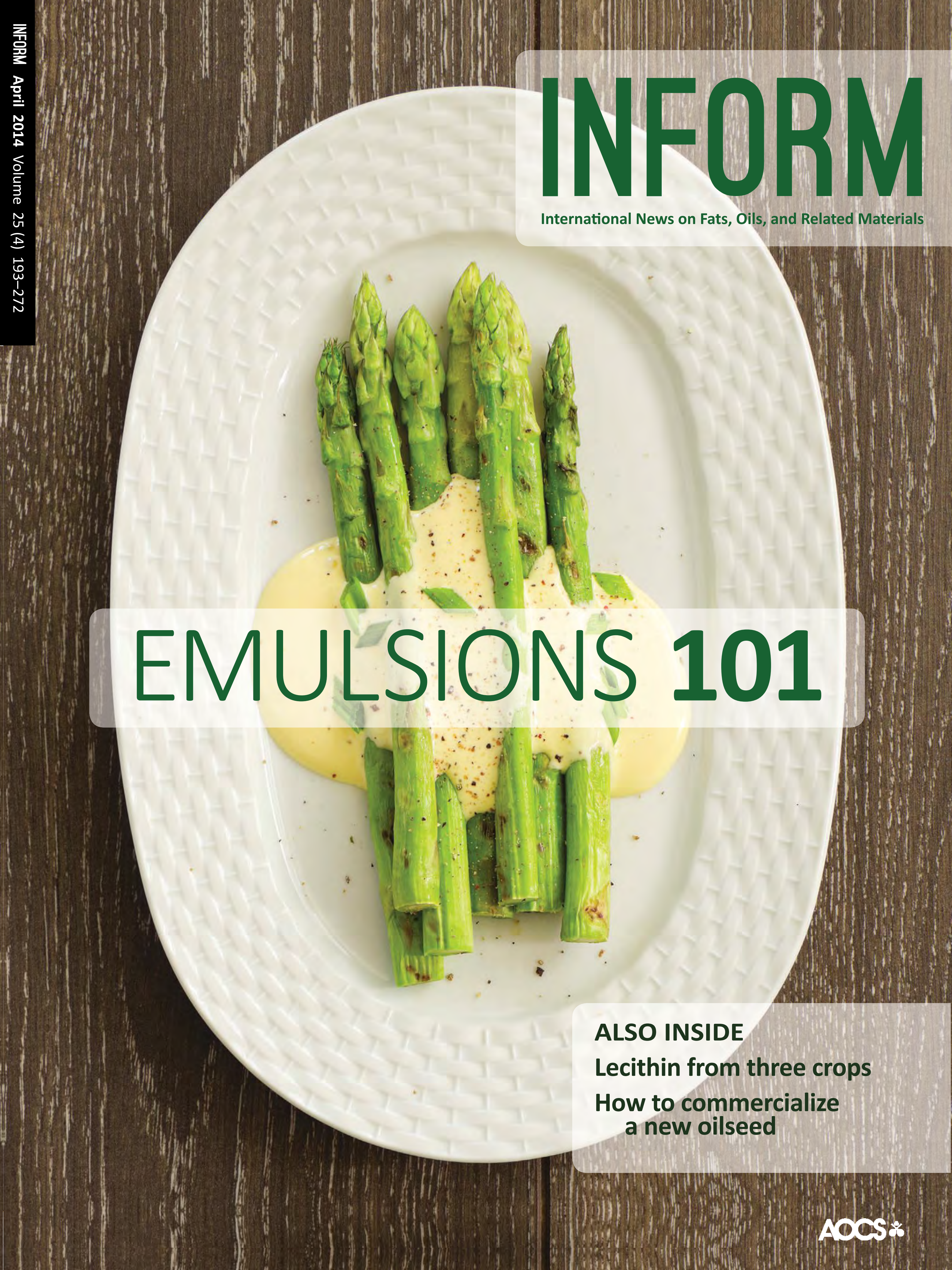

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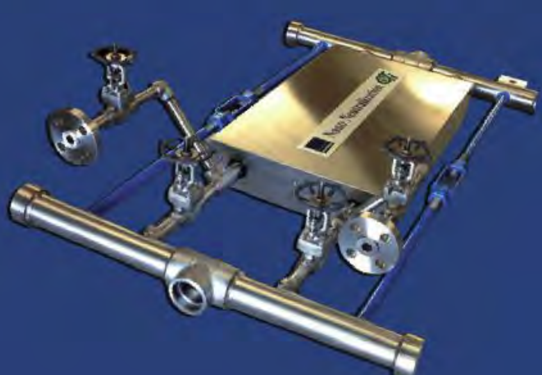

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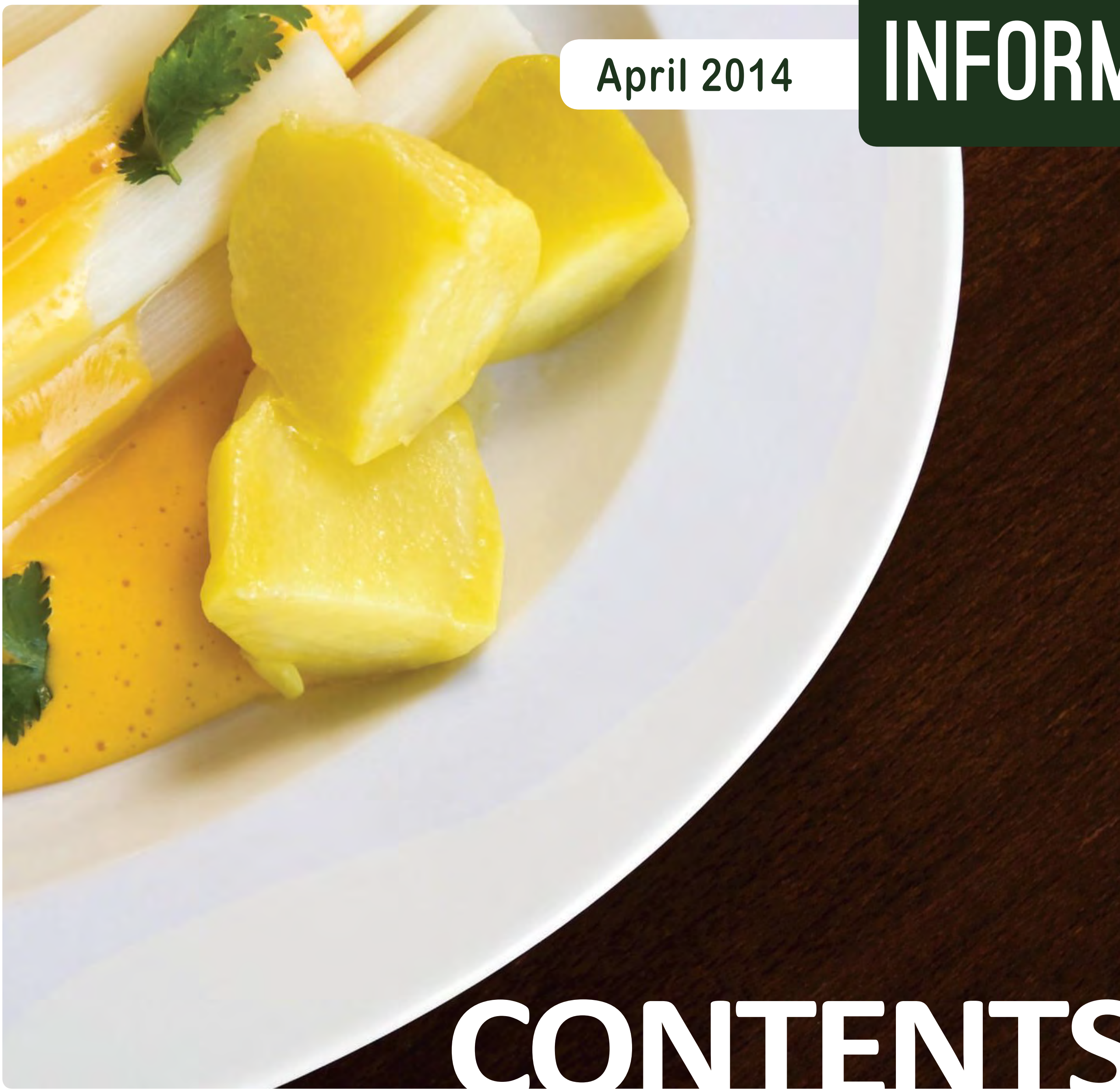

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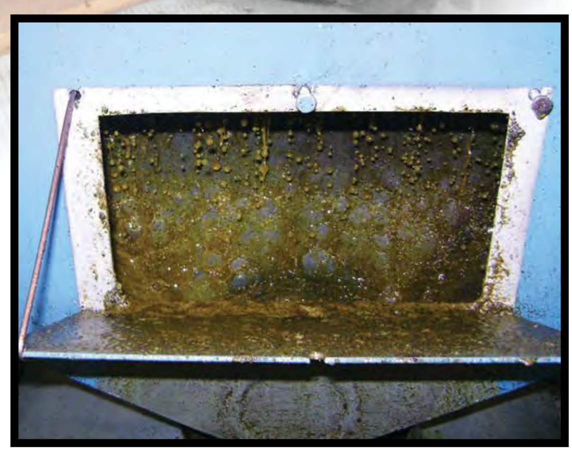

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International News on Fats, Oils, and Related Materials

ISSN: 1528-9303 IFRMEC 25 (4) 193–272

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Formerly published as *Chemists' Section*, *Cotton Oil Press*, 1917–1924; *Journal of the Oil and Fat Industries*, 1924–1931; *Oil & Soap*, 1932–1947; news portion of *JAOCS*, 1948–1989. The American Oil Chemists' Society assumes no responsibility for statements or opinions of contributors to its columns.

Inform (ISSN: 1528-9303) is published 10 times per year in January, February, March, April, May, June, July/August, September, October, November/December by AOCS Press, 2710 South Boulder Drive, Urbana, IL 61802-6996 USA . Phone: +1 217-359-2344. Periodicals Postage paid at Urbana, IL, and additional mailing offices. **POSTMASTER:** Send address changes to *Inform*, P.O. Box 17190, Urbana, IL 61803-7190 USA.

Subscriptions to *Inform* for members of the American Oil Chemists' Society are included in the annual dues. An individual subscription to *Inform* is $190. Outside the U.S., add $35 for surface mail, or add $120 for air mail. Institutional subscriptions to the *Journal of the American Oil Chemists' Society* and *Inform* combined are now being handled by Springer Verlag. Price list information is available at www.springer.com/pricelist. Claims for copies lost in the mail must be received within 30 days (90 days outside the U.S.) of the date of issue. Notice of change of address must be received two weeks before the date of issue. For subscription inquiries, please contact Doreen Berning at AOCS, doreenb@aocs.org or phone +1 217-693-4813. AOCS membership information and applications can be obtained from: AOCS, P.O. Box 17190, Urbana, IL 61803-7190 USA or membership@ aocs.org.

Letter from the president

During my 2013–2014 tenure as AOCS president, my primary goals were to engage the governing board in leading the society, and to work with our CEO, Pat Donnelly, to build a systematic, ongoing process for strategic planning and implementation that will lead us toward achieving our long-term objective.

A few years ago, we formally restructured the governing board into four working groups: strategic planning, board operations, constituent relations, and finance tracking. These working groups were initially staff-driven and generally met only once or twice per year. This past year, we stepped up the leadership role of the governing board. Each working group is now led by a governing board member, and regular conference call meetings are held throughout the year to advance progress. Input from these working groups ultimately feeds into the strategic planning process that sets the key initiatives to be accomplished the following year. I would like to thank the governing board for stepping up, and especially thank Mike Snow (strategic planning), Deland Myers (board operations), Neil Widlak (constituent relations), and Blake Hendrix (finance tracking) for leading their working groups in 2013–2014.

Until it is properly implemented, a strategic plan is simply a neatly organized stack of paper filled with good ideas. While most organizations engage in strategic planning, the majority of them fail to properly implement their plans. For this reason, I wanted to make sure that we have an ongoing systematic process in place to ensure that we actually do what we say we are going to do. It has been a real pleasure to work with Pat Donnelly in that effort. Pat has excellent experience in this area and helped to pull together a very logical approach. Together, we created a simple one-page (albeit small font) strategic execution document with five columns we refer to as our strategic pillars. These pillars are technical services, membership and engagement, meetings, information and awareness, and operations. Under each pillar, we listed approximately seven supporting initiatives along with the names of the people responsible for accomplishing them during that planning year. We then measured our progress monthly to ensure that we were on track. Most of the initiatives were assigned to AOCS staff, who accomplished these tasks on top of their normal duties. I would like to thank them for doing an excellent job of achieving their assigned 2013 initiatives, and I am pleased to report that they are off to a good start in 2014 as well. With this systematic process in place, we can ensure that AOCS has a means to execute the strategic plan developed by the governing board.

On the operational side of the organization, 2013–2014 was a very busy year. A new Association Management System (AMS) was installed from software supplier Personify. For any of you who have been through installation of a completely new enterprise management software system, you know the work and potential grief this can cause. Many staff worked very long hours in the preparation effort in 2013, and when the new system went live in January 2014, it was an amazingly smooth transition. I would like to express my thanks to the dedicated AOCS staff for the extraordinary effort and the outstanding result. We now have the foundation in place to fully integrate all of our activities. While this change is not so visible to the typical member, it will allow AOCS to serve you much better, especially as our interaction with the web increases.

This new AMS software system also allows us to connect to the world in ways we previously could not have. Our first example will be Inform|Connect, a global interface site designed by Higher Logic, which we will host for interaction among all people interested in oils & fats-related science. It is our goal to open this site to the world and make Inform|Connect the connection interface of anyone interested in our fields. Our goal is to enhance the reach of AOCS members, as well as find and attract interested people around the world to AOCS and our products and services.

My term as AOCS president sped by quickly, and it will soon be time to pass the gavel to Steve Hill. I am confident that Steve will continue the momentum of AOCS as a globally respected and forward-looking society.

Thanks to all of you for the opportunity to serve!

Timothy G. Kemper
AOCS President 2013–2014

EMULSIONS: MAKING OIL AND WATER MIX

Laura Cassiday

The immiscibility of oil and water has inspired the proverb "Oil and water don't mix" and other expressions that reflect the general incompatibility of two entities, such as "My coworker and I are like oil and water." Yet within our homes are numerous examples of products in which oil and water *do* mix: mayonnaise, milk, salad dressings, hand lotion, and hair conditioner, to name but a few. These examples represent emulsions, which are stable mixtures of tiny droplets of one immiscible fluid within another, made possible by chemicals called emulsifiers.

After reading this article, you will understand:

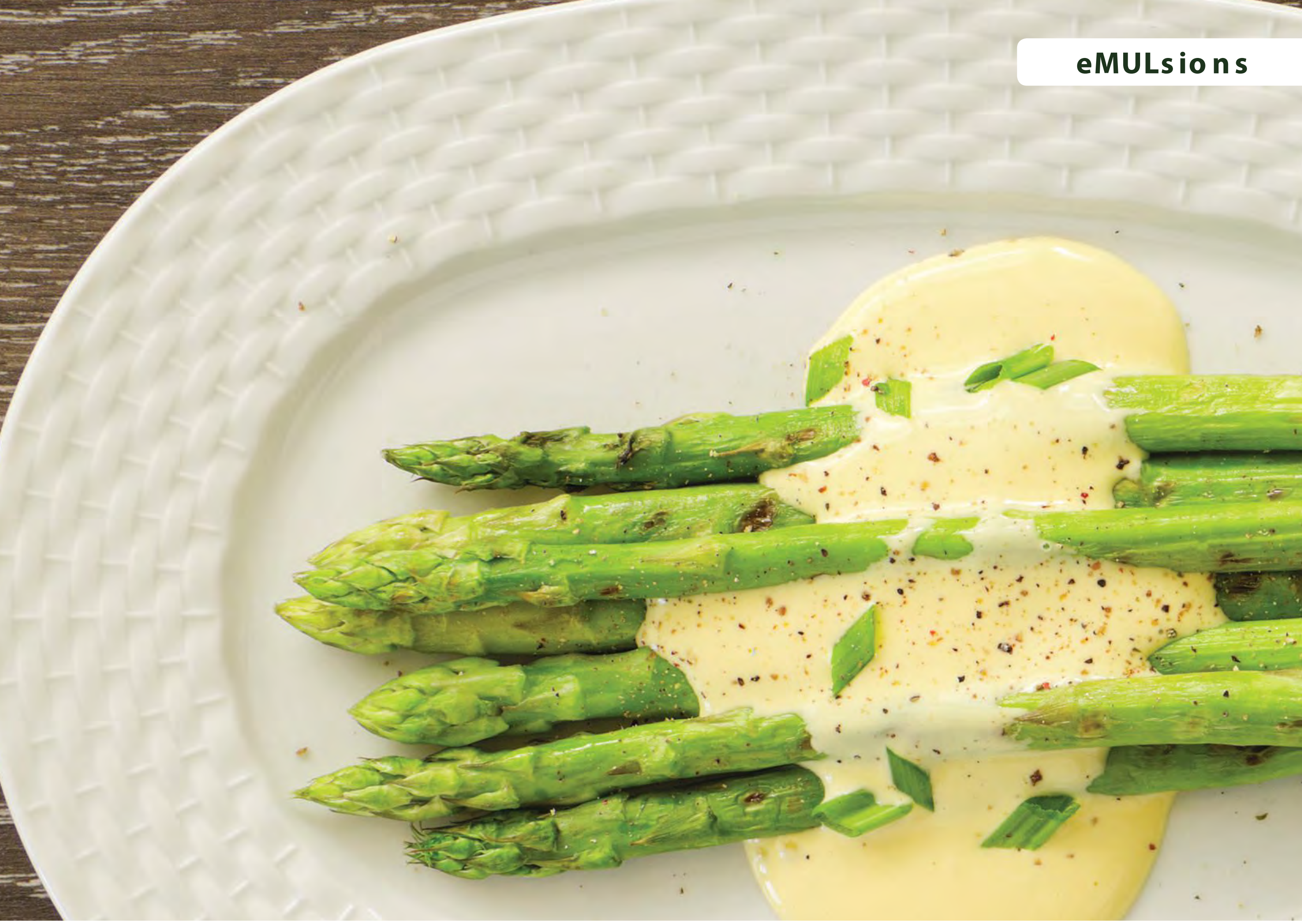
- **the basic science of emulsions;**
- **how formulators choose which emulsifier to use for a particular emulsion;**
- **how emulsifiers are used in foods, nutraceuticals, personal and home care products, industrial lubricants, environmental technologies, biofuels, and other applications.**

HOW EMULSIONS AND EMULSIFIERS WORK

Simple emulsions are either oil suspended in an aqueous phase (o/w), or water suspended in oil (w/o). Milk is an example of an o/w emulsion, in which the fat phase or cream forms tiny droplets within the skim milk, or water phase. In contrast, margarine is a w/o emulsion containing droplets of water or skim milk in a blend of vegetable oils and fat. In both cases, emulsifiers are needed to prevent the suspended droplets from coalescing and breaking the emulsion.

Anybody who has made a simple oil-and-vinegar salad dressing knows that, with enough shaking or whisking, one can make a temporary emulsion. However, in the absence of emulsifiers, this unstable emulsion breaks down within minutes, and the oil forms a layer on top of the vinegar. For centuries, cooks have added natural emulsifiers, such as egg yolk, mustard, or honey, to help prevent this separation. Today, a wide variety of nature-based and synthetic emulsifiers are available for the diverse fields that benefit from them, including food, nutraceuticals, home and personal care, biofuel, environmental cleanup, and industrial lubricant applications.

Emulsifiers work by forming physical barriers that keep droplets from coalescing. A type of surfactant (see sidebar on page 202), emulsifiers contain both a hydrophilic (water-loving, or polar) head group and a hydrophobic (oil-loving, or nonpolar) tail. Therefore, emulsifiers are attracted to both polar and nonpolar compounds. When added to an o/w emulsion, emulsifiers surround the oil droplet with their nonpolar tails extending into the oil, and their polar head groups facing the water (Fig. 1). For a w/o emulsion, the emulsifier's orientation is reversed: nonpolar tails extend outward into the oil phase, while polar head groups point into the water droplet. In this way, emulsifiers lower the interfacial tension between the oil and water phases, stabilizing the droplets and preventing them from coalescing.



Emulsifiers can be cationic (positively charged polar head group), anionic (negatively charged head group), or non-ionic (uncharged head group). When charged emulsifiers coat droplets in an o/w emulsion, the positive or negative charges on the outside of the oil droplets electrostatically repel each other, helping to keep the droplets separated. Non-ionic emulsifiers tend to have large, bulky head groups that point away from the oil droplet. These polar head groups clash and tangle with head groups on other water droplets, sterically hindering the droplets from coming together. The type of emulsifier used depends on the application, with cationic emulsifiers typically used in low-to-neutral pH solutions and anionic emulsifiers in alkaline solutions. Non-ionic emulsifiers can be used alone or in combination with charged emulsifiers to increase emulsion stability.

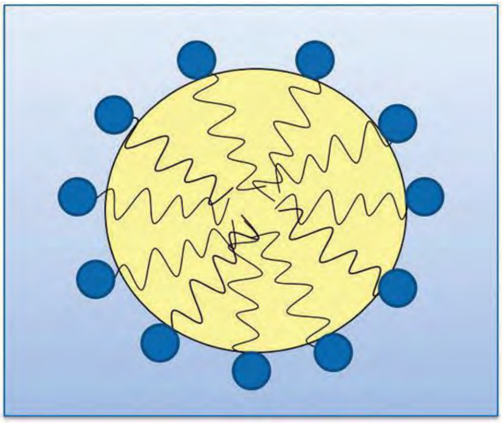


FIG. 1. When a surface-active emulsifier is used to combine water and oil, the polar head group (shown in the blue circle) is attracted to water, while the non-polar tail (wavy black line) is attracted to oil, allowing the water and oil to combine. Courtesy of The Lubrizol Corp. (Wickliffe, Ohio, USA); reprinted with permission from *Tribology & Lubrication Technology 69*(9):32–39 (2013).

HOW TO CHOOSE THE RIGHT EMULSIFIER

How do product formulators choose which emulsifier to use for a particular emulsion? Calculating the hydrophilic-lipophilic balance (HLB) of an emulsifier or combination of emulsifiers can help. In an ideal emulsion, the emulsifier is equally attracted to the water phase and the oil

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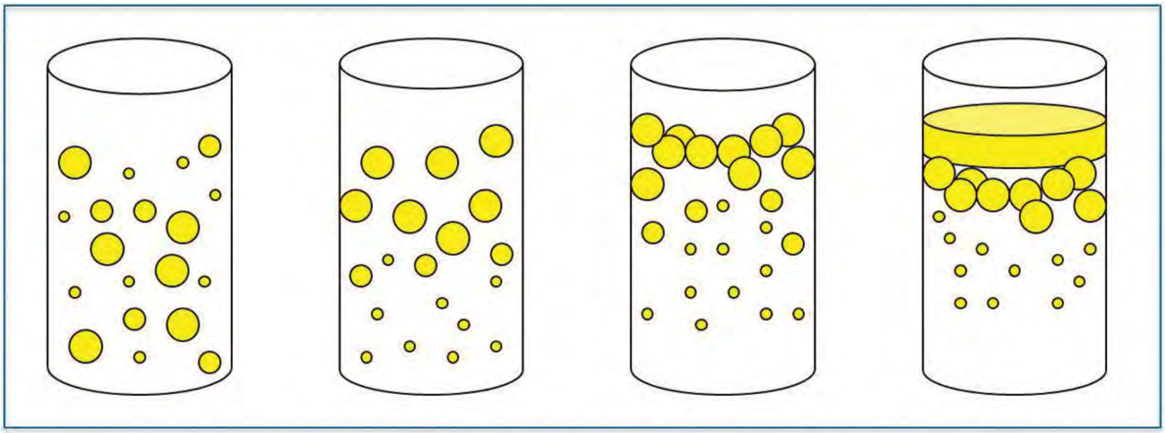

FIG. 2. Emulsions offer different stability, and applications demand varying levels of emulsification stability. From left to right: a stable emulsion; the emulsion has begun to separate; the emulsion is creaming (thick white layer on top of the mixture); the emulsion has broken (noticeable oil layer on top of the water phase). Courtesy of The Lubrizol Corp. (Wickliffe, Ohio, USA); reprinted with permission from *Tribology & Lubrication Technology 69*(9):32–39 (2013).

phase. If the balance is tipped in either direction, the emulsifier may lose contact with the phase to which it is less attracted, causing the emulsion to break down.

