in aphids, mainly in the extracts of overcrowded larval cultures. Acetylenic FA are present in a number of insects, mainly as pheromone precursors. Whereas FA found in insects are also generally found in higher organisms, there are examples unique to insects, including *trans* sorbic acid (6:2), which is found in certain aphids but not in their host plants. The mealybug, *Pseudococcus comstocki*, contains up to 12% tetradecan-1,14-dioic acid.

Both 18:2 and 18:3 are considered essential to most insect species and must be consumed in the larval diet. Larvae grown on an 18:3-deficient diet are characterized by decreased growth and survival rates. Certain insects (crickets and beetles) are able to produce 18:2 *de novo* via recently characterized Δ-12 desaturases. Whitefly also appears to be able to convert labeled acetate to 18:3. Most insects are able to elongate 18:2 and 18:3 into longer-chain FA, including eicosapentaenoic aicd (20:5, or EPA). Mosquitoes, however, lack such mechanisms, and therefore EPA is considered essential for them. The exact roles of these essential FA, however, are still uncertain.

Some essential FA are found as fatty acid conjugates (FAC), for example N-(17-hydroxylinolenoyl)-L-glutamine, or volicitin (see Scheme 1), found in the oral secretions of certain Lepidopteran larvae. Volicitin triggers defense responses in the plants, including the emission of volatiles that attract wasps to attack their larval prey. These FAC, however, are also thought to benefit the insect, acting as a surfactant to aid digestion or allowing the insect to store glutamine, which is crucial in nitrogen metabolism. Insects have also evolved a mechanism whereby FA are esterified to phytoecdysteroids, facilitating their rapid excretion. Ecdysteroids are insect molting hormones that signal the insect to shed its rigid exoskeleton, enabling further growth. Many plants produce identical ecdysteroids in substantially higher amounts to defend against insect invasion by causing premature molting.

NOVEL APPLICATIONS

A greater understanding of insect lipids and their metabolism has allowed the development of many novel applications. Many insects

are serious agricultural pests and cause billions of dollars in crop damage annually. Cyclopropene FA have been effective in inhibiting desaturation of pheromone precursors, thereby restricting mating and propagation of many pest species. Recently, larvae of the European corn borer moth, *Ostrinia nubilalis*, were fed diets supplemented with conjugated linoleic acid (CLA). Decreases in the incorporation of unsaturated FA and survival rate were noted, suggesting that CLA may be used as an ecologically friendly pest control method.

In many developing countries, edible insects are an important food source, and their rearing has been considered a strategy for achieving global food security. Although entomophagy is generally taboo in Western culture, the practice is gaining increased acceptance. Aside from being rich in high-quality proteins, phytophagous insects are rich in essential FA. In Sudan, melon bug oil (MBO) and sorghum bug oil (SBO) are extracted and used for cooking, particularly in times of famine. The oils are also used for meat preservation and have been considered for use as antibacterial agents. Both oils have high oxidative stability, which is advantageous in countries with high temperatures and limited cold storage. Blending MBO and SBO with sunflower oil has been shown to increase its stability. Esters have also been prepared from these oils, and their potential as biodiesel has been studied.

Traditionally, many insects and their larvae have been applied as cancer treatments. Several FA with anticancer activity have recently been isolated from *Protaetia brevitarsis* larvae. There is also potential for the lipid content of insects to be engineered, introducing nutraceutical FA such as CLA. Silkworms fed on leaves sprayed with CLA readily incorporated the isomers into triglycerides. Powdered silkworm is currently sold in countries such as Japan and Korea as a treatment for diabetes. The health benefits of CLA are synergistic with those inherent in silkworm.

Insects have been used as models to study memory and behavior, and may also have application in the study of many lipid-related diseases.

Much about insect lipids and their metabolism remains to be understood, and a host of innovations relevant to agriculture and medicine may yet be discovered. One can hope that this interesting field will continue to gain recognition.

inform Contributing Editor Brent Sørensen is currently a Ph.D. student at the Max Planck Institute for Chemical Ecology in Jena, Germany. He may be contacted at bsoerensen@ice.mpg.de.

information

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Award Address

Regiospecific quantification of triacylglycerols containing ricinoleate and dihydroxy fatty acids in castor oil by mass spectrometry

Editor's note: The following article is based on the address given by Jiann-Tsyh (Ken) Lin, the 2009 Herbert J. Dutton Award winner, at the 100th AOCS Annual Meeting & Expo, held in Orlando, Florida, USA, May 3–6.

Jiann-Tsyh (Ken) Lin

The presence of a hydroxyl group on a fatty acid drastically changes the physical properties of the oil, for example, viscosity, pour point, melting point, solubility, and crystal structure. Ricinoleate (R, OH18:1, Fig. 1), a monohydroxy fatty acid, has many industrial uses (including in the manufacture of aviation lubricant, plastic, paint, and cosmetics), because of the presence of a hydroxyl group. Ricinoleate occurs as acylglycerols (AG) in castor oil, and about 70% of castor oil is triricinolein (RRR). Castor oil is the only commercial source of ricinoleate. We have previously identified and quantified 14 molecular species of AG containing ricinoleate in castor oil using high-performance liquid chromatography (HPLC) as shown in Figure 2 and Table 1 (Lin *et al*., 2003). We have also recently identified four diacylglycerols (DAG) and eight triacylglycerols (TAG) in castor oil containing dihydroxy fatty acids (Lin *et al*., 2009). These dihydroxy fatty acids were new fatty acids and were proposed as 11,12-dihydroxy-9-octadecenoic acid (11,12-dihydroxyoleic acid, diOH18:1), 11,12-dihydroxy-9,13-octadecadienoic acid (diOH18:2), and 11,12-dihydroxyoctadecanoic acid (11,12-dihydroxystearic acid,diOH18:0) as shown in Figure 1. Dihydroxy fatty acids were not previously reported in higher plants. According to HPLC, the AG containing dihydroxy fatty acids represented about 2.5% of the castor oil. Individual AG containing dihydroxy fatty acids were about 0.5% or less. The physical properties of dihydroxy fatty acids are different from those of ricinoleate. Dihydroxy fatty acids have not been used in industry yet and can be used to produce biobased products similar to those of ricinoleate with different physical properties, for example, as a thickening agent for lubricants.