Different emulsifiers have different HLB values, which can predict their ability to stabilize various kinds of emulsions (Fig. 2). The HLB scale ranges from 0 to 20, with 10 corresponding to an emulsifier that is equally attracted to water and oil. Emulsifiers with HLB values greater than 10 are more hydrophilic and thus better at stabilizing o/w emulsions. In contrast, emulsifiers with HLB values less than 10 are more hydrophobic and therefore better suited for w/o emulsions.

Furthermore, different oils have different HLB requirements. For example, vegetable oil emulsions need an emulsifier with an HLB of 7–8, whereas the required HLB value to form a stable castor oil emulsion is 14. By matching the HLB value of the emulsifier with that of the oil, formulators can greatly increase their chances of producing a stable emulsion.

According to George Smith, technical director for the Americas at Huntsman Performance Products in The Woodlands, Texas, USA, a combination of emulsifiers usually works better than any single emulsifier. "If you're trying to make a mineral oil emulsion, for example, the HLB for mineral oil is 10," he says. "So you'll pick a pair of emulsifiers, one with an HLB higher than 10 and another with an HLB lower than 10. When you combine them, the average comes out around 10."

The HLB system, which works primarily for non-ionic emulsifiers, has been around since 1954. In the 1970s, the hydrophilic-lipophilic difference (HLD) system was introduced. The HLD system works for ionic as well as non-ionic surfactants, and it is better able to take into account detailed characteristics of a particular emulsion such as salinity, oil type, surfactant concentration, and temperature.

The HLD equation includes terms for the salt concentration, "oiliness" of the oil (the effective alkane car-

What's the difference?

The terms surfactant, emulsifier, and detergent are often used interchangeably, but there are distinctions.

Surfactant is the broadest term: Both emulsifiers and detergents are surfactants. Surfactants, or *surface-active agents*, are compounds that lower the surface tension between two liquids or between a liquid and a solid. Surfactants are amphiphilic, meaning that they contain hydrophilic (water-loving) head groups and hydrophobic (water-hating, or oil-loving) tails. Surfactants adsorb at the interface between oil and water, thereby decreasing the surface tension.

An *emulsifier* is a surfactant that stabilizes emulsions. Emulsifiers coat droplets within an emulsion and prevent them from coming together, or coalescing.

A *detergent* is a surfactant that has cleaning properties in dilute solutions.

Likewise, the terms emulsion, suspension, and foam are sometimes confused.

An *emulsion* is a mixture of two or more liquids, with or without an emulsifier, that are normally immiscible. One of the liquids, the "dispersed phase," forms droplets in the other liquid, the "continuous phase."

A *suspension* is a solid dispersed in a liquid. The particles are large enough for sedimentation.

A *foam* is a substance in which gas bubbles are suspended in a liquid.

bon number), and the characteristic curvature (Cc) of the emulsifier. The Cc value of an emulsifier reflects whether the emulsifier prefers to curve around an oil droplet in water (negative Cc) or to curve around a water droplet in a w/o emulsion (positive Cc). For example, a very hydrophilic emulsifier, sodium laurel sulfate, has a Cc of –2.3, whereas a very hydrophobic emulsifier, dioctyl sodium sulfosuccinate, has a Cc of 2.6. The Cc for combinations of emulsifiers is the weighted average for each emulsifier. The HLD scale centers on 0, which corresponds to the optimal emulsion. Online calculators exist to optimize the HLD for a particular emulsion (e.g., www.stevenabbott.co.uk/HLD-NAC.html).

MACRO- AND MICROEMULSIONS

Increasingly, formulators are interested in making microemulsions, which offer greater stability than conventional macroemulsions. As the name suggests, microemulsions have smaller droplet sizes than regular emulsions, making them appear transparent rather than opaque. Unlike macroemulsions, microemulsions are thermodynamically stable. "Given enough time, a macroemulsion will break down into water and oil phases," says David Sabatini, associate director of the Institute for Applied Surfactant Research at the University of Oklahoma, Norman, USA. "But time is not a factor in how long a microemulsion will remain in its current state." In addition, if a temperature change causes an emulsion to break down, a microemulsion will spontaneously reform when the temperature changes back to its original value. In contrast, a macroemulsion requires an energy input to reappear.

Microemulsions are made differently from macroemulsions. Macroemulsions require high-intensity mixing. Because microemulsions are a thermodynamically stable end point that a system naturally migrates toward, they generally do not require vigorous mixing. However, formulators often use gentle agitation to evenly spread the components and speed up the process of microemulsion formation.

Compared to macroemulsions, microemulsions require more surfactant. "Time stability points in the direction of microemulsions, but surfactant requirement may point in favor of macroemulsions," says Sabatini. "It may be that 3 or 6 months is plenty long enough for your application and time may not be a factor in that situation." For example, food products will often go bad before a macroemulsion breaks down, he says.

Because of their remarkable stability, microemulsions are finding applications in diverse fields

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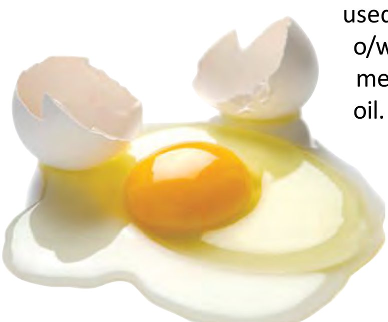
such as personal care products, oil field chemicals, and medicine. “Macroemulsion concepts have been around for centuries, but advanced microemulsion concepts are only about two to three decades old,” says Sabatini. “There’s growing interest in microemulsions because we’re just beginning to understand their capabilities.”

FOODS

Many popular food items are emulsions, including mayonnaise, salad dressings, sauces such as Hollandaise, chocolate, and ice cream. Lecithin, a blend of naturally occurring phospholipids, is widely used in the food industry to promote o/w emulsions. Worldwide, most commercial lecithin comes from soybean oil. Egg yolk, the traditional emulsifier for mayonnaise and sauces, also contains lecithin. Other common emulsifiers in foods are proteins, fatty acid esters, sodium stearoyl lactylate, and mono- and diglycerides.



Making food emulsions can be challenging because “foods are complex systems with many different ingredients interacting,” says John Neddersen, senior application scientist in fats, oils, and emulsifiers at DuPont Nutrition and Health, based in New Century, Kansas, USA. “Although guidelines like the HLB scale can help, most of the time experience and experimentation are needed to find the optimal choice of emulsifiers and usage rates.” Neddersen notes that processing can be another challenge when working with food emulsions. “A company might have a single formula run at multiple locations and see different results at the different plants,” he says. These differences may arise from seemingly subtle variations in plant conditions.

DuPont sells a broad range of emulsifiers, including the Panodan® DATEM (diacetyl tartaric acid ester of monoglycerides) line especially for bakery products and the Cremodan® line for ice creams and other frozen desserts. As an alternative to lecithin in chocolates and other confectionary, DuPont offers Grindsted® CITREM, a citric acid ester. This emulsifier can substitute for soy lecithin, which has recently come under fire, particularly in Europe, because most soy crops grown for export (especially the United States, Brazil, and Argentina) are genetically modified. Non-genetically modified soy is expensive and in short supply. Therefore, CITREM may prove an attractive alternative for confectioners who want to avoid ingredients made from genetically modified soy.

Sustainable sourcing of palm oil has also become a customer concern, as reports have surfaced that the development of palm oil plantations harms the environment and threatens endangered wildlife in Malaysia and Indonesia, where most palm oil originates. As a result, DuPont introduced a portfolio of emulsifiers based on sustainably sourced palm and non-palm oils. By 2015, DuPont has pledged to source 100% of its palm oil from plantations certified by the Roundtable on Sustainable Palm Oil (RSPO).

Reduced-fat emulsions are another hot topic for the food industry. When fat is removed from a food to make a reduced-fat or fat-free version, the taste, appearance, and texture often suffer. D. Julian McClements, professor of physico-chemistry at the University of Massachusetts Amherst, USA, says that there are several ways that emulsions or emulsifiers could help reduce the fat content of foods. For instance, researchers could structure water-in-oil-in-water (w/o/w) emulsions. “You could take some of the fat out of the droplets and replace it with water,” he says.

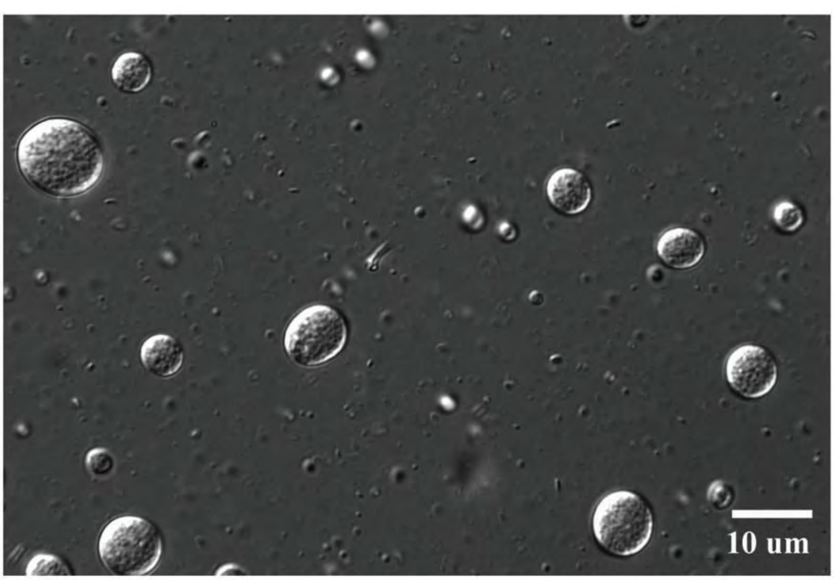


FIG. 3. Filled hydrogel particles in foods can deliver nutraceuticals to the body. The filled hydrogel microspheres consist of tiny fat droplets trapped within larger spheres made from food biopolymers. The fat droplets may contain nutraceuticals, such as vitamins, carotenoids, or curcumin. This is an example of an o/w/w emulsion, since the hydrogel particles are mainly water, and they are surrounded by water. Courtesy of D. Julian McClements, University of Massachusetts Amherst.

Another approach, called heteroaggregation, is to mix oil droplets coated with emulsifiers of opposite charge. “We mix a positive droplet and a negative droplet together, and they form a gel network,” says McClements. “The resulting emulsion has a very high viscosity and low fat content and mimics some of the characteristics of a high-fat product.”

NUTRACEUTICALS

Researchers are exploring emulsions as delivery vehicles for vitamins, supplements, and other nutraceuticals. McClements’ lab has used emulsions to encapsulate vitamin E, carotenoids, omega-3 fatty acids, curcumin, coenzyme Q_{10}, and other bioactive compounds. Eventually, he would like to incorporate nutraceuticals such as these into functional foods.

“One of our goals is to increase the stability of active compounds that are encapsulated in emulsions in food particles,” says McClements. “We’d also like to control their fate in the gastrointestinal tract once they’ve been digested.”

In addition to conventional emulsions, McClements’ lab makes more complex emulsions such as nanoemulsions, solid-lipid nanoparticles, filled hydrogel particles (Fig. 3), and multilayer emulsions. Different types of emulsions could have different applications. “Some of them can protect components from chemical degradation, some can deliver compounds to the colon, and some can control flavor release,” says McClements. “So you have to have a different kind of delivery system for each application.”

Multilayer emulsions consist of oil droplets coated with an emulsifier plus one or more biopolymer layers, dispersed in an aqueous solution. The emulsifier is typically electrically charged, and the polymer layer(s) have opposite charges that attract them to the surface of the oil droplet.

According to McClements, multilayer emulsions tend to have better physical stability than single-layer emulsions through fluctuations in pH, ionic strength, temperature, freezing and thawing, and dehydration. In addition, researchers can design multilayer emulsions to control their breakdown in the gastrointestinal tract. “You can make them so they’re digested very quickly, like a normal emulsion, or you can make them so they go further down the gastrointestinal tract,” he

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says. "The latter might be useful if you want to deliver something to the colon or you're trying to control satiety by getting undigested compounds further down in the gastrointestinal tract."

PERSONAL CARE

Most personal care products, including lotions, creams, shampoos, and conditioners, are emulsions. Common emulsifiers for personal care products include ethoxylated alcohols, carboxylates, sodium isethionate, glycerol monostearate, cetyl alcohol, stearyl alcohol, and silicone emulsifiers such as dimethicones.

"The trend right now is most people would like to use an emulsifier that's based on plant raw materials rather than petrochemicals," says Smith. Synthetic emulsifiers such as ethoxylated alcohols and their naturally derived counterparts have identical structures, performance, and biodegradation. "The price swings back and forth depending on the price of palm kernel oil in Malaysia and the price of ethylene in North America," says Smith. "At the moment, I think petrochemicals have the advantage, but it switches every two to three years."

Juan Mateu, technical director at JEEN International in Fairfield, New Jersey, USA, says that there has been a move away from synthetic ethoxylated alcohols in recent years due to worries about residual 1,4-dioxane, a suspected carcinogen that is a by-product in their manufacture. Naturally derived glucosides have been suggested as replacements for some applications. However, "It's too early to say that ethoxylated alcohols can be replaced," says Mateu. "There are some emulsions you can make with glucosides, but for the most part the whole world is still using ethoxylates."

In 2009, JEEN International launched its Jeesperse line of cold-process emulsifiers, which allows formulators to make emulsions containing waxy substances at ambient temperatures (25–30°C). Many common emulsifiers in personal care products, such as cetyl alcohol and glycerol monostearate, are waxes with relatively high melting points (up to 165°C). Prior to Jeesperse, manufacturers had to heat emulsifiers in the oil phase to melt them, and then add the melted emulsifier to the aqueous phase and cool the emulsion at a controlled rate down to room temperature. In contrast, Jeesperse allows the emulsion to be made in a single kettle at room temperature, resulting in significant savings of money and time.

The secret ingredients in Jeesperse products are polyelectrolytes, such as sodium polyacrylate. The polyelectrolytes are polar molecules that can induce polarity in nonpolar waxes, enabling them to dissolve in cold water (a polar solvent). Mateu says that in the lab, he can make an emulsion with the cold process in about 20 minutes, as opposed to several hours of mixing, heating, and cooling with the conventional process. "Aesthetically, the product is the same thing—it feels the same and looks the same—so why not?" he says.

A short video demonstrating the cold-process formulation of a lotion with a Jeesperse emulsifier can be seen at http://tinyurl.com/Jeesperse-formulation.

Technical session highlights suspensions, emulsions, and foams

You can learn about the latest developments in suspensions, emulsions, and foams by attending a joint technical session on these topics at the upcoming 2014 AOCS Annual Meeting & Expo in San Antonio, Texas, USA. The session, which will be held on Wednesday, May 7, from 1:55–5 p.m., will feature a wide range of technical topics—from the fabrication of reduced-fat products by controlled aggregation of lipid droplets to the formulation of lipopeptide biosurfactant mixtures for dispersing oil spills in seawater.

The session is jointly sponsored by AOCS' Edible Applications Technology (EAT) and Surfactant & Detergent (S&D) divisions, and is cross listed in the program as EAT 5.0 and S&D 5.1. A complete list of presentations is available at http://tinyurl.com/AnnMtg-EAT-SD.

HOME CARE

Many household cleaners and laundry detergents contain surfactants that emulsify oily dirt particles so that they can be diluted and washed away. Ethoxylated alcohols are a common ingredient of laundry detergents. Many detergents contain a blend of nonionic and anionic emulsifiers to lift stains out of textiles.

According to Sabatini, removing triglycerides such as fats, bacon grease, and vegetable oils from fabrics is particularly challenging. His lab has shown that extended surfactants, which are surfactants with intermediate polarity groups (e.g., polypropylene oxide and polyethylene oxide) inserted between the hydrophilic head and hydrophobic tail, are effective in removing these types of oily stains.

INDUSTRIAL LUBRICANTS

Metalworking fluids and other industrial lubricants are typically o/w emulsions. Emulsifiers allow metalworkers to make use of both the lubricating properties of oils and the cooling capabilities of water. Anionic and nonionic emulsifiers are often used together in metalworking fluids. Cationic emulsifiers are rarely used because they are unstable in the alkaline solutions (pH 8–9.5) required for metalworking fluids.

ENVIRONMENTAL TECHNOLOGIES

Emulsions and microemulsions have been applied to environmental technologies such as subsurface remediation and biofuel production. For example, when

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oil or gas is spilled, the oil becomes trapped in pores in the soil and rock. Sabatini's lab has developed alcohol-free microemulsions that help remove oil contaminants from the subsurface in an environmentally friendly manner. "The oil is trapped in the pores because of the interfacial tension between water and oil," says Sabatini. "If we can lower that interfacial tension with emulsifiers, we can increase our rate of cleaning up contamination."

In 1997, Sabatini and several colleagues founded a company called Surbec Environmental, LLC, to implement this technology. Since then, Surbec has assisted with the environmental cleanup of multiple sites in the United States and abroad. Examples include a gas station with a leaky underground tank and a military site contaminated with jet fuel.

Sabatini has also applied his emulsions research to the more efficient production of biofuel. Biodiesel is a vegetable oil, such as soybean oil, that has been chemically modified through a transesterification reaction to reduce its viscosity. "In terms of combustion, you don't need to modify the vegetable oil. You can use vegetable oil in a diesel engine, and it'll work pretty well without modification," says Sabatini. "It's just that vegetable oil has viscosity problems, especially at lower temperatures."

As it turns out, microemulsification of vegetable oils can reduce viscosity without the need for the transesterification reaction. This would save time and allow more of the raw material to be used as fuel. However, Sabatini notes that the research is still in its early stages.

Although humans have been making emulsions for hundreds, if not thousands, of years, we are only now beginning to appreciate their diverse applications in many fields. Complex emulsions, such as microemulsions and multilayer emulsions, promise to further expand the repertoire of applications, particularly in emerging areas such as functional foods and biodiesel production. Now if only we could find an emulsifier for that difficult coworker.

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BRIEFS

Renova, a joint venture of three Argentine companies (Oleaginosa Moreno Hermanos, Molinos Rio de la Plata, and Vicentin), recently commissioned Desmet Ballestra (Zaventem, Belgium) to construct what Desmet says will be the world's largest soybean crushing complex and solvent extraction plant. Located near Rosario in Timbues, Argentina, the complex will have a daily crushing capacity of 20,000 metric tons.

■■■

Enzymotec Ltd. (Migdal Ha'Emeq, Israel) recently announced the completion of its Migdal Ha'Emeq manufacturing facility expansion and a successful operating run of a new extraction process for turning krill meal into krill oil in-house.

■■■

Nestlé (Vevey, Switzerland) announced in January 2014 that it will invest $1 billion in Mexico over five years, building two new factories and expanding a third in its sixth-biggest market. The company is erecting an infant nutrition factory in Jalisco and a pet-food factory in Guanajuato, as well as expanding an existing cereal factory. About 40% of the output from the baby food factory will be exported to Latin America and the Caribbean, according to the Reuters news service.

■■■

In early February 2014, the US Food and Drug Administration (FDA) released an interim final rule (http://tinyurl.com/FDA-infant) that sets standards for the manufacture of infant formula. The interim rule applies only to infant formula intended for infants without unusual medical or dietary problems. It amends FDA's quality control procedures, requirements about how and when manufacturers must notify the agency about new formulas and changes to formulas, and requirements concerning what manufacturing and related records and reports must be established and maintained. In addition, the interim final rule will help ensure that infant formula contains all federally required nutrients, such as protein, fat, and certain vitamins and minerals, and that the formula supports healthy growth. ■

NEWS & NOTEWORTHY

Industrial hemp gaining traction

Industrial hemp is one step closer to returning to US farms, thanks to the 959-page farm bill that President Barack Obama signed into law in early February 2014. With the help of several legislators from tobacco-growing states that are much in need of an alternative crop, the final bill included an amendment that relaxes the longstanding restriction on growing the nonintoxicating varieties of *Cannabis sativa* L. for research purposes.

"We're definitely turning a corner in the United States," said David Bronner, president of Dr. Bronner's Magic Soaps (Escondido, California), which uses hemp oil sourced from Canada in its personal care products. "Hempseed foods have been the historical market driver for hemp in the United States," he added, "but in Europe it's been more on the fiber/composite/construction side. With a fully legal and reliable regulatory environment, we expect to see significant investments in infrastructure that will enable both the fiber and seed of the hemp plant to be farmed and processed profitably in North America."

Bronner's vision of a full-fledged US hemp industry may be optimistic. That is because the farm bill amendment stipulates that industrial hemp can at this point only be grown by state agriculture departments, colleges, or universities in states where industrial hemp farming is already legal under state law. According to Vote Hemp, an advocacy group based in Washington, DC, 32 states have introduced pro-hemp legislation and 20 have passed pro-hemp legislation. However, only 10 states—California, Colorado, Kentucky, Maine, Montana, North Dakota, Oregon, Vermont, Washington, and West Virginia—have defined industrial hemp as being distinct from psychoactive varieties of cannabis (marijuana) and have removed barriers to its production.

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Cannabis testing

Industrial hemp is not the only variety of *Cannabis sativa* L. in the news. As more countries and regional entities such as US states approve the use of medical cannabis, or medical marijuana, the issue of laboratory testing and methods of analysis becomes more critical. Next month, *Inform* will present a review of cannabis testing by Heather Despres, who is lab director at CannLabs, Inc. in Denver, Colorado, USA.

Commercial farming of industrial hemp has been outlawed in the United States since passage of the Controlled Substances Act in 1970. That legislation made no distinction between industrial hemp, which contains less than 0.3% THC (tetrahydrocannabinol, the psychoactive agent in marijuana), and *Cannabis sativa* grown for recreational use, which contains anywhere from 2% to more than 20% THC.

Hemp is a particularly versatile and robust plant. It is naturally resistant to pests, grows quickly—maturing in three to four months—and uses less water than many other crops. Hemp produces as much as 250% more fiber than cotton, according to numerous sources; fiber from the stalks is durable and absorbent. The fiber has multiple uses, ranging from clothing to paper to building materials. The oil finds its way into both food and personal care products; various companies are pursuing its use as a biofuel.

TABLE 1.
Typical nutritional analysis of 100 grams of hulled hempseeds[a]

Calories	567 kcal
Protein (N × 5.46)	30.6 g
Carbohydrate	10.9 g
Dietary fiber	6.0 g
Fat	47.2 g
Saturated fat	5.2 g
Palmitic acid (16:0)	3.4 g
Stearic acid (18:0)	1.5 g
Monounsaturated fat	5.8 g
Oleic acid (18:1n-9)	5.8 g
Polyunsaturated fat	36.2 g
Linoleic acid (18:2n-6)	27.6 g
α-Linolenic acid (18:3n-3)	8.7 g
γ-Linolenic acid (18:3n-6)	0.8 g

[a]Source: Adapted from data provided by HempNut, Inc. (www.hempfood.com/nutrition.html).

GLOBAL PRODUCTION

Industrial hemp was reportedly grown on 200,000 acres (about 81,000 hectares) worldwide in 2011, according to a report by the US Congressional Research Service (CRS; see http://tinyurl.com/Hemp-CRS). "Upward trends in global hempseed production roughly track similar upward trends in US imports of hempseed and oil, mostly for use in hemp-based foods, supplements, and body care products," the CRS report noted.

About 30 countries in Europe, Asia, and North and South America currently permit the production of industrial hemp, CRS said, with China among the largest producing and exporting countries of hemp textiles and related products. Production in the European Union is centered in France, the United Kingdom, Romania, and Hungary. Other European countries reporting hemp production include Russia, Ukraine, and Switzerland. Elsewhere, active production and/or consumer markets may be found in Australia, New Zealand, India, Japan, Korea, Egypt, Chile, and Thailand. Canada, which began issuing licenses for research plots in 1994 and for commercial production in 1998, is now a major supplier to the United States.

Hempseed oil used to be the primary product of the oilseed crush, according to Bronner, but hemp protein powder has long since become the primary product. "However, both are in scarce supply because demand has risen so rapidly that recruiting enough farmers to produce hempseed has been the limiting factor," said Bronner. "Thus, even Canadian-based hempseed processors are pushing for US legalization of hemp farming so that they can get more supply."

NUTRITIONAL ASPECTS OF HEMPSEED OIL

Maria Angeles Fernández-Arche and colleagues at Spain's University of Seville note that hempseed oil has high levels of vitamins A, C, and E as well as β-carotene, and it is rich in protein, carbohydrates, minerals, and fiber (see Table 1). With increasing interest in plant oils as a source of healthful compounds, Fernández-Arche's team wanted to investigate hempseed oil's potential and to "accelerate efforts to establish a global database for this valuable oilseed crop."

The researchers conducted a detailed analysis of hempseed oil samples provided by Botanica Nutrients in Seville (*Journal of Agricultural and Food Chemistry*; http://dx.doi.org/10.1021/jf404278q, 2014). They found it has a variety of substances such as sterols, aliphatic alcohols, and α-linolenic acid, which research suggests promote good health. ". . . The most interesting compounds were β-sitosterol, campesterol, phytol, cycloartenol, and γ-tocopherol," they write.

Another recent study, this one led by Ian Graham of Great Britain's University of York, reports the development of a new strain of hemp with "dramatically increased" amounts of oleic acid. Graham and his team used fast-track molecular plant breeding to select plants lacking the enzyme involved in synthesizing polyunsaturated fatty acids. The study appeared in *Plant Biotechnology Journal* (http://dx.doi.org/10.1111/pbi.12167, 2014).

The new high-oleic hemp line produces almost 80% oleic acid, as compared with traditional varieties with less than 10%.

SUSTAINABILITY WATCH

IOM issues report on sustainable diets

The US Institute of Medicine has issued a report that summarizes its Food Forum and Roundtable on Environmental Health Sciences, Research, and Medicine that took place May 7–8, 2013. Titled *Sustainable Diets: Food for Healthy People and a Healthy Planet—Workshop Summary*, the report discusses current and emerging information on the food and nutrition policy implications of increasing environmental constraints on the food system as well as the relationship between human health and the environment.

Visit http://tinyurl.com/IOM-Diet for the complete report.

Mondelēz achieves palm oil sustainability milestone early

Mondelēz International, Inc. (Deerfield, Illinois, USA) says that it achieved Roundtable for Sustainable Palm Oil (RSPO) certification for 100% of the palm oil it bought in 2013. This is two years ahead of the company's stated goal to source its entire palm oil supply needs by 2015 through a combination of RSPO-certified oil and Greenpalm certificates. The company said it will review results from suppliers and publish an action plan during the second quarter 2014 giving priority to supplies that meet the company's sustainability principles, and eliminating supplies that do not, by 2020 at the latest.

In other company news, Mondelēz also announced that it is building a $190 million plant in Sri City in the Indian state of Andhra Pradesh. The facility will be the company's largest plant in the Asia Pacific region and the largest chocolate plant in India, with a capacity of 250,000 metric tons per year. The first phase of the project is expected to be completed by 2015.

Mondelēz is not the only company to surpass its sustainability goals: IOI Loders Croklaan (Pasir Gudong, Malaysia) said in late February 2014 that certified sustainable palm oil represented 34% (348,000 metric tons) of its European sales volume in 2013. The company's goal had been 30%, an IOI Loders Croklaan spokesperson told www.foodnavigator.com.

RSB streamlines operations

The Roundtable on Sustainable Biomaterials (RSB; Geneva, Switzerland; www.rsb.org) has streamlined its operations by integrating certification and standard development under one roof. The certification activities previously carried out under license by the RSB Services Foundation will now be carried out by the RSB in Geneva, as of February 1, 2014. RSB said in a news release that this change "will improve the efficiency of communications and internal operations and administrative functions, while allowing the continuation of certification activities and the validity of RSB certificates." The group's mission, according to its website, is to provide and promote the global standard for socially, environmentally, and economically sustainable production and conversion of biomass.

The researchers have completed a small field trial and more trials will be completed in Europe throughout 2014, according to www.foodnavigator.com.

"All hempseed derivatives (nut, protein powder, oil) are on a very nice growth trajectory," said Bronner. "As the stigma around cannabis generally recedes, and the [awareness grows] . . . that hempseed is no more a drug than poppy seed, the incredible nutritional qualities of hempseed [will] dominate market and consumer interest."

Final proposed rule under FSMA released

On January 31, 2014, the US Food and Drug Administration (FDA) released the final proposed regulation under the 2010 Food Safety Modernization Act (FSMA). The rule would require certain shippers, receivers, and carriers who transport

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food by motor or rail vehicles to take steps to prevent the contamination of human and animal food during transportation.

"Sanitary Transportation of Human and Animal Food" (see http://tinyurl.com/FSMA-Transport) details requirements for vehicle and transportation equipment, transportation operations, the exchange of information, training, written procedures, and records. It does not apply to the conveyance of fully packaged shelf-stable foods, live food animals, or raw agricultural commodities when transported by farms. The proposed rule also excludes food that is shipped through the United States on its way to another country as well as those entities engaged in food transportation that have less than $500,000 in total annual sales.

Although the proposed regulation is part of FSMA, which was signed into law in January 2011, it is also designed to implement the Sanitary Food Transportation Act of 2005, which directed FDA to create rules "to ensure that food is not transported under conditions that may render the food adulterated."

As FDA noted when it released the proposed rule, "the proposal marks the seventh and final major rule in the . . . FSMA central framework aimed at systematically building preventive measures across the food system." Comments on the final proposed rule are due by May 31, 2014.

In related news, Michael Taylor, FDA's deputy commissioner for foods and veterinary medicine, told the Energy and Commerce Committee of the US House of Representatives that the FDA does not have enough resources to implement FSMA.

"We will continue efforts to make the best use of the resources we have, but, simply put, we cannot achieve FDA's vision of a modern food safety system and a safer food supply without a significant increase in resources," Taylor said in his opening statement. Taylor testified before the committee on February 5, 2014.

Implementation had been set to begin in June 2015 after all seven final rules are published—a deadline imposed by a court ruling in a lawsuit brought in 2012 against FDA by the Center for Food Safety and the Center for Environmental Health. But in late February, FDA reached an agreement with the consumer groups to extend and stagger the deadlines for the release of final rules. In return, FDA will drop its appeal of the initial court ruling.

The new deadlines are:

- August 30, 2015—Preventive controls for human food and preventive controls for animal food and feed.
- October 31, 2015—Produce safety, foreign supplier verification program, and third-party accreditation.
- March 31, 2016—Sanitary transport.
- May 31, 2016—Intentional adulteration. ■

KODA Distribution Group (headquartered in Stamford, Connecticut, USA) and Solazyme, Inc. (South San Francisco, California, USA) announced in January 2014 their entrance into a distribution partnership in the lubricants and metal-working fluids industry. Monson Companies, Inc., a KODA Distribution Group Company, will make available Solazyme's Renewable™ Tailored™ High Oleic Algal Oil in Canada and the United States. KODA chose to work with Solazyme because it believes Solazyme's "biobased, algae-produced oil" can outperform "the traditional petroleum-based products in lubricants and metal-working fluids," according to Frank Bergonzi, CEO and president of KODA Distribution Group.

■■■

French adventurer Raphaël Dinelli is planning to fly across the Atlantic Ocean in June 2015 in a still-unbuilt plane powered by algae and the sun. The flight will depart from Saint-Pierre-et-Miquelon, a territorial overseas collectivity of France off the eastern coast of Canada. The plane, named Eraole, will be made of carbon fiber. Design specifications call for it to be 8 meters long with a wingspan of 14 meters and to weigh 750 kilograms. Dinelli estimates the solar panels will generate 25% of its energy requirement; the remainder will come from a diesel generator powered by oil extracted from microalgae. He estimates the trip will take 50 hours, and that the plane could glide for 3–4 hours a day to save energy. If all these plans are actualized, it will be the first transatlantic flight without a carbon footprint.

■■■

Cologne-based LANXESS AG introduced a highly concentrated stabilizer for biodiesel, called Baynox Extra, at the Fuels of the Future trade show held in Berlin, Germany, in January 2014. The active ingredients are Baynox (butylated hydroxytoluene) and Baynox Plus (6,6′-di-*tert*-butyl-2,2′-methylene-di-*p*-cresol), according to company's technical data sheets. Baynox Extra, added at 200–500 ppm, intercepts peroxide radicals and stops the autocatalytic oxidation of the unsaturated fatty acids. It can be used at temperatures as low as –10°C. ■

BIOFUELS+

Halophytes being tested for biofuel production by Boeing and its research partners. Used by permission. Copyright © Boeing

Potential new feedstock for sustainable diesel

In January 2014, aviation company Boeing and its partners—the United Arab Emirates, Etihad Airways, Honeywell UOP, and Masdar Institute of Science and Technology—announced they had made considerable progress in their development of shrub-like halophytes (such as *Salicornia bigelovii*, whose seed oil content is approximately 30%) for production of sustainable biofuels. The five organizations have been cooperating through their Sustainable Bioenergy Research Consortium (SBRC) to identify biofuel feedstocks that can thrive on seawater in desert terrains (http://tinyurl.com/SRBC-halophytes).

These institutions want to develop biofuels for two reasons. The first is to meet carbon emission standards that have been coming into play over the past decade.

The second reason has to date received less media coverage. US and global oil production has been growing owing to development of processes to win crude petroleum from tar sands and shale oil. These processes are dirtier and more complicated than conventional processes and require the use of a variety of chemicals.

According to Darrin L. Morgan, director of sustainable aviation fuels and environmental strategy at Boeing, the chemicals in these unconventional oils reduce engine efficiency and lead to other complications (http://tinyurl.com/CleanTechnica-Boeing). The oil

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What other ways are there to produce green chemicals?

Scientists have been exploring many avenues to identify new ways to produce commercially valuable green chemicals, including biofuels. In Table 1 are listed some novel pathways that are being explored to identify new ways to generate sustainable chemicals.

TABLE 1. Selected research on alternative sources of green chemicals

Organism	Growth conditions	Description of project	Products	References
Zooplankton	Wastewater treatment lagoons	Harvest zooplankton, which consume algae and accumulate oil in their structures and eggs	Biofuel	*Environ. Technol. 34*:1793–1981, 2013 doi:10.1080/09593330.2013.795985
Genetically engineered *Yarrowia lipolytica*, a yeast	Laboratory study	Lipogenesis uncoupled from nitrogen starvation	Cells with up to 90% lipid content	*Nature Communications:* doi:10.1038/ncomms4131, 2014
Methylomicrobium buryatense; genetically engineered *M. buryatense*	Methane found in natural gas. CH_4 wasted from fraccing?	In laboratory study, lipids produced at 17–22%	Liquid diesel fuel. Single-cell protein?	www.nrel.gov/news/features/feature_detail.cfm/feature_id=7300, 2014
Botryococcus braunii, an alga	Laboratory study	Non-destructive extraction, or "milking"	Hydrocarbons	*Journal of Applied Phycology:* doi:10.1007/210811-013-0179-0, 2013
Dunalliela, an alga	Grows in nature in marine/saline environments; in industrial settings, in raceways, photobioreactors and lakes	Organism can produce up to 80% of its biomass as fuel	Ingredients for pharmaceutical, cosmetic, nutraceutical and other applications. In the future: fuel	http://tinyurl.com/Dunalliela-Sustain-products

industry has not been interested in developing solutions to these problems, since aviation fuels represent a very small portion of its total output.

Thus, the SRBC is dedicated to developing and commercializing aviation biofuel that maintains the efficiency and integrity of the planes in which it is used and that is sustainable, defined as emitting 50–80% less carbon through its life cycle than fossil fuel.

The oil contained in halophyte seeds provides a biofuel feedstock, but the SBRC has found that the entire plant can be converted into biofuel, and much more effectively than many other feedstocks. Morgan said, "The types of halophytes we are working on are very amenable to being converted into sugars." In addition, "What the scientists here have found is that the halophytic family tends to be low in lignin and high in the right type of sugars, which can be converted into hydrocarbons." And because the plants free their sugars relatively easily, relatively low temperatures function well in the production process, lowering the energy requirements (http://tinyurl.com/Morgan-Boeing).

In the coming year, SBRC scientists will create a test ecosystem by planting two crops of halophytes in Abu Dhabi's sandy soil. Waste seawater from a fish and shrimp farm, which contains polluting amounts of nitrogen and phosphorus, will provide nutrients for halophytes as they grow. Once the halophytes have lowered the nutrient content of the water, it will flow into a field of mangroves before it is discharged to the ocean. Meanwhile, protein meal remaining after oil has been extracted from the plant seeds for fuel production can be looped back to the head of the system to feed the fish and shrimp.

In a company statement, Boeing indicated it will also be developing processes to convert mangrove biomass into aviation biofuel (http://tinyurl.com/Boeing-mangroves).

Shipping and biodiesel

Canada's bumper crop of grain in 2013 and the growth of fraccing in Canada and the northern portion of the United States are having an effect on biodiesel production by at least one manufacturer in the US state of Washington. Congestion along the rail lines has increased considerably as grain and fracced oil compete for access to rail transportation. To circumvent the shortage of rail cars, Pacific Coast Canola (PCC), a subsidiary of Legumex Walker Inc. (Winnipeg, Manitoba, Canada), signed a six-month contract in January to deliver by truck a portion of its super degummed canola oil to Imperium Renewables, a biodiesel manufacturer headquartered in Seattle, Washington.

In a company statement, Joel Horn, president and chief executive officer of Legumex Walker Inc., pointed out the logic behind this business decision: "North American rail congestion is now affecting our inbound delivery of seed from the Canadian prairies and North Dakota. While there is a large amount of seed available, the rail congestion is making us work harder to get the quantities we need to bring PCC to full capacity. This short-term challenge underscores the power of our local seed sourcing and product delivery strategy, as the rail congestion also impacts local customers' ability to bring in canola oil and meal from long distances in a timely and predictable manner."

Imperium's production facility in Hoquaim, Washington, can produce up to 100 million gallons (380 million liters) per year of pure (B100) biodiesel.

REG purchases LS9

In late January 2014 Renewable Energy Group, Inc. (REG), located in Ames, Iowa, USA, marked its entrance into the industrial biotechnology market by acquiring renewable chemical technology developer LS9 Inc. for up to $61.5 million, consisting of up-front and earnout payments, in stock and cash.

Most of the LS9 team, which has had its headquarters in South San Francisco, California, USA, will remain in California, under the name REG Life Sciences, LLC.

Daniel J. Oh, REG president and CEO, said, "The industrial biotechnology platform and robust patent portfolio LS9 has been building will now be combined with REG's proven production and commercialization capabilities to accelerate the commercial introduction of renewable chemicals to meet increasing customer demand for sustainable products."

LS9 has been using its proprietary technologies to harness the efficiency of the fatty acid metabolic pathway of microorganisms with the intention of offering a wide range of renewable chemicals for markets such as detergents and personal care, as well as renewable fuels. LS9's technology can use feedstocks as diverse as conventional corn and cane sugars, low-cost crude glycerin from biodiesel production, and cellulosic sugars.

REG's purchase of LS9 follows close on the heels of its purchase of Syntroleum Corp. of Tulsa, Oklahoma, USA, in December 2013 (*Inform* 25:IPG, 2014). Syntroleum pioneered Fischer-Tropsch gas-to-liquids and renewable diesel

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fuel technologies, and till now REG had concentrated on producing biodiesel.

The immediate reaction of the stock market to these purchases by REG was not favorable. From October to December 2013 shares of REG fell from approximately $16 to about $11.50. By the first of February they had fallen further to below $10, but by the end of the month prices crept up to nearly $12.

Manual for building algae industry

The Algae Biomass Organization (ABO) released its publication "Industrial Algae Measurements, Version 6.0" (IAM 6.0) in February 2014. The document is intended to set standards to measure and compare diverse algae industry operations. IAM 6.0 is a collaboration of more than 30 industry experts and organizations providing a "methodology and common descriptive language that can be applied across a variety of algae operations, regardless of size, technology or end products."

According to Lieve Laurens, chair of ABO's Technical Standards Committee and senior scientist at the US National Renewable Energy Laboratory (Golden, Colorado), "The descriptive language established by the ABO will help compare and quantify how diverse algae technologies are performing, and how they measure up at commercial production scale. This can help give information to commercial and industrial groups and could be considered an operator's manual for building the algae industry. The document provides references and resources for anyone looking into regulatory, characterization, and certification routes for biofuels and bioproducts."

The manual is available as a free download at http://tinyurl.com/ABO-manual.

Neste ranked high for sustainability

In January Neste Oil, which produces renewable diesel and renewable aviation fuel, was ranked the world's sixth most sustainable company in The Global 100 for 2014. This is the eighth consecutive time that Neste Oil has been selected for inclusion in this list of the world's 100 most sustainable companies. In 2013, Neste Oil was ranked fourth. Top place in The Global 100 for 2014 went to Westpac Banking Corporation of Australia. In addition to Neste Oil, two other Finnish companies were included: Outotec Oyj (minerals and metals processing technologies) and Kesko Oyj (retailing conglomerate).

The Global 100 list is produced by Corporate Knights, an independent consultancy company, based on an analysis of around 4,000 listed companies across a range of industries. These are reviewed against a range of indicators including greenhouse gas emissions, energy and water consumption, and the amount of waste they generate in relation to the financial benefit they produce. The review process also covers safety performance, remuneration, leadership, equality, commitment to research and development, and the taxes they pay.

Upgraded biodiesel facility in Kakinda, India

Aemetis, Inc., which is headquartered in Cupertino, California, USA, announced on February 4, 2014, that its 50 million gallon (200 million liter) per year capacity biodiesel and refined glycerin production facility in Kakinada, India has been upgraded to produce high-quality distilled biodiesel. The Aemetis plant was built in 2008 to use large volumes of lower-cost, non-food by-products from the edible oil industry as feedstock to manufacture biodiesel and glycerin for the biofuel, pharmaceutical, and industrial markets.

"The new distillation production unit . . . now produces biodiesel meeting or exceeding the highest standards for biodiesel quality worldwide," according to Sanjeev Gupta, managing director of Aemetis' subsidiary in India, Universal Biofuels Private Ltd.

The Aemetis plant is the only distilled biodiesel producer in India and is one of the only plants in Asia, according to Aemetis, that is capable of producing large supplies of biodiesel that meet European Union (ISCC) standards. During 2013, approximately $20 million of biodiesel was produced by the Aemetis plant in India and delivered to customers in Europe.

According to Eric McAfee, chairman and CEO of Aemetis, "Recently, the European Union adopted five-year, antidumping tariffs against Argentina and Indonesia due to large subsidies provided to their local producers. Since an antidumping tariff already exists against US biodiesel imports, European fuel customers are now focused on Malaysia and India as the remaining low-cost biodiesel suppliers to Europe. Using lower-cost by-products from the edible oils industry, the Aemetis biodiesel plant in India now has among the lowest cost and highest quality of any biodiesel produced."

China starts move to aviation biofuel

In mid-February China started commercial use of aviation biofuel, both as a means to ease pressure on petroleum-based sources and as a way to cut carbon emissions. Sinopec, China's largest oil refiner, was given a license to allow the commercial use of its aviation biofuel, according to the Civil Aviation Administration of China.

By licensing aviation biofuel, China becomes the fourth country in the world to produce aviation biofuel, following the United States, France, and Finland.

At present, Sinopec can produce 3,000 metric tons of aviation biofuel a years from materials such as rapeseed, cottonseed and waste cooking oil. According to the Chinese news agency Xinhua, Sinopec is considering working with private enterprise to plant, collect, and process feedstocks (http://tinyurl.com/Xinhua-biofuel-Sinopec). It has already been working with McDonald's to collect cooking oil.

China is the world's second-largest consumer of aviation fuel, and demand is estimated to be rising by 10% per year. The global average is less than 5%. ■

US researchers report the successful transformation of four refined vegetable oils (canola, soybean, olive, and grapeseed, tested individually) to a semisolid structured oil using low-calorie sugars such as mannitol and sorbitol dioctanoates as structuring agents. George John of City College of New York led the study, which appeared in the *Journal of Agricultural and Food Chemistry* (http://dx.doi.org/10.1021/jf401987a, 2013). When mixed with the oils, the gelation agents self-assembled into three-dimensional crystalline networks that encapsulated the oils in liquid stage, John and his team report.

■■■

Scientists at the University of Birmingham in the UK say they have exposed the myth that coffee consumption causes dehydration. The scientists, led by Sophie Killer, say that caffeine acts as a diuretic when consumed in large doses of >500 milligrams (about five cups of caffeinated coffee) but does not do so at low-to-moderate doses. "Our data shows [sic] no significant differences in the hydrating properties of coffee and water across a wide range of hydration indices," the scientists write in *PLOS One* (http://dx.doi.org/10.1371/journal.pone.0084154, 2014).

■■■

Scientists with the Agricultural Research Service of the US Department of Agriculture teamed with university collaborators to validate the ability of a database of allergenic proteins to predict when a person who is allergic to one kind of nut may also be allergic to proteins in another kind of nut, a condition called "cross-reactivity." Proteins in cross-reactive nuts are thought to have similar IgE (immunoglobulin E) antibody-recognition sites. So the researchers took known IgE binding sites (epitope sequences) from peanut and nut proteins and ran those through the Structural Database of Allergenic Proteins (SDAP) in order to predict cross-reactive epitopes in other nuts. The finding indicates that the SDAP database (see http://fermi.utmb.edu) can be used to predict if persons who are allergic to one type of nut may also be allergic to another type of nut. ■

FOOD, HEALTH & NUTRITION

Finally, a way to authenticate premium chocolate

For some people, nothing can top a morsel of luxuriously rich, premium chocolate. But until now, other than depending on their taste buds, chocolate connoisseurs had no way of knowing whether they were getting what they paid for.

In the *Journal of Agricultural and Food Chemistry* (http://dx.doi.org/10.1021/jf404402v, 2014), scientists have reported for the first time a method to authenticate the varietal purity and origin of cacao beans, the source of chocolate's main ingredient, cocoa.

Dapeng Zhang and colleagues with the Agricultural Research Service (ARS) of the US Department of Agriculture (USDA) note that lower-quality cacao beans often are mixed in with premium varieties on their way to becoming chocolate bars, truffles, sauces, and liqueurs. But the stakes for policing the chocolate industry are high. It is a multi-billion-dollar global enterprise, and in some regions, it is as much art as business.

There is also a conservation angle to knowing whether products are actually what confectioners claim them to be. The ability to authenticate premium and rare varieties would encourage growers to maintain cacao biodiversity rather than depend on the most abundant and easiest-to-grow trees. Researchers have found ways to verify through genetic testing the authenticity of many other crops, including cereals, fruits, olives, tea, and coffee, but those methods are not suitable for cacao beans. Zhang's team wanted to address this challenge.

Applying the most recent developments in cacao genomics, they were able to identify a small set of the DNA markers known as single nucleotide polymorphisms that make up the unique fingerprints of different cacao varieties. The technique works on single cacao beans and can be scaled up quickly to handle large samples. "To our knowledge, this

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is the first authentication study in cacao using molecular markers," the researchers state.

The authors acknowledge funding from ARS, USDA, and a financial gift from the Lindt & Sprüngli chocolate company through the World Cocoa Foundation.

Scientists find genetic mechanism linking aging to specific diets

Your best friend swears by the Paleo Diet. Your boss loves Atkins. Your sister is gluten-free, and your roommate is an acolyte of Michael Pollan. So who is right? Maybe they all are.

In a study that appeared in *Cell Metabolism* (http://dx.doi.org/10.1016/j.cmet.2013.12.005, 2014), University of Southern California (Los Angeles, USA) scientists Sean Curran and Shanshan Pang identify a collection of genes that allow an organism to adapt to different diets and show that without them, even minor tweaks to the diet can cause premature aging and death.

Finding a genetic basis for an organism's dietary needs suggests that different individuals may be genetically predisposed to thrive on different diets—and that now, in the age of commercial gene sequencing, people might be able to identify through a simple blood test which diet would work best for them.

"These studies have revealed that single gene mutations can alter the ability of an organism to utilize a specific diet. In humans, small differences in a person's genetic makeup that change how well these genes function could explain why certain diets work for some but not others," said Curran, corresponding author of the study.

Curran and Pang studied *Caenorhabditis elegans*, a one millimeter long nematode that scientists have used as a model organism since the 1970s. Decades of tests have shown that genes in *C. elegans* are likely to be mirrored in humans, and its short lifespan allows scientists to conduct aging studies.