Regioisomers of TAG also affect the physical properties of the oils for industrial uses. Regioisomers of TAG in biological samples have been identified and quantified by mass spectrometry (MS) based on the premise that the loss of the acyl chain from the *sn*-1 or *sn*-3 position is energetically favored over the loss from the *sn*-2 position. We have identified and quantified the regiospecific TAG in castor oil using a different MS method. The regiospecific quantification of both AAB (with two different fatty acids) and ABC types (with three different fatty acids) of TAG containing ricinoleate and dihydroxy fatty acids by MS is presented here. The regiospecific identification and quantification of TAG can help in both the industrial uses of the oils and the understanding of the biosynthesis of TAG (Fig. 3) for the development of transgenic oil seed plants to produce ricinoleate and dihydroxy fatty acids.

REGIOSPECIFIC ANALYSIS OF TAG IN CASTOR OIL

The regiospecific fragment ions used for the analysis of regioisomers of TAG were from the loss of the fatty acid specific at the *sn*-2 position as α,β-unsaturated fatty acid using electrospray ionization (ESI)–MS of TAG lithium adducts. Six diricinoleoylacylglycerols (RRAc) containing one non-ricinoleoyl chain in the HPLC fractions of castor oil (Fig. 2) were used for the regiospecific quantification

TABLE 1. *Molecular species of acylglycerols identified and their contents (%) in castor oil*

Acylglycerols[a]	%	Acylglycerols	%	Acylglycerols	%
RR	0.14	RRO	7.23	RLS	0.02
RRR	70.92	RRRR	0.47	ROS	0.01
RRLs	0.67	RRS	1.08	LLL	0.002
RRLn	0.15	RLL	0.08	LLO	0.005
RRL	6.58	RLO	0.13	LOO	0.01
RRP	1.57	ROO	0.05		

[a]Abbreviation: R = ricinoleic acid, Ls = lesquerolic acid, Ln = linolenic acid, L = linoleic acid, O = oleic acid, P = palmitic acid, S = stearic acid, RR = diricinoleoylglycerol, RRRR = (ricinoleoylricinoleoyl)diricinoleoylglycerol.

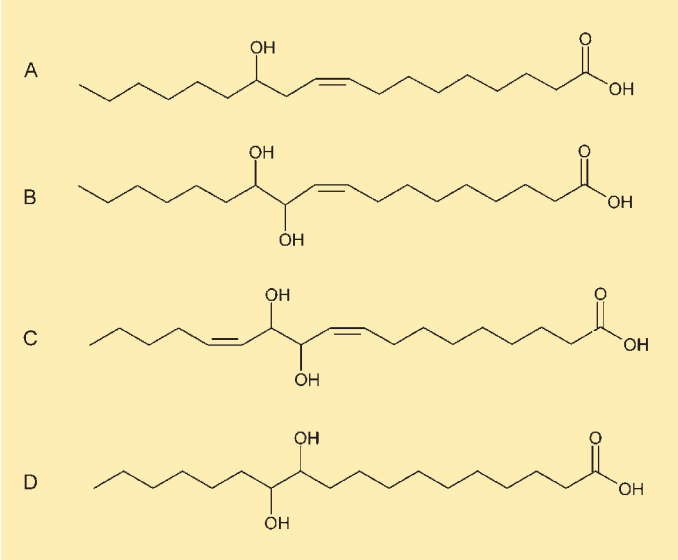

FIG. 1. *The structure of ricinoleate and the proposed structures of dihydroxy fatty acids in castor oil (Lin et al., 2009). (A) ricinoleate; (B) 11,12-dihydroxy-9-octadecenoic acid, (C) 11,12-dihydroxy-9,13-octadecadienoic acid, (D) 11,12-dihydroxyoctadecanoic acid.*

(Lin and Arcinas, 2007). The non-ricinoleoyl chain (Ac) was a normal fatty acid—oleic acid (O), linoleic acid (L), linolenic acid (Ln), stearic acid (S), and palmitic acid (P)—or a hydroxy fatty acid, lesquerolic acid (Ls). The MS^2 spectra of $[RRAc + Li]^+$ showed the fragment ions of $[RRAc + Li - RCOOH]^+$ and $[RRAc + Li - AcCOOH]^+$, reflecting the neutral losses of ricinoleic acid and non-ricinoleic acid, respectively. The fragment ions of $[RRAc + Li - RCOOH]^+$ were used for MS^3 fragmentations. The MS^3 spectra showed the fragment ions from the loss of fatty acids specific at the *sn*-2 position as α,β-unsaturated fatty acid, $[RRAc + Li - RCOOH - AcCH{=}CHCOOH]^+$ and $[RRAc + Li - RCOOH - RCH{=}CHCOOH]^+$. Hsu and Turk (in Lin and Arcinas, 2007) proposed a fragmentation pathway of the loss of fatty acid specific at the *sn*-2 position as an α,β-unsaturated fatty acid from TAG lithium adducts (MS^3). The abundance of the latter ion was very low except for RRLs. The abundances of these two ions reflected the abundances of the two fatty acids at the *sn*-2 position and also the abundances of the two regioisomers of RAcR and RRAc (AcRR). The approximate contents of RAcR among the three stereoisomers—RAcR, RRAc, and AcRR—combined were as follows: ROR (91%), RLR (95%), RLnR (96%), RSR (96%), RPR (78%), and RLsR (31%). The non-hydroxyl fatty acids were mostly at the *sn*-2 position of TAG in castor oil. Figure 3 shows the proposed biosynthetic pathway of castor oil. Transgenic inhibition of phospholipase C hydrolysis of phosphatidylcholines might be used to block the incorporation of non-hydroxyl fatty acids into TAG, thus increasing the content of ricinoleate in seed oil.