In the current study, the researchers identified a gene called *alh-6*, which delays the effects of aging—depending on what type of diet the worm is fed—by protecting it against diet-induced mitochondrial defects.

"This gene is remarkably well-conserved from single-celled yeast all the way up to mammals, which suggests that what we have learned in the worm could translate to a better understanding of the factors that alter diet success in humans," Curran said.

Future work will focus on identifying what contributes to dietary success or failure, and whether these factors explain why specific diets do not work for everyone. This could be the start of personalized dieting based on an individual's genetic makeup, according to Curran.

"We hope to uncover ways to enhance the use of any dietary program and perhaps even figure out ways of overriding the system(s) that prevent the use of one diet in certain individuals," he said.

Short-term changes in the diet can alter gut bacteria

Changes to microbial communities in the human gut (the microbiome) are now thought to contribute to the increase in chronic illnesses including obesity and inflammatory bowel disease. Long-term dietary intake influences the structure and activity of the microbiome. But how quickly is the gut microbiome affected by dietary changes?

A group of researchers from Harvard and the University of California, San Francisco—led by Lawrence David, now of Duke University—set out to answer just that question. They recruited 10 volunteers, including one vegetarian, who for five days consumed either an animal-based diet of about 1,800 kcal (meat, eggs, and cheese) or a plant-based diet of about 1,700 kcal (grains, fruit, and vegetables).

The animal-based diet had the greater effect on the gut microbiome, increasing the abundance of bile-tolerant microorganisms and decreasing the levels of microbiota that metabolize dietary plant polysaccharides. The researchers note in particular that there was an increase in the abundance and activity of *Bilophila wadsworthia* in those consuming the animal-based diet. This organism feeds on bile acids, which aid the digestion of saturated fats in milk. An increase in *B. wadsworthia* has been linked to inflammatory bowel disease in mice. Further, those subjects on the plant-based diet were found to have an increase in the number of bacteria that produce butyrate, a fatty acid that has been reported to decrease inflammation.

"In concert, these results demonstrate that the gut microbiome can rapidly respond to altered diet," the scientists write, "potentially facilitating the diversity of human dietary lifestyles."

The work was reported in a letter published in *Nature* (http://dx.doi.org/10.1038/nature12820, 2013).

Omega-3 fatty acids may help reduce risk of type 2 diabetes

High concentrations of serum long-chain omega-3 fatty acids resulting from the consumption of fatty, coldwater fish or fish oil may help reduce the risk of type 2 diabetes, according to a study led by Jyrki K. Virtanen at the University of Eastern Finland (UEF) in Kuopio.

Type 2 diabetes is widespread throughout the world. Overweight is the most significant risk factor, which means that diet and other lifestyle factors play important roles in the development of type 2 diabetes. Earlier research has established that weight management, exercise, and high serum linoleic acid concentrations, among other things, are associated with reduced risk of diabetes. However, findings on how fish consumption or long-chain omega-3 fatty acids affect the risk of diabetes have been contradictory. A protective link has mainly been observed in Asian populations, whereas a similar link has not been observed in European or US studies—and some studies have even linked a high consumption of fish to increased diabetes risk.

The Kuopio Ischaemic Heart Disease Risk Factor Study at UEF determined the serum omega-3 fatty acid concentrations of 2,212 men between 42 and 60 years of age at the onset of the study, in 1984–1989. During a follow-up period of 19.3 years, 422 men were diagnosed with type 2 diabetes.

Serum long-chain omega-3 fatty acid concentrations were used to divide the subjects into four categories. The risk of developing type 2 diabetes of the men in the quartile with the highest serum omega-3 fatty acid concentration was 33% lower than the risk of men in the lowest quartiles, the researchers said.

The study appeared in *Diabetes Care* (http://dx.doi.org/10.2337/dc13-1504, 2014).

Humans can use smell to detect levels of dietary fat

A new study reveals that humans can use the sense of smell to detect dietary fat in food. Because the smell of food almost always is detected before the food is tasted, the findings identify one of the first sensory qualities that signals whether a food contains fat. The research suggests that innovative methods using odor to make low-fat foods more palatable could someday aid public health efforts to reduce dietary fat intake.

"The human sense of smell is far better at guiding us through our everyday lives than we give it credit for," said senior author Johan Lundström, a cognitive neuroscientist at the Monell Chemical Senses Center in Philadelphia, Pennsylvania, USA. "That we have the ability to detect and discriminate minute differences in the fat content of our food suggests that this ability must have had considerable evolutionary importance."

As the most calorically dense nutrient, fat has been a desired energy source across much of human evolution. As such, it would have been advantageous to be able to detect sources of fat in food, just as a sweet taste often signals a source of carbohydrate energy.

Although previous work has shown that humans use sensory cues to detect fat, it remained unclear which sensory systems contribute to this ability. The Monell researchers reasoned that fat detection via smell would have the advantage of identifying food sources from a distance.

While earlier research had determined that humans could use the sense of smell to detect high levels of pure fat in the

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form of fatty acids, it was not known whether it was possible to detect fat in a food matrix.

In the current study, reported in the open access journal *PLOS ONE* (http://dx.plos.org/10.1371/journal.pone.0085977, 2014), the researchers explored whether people could detect and differentiate the amount of fat in a commonly consumed food product: milk. To do this, they asked 18 healthy subjects to smell milk containing an amount of fat that might be encountered in a typical milk product: either 0.125%, 1.4%, or 2.7% fat.

The milk samples were presented to blindfolded subjects in three vials. Two of the vials contained milk with the same amount of fat, while the third contained milk with a different percentage of fat. The subjects' task was to smell the three vials and identify which of the samples was different.

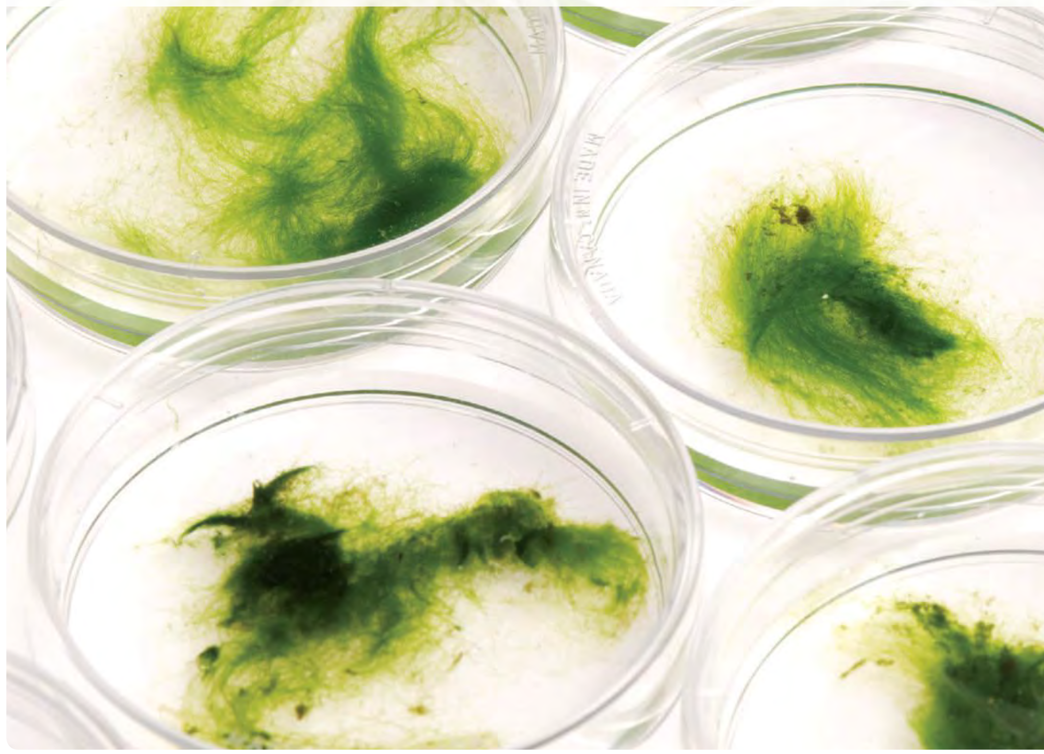
The same experiment was conducted three times using different sets of subjects. The first used healthy normal-weight people from the Philadelphia area. The second experiment repeated the first study in a different cultural setting, the Wageningen area of the Netherlands. The third study, also conducted in Philadelphia, examined olfactory fat detection both in normal-weight and overweight subjects.

In all three experiments, participants were able to discriminate between different levels of fat in the milk. This ability did not differ in the two cultures tested, even though people in the Netherlands on average consume more milk on a daily basis than do persons in the United Sates. There was no relation between weight status and the ability to discriminate fat.

"We now need to identify the odor molecules that allow people to detect and differentiate levels of fat. Fat molecules typically are not airborne, meaning that they are unlikely to be sensed by sniffing food samples," said lead author Sanne Boesveldt, a sensory neuroscientist. "We will need sophisticated chemical analyses to sniff out the signal." ■

CLASSIFIED

BIOTECHNOLOGY



Alternative sources of DHA and EPA

Evidence showing that long-chain polyunsaturated fatty acids (PUFA) such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are essential for human health has been accumulating for over 20 years. At present the main sources of EPA and DHA for human nutrition are derived from marine organisms such as fish and krill. These are finite resources, though, so a number of researchers are trying to identify alternative sustainable sources that could be exploited for these PUFA.

Myxobacteria. Scientists at Saarland University (Saarbrücken, Germany) recently demonstrated that soil-dwelling bacteria known as myxobacteria have the genes to synthesize certain n-3 long-chain PUFA, including DHA, EPA, and linoleic acid (LA). The researchers identified two distinct biochemical pathways for these syntheses. One organism, *Sorangium cellulosum*, can make LA, and members of the genus *Aetherobacter* can turn out EPA and DHA prolifically.

Rolf Müller, head of the research team, said, "The presence of different types of PUFA biosynthetic pathways with such product diversity within the same bacterial family is an outstanding aspect in the field of research on PUFA biosynthesis" (http://tinyurl.com/Muller-PUFA-myxo).

The pathways to long-chain PUFA in myxobacteria differ from those in marine organisms in terms of gene organization, catalytic domain arrangement, and the sequence identity of the encoded PUFA synthases.

Native producer stains of *Sorangium* and *Aetherobacter* grow slowly and are difficult to handle, but Müller and his colleagues reported that the relevant genes of these organisms can be transferred into and expressed by *Myxococcus xanthus*, a fast-growing model strain of myxobacteria.

For further information, see K. Gemperlein, S. Rachid, R.O. Garcia, S.C. Wenzel, and R. Müller, Polyunsaturated fatty acid biosynthesis in myxobacteria: Different PUFA synthases and their product diversity,

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BRIEFS

In a presentation to the Oxford Farming Conference in January 2014, the UK Secretary of State for Environment, Food and Rural Affairs Owen Paterson said, "The longer Europe continues to close its doors to GM [genetically modified crops], the greater the risk that the rest of the world will bypass us altogether." He added, "Europe risks becoming the museum of world farming as innovative companies make decisions to invest and develop new technologies in other markets" (http://tinyurl.com/Paterson-museum).

■■■

The US Supreme Court upheld a patent ruling on January 13, 2014, that protects the ability of Monsanto Co. (St. Louis, Missouri) to sue farmers whose fields are inadvertently contaminated by plants containing the company's genetically modified traits. The original lawsuit was filed at the Manhattan, New York, district court in March 2011 on behalf of 60 family farmers, seed businesses, and agricultural organizations, including the Organic Seed Growers and Trade Association. The district court and the US Court of Appeals for the Federal Circuit in Washington, DC, both ruled in favor of Monsanto prior to the Supreme Court ruling.

■■■

Biocatalysts Ltd., a Wales-based company that provides specialty food enzymes—both off-the-shelf and customized products—announced in late January 2014 that it had achieved a kosher certificate. This allows the company to manufacture its kosher enzymes without needing to have a rabbi on-site. As a consequence, customers will no longer have to order kosher products well in advance of need in order to coordinate with the presence of a rabbi. Biocatalysts Ltd. is also able to produce enzymes that meet Islamic dietary laws (halal) and vegetarian restrictions, providing it an extra level of competitive advantage. ■

Chemistry World, http://dx.doi.org/10.1039/C3SC53163E, 2014.

Marine diatoms (algae). Microalgae and diatoms are the primary producers of EPA and DHA in the marine food web. If these organisms could be cultivated for this property, perhaps they could become important sources of PUFA for human consumption.

According to scientists at Rothamsted Research (Harpenden, UK), no algal strains are known at present that accumulate high levels of both EPA and DHA in their triacylglycerols. The diatom *Phaeodactylum tricornutum* naturally accumulates high levels of EPA, up to ~35%, and is likely a good source for industrial production of EPA, but it produces only trace amounts of DHA.

The Rothamsted Research team, headed by Johnathan A. Napier, used biolistic transformation to overexpress two different genes encoding enzyme activities of the long-chain PUFA biosynthetic pathway, namely Δ6-desaturase and Δ5-elongase, in *P. tricornutum.* The team found that heterologous expression of a Δ5-elongase from the picoalga *Ostreococcus tauri* resulted in "significantly increased accumulation of DHA" in *P. tricornutum*. Furthermore, co-expression with an acyl-CoA dependent Δ6-desaturase led to still further increases in DHA.

Expression of both Δ6-desaturase and Δ5-elongase from *O. tauri* in *P. tricornutum* led to eightfold accumulation of DHA beyond what was present in the original strain. The authors report that their work represents for the first time in a transgenic diatom the co-expression of two heterologous activities.

For further information see M.L. Hamilton, R.P. Haslam, J.A. Napier, and O. Sayanova, Metabolic engineering of *Phaeodactylum tricornutum* for the enhanced accumulation of omega-3 long chain polyunsaturated fatty acids, *Metabolic Engineering*, http://dx.doi.org/10.1016/j.ymben.2013.12.003.

Field trials for omega-3 fatty acid-producing camelina

Following up on its publication that it has developed genetically modified *Camelina sativa* capable of accumulating omega-3 long-chain polyunsaturated fatty acids (LC-PUFA; termed "fish oils" for short), Rothamsted Research submitted an application to the UK Department for Environment, Food and Rural Affairs (DEFRA) for permission to carry out field trials of the plant on the Rothamsted Farm (Harpenden, UK) in 2014, 2015, 2016, and 2017. The goal is to ascertain whether camelina can make significant quantities of LC-PUFA under field conditions.

At present, the primary human dietary sources of these fatty acids are marine fish, whether wild or farmed. Fish do not themselves produce these oils, but rather they accumulate them through their diet. Wild-caught fish acquire LC-PUFA from eating algae and organisms lower in the food chain, but farmed fish must accumulate these fatty acids by consuming fishmeal and fish oil.

Currently, around 80% of all harvested fish oil is fed to farmed fish. If there were other nonfish sources of these omega-3 LC-PUFA, the aquaculture industry would be better able to ensure that its production practices remain sustainable and reduce pressure on the essential marine food web.

The UK newspaper *The Telegraph* reported that a hectare of GM camelina would be expected to generate just under a metric ton of vegetable oil, or about 80% of the yield one would expect from oilseed rape (http://tinyurl.com/telegraph-GMOcamelina). The vegetable oil would likely contain about 14% docosahexaenoic acid and 12% eicosapentaenoic acid.

Andrew Mallison, director general of IFFO The Marine Ingredients Organisation, wrote in a letter to the editor of *The Independent*, "Major animal feed companies, through their support for fish oil, are incentivizing fishery improvement programs. Losing markets to vegetable alternatives would reduce the incentive for this positive change and favor competition, which itself is not free from environmental concerns" (www.iffo.net/node/536).

At press time, DEFRA had not yet announced its decision regarding Rothamsted's application.

Test to monitor for GMOs

A Chinese team of researchers headed by Li-Tao Yang and Sheng-Ce Tao recently published the results of their efforts to develop a system for high-throughput monitoring of genetically modified organisms (GMOs; *Anal. Chem. 86*:1269–1276, 2014; http://dx.doi.org/10.1021/ac403630a). Their work involved developing a multiplex amplification on a chip with readout on an oligo microarray (MACRO) system. The MACRO contained a total of 91 targets (18 universal elements, 20 exogenous genes, 45 events, and 8 endogenous reference genes) that covered 97.1% of all GM events that had been commercialized up to 2012 The authors claim the specificity of MACRO is ~100% and that the limit of detection is suitable for real-world applications. The authors suggested that MACRO can be used to effectively monitor the majority of commercialized GMOs in a single test.

The authors also propose that the test can easily be expanded in the future to include new GMOs.

GMO soybeans may affect international trade in honey

Mexican researchers found pollen from genetically modified (GM) soybeans in honey collected in 2012 from beehives near the soybean fields. Although soybean plants can self-pollinate, the scientists pointed out that there is much evidence that the bee *Apis mellifera* visits soybean flowers.

Studies were carried out in Hopelchén, Campeche, Mexico, where about 10,000 hectares of soybeans were cultivated in 2012. Five beekeepers furnished a total of nine honey samples, representing complete combs, so as to obtain enough honey for pollen and genetic analysis. The soybean fields were within 300 meters of the hives. *Apis mellifera* bees are known to forage at distances averaging 2 km from their hives; the maximum radius is generally 8 km.

Of the nine samples analyzed, pollen grains of soybeans were found in six. Soybean pollen constituted 8–48% of pollen from all sources in the honey samples; the rest came from wild plant species in the area. The honey was then tested for GMO using a polymerase chain reaction analysis; two of the six samples tested positive for soybean transgenic material.

The research team, headed by David W. Roubik of the Smithsonian Tropical Research Institute, Republic of Panama, pointed out that Mexico is the fourth-largest producer and fifth-largest exporter of honey in the world (*Sci. Rep. 4*, 4022; doi:10.1038/srep04022, 2014). Exports, particularly to Europe, are affected by the presence or absence of GM materials. For example, honey exported to Germany is rejected if it is contaminated with transgenic pollen grains regardless of whether they are from a genetically modified products approved for human consumption.

The scientists suggest that the subsistence agriculture associated with honey production in Mexico is likely to be adversely affected by GM soybeans, and beekeeping practices in general may be brought into question.

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AOCS MEETING WATCH

May 4–7, 2014. 105th AOCS Annual Meeting & Expo, Henry B. Gonzalez Convention Center, San Antonio, Texas, USA. http://annualmeeting.aocs.org

October 6–9, 2014. World Conference on Fabric and Home Care—Montreux 2014, Montreux Music & Convention Centre, Montreux, Switzerland. http://montreux.aocs.org

May 3–6, 2015. 106th AOCS Annual Meeting & Industry Showcase. Rosen Shingle Creek, Orlando, Florida, USA

For in-depth details on these and other upcoming meetings, visit http://aocs.org/meetings or contact the AOCS Meetings Department (email: meetings@aocs.org; phone: +1 217-693-4821; fax: +1 217-693-4865).

Also, be sure to visit AOCS' online listing of industry events and meetings at http://tinyurl.com/industry-calendar. Sponsoring organizations can submit information about their events to the web-based calendar by clicking a link and completing a web form. Submission is free. No third-party submissions, please. If you have any questions or comments, please contact Valorie Deichman at valoried@aocs.org.

US breakfast cereal makers announce new products

In response to special interest groups and American retailers, General Mills, Inc. (Golden Valley, Minnesota, USA) announced in January 2014 that it would introduce a non-GMO (non-genetically modified organism) version of its popular Original Cheerios® breakfast cereal. General Mills' Vice President of Global Communications Tom Forsythe said the company wanted to offer its customers a non-GMO choice; General Mills did not reformulate because of GMO safety concerns, and there are no plans to reformulate other brands.

Later in the month, Post Holdings, Inc. (St. Louis, Missouri, USA) announced it was reformulating its Original Grape Nuts cereal as well to contain no GMO. The company did not specifically state what changes had been made to the recipe, for example, whether the soy protein had been changed (http://tinyurl.com/PostGrapeNuts-nonGMO). The recipe no longer contains vitamin A, vitamin D, riboflavin, or vitamin B12

Kellogg's (Battle Creek, Michigan), the third of the three largest US cereal manufacturers, is expected to make a similar announcement, according to FoodNavigator-USA (http://tinyurl.com/will-kellogg-join), but the company had made no comment by press time.

GMO purchase decisions based on price

The NPD Group, an international market research firm with US offices in Port Washington, New York, released a report in February 2014 entitled "Gauging GMO Awareness and Impact" (http://tinyurl.com/NPD-grocery-shoppers). The report found that 67% of all US primary grocery shoppers are not willing to pay a higher price for foods that are identified as being non-genetically modified.

Although half of US consumers express some level of concern about genetically modified organisms (GMO), according to the report, many cannot clearly describe what a GMO is. This lack of clarity may contribute to their unwillingness to pay a higher price for non-GMO foods.

NPD Group also found that consumers did not have a clear idea of the prevalence of GMO vs. non-GMO items at their grocery stores.

Whereas the major of shoppers say they do not want to pay more for non-GMO foods and beverages, NPD reports a subset of grocery shoppers who are aware and concerned about GMOs are willing to pay more, or 11% of all primary shoppers. Additionally NPD reported "half of people who primarily shop specialty stores are willing to pay more for non-GMO products." ■

Bookstore

AOCS PRESS

New Products on Display at the 105th AOCS Annual Meeting & Expo

May 4–7, 2014 | San Antonio, Texas, USA

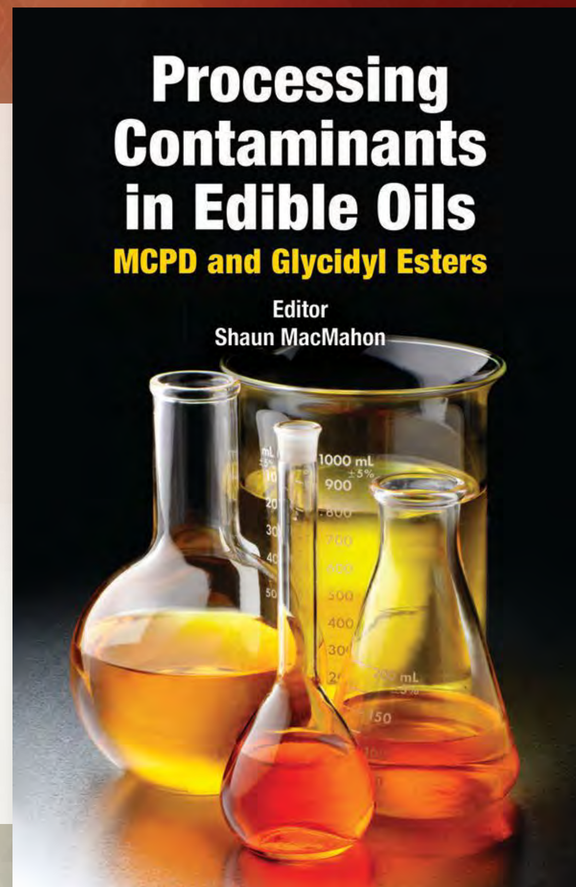
Processing Contaminants in Edible Oils

MCPD and Glycidyl Esters

Edited by Shaun MacMahon
2014. Hardback. 266 pages. ISBN: 978-0-9888565-0-9.
Product Code 272
List: $155 • AOCS Member: $110

This book discusses the current research on monochloropropanediol (MCPD) and glycidyl esters in edible oils. These potentially harmful contaminants are formed during the industrial processing of food oils during deodorization. The mechanisms of formation for these contaminants, as well as research identifying possible precursor molecules are reviewed. Strategies which have been used successfully to decrease the concentrations of these contaminants in edible oils are discussed, including the removal of precursor molecules before processing, modifications of deodorization protocol, and approaches for the removal of these contaminants after the completion of processing. Analytical strategies for accurate detection and quantitation of MCPD and glycidyl esters are covered, along with current information on their toxicological properties. This book serves as a single point of reference for the significant research related to these contaminants.

Also available as an eBook on iTunes and Amazon.



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Ernie Rosenberg, an AOCS member and president and CEO of the American Cleaning Institute (ACI), has been elected chair of the National Association of Manufacturer's Council of Manufacturing Associations (CMA) and will serve a one-year term (January 2014–January 2015). "The CMA is a vital component of the NAM, made up of nearly 240 industry-specific manufacturing associations that provide resources and networks to members to broaden the reach of the NAM's advocacy efforts," ACI said in a news release. ACI is a trade group based in Washington, DC, USA.