We have previously identified (12-ricinoleoylricinoleoyl) diricinoleoylglycerol [RRRR, tetraacylglycerol]) in castor oil by ESI-MS of the RRRR sodium adduct. HPLC-purified RRRR from castor oil (Fig. 2) was subjected to ion trap and high-resolution $ESI\text{-}MS^2$ for identification. By using $ESI\text{-}MS^4$ of the lithium adduct of RRRR, the regiospecific location of 12-ricinoleoylricinoleoyl chain on the glycerol backbone was identified and quantified by the ions from the losses of the acyl chains specific at the *sn*-2 position as α,β-unsaturated fatty acids (Lin and Arcinas, 2008). Ninety-five percent of the 12-ricinoleoylricinoleoyl chain was identified at the *sn*-2 position of RRRR.

TAG containing dihydroxy fatty acids were eluted before RRR (Fig. 2). No TAG containing dihydroxy fatty acids and non-hydroxyl fatty acid were detected, and TAG containing three dihydroxy fatty acids were detected in castor oil. The two regioisomers

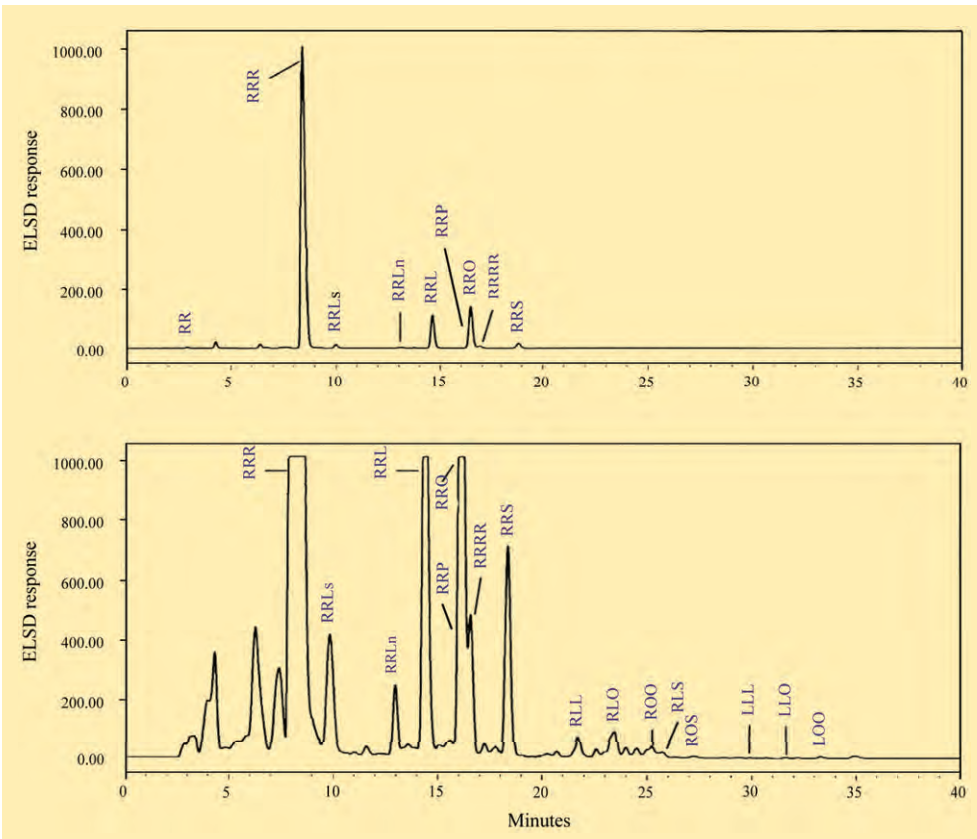

FIG. 2. *High-performance liquid chromatography chromatograms of castor oil detected by evaporative light-scattering detector (ELSD; Lin et al., 2009). (A) 0.032 mg of castor oil in 4 µL ethanol; (B) 0.79 mg of castor oil in 100 µL ethanol. C_{18} column (25 × 0.46 cm, 5 µm). Eluent: Linear gradient from 100% methanol to 100% isopropanol in 40 min. Flow rate: 1 mL/min. Abbreviations: Acylglycerols, where R = ricinoleic acid, Ls = lesquerolic acid, Ln = linolenic acid, L = linoleic acid, O = oleic acid, P = palmitic acid, S = stearic acid, RR = diricinoleoylglycerol, RRRR = (ricinoleoylricinoleoyl)diricinoleoylglycerol.*

of TAG of the AAB type were quantified by the ESI-MS^3 of the TAG lithium adducts using the regiospecific ions from the losses of fatty acids specific at the *sn*-2 position as α,β-unsaturated fatty acids, as described as that of RRAc. The approximate contents of regioisomers are as follows: diOH18:1-OH18:1-diOH18:1 (92%), diOH18:1-OH18:1-OH18:1 (92%), diOH18:1-diOH18:0-diOH18:1 (91%), diOH18:2-OH18:1-OH18:1 (80%), and diOH18:0-OH18:1-OH18:1 (96%). Three regioisomers of TAG of the ABC type were also quantified by the ESI-MS^3 of the TAG lithium adducts.