■■■

TRI-K Industries, Inc. (Denville, New Jersey, USA), a unit of India's Galaxy group, has acquired Surfactants International, Inc. and its Surety Laboratories division from Actives International. Founded in 1977, Surfactants International (Middlesex, New Jersey) provides surfactants, polymers, and preservatives for personal care, household, and specialty industrial products.

■■■

In mid-January 2014, Clariant AG (Muttenz, Switzerland) closed the sale of its Detergents & Intermediates business to a European investment group, International Chemical Investors Group (ICIG), based in Luxembourg and Germany. The unit was sold for CHF58 million ($64 million), according to Clariant. Globally, 660 employees were transferred from Clariant to the new ICIG business, which began operating under the WeylChem brand.

■■■

Evonik Corp., the North American operating arm of Germany's Evonik Industries, announced in January 2014 that it has completed its merger with Evonik Goldschmidt Corp., a provider of specialty surfactants to numerous industries, with a focus on the consumer market. "As of January 1, 2014, Evonik Goldschmidt Corp. is fully incorporated into Evonik Corp. and is no longer a separate legal entity," said Reinhold Brand, senior vice president and general manager of Evonik's Consumer Specialties North American Business Unit. ■

HOME & PERSONAL CARE

Concerns over triclosan and BPA raised in Europe

Triclosan, the antibacterial compound under investigation by the US Food and Drug Administration (FDA) partly because of its widespread use in liquid soaps and body washes, is also a subject of concern in Europe.

The Chemical Watch (CW) news service reported in January 2014 that Ciprian Tănăsescu, Romanian member of the European Parliament (MEP), has raised concerns over the use of triclosan in toothpaste, based on research from Denmark suggesting that the substance is a potential endocrine disruptor. There are also studies showing that triclosan causes antibacterial resistance in people, the MEP argued. (The FDA, it should be noted, did not mention toothpastes in its December 2013 proposed rule regarding the safety and effectiveness of antibacterial soaps. See http://tinyurl.com/triclosan-FDA.)

European Union Health Commissioner Tonio Borg reportedly responded by saying that "according to the opinions issued by the Scientific Committee on Consumer Safety, triclosan is safe to use at a maximum concentration of 0.3% in toothpastes, hand soaps, and other similar toiletry products," according to CW. The Commissioner also was quoted as saying that there is no possibility of determining the risk of triclosan causing antimicrobial resistance based on the data currently available.

BPA ALSO UNDER SCRUTINY

In the meantime, the European Food Safety Authority (EFSA) announced in January 2014 that it will conduct a public consultation on its draft assessment of the human health risks posed by exposure to bisphenol A (BPA). BPA is used to manufacture certain plastics and resins and may be found in thermal receipt paper, food contact materials such as

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packaging, and in consumer products such as cosmetics and personal care products.

EFSA examined more than 450 studies relating to potential health hazards associated with BPA and identified likely adverse effects on the liver and kidney as well as on the mammary gland. The agency recommended, in its draft report, that the current tolerable daily intake (TDI) temporarily be lowered from its current level of 50 μg/kg of bodyweight (bw)/day to 5 μg/kg bw/day. Despite that recommendation, EFSA concluded that "BPA poses a low health risk to consumers as exposure to the chemical is well below the temporary TDI." (See http://tinyurl.com/EFSA-Draft-BPA.)

Questions about BPA and other endocrine disruptors found in household products arose in 2012 after the release of a study in *Environmental Health Perspectives* of more than 200 cleaning and personal care products (http://dx.doi.org/10.1289/ehp.1104052). Study leader Robin Dodson of the Silent Spring Institute (Newton, Massachusetts, USA) and her team found BPA in dish and laundry detergent, tub and tile cleaner, soaps, lotions, shampoo, conditioner, shaving cream, nail polish, and sunscreen. "Concentrations were <100 μg/g, with most <10 μg/g. BPA was not detected in alternative samples except sunscreen, so selecting alternative products according to our criteria appears to avoid BPA," the scientists said. "No labels listed BPA."

Linda Loretz of the Personal Care Products Council (PCPC; Washington, DC, USA) pointed out that BPA is not intentionally added to cosmetics or personal care products and is present at only parts per billion levels. Further, she noted that the EFSA draft report found that the major source of exposure is from the diet, with exposure through the skin ranking second. Loretz is the PCPC's director of safety and regulatory toxicology and chief toxicologist.

ACI introduces sustainable charter and hazard data portal

The American Cleaning Institute (ACI; Washington, DC) introduced a charter for sustainable cleaning and a hazard data portal—which forms the second phase of the trade group's ingredient inventory—at the trade group's annual meeting in Orlando, January 27–February 1, 2014.

The charter (www.cleaninginstitute.org/charter) is designed to provide a framework for industry best practices and sustainability goals throughout a product's life cycle. Participation in the charter is voluntary, and requires companies to:

- commit to the ACI principles for sustainability;
- use the ACI's sustainability metrics program; and
- work toward implementing the group's essential sustainability procedures and activities covering design, raw material use, manufacture, consumer use, and disposal of products and packaging.

ACI vice president of sustainability initiatives, Brian Sansoni, said the charter "creates a credible industrywide initiative for continual assessment, review, and improvement of sustainability performance at major stages of the product life cycle."

HAZARD PORTAL ALSO INTRODUCED

The hazard data portal (http://tinyurl.com/ACI-Portal) provides publicly available information for each chemical ingredient in ACI members' cleaning products. It will be part of the ACI's ingredient inventory, which includes more than 900 substances that are searchable by chemical name or CAS (Chemical Abstract Service) number.

Primary information sources for the database include the US Environmental Protection Agency's high production volume data, the European Union's REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals) dossiers, Canada's Domestic Substances List, and Japan's Chemicals Collaborative Knowledge database.

"In this first iteration of our hazard data portal, we found that sufficient information was available for decision making and risk assessment for 80% [of the] ingredients in the cleaning products of ACI members," said ACI Senior Director of Environmental Safety Paul DeLeo. "This initiative represents the cleaning product industry's continued commitment to transparency," he added.

In the third quarter of 2014, ACI will add exposure assessment data to the inventory. In the fourth and final phase of the project, planned for mid-2015, the group will prepare screening-level risk assessments for each chemical in the ingredient database.

Women's Voices for the Earth science and research director Alexandra Scranton said she welcomes the database, but noted that there are outstanding data gaps, particularly in fragrance ingredients, and that the system does not provide users with a navigation tool for ingredients with multiple names.

ACI responded by saying the database is intended for professionals seeking detailed information.

Strong growth in chemical management activity

Two-thirds of companies surveyed by the Chemical Watch (CW) regulatory news service will expand their internal chemical compliance teams in the next five years, according to preliminary findings. In addition, 62% will increase their use of external service providers. "Both these figures represent an increase of 60% compared with 2013's results," CW said, indicating that the global drivers for chemical regulation activity remain strong.

The preliminary results reported on the CW website (www.chemicalwatch.com) suggest that:

- In Europe, the REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals) and CLP (Classification, Labeling, and Packaging) regulations continue to be the main global drivers of chemical regulation.
- Almost half (48%) of the responses mention at least one US-based regulation, with the new California

Safer Consumer Products Regulation identified as a global driver by 21% of respondents.

- Chinese regulation has gained in importance, rising from 34% of respondents claiming it was the main global driver in 2013 to 43% this year. A further 27% cite South Korea and 18% specify regulations from Japan.
- Overall, 70% of participants are satisfied with their chemical management service providers, continuing what CW called the "steady decline in satisfaction" since CW's first survey in 2010, in which 88% of respondents were satisfied.

Stuart Foxon, *Chemical Watch* commercial director, said: "Almost 1,300 professionals have completed this year's survey so far, and they are telling us that, despite the passing of some significant REACH deadlines, there is little let up for the global chemical compliance manager as regulations in other countries are enacted and implemented. Teams are getting larger, job security is improving, and the use of external service providers is increasing."

Versalis and Elevance partner

Versalis—the chemical subsidiary energy conglomerate Eni S.p.A. (Rome, Italy)—and Elevance Renewable Sciences, Inc. (Woodridge, Illinois, USA)—a producer of specialty chemicals from natural oils—have signed a Memorandum of Understanding to develop and scale a new metathesis technology to produce biochemicals from vegetable oils.

Versalis and Elevance said in a news release that they intend to focus on jointly developing and scaling new catalysts. In addition, the partners will assess the design and construction of the first world-scale ethylene metathesis-based production facility that will utilize renewable oils at the Versalis Porto Marghera site in Italy.

The market applications of the future biochemicals production will be personal care, detergents and cleaners, biolubricants, and oilfield chemicals, the companies said.

Elevance also announced that it has selected URS Corp. to provide engineering, procurement, and construction services for its second world-scale biorefinery in Natchez, Mississippi, USA. This manufacturing facility will produce novel specialty chemicals, including multifunctional esters such as 9-decenoic methyl ester; a unique distribution of biobased alpha and internal olefins including decene; and a premium mixture of oleochemicals. It will have a capacity of 280,000 metric tons per year.

CONTINUED ON NEXT PAGE

What is next for the US laundry sector?

The most recent laundry innovation offered to US consumers—unit-dose laundry detergent capsules—was a success, but "their introduction has done little to increase overall category sales in the [United States]," writes Tom Branna of *HAPPI* magazine. That fact, he says, leaves formulators trying to lure buyers with "even more product forms, different concentrations, complex fragrances and, of course, new products."

The weak economy has not helped the home-care sector. Sales were down by 3%, Branna said—according to Information Resources, Inc. (Chicago, Illinois, USA)—for the 52 weeks ending November 3, 2013. Sales still amounted to more than $7 billion in total; unit-dose products were up nearly 80%, whereas liquids were down 6%, and powders declined by 12%.

The *HAPPI* article quotes Ed Vlacich, executive vice president and general manager of national brands for Sun Products, who noted that consumers who adopt unit-dose products are less likely to overdose "as they might with liquids." Further, high-efficiency washing machines—which now have a 40% share of the US market—use less detergent than traditional washing machines, *HAPPI* says, because of their built-in automatic detergent dispensers.

P&G and J&J reformulation news

The Procter & Gamble Co. (P&G; Cincinnati, Ohio, USA) told UK's *The Guardian* newspaper in late January 2014 (http://tinyurl.com/PG-Phosphates) that it will eliminate phosphates from all of its laundry detergents, including Tide™, within two years.

Because P&G removed phosphates from detergents in the United States in the 1990s and from laundry products sold in Europe several years ago, the change "will likely have the greatest impact on developing countries that don't have regulations limiting phosphates in detergents," *The Guardian* noted.

Another US-based company, Johnson & Johnson (J&J; New Brunswick, New Jersey), was also in the news because of a product reformulation. This time, the news involved the company's stated objective to remove by the end of 2013 two potentially harmful chemicals—formaldehyde and 1,4-dioxane—from its baby products. J&J told *The New York Times* (http://tinyurl.com/NYT-reformulation) that it not only had met its goal on time but also will remove the chemicals from all of its consumer products by 2015. ■

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Active membership is "individual" and is not transferable. Membership year is from January 1 through December 31, 2014.
*Complimentary student membership includes free access to online *inform* only. Student membership applies to full-time graduate students working no more than 50% time in professional work, excluding academic assistantships/fellowships.

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$__________

❑ *JAOCS* — $175 | ❑ *Lipids* — $175 | ❑ *Journal of Surfactants and Detergents* — $175

These prices apply only with membership and include print and online versions and shipping/handling.

DIVISIONS AND SECTIONS DUES (Division memberships are free for students.)

$__________

Divisions	Dues/Year	Divisions	Dues/Year	Sections	Dues/Year	Sections	Dues/Year
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❑ Analytical	$15	❑ Phospholipid	$20	❑ Australasian	$25	❑ Latin American	$15
❑ Biotechnology	$20	❑ Processing	$10	❑ Canadian	$15	❑ USA	FREE
❑ Edible Applications Technology	$20	❑ Protein and Co-Products	$12	❑ European	$25		
❑ Health and Nutrition	$20	❑ Surfactants and Detergents	$30				
❑ Industrial Oil Products	$15						

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❑ To pay by credit card, please use our online application (www.aocs.org/join) or contact Doreen Berning at +1 217-693-4813.

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AOCS: Your international forum for fats, oils, proteins, surfactants, and detergents.

This Code has been adopted by AOCS to define the rules of professional conduct for its members.

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.

PEOPLE/INSIDE AOCS

Hill, Trautmann, elected to lead AOCS

Hill

Trautmann

Steven Hill, vice president, cheese and dairy R&D and quality, Kraft Foods, Glenview, Illinois, USA, was elected AOCS president in the 2014–2015 officer election. **Manfred Trautmann**, managing director, detergents & intermediates, WeylChem Switzerland AG, Muttenz, was elected vice president. Under AOCS by-laws, the vice president is also president-elect and runs unopposed for president the following year.

Neil R. Widlak, retired, USA, was elected to a two-year term as secretary.

Elected as AOCS Governing Board members-at-large were: **Roberto Berbesi Anaya**, sales manager LATAM/ASIA Oil-Dri Corporation of America, Ft. Lauderdale, Florida, USA; **Richard (Rick) Della Porta**, senior principal scientist, Frito-Lay North America Research and Development Analytical Laboratories, Plano, Texas, USA; **Robert A. Moreau**, lead scientist, Eastern Regional Research Center, Agricultural Research Service, United States Department of Agriculture, Wyndmoor, Pennsylvania, USA; **Leonard M. Sidisky**, Supelco/Division of Sigma Aldrich-Gas Separation R&D Manager, Bellefonte, Pennsylvania, USA; **Masaki Tsumadori**, research fellow, Global R&D, Kao Corporation, Wakayama-shi, Japan.

The new officers and members-at-large will be installed May 7, 2014, during the 105th AOCS Annual Meeting & Expo in San Antonio, Texas, USA.

Continuing in their current member-at-large terms are **Douglas M. Bibus**, president, Lipid Technologies, LCC and director, Holman Center for Lipid Research, Austin, Minnesota, USA; **Carol J. Lammi-Keefe**, Alma Beth Clark professor and head, Human Nutrition and Food, School of Human Ecology and adjunct professor, Pennington Biomedical Research Center, Louisiana State University, Baton Rouge, Louisiana, USA; and **Michael A. Snow**, industrial director, Bunge North America, St. Louis, Missouri, USA.

W. Blake Hendrix, president and CEO, Desmet Ballestra North America, Marietta, Georgia, USA, continues as treasurer.

Ballots were emailed or mailed to eligible members in December 2013. Ballots received prior to the voting deadline were counted at AOCS headquarters on February 17, 2014.

Hicks retires from ERRC

AOCS member **Kevin Hicks** retired from his position as research leader of the Sustainable Biofuels and Co-Products Research Unit at the Eastern Regional Research Center (ERRC), Agricultural Research Service (ARS), US Department of Agriculture (USDA) in Wyndmoor, Pennsylvania, on January 3, 2014. He will retain a collaborator (emeritus) status with ERRC to complete work on commercialization of several new food and industrial products he and his team have developed with industry over the last few years.

Hicks

After completing his Ph.D. in biochemistry in 1979 at the University of Missouri-Columbia (USA) Hicks joined ERRC. In his final position as research leader, he headed a team of 30 scientists and engineers conducting research to develop sustainable biofuels and co-products from agricultural commodities and byproducts. He was author of approximately 250 peer-reviewed and technical publications and 16 patents with four more pending as well as numerous presentations to national and international audiences.

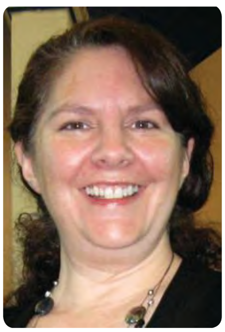
Over his career, Hicks won 13 major awards for his work, including a 2013 International Award of Research Excellence from the Fuel Ethanol Industry and a 2010 Superior Technology Transfer Group Award from ARS/USDA for helping to develop a new advanced biofuel, winter barley ethanol, which led to the construction of a 65 million gallons (250 million liters) per year winter barley ethanol production facility in Hopewell Virginia. Other awards included the Federal Laboratory Consortium Group Award for Excellence in Technology Transfer for Corn Fiber (Amazing) Oil technology in 1999, and Scientist of the Year for the North Atlantic Area in 2008.

In "retirement," Hicks is anticipating his term in 2015 as president of the Philadelphia Society for Promoting Agriculture (established 1785), the nation's oldest organization for promoting improvement and innovation in agricultural and food systems; spending time on the family farm in Missouri; adding to his collection of antique John Deere tractors; and serving with several local and international philanthropic organizations.

Changes at *JAOCS*

During 2013, longtime senior associate editors **William E. Artz** (University of Illinois–Urbana Champaign, USA), Analytical and Physical Chemistry; former AOCS President **Michael J. Haas** (US Department of Agriculture/Agricultural Research Service/Eastern Regional Research Center, Wyndmoor, Pennsylvania), Biotechnology and Biocatalysis; and former AOCS President **Lawrence A. Johnson** (Iowa State University, Ames, USA), Processing and Engineering Technology retired from their positions overseeing peer review. Each of them served as senior associate editors for over a decade. We thank them for their dedication to the *Journal of the American Oil Chemists' Society*.

Taking over in Analytical and Physical Chemistry is **Andrew Proctor** (University of Arkansas, Fayetteville, USA), who formerly served as backup senior associate editor for Processing and Engineering. **Douglas G. Hayes** (University of Tennessee, Knoxville, USA) is the new senior associate editor for Biotechnology and Biocatalysis. And **Michael K. Dowd** (USDA/ARS/Southern Regional Research Center, New Orleans, Louisiana) is the new senior associate editor for Processing and Engineering Technology.



Germain

Germain joins Univar

Terri Germain, who was featured in the February Professional Pathways column of *Inform* (25:110–112, 2014), has joined Univar as business manager, home, industrial & institutional care. She is now working out of Downers Grove, Illinois, USA, where she will be working with internal and external professionals to bring about long-term growth. In this position Germain will have frequent contacts with customers, suppliers, sales, marketing, and management.

Haas retires from ERRC

Former AOCS President **Michael Haas** retired from the US Department of Agriculture Agricultural Research Service Eastern Regional Research Center (ERRC; Wyndmoor, Pennsylvania) in January 2014. He started at ERRC as a research chemist in 1981, his first position following completion of a post-doctoral appointment. Despite his retirement, Haas stayed on a few months longer "to wind up loose ends."

Mike Haas and wife Debbie enjoying the family cabin.

Haas was featured in the Professional Pathways column in the March 2014 issue of *Inform*. There he reviewed his accomplishments with ERRC and discussed the importance of AOCS in his professional life.

Once those loose ends are out of the way, Haas plans to spend at least the early years of his retirement finishing up the log cabin that he and his family have built in northern Pennsylvania, volunteering with habitat restoration teams, and caretaking antique International Harvester tractors. ■

IN MEMORIAM

Thomas A. Foglia, Jr.

Former AOCS President Thomas A. Foglia, Jr., died January 30, 2014, of amyotrophic lateral sclerosis in Lafayette Hill, Pennsylvania, USA. He was 73 years old.

Foglia

Foglia joined AOCS in 1973 and was a tireless volunteer for the organization until his retirement in 2007. He held national offices in AOCS, including Governing Board, member at large, 1989–1991, 1999–2000; secretary, 1996–1997; vice president, 2001–2002; president, 2002–2003; and past president, 2003–2004. He also held positions in the Northeast Section of AOCS; served as associate editor of the *Journal of the American Oil Chemists' Society* (1997–2009) and was on the *INFORM* advisory committee (2000–2007). He co-chaired the technical program for the AOCS Annual Meetings in 1980 and 1985; was technical chair for the 1995 meeting, and served on program committees and annual meetings committees throughout the 1990s.

A Philadelphia native, Foglia received his B.S. degree in 1964 from Drexel University (Philadelphia, Pennsylvania) and his Ph.D. in organic chemistry under Daniel Swern from Temple University (Philadelphia) in 1968. After a National Institutes of Health postdoctoral position with Johns Hopkins University (Baltimore, Maryland, USA), he accepted a position at the US Department of Agriculture (USDA) Agricultural Research Service (ARS) Eastern Regional Research Center (ERRC) in Wyndmoor, Pennsylvania, in 1969 and served as a research chemist there until his retirement.

His early research at ERRC focused on organic syntheses. By the early 1970s, his interests turned to fatty acid reaction chemistry and, in 1983, Foglia received his first patent describing a process for preparing branched-chain fatty acids and esters. He continued with fatty acid research for the rest of his career and was involved in research on branched fatty acid isomers, the conversion of fats and oils and their processing stream co-products into biodiesel, the enzymatic restructuring of natural triglycerides, the biocatalytic and biomimetic oxygenation of glycerides, and the microbial conversion of fats and oils into biodegradable polymers and surfactants. Over the course of his career at ERRC, he hosted numerous visiting scientists from all over the world, including Japan, France, Nigeria, Germany, Austria, and South Korea.

The USDA recognized Foglia's abilities as a chemist, presenting him with the ARS Distinguished Research Scientist of the Year Award in 2006. At that time, ARS Administrator Edward Kipling said, in part, "Dr. Foglia's career has been distinguished not only by his spirit of scientific discovery, but also by the dedication, integrity, and leadership that have won him the respect of his peers both in the United States and abroad."

AOCS recognized his achievements as well. Foglia received the Alton E. Bailey Award in 1996 and was named a Fellow in 2003. In 2006 he received the Biotechnology Division Lifetime Achievement Award, and in 2009 he was presented with the AOCS-Supelco/Nicholas Pelick Research Award. Additionally, the International Society for Fat Research selected Foglia as winner of the 2005 Kaufmann Memorial Lecture Award.

During his career, Foglia published over 200 scientific papers and received 15 patents. He also served as an adjunct professor at both Drexel University (1973–2000) and Saint Joseph's University (Philadelphia, 1979–2008).

Foglia is survived by his wife Merle ("Mickie"), daughter Karen, sons Thomas and Michael; their spouses Carmen, Colleen, and Stephanie, respectively; and eight grandchildren.

David R. Erickson

David Rae Erickson, who served as president of AOCS in 1990–1991, died on February 1, 2014, in Santa Rosa, California, USA, at the age of 84. His survivors include his wife, Judy, to whom he was married for 62 years; his children Michael D., Andrew T., and Laura E.; and two grandchildren.

Erickson

Erickson was born in Portland, Oregon, in 1929. He served in the US Army 1950–1953, and was stationed (1951–1952) in Korea during the Korean War. He received a Purple Heart for having been wounded in the conflict.

On his return from Korea, Erickson entered Oregon State University (Corvallis) and received degrees in dairy technology (B.S., 1956; M.S., 1958). He then completed a Ph.D. in agricultural chemistry at the University of California-Davis in 1963.

His first position out of graduate school was with Swift & Company as a research chemist. His accomplishments with Swift included the invention of the self-basting (Butterball®) turkey. He was also involved in developing liquid margarine and "space food" for the Apollo space missions. Erickson stayed with Swift until 1977, when he went with Unitech Chemical Inc. as director of research, working with adhesives for a variety of applications.

In 1979, he joined the American Soybean Association (ASA) as director of technical services for international marketing. During his 13-year career with ASA he provided technical processing consultation services in 60 countries for the American soybean farmer.

Erickson joined AOCS in 1963 and participated in its governance, serving as a North Central section officer from 1969–1972. He also was on the Governing Board as a member at large during 1984–1986; secretary 1986–1988; vice president, 1989–1990; president, 1990–1991; and past president 1991–1992.

He participated in AOCS meetings and short courses and served as speaker as well at short courses, workshops, seminars, and symposia. Erickson was co-editor of *Food Uses of Whole Oil and Protein Seeds*, the proceedings of a short course on that topic held at Mahaka, Hawaii, in 1986. He was responsible for the technical program for the AOCS World Conference on Soya Processing and Utilization held in Acapulco, Mexico, in November 1980. One outcome of that meeting was publication of the *Handbook of Soy Oil Processing and Utilization* (American Oil Chemists' Society Press, 1980), which Erickson edited and had distributed at that meeting in both English and a Spanish translation.

Erickson also served as editor for the transactions of the 1989 AOCS *World Conference on Edible Fats and Oils Processing: Basic Principles and Modern Practices*, held in Maastricht, Netherlands, in 1989. AOCS published the proceedings in 1990.

Another widely used publication that Erickson edited was the *Practical Handbook of Soybean Processing and Utilization* (AOCS Press, 1995).

AOCS recognized Erickson's contributions a number of times. He received the A.E. Bailey Award in 1989 and was made an AOCS Fellow in 1999. In 2005 he was presented with the A. Richard Baldwin Award for outstanding contributions to AOCS.

Pamela White, presently dean of the College of Human Sciences at Iowa State University (Ames, USA), served as secretary of the AOCS Governing Board the same year that David Erickson was president. She recalls that "he was a solid leader for AOCS, helping to build the society into a globally known entity. He also was the face for the American Soybean Association for many years and helped direct resources to many important educational and research programs to assist the industry and farmers. Dave had a great sense of humor and was a pleasure to work with, both personally and as a fellow AOCS board member." ■

PATENTS

High modulus bio-based polymer formulations

Boyles, D., *et al.,* South Dakota School of Mines and Technology, US8552081, October 8, 2013

The present invention is a high modulus bio-based polymer plastic composition or mixture and methods of preparing the same. The composition is formed from the reaction of a bio-based epoxidized triglyceride oil, an energy-activated catalyst, and a bio-based non-aromatic cross-linking compound to form a structural polymer plastic. The bio-based epoxidized triglyceride oil is selected from a bio-based epoxidized triglyceride or a bio-based acrylated epoxidized triglyceride. The non-aromatic cross-linking compound is selected from itaconic acid or itaconic anhydride, and the energy-activated catalyst is activated by ultraviolet radiation or heat.

Preparation process of oil extended rubber for tire, oil extended rubber for tire, and rubber composition and tire using the same

Sakaki, T., *et al.,* Sumitomo Rubber Industries, Ltd., US8563628, October 22, 2013

The present invention provides an oil extended rubber for a tire, which is obtained by: (i) a step of preparing an oil-in-water type emulsion by emulsifying a vegetable oil having an iodine value of not less than 135 with a surfactant; (ii) a step of mixing said emulsion of vegetable oil and a modified natural rubber latex, and then maturing the mixture; and (iii) a step of coagulating the mixture obtained in step (ii) to obtain a lump of a rubber.

Preparation of soy protein isolate using calcium chloride extraction (“S703”)

Segall, K.I., *et al.,* Burcon Nutrascience (MB) Corp., US8557321, October 15, 2013

A soy protein product having a protein content of at least about 60 wt% (N × 6.25) dry basis, preferably an isolate, is formed by a procedure in which soy protein is extracted from a soy source material using an aqueous calcium chloride solution at low pH, generally about 1.5 to about 5, and separating the resulting aqueous soy protein solution from residual soy protein source. The resulting clarified aqueous soy protein solution may be diluted and the pH adjusted within the range of 1.5–5.0. The solution may be concentrated by ultrafiltration, diafiltered, and then dried to provide the soy protein product. The soy protein product is soluble in acidic medium and produces transparent, heat stable solutions and hence may be used for protein fortification of soft drinks and sports drinks.

Liquid preparation

Goto, N., and K. Shibusawa, Eisai R&D Management Co., Ltd., US8557259, October 15, 2013

It is an object of the present invention to provide a liquid preparation that excels in stability with no occurrence of precipitates and lees even after long storage. The liquid preparation contains a lipophilic material, a sucrose fatty acid ester, a polyoxyethylene hydrogenated castor oil, a polyglycerin fatty acid ester, a polyol, and water. Also provided are a pharmaceutical preparation, cosmetic preparation, and food and drink that contain the liquid preparation.

Antimicrobial composition based on botanical extracts from oil palm vegetation liquor

Sambanthmurthi, R., and Y.A. Yew, Malaysian Palm Oil Board, US8557309, October 15, 2013

The present invention provides an antimicrobial composition comprising compounds extracted from the vegetation liquor of the palm oil milling process. This composition is rich in antioxidants and exhibits enhanced antimicrobial activity and bactericidal effect against a number of micro-organisms.

High-strength, environmentally friendly corrugated board

Netravali, A., and P. Govang, Cornell University, US8557367, October 15, 2013

The present invention includes a high-strength, lightweight corrugated board. The board comprises a first sheet made of a soy protein-based resin and one or more sheets of plant-based fibers. The first sheet is connected to a corrugated member. In one aspect of the present invention, there is a method of manufacturing a high-strength, corrugated board.

Compositions and methods for making and modifying oils

Lam, D., *et al.,* DSM IP Assets B.V., US8557551, October 15, 2013

The invention provides novel methods for making or modifying oils, for example, plant, animal or microbial oils, such as vegetable oils or related compounds, that are low in a particular fatty acid(s), for example, low linoleic oils, low linolenic oils, low palmitic oils, low stearic oils, or oils low in a combination thereof. Oils are incubated with a polypeptide that selectively hydrolyzes palmitic acid.

Oral composition

Casey, J., *et al.*, Conopco, Inc., US8546445, October 1, 2013

A composition that is adapted for oral consumption comprising daidzein and an anthocyanidin, wherein the weight ratio of daidzein to anthocyanidin is in the range of from 1:1 to 1:100, wherein the daidzein is in the form of a pre-prepared aqueous dispersion, and wherein the composition is free of soy protein, which can exhibit an anti-inflammatory effect in skin, the use of a composition containing daidzein and an anthocyanidin for obtaining an anti-inflammatory effect in the skin and a method of reducing skin inflammation through the oral consumption of the composition.

Antispattering agent

Garcia, R.E., and G.A. Viecco Castillo, Team Foods Colombia S.A., US8563068, October 22, 2013

The invention relates to an agent comprising vegetable oil, a hydrophilic colloidal metal oxide, a hydrophobic treated metal oxide, and a mixture of polypropylene glycols, which, when added to pure edible fats or oils, provides same with a low spatter property when said oils and fats are used for frying foods. Said antispattering agent does not alter the organoleptic properties or appearance of the oil or fat, such as smell, taste, color, transparency, and stability at low temperatures, or produce any negative effects, such as the formation of scum during frying or the presence of particles.

Environment friendly base fluid to replace the toxic mineral oil-based base fluids

Amanullah, M., Saudi Arabian Oil Co., US8563482, October 22, 2013

Processes for producing alkyl esters useful as base fluids in oil-based mud compositions. The alkyl esters are produced from raw material waste oil that includes vegetable oil. The raw material waste oil can be obtained from the food industry, such as from food chains. The raw material waste oil is purified by removing impurities from it. The raw material waste oil is then esterified with an alcohol in the presence of a catalyst. The resulting alkyl ester products are then separated from triglycerides. The alkyl ester products are then washed and dried.

Skin cleansing agent with particles containing hydrogenated castor oil

Stolz, H.J., *et al.*, Peter Greven Hautschutz GmbH & Co., US8563492, October 22, 2013

A skin cleaning agent containing from 2 to 25% by weight of a cleaning body having a mean grain size of from 100–1000 μm and containing at least 50% hydrogenated castor oil; from 2 to 30% by weight of surfactants; from 0.1 to 10% by weight of thickeners; water and optionally further auxiliaries.

Synthetic lung surfactant and use thereof

Notter, R.H., *et al.*, University of Rochester, Los Angeles Bio-Medical Research Institute at Harbor-UCLA Medical Center N/A, University of Guelph, US8563683, October 22, 2013

The present invention relates to synthetic lung surfactant compositions that contain one or more of phospholipase-resistant phosphoglycerol derivatives, phospholipase-resistant phosphocholine derivatives, and surface active proteins or peptides, more preferably a combination of at least two or all three of these materials. Novel phospholipase-resistant phosphoglycerol derivatives, phospholipase-resistant phosphocholine derivatives, and surface active peptides are also disclosed herein. Uses of the surfactant compositions of the present invention to treat endogenous surfactant dysfunctional or deficient lung tissue, to prepare synthetic peptides for use in the surfactant compositions, and to deliver therapeutic agents are also disclosed.

Process for extracting lipids from microalgae

Hutton, M.W., and C.R. Lehr, Cal Poly Corp., US8563759, October 22, 2013

A process for extracting lipids from microalgae; the process involves pretreating a quantity of non-homogenized microalgae with an aliphatic alcohol for a predetermined period of time. The pretreatment liberates a substantial portion of lipids from the microalgae without requiring energy intensive cell membrane disruptive technologies. The liberated lipids are then treated with a transesterification reagent to form fatty acid methyl esters. The fatty acid methyl esters are separated from the resulting mixture and may be further purified to remove remaining solvents or other impurities. The fatty acid methyl esters produced by the process are suitable as a green energy biodiesel product.

Glutathione-based delivery system

Wang, A.J., *et al.*, Industrial Technology Research Institute, US8569239, October 29, 2013

A delivery system that includes a carrier or an active compound and a glutathione or a glutathione derivative grafted thereon. The invention also provides a compound including a moiety comprising a vitamin E derivative or a phospholipid derivative, a polyethylene glycol (PEG), or a PEG derivative bonded thereto, and a glutathione (GSH) or a GSH derivative bonded to the polyethylene glycol or the polyethylene glycol derivative.

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@adm.com.

EXTRACTS & DISTILLATES

Quantification of the level of fat-soluble vitamins in feed based on the novel microemulsion electrokinetic chromatography (MEEKC) method

Olędzka, I., *et al., J. Sci. Food Agric. 94*:544–551, 2014, http://dx.doi.org/10.1002/jsfa.6290.

Simultaneous quantification of liposoluble vitamins is not a new area of interest, since these compounds co-determine the nutritional quality of food and feed, a field widely explored in the human and animal diet. However, the development of appropriate methods is still a matter of concern, especially when the vitamin composition is highly complex, as is the case with feed designated for laboratory animals, representing a higher health and microbiological status. A method combining microemulsion electrokinetic chromatography (MEEKC) with liquid–liquid extraction was developed for the determination of four fat-soluble vitamins in animal feed. A separation medium consisting of 25 mmol L^{-1} phosphate buffer (pH 2.5), 2-propanol, 1-butanol, sodium dodecyl sulfate, and octane allowed the simultaneous determination of vitamins A, D, E, and K within a reasonable time of 25 minutes. The polarity of the separation voltage was reversed in view of the strongly suppressed electro-osmotic flow, and the applied voltage was set at 12 kV. The fat-soluble vitamins were separated in the order of decreasing hydrophobicity. It was proved that the proposed MEEKC method was sufficiently specific and sensitive for screening fat-soluble vitamins in animal feed samples after their sterilization.

The impact of dietary fatty acids on macrophage cholesterol homeostasis

Afonso, M.S., *et al., J. Nutr. Biochem. 25*: 95–103, 2014, http://dx.doi.org/10.1016/j.jnutbio.2013.10.001.

The impact of dietary fatty acids in atherosclerosis development may be partially attributed to their effect on macrophage cholesterol homeostasis. This process is the result of interplay between cholesterol uptake and efflux, which are permeated by inflammation and oxidative stress. Although saturated fatty acids (SAFA) do not influence cholesterol efflux, they trigger

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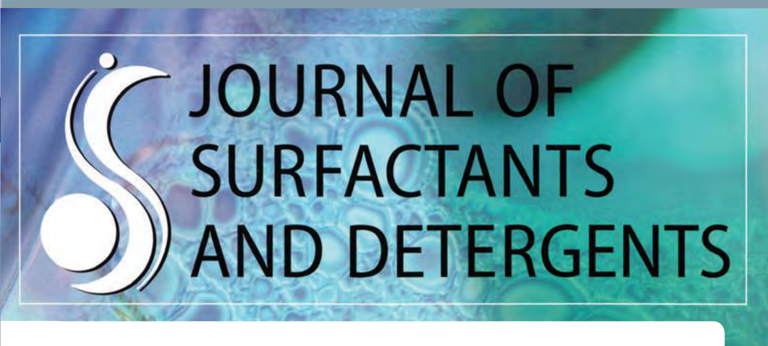
JAOCS
JOURNAL OF THE AMERICAN OIL CHEMISTS' SOCIETY

Journal of the American Oil Chemists' Society (March)

- Medic, J., C. Atkinson, and C.R. Hurburgh Jr., Current knowledge in soybean composition
- Kesen, S., H. Kelebek, and S. Selli, LC–ESI–MS characterization of phenolic profiles turkish olive oils as influenced by geographic origin and harvest year
- Khodadadi, M., and S. Kermasha, Optimization of lipase-catalyzed interesterification of flaxseed oil and tricaprylin using response surface methodology
- Santibáñez, L., L. Wilson, A. Illanes, Synthesis of ascorbyl palmitate with immobilized lipase from *Pseudomonas stutzeri*
- Simões, T., F. Valero, C. Tecelão, and S. Ferreira-Dias, Production of human milk fat substitutes catalyzed by a heterologous *Rhizopus oryzae* lipase and commercial lipases
- Abedi, A.-S., R. Khaksar, R. Ferdousi, R. Komeilifanood, E. Azadnia, and S. Eskandari, Influence of radiation processing of cooked beef sausage on its lipids
- Silva, B.C., H.M.C. dos Santos, P.F. M0ontanher, J.S. Boeing, V.C. Almeida, and J.V. Visentainer, Incorporation of omega-3 fatty acids in nile tilapia (*Oreochromis niloticus*) fed chia (*Salvia hispanica* L.) bran
- Park, J.W., J.Y. Kim, M.-J. Kim, and J. Lee, Evaluation of oxygen-limitation on lipid oxidation and moisture content in corn oil at elevated temperature
- Kim, H.J., and H.-D. Paik, Effect of α-, β-, γ-, and δ-tocotrienol on the singlet oxygen oxidation of lard
- Kittipongpittaya, K., A. Panya, D.J. McClements, and E.A. Decker, Impact of free fatty acids and phospholipids on reverse micelles formation and lipid oxidation in bulk oil
- Bhogal, N.S., M. Bala, S. Kumar, J. Nanjundan, and Y.P. Singh, Distribution of (n-9) and (n-7) isomers of monounsaturated fatty acids in Indian mustard (*Brassica juncea*)
- Tchobo, F.P., G.A. Alitonou, M.M. Soumanou, B. Barea, C. Bayrasy, M. Laguerre, J. Lecomte, P. Villeneuve, and K.C.D. Souhounhloue, Chemical composition and ability of essential oils from six aromatic plants to counteract lipid oxidation in emulsions
- Zou, X., J. Huang, Q. Jin, Z. Guo, Y. Liu, L. Cheong, X. Xu, and X. Wang, Characterization and oxidative stability of human milk fat substitutes enzymatically produced from palm stearin
- Haagenson, D.M., J.R. Perleberg, and D.P. Wiesenborn, Fractionation of canola biodiesel sediment for quantification of steryl glucosides with HPLC/ELSD
- Torrego-Solana, N., M.J. García-Celma, A. Garreta, A.M. Marqués, P. Diaz, and A. Manresa, Rhamnolipids obtained from a PHA-negative mutant of *Pseudomonas aeruginosa* 47T2 ΔAD: composition and emulsifying behavior
- Wang, H., L. Yao, and T. Wang, Extraction of phospholipids from structured dry egg yolk

- Shah, U., J.I. Baum, and A. Proctor, A new perspective on *trans,trans* conjugated linoleic acid (CLA), an overlooked CLA isomer



Journal of Surfactants and Detergents (March)

- Trends to attain a lower interfacial tension in a revisited pure alkyl polyethyleneglycol surfactant–alkane–water ternary system. Basic concepts and straightforward guidelines for improving performance in enhanced oil recovery formulations, Salager, J.-L., L. Manchego, L. Márquez, J. Bullón, and A. Forgiarini
- Synthesis and characterization of hyperbranched linear surfactants, Qiang, T., Q. Bu, Z. Huang, and X. Wang
- Effects of pH, temperature and ionic strength on aggregation behavior of dodecyldiethoxylamine oxide, Wang, R., Y. Li, Y. Song, and L. Zhi
- The effect of NaCl on the Krafft temperature and related behavior of cetyltrimethylammonium bromide in aqueous solution, Roy, J.C., M.N. Islam, and G. Aktaruzzaman
- High yield synthesis, detailed spectroscopic characterization and electrochemical fate of novel cationic surfactants, Ullah, I., A. Naveed, A. Shah, A. Badshah, Zia-ur-Rehman, G.S. Khan, and A. Nadeem
- Synthesis, characterization and evaluation of the surface active properties of novel cationic imidazolium gemini surfactants, Patial, P., A. Shaheen, and I. Ahmad
- Synthesis and characterization of novel cationic lipids derived from thio galactose, Qiao, W., M. Zhou, and L. Luo
- Cationic imidazolium monomeric surfactants: their synthesis and surface active properties, Ahmad, I., P. Patial, C. Kaur, and S. Kaur
- Synthesis and performance of allyl dimethyl dehydroabietyl ammonium chloride, Pei, L., Z. Cai, S. Shang, and Z. Song
- Comparison of estimation capabilities of the artificial neural network with the wavelet neural network in lipase-catalyzed synthesis of triethanolamine-based esterquats cationic surfactant, Masoumi, H.R.F., M. Basri, A. Kassim, D.K. Abdullah, Y. Abdollahi, and S.S.A. Gani
- Effect of a hydrophilic head group on Krafft temperature, surface activities and rheological behaviors of erucyl amidobetaines, Wang, Y., Y. Zhang, X. Liu, J. Wang, L. Wei, and Y. Feng
- Thermodynamic properties of sulfobetaine-type surfactants, Zhu, H., Z. Hu, J. Wang, and D. Cao
- Amphiphilic properties of dodecylammonium chloride/4-(1-pentylheptyl) benzene sodium sulfonate aqueous mixtures and study of the catanionic complex, Mihelj, T., and V. Tomašić
- Electrostatic effect on synergism of wormlike micelles and hydrophobically modified polyacrylic acid, Mei, Y., Y. Han, H. Wang, L. Xie, and H. Zhou
- The influence of silicone softeners on fabric stain removal and whiteness maintenance during home laundry, Pei, L., H. Ge, D. Wang, Q. Zhong, and J. Wang
- Synthesis and inhibition effect of a novel tri-cationic surfactant on carbon steel corrosion in 0.5 M H_2SO_4 solution, El-Tabei, A.S., M.A. Hegazy, A.H. Bedair, and M.A. Sadeq
- Influence of 1,3-butanediol on the viscoelasticity of surfactant solutions, Abdel-Rahem, R.A
- Combined use of ozonation and biodegradation of anionic and non-ionic surfactants, Lechuga, M., A. Fernández-Arteaga, M. Fernández-Serrano, E. Jurado, A. Burgos, and F. Ríos
- Effect of branched alcohols on phase behavior and physicochemical properties of Winsor IV microemulsions, Thampi, N.V., K. Ojha, and U.G. Nair

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- Rahman, M.M., G. Fernandes, and P. Williams, Conjugated linoleic acid prevents ovariectomy-induced bone loss in mice by modulating both osteoclastogenesis and osteoblastogenesis
- Sugasini, D., V.C. Devaraj, M. Ramesh, and B.R., Lymphatic transport of α-linolenic acid and its conversion to long chain n-3 fatty acids in rats fed microemulsions of linseed oil
- Petzinger, C., J.J. Heatley, C.A. Bailey, and J.E. Bauer, Lipid metabolic dose response to dietary alpha-linolenicacid in monk parrot (*Myiopsitta monachus*)
- Westerink, J., G.R. Hajer, M.E.G. Kranendonk, H.S. Schipper, H. Monajemi, E. Kalkhoven, and F.L.J. Visseren, An oral mixed fat load is followed by a modest anti-inflammatory adipocytokine response in overweight patients with metabolic syndrome
- Perreault, M., K. Roke, A. Badawi, D.E. Nielsen, S.A. Abdelmagid, A. El-Sohemy, D.W.L. Ma, and D.M. Mutch, Plasma levels of 14:0, 16:0, 16:1n-7, and 20:3n-6 are positively associated, but 18:0 and 18:2n-6 are inversely associated with markers of inflammation in young healthy adults
- Amusquivar, E., C. Sánchez-Blanco, J. Clayton, G. Cammarata, and E. Herrera, Maternal consumption of *trans*-fatty acids during the first half of gestation are metabolically available to suckled newborn rats
- Mapiye, C., J.L. Aalhus, T.D. Turner, D.C. Rolland, J.A. Basarab, V.S. Baron, T.A. McAllister, H.C. Block, S.D. Proctor, and M.E.R. Dugan, Types of oilseed and adipose tissue influence the composition and relationships of polyunsaturated fatty acid biohydrogenation products in steers fed a grass hay diet
- Nimptsch, A., S. Pyttel, U. Paasch, C. Mohr, J.-M. Heinrich, and J. Schiller, A MALDI MS investigation of the lysophosphatidylcholine/phosphatidylcholine ratio in human spermatozoa and erythrocytes as a useful fertility marker
- Ishikawa, T., H. Imai, and K.-Y. Maki, Development of an LC–MS/MS method for the analysis of free sphingoid bases using 4-fluoro-7-nitrobenzofurazan(NBD-F)

endoplasmic reticulum stress, which culminates in increased lectin-like oxidized low density lipoprotein (oxLDL) receptor (LOX1) expression and, consequently, oxLDL uptake, leading to apoptosis. Unsaturated fatty acids prevent most SAFA-mediated deleterious effects and are generally associated with reduced cholesterol efflux, although α-linolenic acid increases cholesterol export. Trans fatty acids increase macrophage cholesterol content by reducing ABCA-1 expression, leading to strong atherosclerotic plaque formation. As isomers of conjugated linoleic acid are strong PPARγ (peroxisome proliferator-activated receptor γ) ligands, they induce cluster of differentiation (CD36) expression, increasing intracellular cholesterol content. Considering the multiple effects of fatty acids on intracellular signaling pathways, the purpose of this review is to address the role of dietary fat in several mechanisms that control macrophage lipid content, which can determine the fate of atherosclerotic lesions.

Beneficial effects of camellia oil (*Camellia oleifera* Abel.) on ketoprofen-induced gastrointestinal mucosal damage through upregulation of HO-1 and VEGF

Cheng, Y.-T., *et al.*, *J. Agric. Food Chem.* *62*:642–650, 2014, http://dx.doi.org/10.1021/jf404614k.

Nonsteroidal anti-inflammatory drugs, such as ketoprofen, are generally used to treat pain and inflammation and as pyretic agents in clinical medicine. However, the usage of these drugs may lead to oxidative injury to the gastrointestinal mucosa. Camellia oil (*Camellia oleifera* Abel.) is commonly used in Taiwan and China as cooking oil. Traditional remedies containing this oil exert beneficial health effects on the bowel, stomach, liver, and lungs. However, the effects of camellia oil on ketoprofen-induced oxidative gastrointestinal mucosal lesions remain unknown. The objective of this study was to evaluate the effect of camellia oil on ketoprofen-induced acute gastrointestinal ulcers. The results showed that treatment of Int-407 cells with camellia oil (50–75 μg/mL) not only increased the levels of heme oxygenase-1 (HO-1), glutathione peroxidase (GPx), and superoxide dismutase (SOD) mRNA expression but also increased vascular endothelial growth factor (VEGF) and prostaglandin E_2 (PGE_2) protein secretion, which served as a mucosal barrier against gastrointestinal oxidative injury. Moreover, Sprague–Dawley (SD) rats treated with camellia oil (2 mL/kg/day) prior to the administration of ketoprofen (50 mg/kg/day) successfully inhibited COX-2 protein expression, inhibited the production of interleukin-6 (IL-6) and nitrite oxide (NO), reversed the impairment of the antioxidant system, and decreased oxidative damage in the gastrointestinal mucosa. More importantly, pretreatment of SD rats with camellia oil strongly inhibited gastrointestinal mucosal injury induced by ketoprofen, which was proved by the histopathological staining of gastrointestinal tissues. Our data suggest that camellia oil exerts potent antiulcer effects against oxidative damage in the stomach and intestine induced by ketoprofen.

Algal sterols are as effective as β-sitosterol in reducing plasma cholesterol concentration

Chen, J., *et al.*, *J. Agric. Food Chem.* *62*:675–681, 2014, http://dx.doi.org/10.1021/jf404955n.