However, the MS^2 spectra of $[ABC + Li]^+$ showed the fragment ions of $[ABC + Li - A]^+$, $[ABC + Li - B]^+$ and $[ABC + Li - C]^+$ reflecting the neutral losses of three fatty acids, A, B, and C, respectively. From the MS^3 spectrum of $[ABC + Li - A]^+$, the ratio of fatty acids B:C at the *sn*-2 position was obtained. Similarly, from the other two ions the ratios of A:B and A:C were also obtained. From the ratios of A:B and B:C, the ratio A:B:C can be estimated. The ratio of A:B:C also can be estimated from A:B and A:C, as well as from A:C and B:C. We have obtained the ratio OH18:1:diOH18:1:diOH18:2 of TAG (ABC), as 71:5:24, 85:6:9, and 64:15:21. The variation might be due to the different abundances of the regiospecific ions from the different precursor ions and the different regiospecific ions. The average of the three ratios (three regioisomers) was about 7:1:2. We also estimated the ratio of OH18:1: diOH18:0: diOH18:1 (three regioisomers) of TAG (ABC) as 7:2:1.

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CONCLUSION

The non-hydroxyl fatty acids are predominantly at the *sn*-2 position of TAG (RAcR) that contain two ricinoleate and one non-hydroxyl normal fatty acid in castor oil. The ricinoleoylricinoleoyl chain is predominantly at the *sn*-2 position of RRRR in castor oil. For the TAG containing dihydroxy fatty acids and ricinoleate in castor oil, ricinoleate is predominantly at the *sn*-2 position and dihydroxy fatty acids are predominantly at the *sn*-1,3 position.

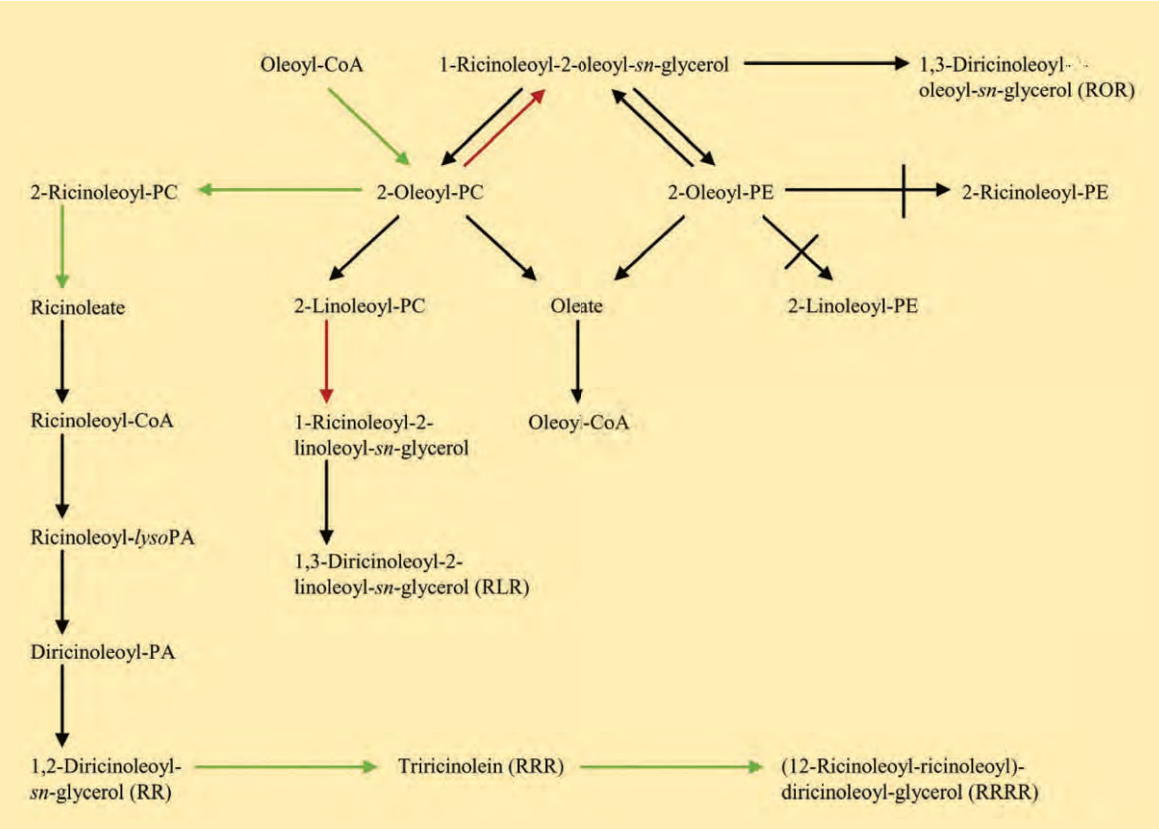

FIG. 3. *Proposed biosynthetic pathway of castor oil (Lin et al., 2009). Green arrows show the key enzyme steps driving ricinoleate into acylglycerols. Two arrows with solid bars show a complete block. Red arrows show the phospholipase C hydrolysis, which can be targeted to block the incorporation of non-hydroxyl fatty acids into triacylglycerols to increase (presumably) the content of ricinoleate in transgenic seed oils. PC, phosphatidylcholine; PA, phosphatidic acid; PE, phosphatidylethanolamine.*

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—JIM KENAR

Ultra-efficient technology for drying and conditioning grains and oilseeds

Editor's note: The third in a periodic series, this article is based on a presentation given Wednesday, May 6, in the Processing Exhibitor Session at the 100th AOCS Annual Meeting & Expo. For the first two articles from this series, see inform 20:469–472 and 473–475.