The present study examined the cholesterol-lowering activity of sterol extract (SE) derived from alga *Schizochytrium* sp. and its interaction with gene expression of transporters, receptors, and enzymes involved in cholesterol absorption and metabolism. Gas chromatography/mass spectrometry analyses found that SE was a mixture of various sterols including lathosterol, ergosterol, stigmasterol, 24-ethylcholesta-5,7,22-trienol, stigmasta-7,24(24^1)-dien-3β-ol, and cholesterol. Results showed that SE at doses of 0.06 and 0.30 g/kg diet were able to decrease plasma cholesterol concentration by 19.5 and 34%, respectively, compared with the control, in hamsters maintained on a 0.1% high-cholesterol diet. SE at a dose of 0.30 g/kg diet was as effective as β-sitosterol in reducing plasma total cholesterol (TC). SE-induced reduction in plasma TC was accompanied by down-regulation of intestinal acyl-CoA:cholesterol acyltransferase 2 (ACAT2) and hepatic 3-hydroxy-3-methylglutaryl-CoA (HMG-CoA) reductase and up-regulation of hepatic low-density lipoprotein (LDL) receptor. Addition of SE to the diet increased the excretion of total fecal sterols. It was concluded that SE possessed the same cholesterol-lowering activity as β-sitosterol and the underlying mechanisms were mediated by increasing sterol excretion and decreasing cholesterol absorption and synthesis.

Dietary omega-3 fatty acids enhance the B1 but not the B2 cell immune response in mice with antigen-induced peritonitis

Tomasdottir, V., *et al.*, *J. Nutr. Biochem.* *25*:111–117, 2014, http://dx.doi.org/10.1016/j.jnutbio.2013.09.010.

The effects of omega-3 fatty acids on the adaptive immune response have mainly been analyzed *in vitro* with varying results. How omega-3 fatty acids affect the adaptive immune response *in vivo* is largely unknown. This study examined the effects of dietary fish oil on the adaptive immune response in antigen-induced inflammation in mice, focusing on its effects on B cells and B cell subsets. Mice were fed a control diet with or without 2.8% fish oil and immunized twice with methylated bovine serum albumin (mBSA). Peritonitis was induced by intraperitoneal injection of mBSA. Serum, spleen, and peritoneal exudates were collected prior to and at different time points after induction of peritonitis. Serum levels of mBSA-specific antibodies were determined by ELISA and the number of peritoneal and splenic lymphocytes by flow cytometry. The levels of germinal center B cells and IgM^+, IgG^+, and $CD138^+$ cells in spleen were evaluated by immunoenzyme staining. Mice fed the fish oil diet had more peritoneal B1 cells, more IgM^+ cells in spleen, and higher levels of serum mBSA-specific IgM antibodies compared with that in mice fed the control diet. However, dietary fish oil did not affect the number of peritoneal B2 cells, splenic IgG+, or CD138+ cells or serum levels of mBSA-specific IgG antibodies in mice with mBSA-induced peritonitis. These results indicate that dietary fish oil can enhance the adaptive immune response, specifically the B1 cell response, which may lead to better protection against secondary infection as well as improvement in reaching homeostasis following antigenic challenge.

Does "Best Before" date embody extra-virgin olive oil freshness?

Aparicio-Ruiz, R., *et al., J. Agric. Food Chem. 62*:554–556, 2014, http://dx.doi.org/10.1021/jf405220d.

Virgin olive oil (VOO) decays in quality properties during aging, so aged VOO may have detectable undesirable sensory descriptors in comparison with oils recently extracted. For that reason, freshness has become a parameter of paramount importance to maintain the highest standard levels within the period indicated in the "best before" date. However, it is important to note that freshness of VOO is not necessarily related to its sensory quality. Pigments have been suggested for tracing aging of VOO, and pyropheophytin *α* (PPP) seems to be the most promising molecule for this task. A predictive model has been used to estimate %PPP in VOO stored at different worldwide locations characterized with different temperatures. The recorded average temperatures, on a monthly basis, were inputs of the predictive model. The results show the influence of temperature in %PPP and how this molecule could serve as a better monitor of the storage period of VOO. The initial value of %PPP in the oil could help to carry out the storage traceability. This information would be of interest for producers, sellers, and inspection agencies.

Lipid rafts and *Fas/FasL* pathway may involve in elaidic acid-induced apoptosis of human umbilical vein endothelial cells

Rao, H., *et al., J. Agric. Food Chem. 62*:798–807, 2014, http://dx.doi.org/10.1021/jf404834e.

Our previous study showed that trans-fatty acids can cause apoptosis of endothelial cells through the caspase pathway and the mitochondrial pathway. The objective of this study was to explore how trans-fatty acids activate the caspase pathway, whether there exist specific receptors induced apoptosis by comparing normal cells and non-rafts cells treated with elaidic acid (9*t*18:1) and oleic acid (9*c*18:1), respectively. Compared to normal cells treated with 9*t*18:1, the cell viability increased by 13% and the number of apoptotic cells decreased by 3% in non-rafts cells treated with 9*t*18:1 ($p < 0.05$), and the expression levels of pro-apoptotic proteins such as caspase-3, -8, -9, Bax, and Bid decreased, and expression of antiapoptotic protein Bcl-2 increased ($p < 0.05$). In addition, *Fas/FasL* expression in cell membrane decreased significantly ($p < 0.05$). In conclusion, the lipid rafts and *Fas/FasL* pathway may involve in 9*t*18:1-induced apoptosis of human umbilical vein endothelial cells.

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Mintec

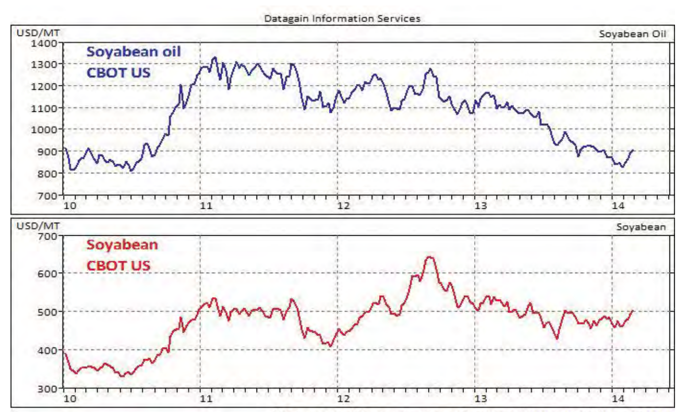
STATISTICAL ANALYSIS FROM MINTEC

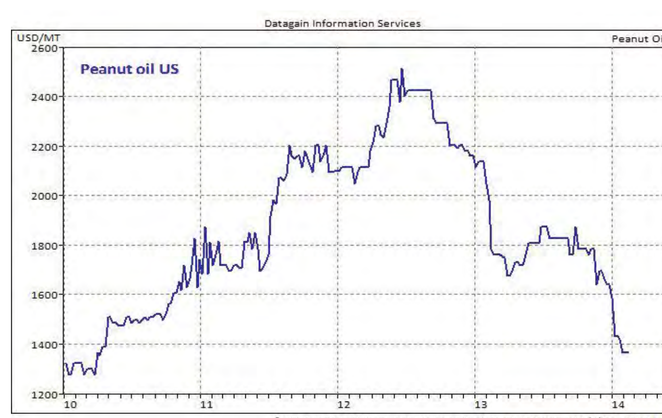
Liliana Gonzalez at Mintec

Soybean oil prices rose by 10% in February 2014 supported by two factors: a tight supply and demand balance in the United States due to record soybean exports, and a deterioration of the soybean crop in some parts of South America. Soybean exports in the United States are forecast 15% up year-on-year in 2013/14, with record shipments seen so far in the season, due to strong demand for US soybeans in the three months to February. A large proportion of the exports have been to China, with demand up 15% year-on-year.

As the soybean harvest progresses in South America, the market has placed more emphasis on crop development there. Dry weather in the south of Brazil and in La Pampa, Argentina during January and into February has led to some crop losses. The extent of these losses is still unknown; however, overall good yield levels are expected to offset declines in some parts of the region. Despite the bullish market sentiment, a global soybean surplus is still expected for 2013/14.

The impact of the large 2012/13 US groundnut crop continued to be felt, as groundnut oil prices have dropped considerably since mid-2013. Opening stocks in the US are estimated at 0.94 million metric tons (MMT), almost a threefold increase year-on-year. World groundnut oil production is forecast to rise to 4.12 MMT in 2013/14, up 8% year-on-year.





Thanks to the Editor is a regular Inform *column that recognizes those who work on AOCS journals. Eric J. Murphy has been the editor-in chief of AOCS'* Lipids *since 2006. He is a tenured professor in the Department of Pharmacology, Physiology, and Therapeutics at the University of North Dakota (UND), Grand Forks, USA, where his research looks at the way the brain maintains the unique lipid environment essential for normal brain function, the mechanisms that underlie fatty acid uptake into the brain, and how to get* more n-3 fatty acids *in the human diet. Murphy was a National Research Council Senior Fellow in the Laboratory of Neurosciences at the National Institute of Aging from 1997-2000 and has been an associate editor with the* Journal of Neurochemistry *since 2004.*

Thanks to the Editor is a regular *Inform* column that recognizes those who work on AOCS journals.

Eric J. Murphy

In what ways did your previous career and publishing experiences prepare you for the job, and how has being an editor of the journal shaped your career?

It helps that I worked with some of the best mammalian lipid biochemists in the business. I saw the efforts of my mentor, Professor Lloyd Horrocks, with his own journal and learned more about grammar from him than I ever did in high school English classes. He made grammar very real for me and applied it to my technical writing. When I published my first paper in *Lipids*, the first manuscript submitted came back with what at the time I thought were harsh comments. I remember one reviewer chastising me for using the phrase "the cells were split," commenting that I must have used a really little razor blade to accomplish that task. Point taken: be specific and precise. So learning precision in my writing was a huge point of emphasis and something from my background I bring to the journal.

Working for Professor Friedhelm (Fred) Schroeder taught me how to put together and present data in a meaningful manner. Similarly, Dr. Stanley Rapoport at the US National Institutes of Health helped to further refine my style, while Dr. Robert Nussbaum, a close collaborator, taught me a lot about how to tell a story. Every good manuscript tells a story, and we need to arrange the text in a manner that presents a meaningful story to the reader. If it is done well, readers really absorb the major points of the paper. That is a huge factor in conveying the message.

Being a peer reviewer early on in and throughout my career has given me insight into the responsibilities as well as the burdens of the process and helped me understand the importance of quality peer review. My first appointment to an editorial board was as an associate editor for *Lipids*. So I have a lot of firsts with *Lipids*, and that may explain why I care so much about the Journal from so many perspectives. My experience as a peer reviewer also explains my desire to have graduate students perform peer review as a means to help them in their career development. It is also why all of the reviewers for *Lipids* receive copies of each decision letter. This allows them to see the thoughts of others who reviewed the manuscript and is part of our efforts to educate reviewers.

My editorship has shaped my career in some interesting ways. At a critical time in my career, it gave me an opportunity to get back to something I really love (critical but creative writing, i.e., editorials). It also has helped my stature in the field, as many people identify me as the editor-in-chief of *Lipids*. It has helped me learn to work with others in a meaningful way to promote what is best for the whole organization. It has helped me become a better listener, and this has translated into much of my committee work at UND. A negative, of course, is it is time consuming, but overall I think my colleagues and Editorial Board appreciate the hard effort and desire to continue to improve the stature of *Lipids*.

What do you like most about being an editor?

I love accepting manuscripts. I love helping authors from countries where doing research is really tough to accomplish. Working with authors to see their hard work become part of the literature is indeed the most fulfilling and likeable part of being an editor. I remember getting an email from an author from Iran who was so pleased and happy her work had been accepted. It took some effort on everyone's part, including eliciting the help of a reviewer and cooperation from the authors, but we got it done. That short email really made my year. Knowing that what I do daily has a positive impact in people's lives, in their careers, is very fulfilling.

What do you like the least?

I think the biggest headache is scientific misconduct. Sometimes I walk out of my office and the graduate students hear, "Why cannot people just play nice in the sandbox!" Seriously, everything we learn from the time we are 3–4 years old applies to scientific misconduct: don't lie, cheat, or steal. So, don't fabricate, falsify, or plagiarize. Pretty simple, but apparently people don't get it. It is frustrating and time consuming but a very, very important aspect of what I have to do every day. Last year we started using iThenticate to detect plagiarism, and frankly I wasn't sold on it until I used it. After the first couple of times, I was convinced that this was a prudent and important tool to use. I have used it punitively as well as in an educational mode, and its use has really helped me weed out plagiarism prior to peer review. We have had few issues with retractions due to our previous vigilance, but this takes it to a new level.

The second thing I really don't enjoy is rejecting a manuscript. We have a pretty high level of rigor and accept on the order of 30–35% of all submitted manuscripts, but I still never relish typing that letter. I always try to remember that on the other side of that email is someone who has worked hard, perhaps under difficult circumstances, to do their best. It may not be good enough, but it is important to remember the humanity of the situation. I guess this is where my Lutheran upbringing comes into my everyday life. Rigor with fairness is my mantra.

In what ways has scientific publishing changed during your editorship, and what changes do you foresee during the next five years?

During my first few months as Editor-In-Chief, the time from a submission to a first decision letter took an average of about 33 days, and that was after streamlining the process.

Today, we check for plagiarism for each submission using iThenticate and send automated emails to reviewers, AE, and others involved in the peer review process. I can quickly contact authors to update them on their submission via the simple ScholarOne Manuscripts file. If you're anything like me, sometimes we just lose track of time when an email was sent (or not sent) and the audit feature offers a running list of all emails sent and a copy of the e mail as well. So, using ScholarOne Manuscripts has really sped up the process.

I reluctantly see that we will eventually move away from print journals. For the moment, we are keeping print journals, but I think in the next 5–10 years, we'll see *Lipids* going to a solely electronic form.

Is there a particular non-scientific interest or activity you enjoy, and what bearing has it had on your life and career?

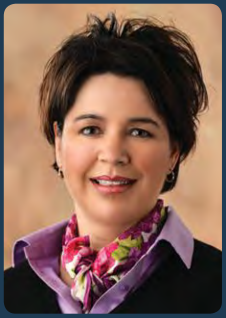
I love baseball and listen to nearly every Cincinnati Reds game every summer, so from a professional sports point of view, it is all about baseball. I also have a big attraction to college sports, but as some know I am a huge OSU Buckeye fan, so "everything Buckeye." A recent change in direction deals with my son who committed to wrestle at the University of Nebraska, so now I really transitioned to cheer hard for the Husker wrestling team even during their dual meet with the Buckeyes. I'm the guy who watches UND hockey while following OSU hockey and Husker wrestling on Twitter, which gets some odd looks when I jump up with a fist pump and cheer. Alternatively, at a Lyle Lovette concert a couple of years ago he asked from the stage what in the world I was doing as I was following a Reds game via the BlackBerry. I hollered down that I was following the Reds and they were winning! So, for those of you who feel I am shy and reserved, well I probably am not overly shy.

I use a lot of sports analogies in teaching at various levels and have used them in editorials I have written for *Lipids*. Having participated in sports in high school and college, and still being very physically active and playing between the pipes in ice hockey, has taught me how not only to work as a team member but also to work to excel and not to accept mediocrity as a high enough standard. Coaching and officiating ice hockey for years has provided a foundation in how to teach and how to approach adversity and anger. I have heard a lot of expletives over the years directed toward me from fans in the stands. Such experiences have given me a skill set to deal with angry authors and have also taught me how to communicate negative and bad news.

Professional Pathways

Professional Pathways is a regular Inform *column in which AOCS members discuss their professional experiences and share advice with young professionals who are establishing their own careers in oils and fats-related fields.*

Tiffanie West is a Bunge Oils Analytical Team Director in Research and Development (R&D) in Bradley, Illinois, USA. West started as a chemist at Bunge in 1995 and later made the transition into lab management.



Describe your career path.

I graduated in 1991 from Olivet Nazarene University in Bourbonnais, Illinois, with a double major in chemistry and zoology and a minor in Spanish. I interned at Armour Pharmaceutical (now CSL Behring) in Kankakee, Illinois, USA, for several summers prior to graduation. Following graduation, Armour hired me to work in its quality control laboratory. I later took a position at Henkel North America, where my responsibilities included providing oversight for lab staff and giving input into laboratory experiments. In 1995, I began with Bunge as an R&D chemist; I made a transition into laboratory management as a lab supervisor in 1998. After I received a master's degree in chemistry from the Illinois Institute of Technology in 2001, I moved from lab supervisor to manager. In 2007, I received an MBA from Olivet Nazarene University. In 2009, I earned a Six Sigma Green Belt, a certification program that recognizes experience and knowledge in the act of improving process quality. Today, I serve as a Bunge Oils Analytical Team Director in R&D.

Why did you join AOCS?

I joined AOCS in 2000 as a means to learn about the oil industry and network with other professionals. I consider AOCS members to be some of the best and brightest lipid chemists in the world. Also, AOCS provided opportunities to participate in method development and collaborative testing.

What do you love about your job?

Lipid science is a fascinating arena. I like that some analytical methods, which seemingly are straightforward, have complexities associated with their chemistry. I enjoy working with other group members in planning experiments and discussing results. I am a student at heart. The very nature of R&D creates opportunities to learn, interact with others, and share new ideas. Having a role in helping young chemists realize their potential is also very rewarding. Bunge has a great group of scientists and staff, with whom I am privileged to work. I truly look forward to going to work every day.

What is the biggest challenge you have encountered in your career, and how did you address it?

Communicating technical information to nontechnical staff is sometimes challenging. The message must be tailored to the needs of the particular department. For example, when communicating to an operations group, the focus is typically on facts pertaining to the quality and efficiency of the operation. Sales groups are more interested in how the product or service benefits the customers and their profitability. Keeping the message and written materials direct and brief are two keys to effective communication.

Using statistics is also an efficient tool for data analysis and interpretation. The ability to communicate data trends or the significance of data is critical for any group. Translating this interpretation into a clear and concise message can be challenging.

How has your industry changed since you entered the field?

When I began my career in the oil industry, it was focused on soybean oil and partially hydrogenated products. The industry has since evolved into trans-free and lower saturated fat products, which create a need for a greater variety of oils and technologies.

In the laboratory, computer technology has revolutionized the analytical world. Use of complex software systems in building calibrations and expressing multiple results has reduced analysis time, made the laboratory more efficient, lowered solvent usage, and changed the role of the chemist.

Do you have any advice for those looking to enter your field?

Follow your passion. Find a career path that excites you. I recommend getting a degree in chemistry, as chemistry course work develops your basic knowledge and skills such as solution chemistry and acid/base chemistry, which are required in the analytical laboratory. Second, build your verbal and written communication skills so you can express ideas clearly.

How do you see the industry changing in the next five years?

I believe the industry will continue its focus on the nutritional qualities of products. FSMA [the US Food Safety Modernization Act] is an exciting new standard.

In the laboratory, I anticipate continued emphasis on sustainability. Real-time analysis and continued reduction in the usage of solvents and chemicals will be forefront issues.

Describe a memorable job experience.

When I began with Bunge, my supervisor, Ellen Schade, sent me to the plant to get a bottle of end points. As she gave the instructions as to how many end points to get, I realized that this was not a real assignment. I responded by asking her what color of end points she preferred. We laughed together, and began our day's work.

Please describe a course, seminar, book, mentor, or speaker that has inspired you in ways that have helped you advance your career.

Ellen Schade was the analytical group manager when I began at Bunge. Ellen was a gifted chemist and an expert writer. She had high standards for herself and her staff. I appreciate all the knowledge she shared with me.

Past and present Bunge R&D directors have been great teachers who have been influential in my career development. Retired Director Frank Kincs had a good base in formulations; Roger Daniels' skill set combined professional communication and technical expertise; current director Bob Johnson is experienced in the process and product line. I truly appreciate their guidance in my development.

Do you have any advice for young professionals who are trying to develop an effective network of other professionals?

Young professionals must seize the opportunity to learn from all situations. Building new industry relationships and taking opportunities to continue your education are both very beneficial for continued advancement. New professionals should network and intentionally try to learn from every professional they meet. For me, involvement in AOCS has provided a great means for learning and networking. It is important for young professionals to find the proper balance between observation and participation.

If you were starting your career again, what would you do differently?

In my education, I would place greater emphasis on mathematics. Mathematics develops skills in critical thinking and logic, both of which are applicable in many disciplines. Second, I would make a greater effort to find networking opportunities early in my career. Being involved in AOCS committees is a great way to do that, as it provides a unique environment for networking and learning from academics, industry experts, and government professionals. Community volunteer work is another effective means of networking. Local chambers of commerce often have a young professionals' society. Networking at this level is important in finding other young professionals in your own city.

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The changing world of lecithins

Willem van Nieuwenhuyzen

Lecithin is one of the most common phospholipids (PL)—a class of polar lipids that support life functions. PL are present in all of our body's cells, where they regulate the transport of molecules across the cell membrane. Vital organs such as our brain are full of them, and their potential has captured the imaginations of scientists from the medical, pharmaceutical, and (health) food sectors for more than a century.

The word "lecithin" comes from the Greek "λέκιθος," meaning "egg, the start of life." Indeed, egg and egg yolk are full of PL, which are active emulsifying components. That knowledge initiated the search for cheaper, more available emulsifiers that could replace eggs in food recipes. Lecithin from soybeans conquered the food industry during the 1940s, when US planting and crushing of soybeans accelerated. Since then, soybean-based lecithin has greatly extended the portfolio of effective emulsifier systems and given rise to what is still the leading group of emulsifiers.

The widespread planting of genetically modified (GM) soybeans, which began in 1995, has caused disruptions in supply streams of commercial food-grade lecithin from traditional soybean varieties that previously flowed from the United States and Latin America to Europe. More recently, sourcing requirements for identity-preserved (IP) non-genetically modified (GM) soy ingredients and lecithin for the European food market have affected lecithin production worldwide. As the availability of traditional non-GM soybeans from the United States and Latin America has decreased, the sourcing of IP soy lecithin from other regions and lecithin from sunflower and canola (rapeseed) has grown. The analytical efforts required for IP tracing are enormous in terms of management time, logistics, and costs.

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- Meanwhile, the analytical efforts required for IP tracing are enormous in terms of management time, logistics, and costs.

COMPOSITION OF LECITHIN FROM THREE DIFFERENT CROPS

Lecithin from soy, sunflower, and canola is produced to comply with food-grade regulatory specifications. The chemical analyses include acetone-insoluble matter, hexane-insoluble matter, acid value, moisture, peroxide value, Gardner color, and viscosity. Specifications in international trade are based on AOCS Official Methods & Recommended Practices. Increasingly, the PL composition of lecithin is analyzed by high-performance liquid chromatography and ^{31}P nuclear magnetic resonance, which provide valuable information on product characteristics and functional emulsifying performance (Fig. 1). For example, phosphatidylcholine (PC) and lysophospholids promote oil-in-water emulsion stability, while phosphatidylethanolamine (PE) has water-in-oil promoting properties

Typical PL values, summarized in Table 1 (page 256), illustrate that the compositions of lecithin from soy, sunflower, and canola are quite close. PL + glycolipids + complex carbohydrates account for the acetone-insoluble matter as measured by classical chemical routine analysis (AOCS Official Method Ja 4-46). The fatty acid (FA) composition of the three types of lecithins (PL plus oil) follows largely the FA composition of the oil (Table 2, page 256).

In other oil crops such as cottonseed, corn germ, palm, palm kernel, and coconut, the low content of PL in the crude oil does not justify economic recovery of the lecithin for commercial use.