Farah Salaria

The drying of oilseeds and grains is critical for downstream processing and storage. It prevents caking, agglomeration, spoilage, and degradation of material. Controllability of the drying process is important in order to compensate for changes in the feedstock. Excessive drying of solids is undesirable and results in weight loss, whereas too much moisture can lead to degradation and numerous quality issues during storage, as well as the imposition of penalties at sale. Varying weather and process conditions call for more efficient and flexible methods of drying. Also, solids have different limits on temperatures to which they can be heated and varying ideal moisture content for storage.

Natural drying is not always an option, and many variations of the air-drying method have been used. The drying process is governed by typical factors such as ambient conditions, relative humidity, temperature, grain texture, sensitivity to heat, moisture content, and toughness of the grains.

Conventional methods for drying oilseeds and grains typically use high volumes of hot air that are blown through the bed of grains. Use of hot air as the heating media, as well as for moisture removal, limits the efficiency of this technique. Large volumes of air must be heated for heat transfer, and as the air picks up moisture from grains, the temperature of the air drops and the air reaches saturation. The larger the volume of air used, the more energy that is expended; much of this energy is lost up the stack (Fig. 1).

Many drying techniques have thermal efficiencies as low as 30%. Also, the distribution of air through the bulk solid beds and silos is often not ideal, which leads to non-uniform heat transfer and drying.

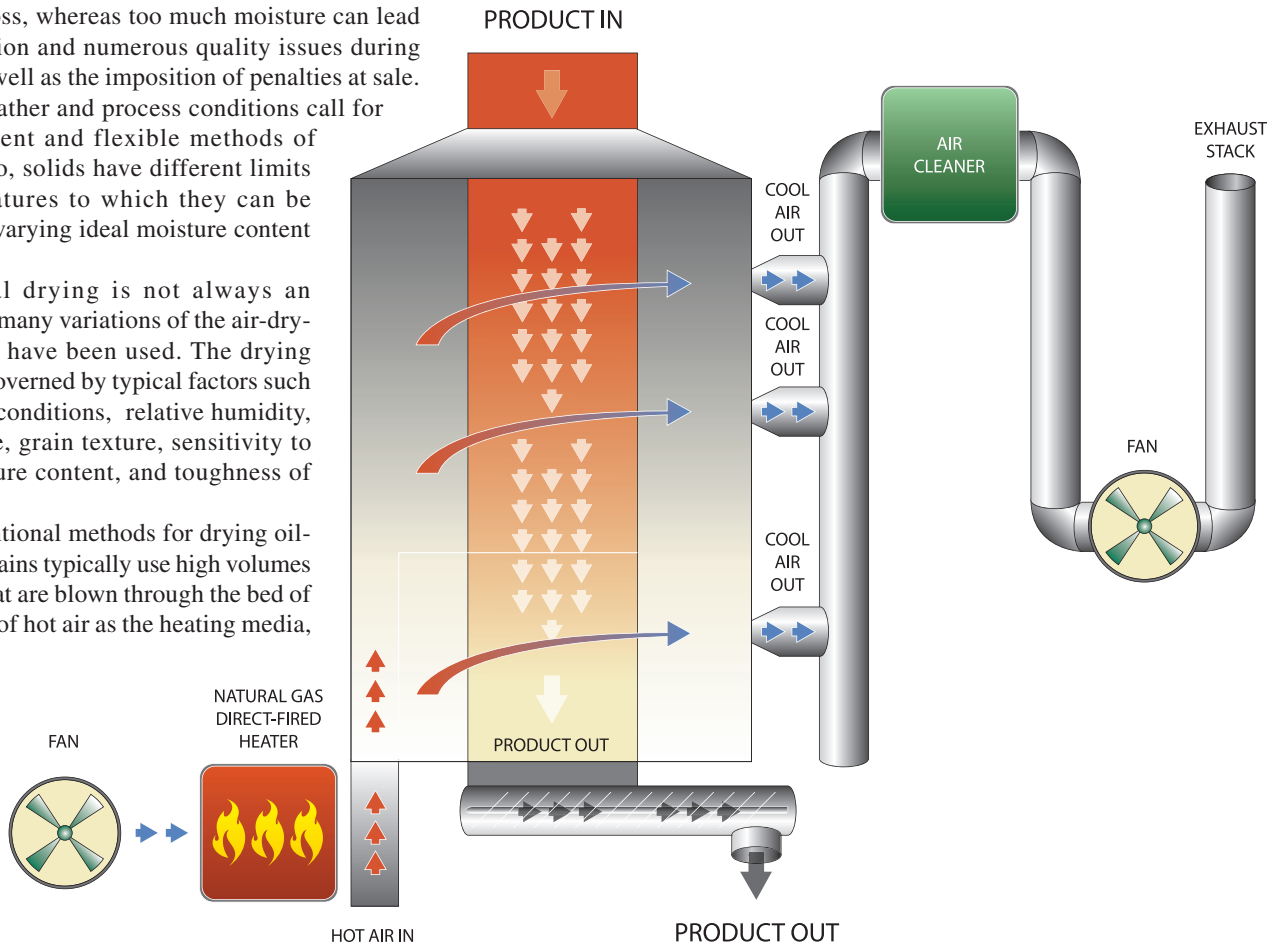

FIG. 1. *Conventional direct air dryers lose energy up the stack.*

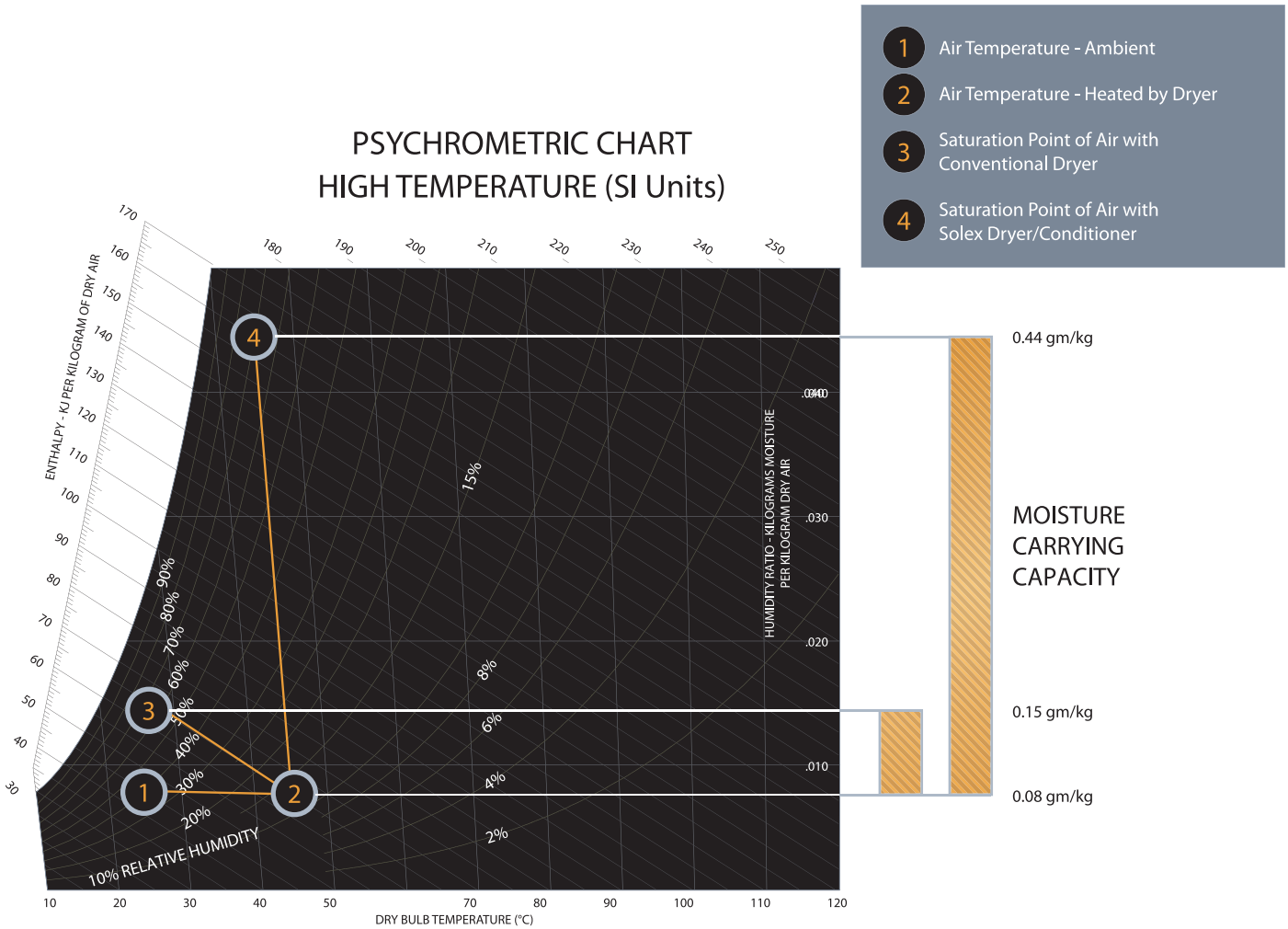

FIG. 2. *Indirect heating of air increases its moisture carrying capacity.*

The use of indirect heat—through hot water or steam—has been shown to reduce the volume of air, consumption of energy, and emissions radically. If heat is available from a waste heat source, this can further add to the energy efficiency of the drying process. The plate heat exchanger design incorporating cross airflow for removal of moisture uses indirect heating of the solids through plates. This reduces the demand for a large volume of hot air and keeps the air temperature constantly high, which enables the air to carry increased amounts of moisture before reaching saturation (Fig. 2).

This technology is unique in that it combines the science of heat transfer and thermal modeling with knowledge of the mass-flow characteristics of bulk solids. The result is a thermally efficient technology that provides precise predictability, control, and flexibility of performance. Moreover, consistent product quality is achieved as the equipment is designed for uniform heat transfer, ideal mass flow, and uniform drying throughout the grain or oilseeds bed.

FIG. 3. *Plate bank heat exchangers (dryers) are energy efficient and can offer greater operational flexibility.*

Plate bank heat exchanger dryers (Fig. 3) are recommended for any manufacturing facility looking to gain green points for environmentally friendly technology use. Installing of such dryers, as preconditioners or residual dryers, will reduce emissions and load on otherwise energy-intensive dryers, thus improving the overall energy efficiency of the facility and ultimately increasing production capacity.

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Highlights from Milan isoflavone symposium

Mark Messina

Isoflavones are a group of diphenolic compounds with a limited distribution in nature. Among commonly consumed foods, they are found in nutritionally relevant amounts primarily only in the soybean. It is largely for this reason that the health effects of soy foods have been the focus of so much attention. Proposed health benefits linked to isoflavone intake include protection against breast and prostate cancer, osteoporosis, and heart disease, as well as the alleviation of menopause-related hot flashes.

The three isoflavones in soybeans are present primarily as the glycosides genistin, daidzin, and glycitin to which can be attached acetic and malonic acids. Most interest in isoflavones stems from their estrogen-like effects, but these same properties have led to concerns that isoflavone and soy food intake may have untoward consequences, especially in specific subpopulations.

For example, despite its long history of use, questions about the safety of soy infant formula have been raised. This issue was formally evaluated by the US National Institutes of Environmental Health Sciences in 2006, but a second evaluation is planned for later this year. Unarguably, however, the concern that has led to most consternation and confusion among both health professionals and the public is the possibility that isoflavone-containing products stimulate the growth of estrogen-sensitive tumors. In fact, this concern was one of several that led to a request by the BfR (Federal Institute for Risk Assessment in Germany) for the European Food Safety Authority (EFSA) to evaluate the safety of dietary isoflavone supplements and isoflavone-rich foods including soy infant formula. A subcommittee of EFSA is expected to submit a report to the executive director by the end of 2009. A separate EFSA working group is also evaluating the efficacy of isoflavones for alleviating hot flashes.

To present the results of recently conducted studies most relevant to understanding the health effects of isoflavones, the Council for Responsible Nutrition (CRN; www.crnusa.org) convened a two-day symposium of internationally recognized experts to discuss the safety and efficacy of isoflavones for postmenopausal women. CRN is a trade association based in Washington, DC, USA. The meeting, held May 13–14 in Milan, Italy, was formally opened by Antonello Sannia, International Academy of Phytotherapy (Dolo Venice, Italy), who presented the objectives of the meeting. Following him was Miriam Jacobs (EFSA), who discussed the agency's mandate to evaluate the safety of isoflavones. Highlights of selected presentations are summarized below.

BREAST CANCER

The session on breast cancer began with Mark Messina, Loma Linda University (California, USA), reviewing the primary evidence on which concern that isoflavones may pose a risk to breast cancer patients and high-risk women is based: Namely, that in athymic ovariectomized mice implanted with MCF-7 cells (an estrogen receptor positive [ER+] human breast cancer cell line), following removal of the estrogen pellet that is needed to stimulate tumor growth (generally removal occurs when the cross-sectional area of the tumor is between 30 and 40 mm^2), there is an initial period of tumor regression in all mice. In mice consuming diets containing genistin/genistein (the aglycone form), though, tumor regression is followed by eventual tumor regrowth. Messina discussed the strengths and weaknesses of this animal model, which has been used extensively in cancer research. One of the more controversial findings arising from this model is that processing influences tumor stimulation. That is, despite containing similar amounts of genistein, more highly processed soy products lead to greater tumor stimulation. The explanation for this observation is that processing leads to higher peak plasma free (unconjugated) genistein levels.

Following Messina, Kenneth D.R. Setchell, Cincinnati Children's Hospital Medical Center (Ohio, USA), presented an extensive review of isoflavone absorption and metabolism. He began by noting that the proportion of isoflavone aglycones in soy foods and supplements is very low (1–2%), unless the food is subjected to fermentation, as in the case of tempeh, natto, and miso, because the intestine and liver are very efficient at glucuronidating isoflavones once absorbed. Next, Setchell presented new data from his research group showing that in humans, processing of genistin-containing soy products does not affect peak circulating free (unconjugated) genistein levels as it does in athymic ovariectomized mice. More specifically, peak unconjugated genistein levels in response to the consumption of soynuts (minimally processed), soymilk, and isolated genistin (highly processed) were similar.

To explore the relationship between soy and breast cancer risk, several clinical studies have examined the impact of isoflavone-containing products on mammographic breast tissue density and

breast cell proliferation in biopsy samples using the immunohistochemical marker Ki67 (a nuclear protein expressed by cells in all active phases of the cycle but not in quiescent or resting cells). Gunnar Söderqvist, Karolinska Institute (Stockholm, Sweden), discussed the value of these markers and noted that conventional hormone therapy (estrogen plus progestin) increases both density and proliferation and breast cancer risk. In contrast to the effects of conventional hormone therapy, isoflavones have no effect on these two breast cancer markers.

Jeffrey Tice, University of California (San Francisco, USA), reviewed the results from the eight studies (half involving premenopausal women; half involving post-) showing that isoflavones do not affect breast tissue density. The trials included nearly 1,700 subjects, their duration ranged from six months to three years, and the isoflavone dose from 40 to 120 mg/d.

Next, Eva Lundström, Karolinska University Hospital, discussed the four studies that took breast biopsies and assessed cell proliferation before and after isoflavone exposure; two involved breast cancer patients, one healthy subjects, and one women undergoing breast biopsy or definitive surgery for breast cancer. Daily isoflavone intake in these trials ranged from 36 to >100 mg/d and study duration from two weeks to one year.

The final presentation in this session was by Xiao Ou Shu, Vanderbilt University (Nashville, Tennessee, USA), who reviewed the three epidemiologic studies that have evaluated the impact of soy food intake on the prognosis of breast cancer patients. A report from the Shanghai Breast Cancer Study (SBCS), which was published in 2005, showed that neither soy protein nor isoflavone intake *prior* to breast cancer diagnosis was related to breast cancer prognosis among 1,459 breast cancer patients, approximately two-thirds of whom were ER+. However, preliminary results from an ongoing cohort study of 5,043 breast cancer patients who are also part of the SBCS, and enrolled approximately six months after cancer diagnosis, show that soy intake, measured either as soy protein or soy isoflavone intake, was associated with favorable outcomes. Further, the benefit of soy food intake on survival was more pronounced among women with ER+ breast cancer, and soy food intake did not impact the efficacy of tamoxifen. The third study that was reviewed, a recently published report from a cohort of 1,954 breast cancer survivors in the United States who were prospectively followed for 6.31 years, also found evidence to suggest soy food intake after diagnosis improved prognosis and that soy foods did not interfere with tamoxifen.

THYROID FUNCTION

The second day of the symposium began with an examination of the impact of isoflavone exposure on thyroid function. *In vitro* and *in vivo*, in rats genistein inactivates thyroid peroxidase (the key enzyme in thyroid hormone synthesis), although despite the inactivation, thyroid function remains normal. In his review of this topic, Francesco Squadrito, University of Messina (Italy), noted that 20 clinical studies, some of which have been conducted for three years in duration, have shown that in euthyroid individuals neither soy foods nor isoflavone supplements affect thyroid function. In fact, unpublished three-year data presented by Squadrito show that genistein (54 mg/d) not only has no effect on thyroid hormones but also does not affect the expression of T3 nuclear receptors and retinoic acid nuclear receptors (RAR, RXR) in human

peripheral blood mononuclear cells, which are sensitive markers of thyroidal influences. Although it remains to be definitively established whether isoflavones affect thyroid function in subclinical hypothyroid individuals, or in those whose iodine intake is inadequate, there are at least preliminary data indicating this is not the case for the former.

ENDOMETRIAL CANCER

Estrogen-only therapy stimulates endometrial thickness, endometrial tissue proliferation, and increases endometrial cancer risk, so it is not surprising that the impact of isoflavone exposure on endometrial tissue and cancer risk has been studied by numerous investigators. These data were discussed by Mark Messina. None of the 24 studies identified reported that isoflavone supplements (from soy and red clover) or isoflavone-rich soy foods or soy protein affected endometrial thickness. However, a five-year study found that, in comparison with the placebo group, isoflavone supplements slightly increased risk of developing simple hyperplasia among postmenopausal Italian women. These results should be interpreted cautiously, however, because there were a number of study limitations. For example, compliance was not assessed, no information on endometrial thickness and bleeding patterns was provided, and specific details about the isoflavone content of the intervention product were lacking. In addition, it is not clear that women with inaccessible endometrium samples (~25%) at baseline were excluded for evaluation at future time points; therefore, it is possible some hyperplasia was present at study onset.

Furthermore, although not a design weakness, there is some evidence that the absence of hyperplasia in the placebo group is atypical. In the Postmenopausal Estrogen and Progestin Interventions (PEPI) Trial, over just a three-year period, 2.4% of the placebo group developed endometrial tissue abnormalities (cancer or hyperplasia). If this rate had occurred in the placebo group in the above-mentioned Italian study, almost certainly the differences between groups would not have been statistically significant.

Finally, although only limited epidemiologic research has been conducted, these data suggest that isoflavone exposure from soy foods is associated with a reduced risk of endometrial cancer. Given all of the data, Messina concluded that the evidence does not allow effects on endometrial cancer risk to be used as a basis for recommending for or against the use of soy foods or isoflavone supplements.

HOT FLASHES

Hot flashes are a classic symptom of menopause; in Europe and North America about 70% of women are affected by them. Maria Andrikoula (University of Ioannina Medical School, Greece) noted, though, that this is the case for only 5 to 18% of Japanese and Southeast Asian postmenopausal women. In 1992, Adlercreutz and colleagues suggested that the low prevalence of hot flashes reported by Japanese menopausal women might be at least partially due to their high consumption of soy foods. More than 50 hot flash trials evaluating the efficacy of isoflavone-containing products have been conducted; however, the results overall are quite mixed. Several explanations for the mixed data have been proposed. These include the variation in baseline hot flash frequency, interindividual differences in isoflavone metabolism, and the differing genistein content of the intervention products.

In an attempt to provide some clarity about the effects of isoflavone supplements on the alleviation of hot flashes, Mindy Kurzer, University of Minnesota (Minneapolis-St. Paul, USA), presented the results of an ongoing systematic review and meta-analysis of the literature (although only studies evaluating the effects of isoflavone supplements derived from soybeans were considered). For the systematic review, 16 studies met the inclusion criteria; of those, 12 reported that isoflavones significantly alleviated hot flash frequency and/or severity. Efficacy was similar for severity and frequency.

For the meta-analysis, 10 trials met the inclusion criteria; the average reduction in frequency and severity beyond the placebo effect was 16 and 20%, respectively. Sub-analysis of the data indicated that supplements providing at least 15 mg/d genistein were more efficacious and potent than those providing less than this amount. Kurzer concluded that these preliminary results show that isoflavones significantly alleviate hot flashes and improve the quality of life for women suffering from frequent hot flashes when considering the overall improvement (including the placebo response) is approximately 50%. Addressing this point, Gordana M. Prelevic, Royal Free Hospital (London, England), noted that many women are seeking natural alternatives to estrogen for the alleviation of hot flashes and that according to a recent survey among those who are, the vast majority would be quite pleased with a treatment that provides at least a 50% reduction in symptom frequency.

The final presentation of the symposium was by Clemens B. Tempfer, University of Vienna School of Medicine (Austria), who reported on the results of a recently accepted-for-publication meta-analysis that used a fixed-effects model to evaluate the side effects of phytoestrogen treatment compared with placebo or no treatment in randomized controlled trials. In total, 92 randomized controlled trials with 9,629 participants were identified. The only side effect that differed in frequency between the active and control groups was a higher rate of gastrointestinal disturbances among the former. Based on the available evidence, it was concluded that phytoestrogen supplements have a safe side effect profile, with moderately elevated rates of gastrointestinal side effects.

inform *Contributing Editor Mark Messina owns his own consulting company, Nutrition Matters, Inc., and is an adjunct associate professor in the Department of Nutrition, School of Public Health, at Loma Linda University (California, USA). He has organized and chaired all eight international symposia on the role of soy in preventing and treating chronic disease and is the chairperson of the editorial board of The Soy Connection, a quarterly newsletter on soy that is distributed to more than 125,000 dietitians and other health professionals. He can be contacted at markm@olympus.net.*

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