PRODUCTION

In the crushing mill the oil is solvent-extracted from the crushed seed, whose cell walls contain relatively high amounts of PL. The extracted oil contains 2–3% PL (0.4–0.6% on the basis of seed), which is removed in the so-called degumming step. In the degumming step water is added to the oil, enabling the PL to dissolve in the heavy water phase, while the oil with a low phosphorus (<100 ppm P, preferably <5 ppm P in the case of physical refining) content is then suitable for low-cost refining. This is in a nutshell the recovery of the lecithin gums,

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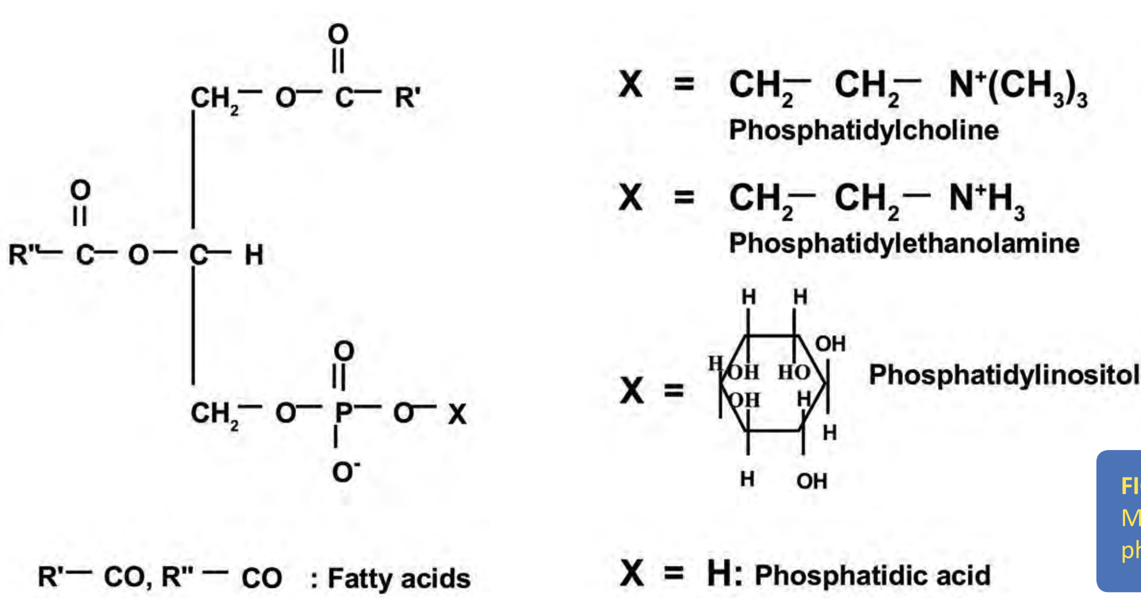

FIG. 1. Molecular structure of phospholipids.

TABLE 1. Phosphoplipid and total composition of three liquid vegetable lecithins[a]

	Soy lecithin (%)	Sunflower lecithin (%)	Canola lecithin (%)
Acetone-insoluble matter			
Phospholipids			
Phosphatidylcholine	15	16	17
Phosphatidylethanolamine	11	8	9
Phosphatidylinositol	10	14	10
Phosphatidic acid	4	3	4
Other phospholipids	7	6	6
SUB-TOTAL: all phospholipids	47	47	46
Glycolipids	11	11?	11?
Complex carbohydrates	4	4?	4?
TOTAL: acetone-insoluble matter	62	63	62
Acetone-soluble matter Oil + added fatty acid	37	36	37
Moisture	<1	<1	<1
TOTAL	100	100	100

[a]Slightly modified from W. van Nieuwenhuyzen and M.C. Tomás, Update on vegetable lecithin and phospholipid technologies, Eur. J. Lipid Sci. Technol. 110:472–486 (2008).

TABLE 2. Fatty acid composition, in percentage, of three vegetable lecithins

Fatty acid	Soy lecithin	Sunflower lecithin	Canola lecithin
C16:0	16	11	7
C18:0	4	4	1
C18:1	17	18	56
C18:2	55	63	25
C18:3	7	0	6
Others	1	4	5

which are dried to lecithin or are sprayed back on the meal (Fig. 2).

SOY LECITHIN. Soybeans are the primary commercial source of vegetable lecithin. Solvent extraction of soybeans is carried out in large crushing plants with capacities of 1,000–6,000 metric tons per day, yielding 18% oil. The extracted oil is filtered to optimize the oil degumming efficiency as well as the production of lecithins with low residual dirt (earth, seed protein residue), expressed as hexane insolubles (HI; in the United States) or toluene insolubles (TI; in Europe).

The water degumming process (Fig. 2) may give the best quality of standard lecithin. The gums removed from the oil in the enzymatic degumming step may contain high amounts of hydrolyzed lysophospholipids with new functional properties. The gums with 20–50% moisture are removed from the oil by continuously operating decanters. Lecithin is dried in rotating film evaporators within 1–2 minutes to a content of <1% moisture, achieving long shelf life and good liquidity. The product is rapidly cooled, preventing post-darkening. Standard lecithin is adjusted for oil content and viscosity; and it is used for processing modified PL, such as hydrolyzed, acetylated, hydroxylated, fractionated, or deoiled lecithins.

SUNFLOWER LECITHIN. Oilseed-type sunflower seeds have mostly black hulls that tend to stick to the meat. Sunflower crushing requires dedicated crushing plants since the seeds are smaller than soybeans. Dehulling efficiency may influence the natural wax content of 0–1% in lecithin. Hence, additional expelling (pressing) is often used to squeeze out oil and reduce the original oil content of the seed (~40%) down to 15% in the press cake; the press cake is then hexane-extracted to reduce the oil to under 0.5%. Both press oil and extraction oil streams are combined for degumming. Sunflower lecithin yields are about 0.3% on seed basis. Intensive filtration of the non-degummed oil is important for obtaining lecithin with low-impurity HI contents of less than 0.3%.

Sunflower lecithin is a preferred alternative to soy lecithin in Europe. The FA composition of sunflower lecithin is attractive. Its taste-flavor profile is pleasant (nutty-like), and its emulsifying properties are good. The main sunflower-growing regions are Argentina, France, Hungary, Ukraine, and Russia.

CANOLA LECITHIN. Canola seed crush and lecithin production are quite similar to sunflower processing; most often an expelling step is used to squeeze out oil from an original 40% to below 20%, followed by solvent extraction. Since canola contains chlorophyll components, lecithin from canola may have a slight greenish tone. This is masked, however, in food recipes because the usual dosage content is less than 0.5%. Canola varieties of rapeseed produce little or no erucic acid (C22:1) and thioglycosides, in contrast to lecithin produced from high-erucic acid rapeseed. The lecithin is used in food, feed, and technical industries. Canola lecithin is produced in Canadian, European, and Chinese crushing plants.

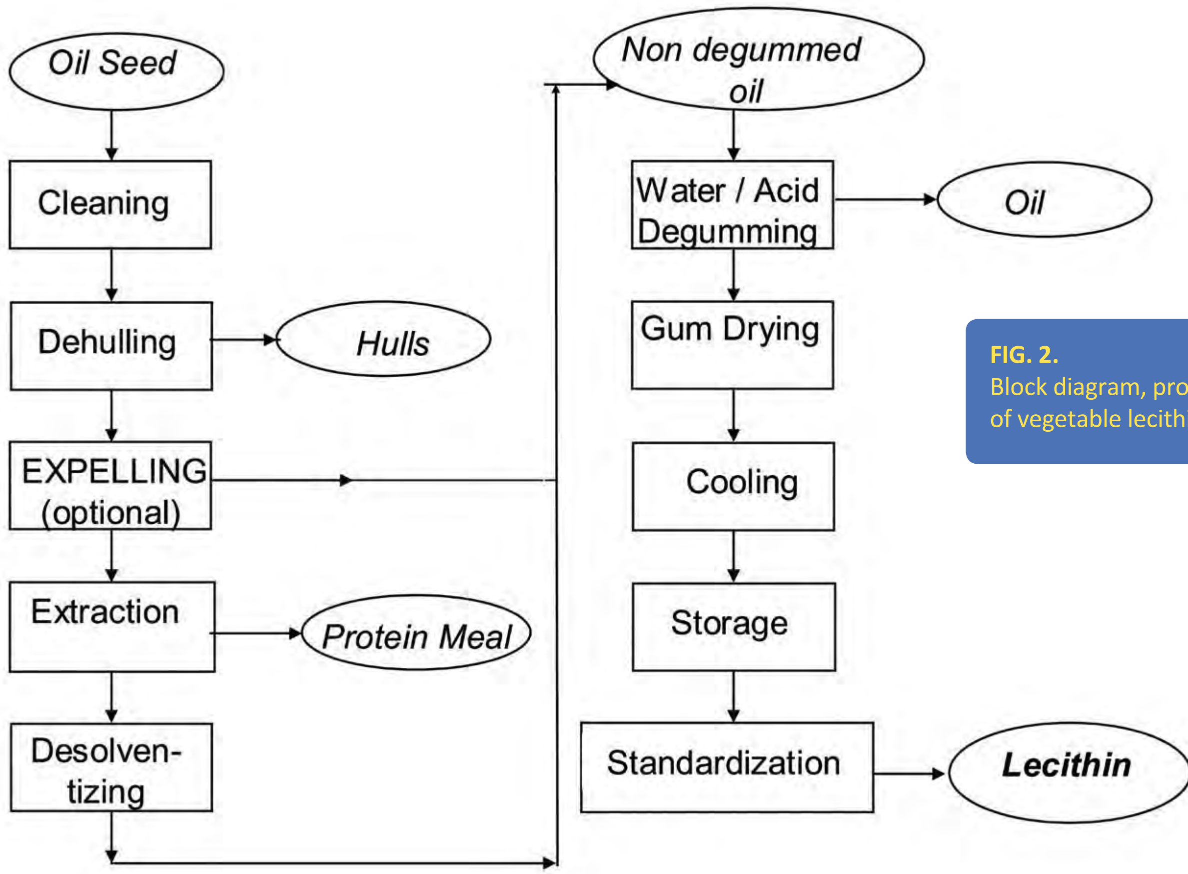

FIG. 2. Block diagram, processing of vegetable lecithins.

KEY CHARACTERISTICS

PL are polar lipids with a hydrophilic and a lipophilic part. They concentrate at the interface between oil and water and reduce the interfacial tension. This property facilitates the formation of emulsions. In food emulsion recipes, the low amount (often <0.5%) of lecithin supports emulsion stability in interactions with the three main food components—fat, protein, and carbohydrates—and other texturizing ingredients. The aims of emulsion stability are the prevention of creaming, coalescence in larger droplets, sedimentation, and separation during the shelf life.

Phosphatidylcholine (PC) forms a lamellar layer in the interface between oil and water, different from the reversed hexagonal phase of phosphatidylethanolamine (PE) or the hexagonal phase of lysophospholipids (Fig. 3, page 258). This knowledge is useful for applying lecithins having adapted, modified, or fractionated PL composition. The enzymatic hydrolysis, acetylation, and alcohol fractionation processes, which improve the functional properties of lecithin, all have in common that the zwitterion group of the PE is modified or removed. The modified lecithins have hydrophilic-lipophilic balance (HLB) values of 2–12, a property used in emulsifier characterization. The specialties are produced on plant scale on the basis of soy lecithin. Nowadays sunflower lecithin and canola lecithin are also sourced for producing standard and modified lecithins. Of course, the switch to another type of lecithin or

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Learn more about lecithin

You can meet the author of this article and build your knowledge about lecithin at the “Lecithin Functions in Technology and Nutrition” short course, June 12–13, 2014, in the Gothic city center of Ghent, Belgium. The course, which is co-sponsored by the International Lecithin and Phospholipid Society (ILPS) and Ghent University, will enhance your knowledge of:

- the technological functions of soy, sunflower, and rapeseed/canola lecithins
- nutrition-related properties of egg, marine, milk, and soy phospholipids
- preparation and characterization of emulsions and liposomal dispersions
- physical chemistry of polar lipids

More than 20 world-class presentations and laboratory demonstrations will present topics on vegetable- and animal-sourced lecithins in many practical applications.

More program and registration information can be found at www.ilps.org/index.php/lecithin-short-course.html.

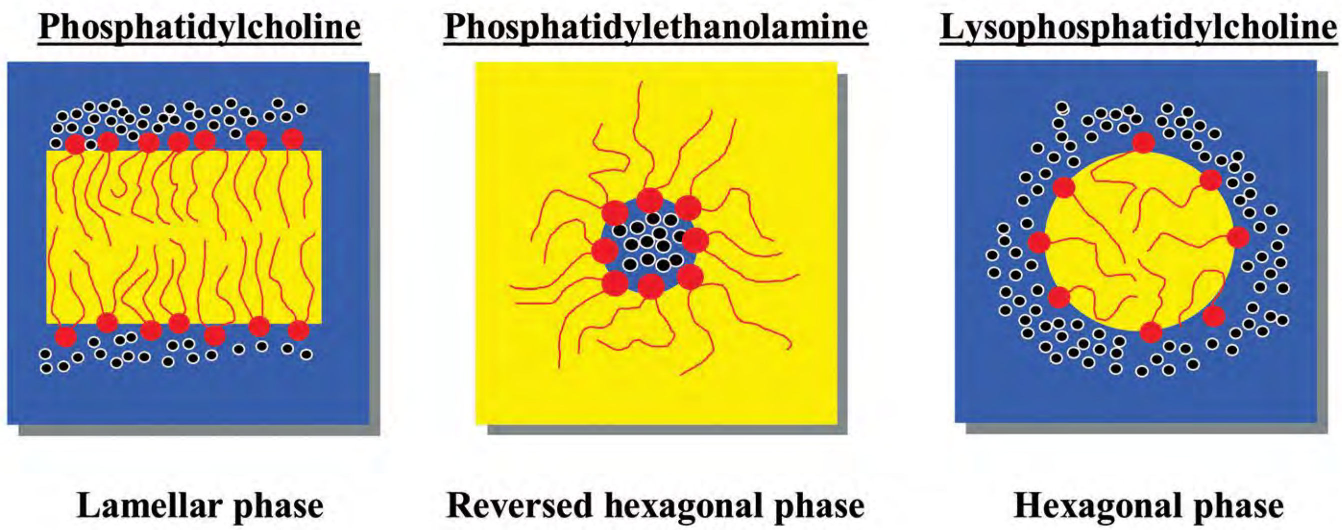

FIG. 3. Phospholipid structures at the oil/water interface.

supplier always requires the optimization of dosage in the food recipe including sensorial evaluation.

APPLICATION

The use of lecithins in food, feed, and technical products is manifold. The main applications in food are given in Table 3. Food scientists have achieved a strong match of key properties and uses for lecithins.

Feed industries use lecithin as emulsifier in milk replacers for feeding of calves and piglets and as a choline and energy supply source in broiler feed. Aquaculture is a fast-growing sector using lecithin, where it serves as an invaluable wetting agent and nutrient in feed pellets, in particular for particular shrimp and salmon feed. Southeast Asia and Latin America use this expertise.

In technical industries, the use of lecithin for lubrication and emulsifying properties in leather processing, paper coating, paints, plant crop protection, and soil bioremediation is validated or has new potential. Lecithins from all three oilseed sources can be used.

In the pharmaceutical sector, soy PL, often deoiled lecithin powder or pure PC fractions, are used as excipient in drug formulations. All approved dossiers and formulations are based on well-defined soy PL compositions. These lecithin specialties are processed from standard lecithin source from either GM or non-GM soybeans, which are available in abundance. This strategy will continue, since availability of the required soy PL is secured.

MARKET STRUCTURE

Vegetable lecithin, as co-product having a 0.3–0.8% yield on a seed basis, influences the crushing calculation only marginally. As an alternative to drying lecithin gums, the gums can be sprayed on the seed meal, contributing to the meal price value. If that outlet is not feasible, dried lecithin gums can still provide value as a "feed oil" additive with high monounsaturated FA/polyunsaturated FA content as an energy source in animal feed.

Worldwide soybean production forecasts for 2012–2013 were 271 million metric tons (MMT); canola, 61 MMT; and sunflowerseeds, 37 MMT (US Department of Agriculture estimates, May 2011; www.fas.usda.gov/data/oilseeds-world-markets-and-trade). Although the lecithin market grows steadily, only an estimated 15–20% of the potential

TABLE 3. Survey of lecithin applications in selected foods

Application	Functions
Baked goods	Volume improvement, fat dispersion Firmness, freshness
Chocolate	Viscosity modification
Chewing gum	Rheology, tackiness, brittleness
Instant drinks dairy/cocoa	Agglomeration, wetting, dispersibility
Margarine	Anti-spattering in frying, emulsification, mouth feel
Pan release agent	Wetting, anti-sticking

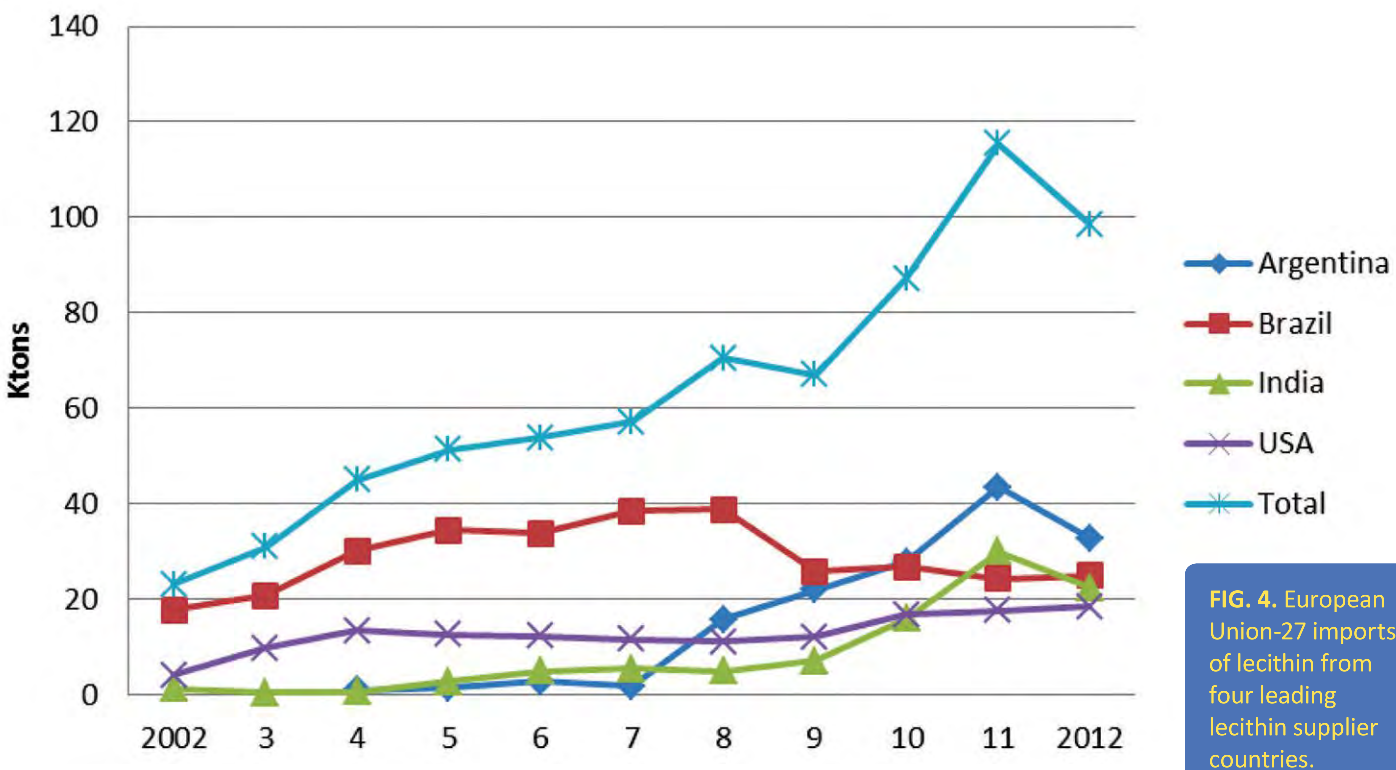

FIG. 4. European Union-27 imports of lecithin from four leading lecithin supplier countries.

gums are processed into lecithin-standard quality and specialties with dedicated technological and nutritional functions in high-value pharmaceutical, (health) food, and feed segments. These market segments are served by dedicated lecithin manufacturing companies, either affiliates of the large crushing multinationals or independent companies. Those companies have expertise in IP sourcing of raw materials; lecithin modification facilities; and logistic tools for transport, special tank parks, and hygienic filling stations in addition to quality assurance and applications laboratories. Industrial users prefer long-term supply relationships that allow them to secure high-quality performance of lecithins, used at low dosage, to achieve remarkable functions. It is in this manner that business-to-business lecithin expert companies develop profitable projects.

Changes in IP requirements, particularly in Europe, have led to a remarkable shift in the lecithin imports in the European Union (EU-27). Figure 4 illustrates Eurostat EU import statistics over a 10-year period from four leading lecithin-producing countries, totaling 100 kilotons (100,000 metric tons) in 2011. Data on increased imports may reflect higher consumption, lower European soy lecithin production, increased availability of IP non-GM soy lecithin from Brazil and India, and sunflower lecithin from Argentina. Replacing soy lecithin allows food manufacturers also to omit the labeling of "soy" as an allergen on consumer packaging, if appropriate.

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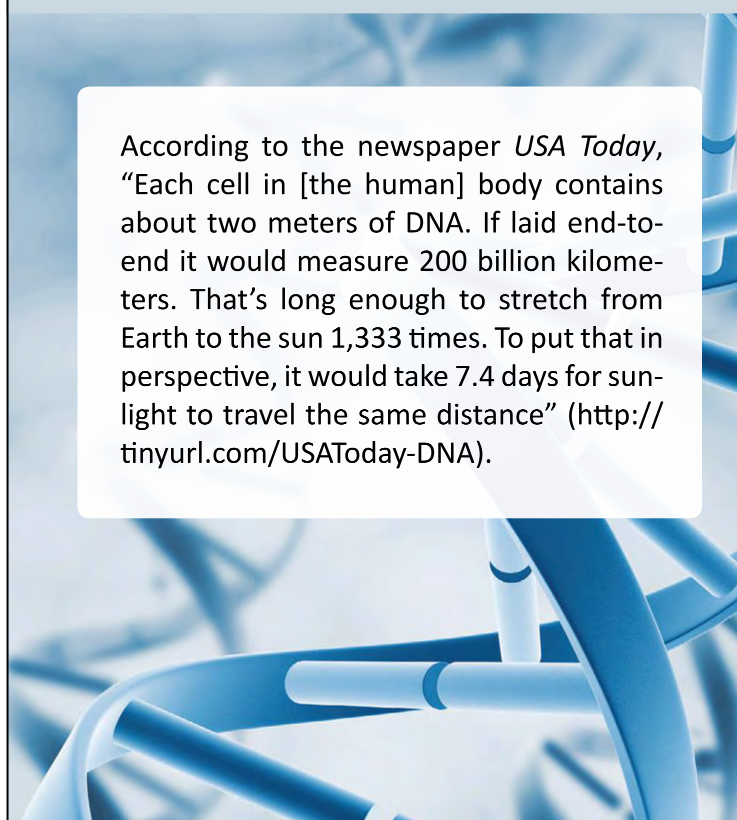

According to the newspaper *USA Today*, "Each cell in [the human] body contains about two meters of DNA. If laid end-to-end it would measure 200 billion kilometers. That's long enough to stretch from Earth to the sun 1,333 times. To put that in perspective, it would take 7.4 days for sunlight to travel the same distance" (http://tinyurl.com/USAToday-DNA).

The commercialization of Ahiflower™ oil, a new and sustainable source of omega-3 fatty acids

Andrew Hebard

This article is not a technical or scientific paper. It is, rather, a distillation of the processes and activities our company has adopted to introduce an entirely new oilseed crop and take it to commercial reality. With the correct management, this new crop could be a game changer in plant-derived essential fatty acids (FA) and serve as a model for other new or specialty crops.

The search for sustainable, cost-competitive, and biologically effective sources of omega-3 (ω-3) FA that can provide meaningful consumer value has attracted a great deal of commercial interest and is largely a market driven-phenomenon, implying an imbalance between emerging demand and existing supply. Broadly speaking, there are three major commercial feedstock origins: algae, marine plants, and terrestrial plants. Each source has unique advantages and disadvantages, and increasing biological efficacy often comes at an elevated cost accompanied by increased concerns over sustainability and provenance. Additionally, the FA eicosapentaenoic acid (EPA; C20:5ω-3) and docosahexaenoic acid (DHA; C22:6ω-3) are generally believed to deliver greater health benefit than the shorter, less unsaturated precursor molecule α-linolenic acid (ALA; C18:3ω-3). EPA and DHA are traditionally derived from algal and marine sources whereas ALA is typically found in oils from various plants, notably flax, chia, and canola, which contain between 15% and 65% ALA in their oil fractions.

Scientific studies generally agree that the major rate-limiting step for converting ALA to EPA in humans is that of initially introducing a fourth double bond, effectively converting ALA (C18:3ω-3) into stearidonic acid (SDA; C18:4ω-3). This reaction is mediated by the Δ6-desaturase enzyme. The conversion of ALA to EPA in humans is reportedly about 5%, whereas SDA is converted to EPA with an efficiency of up to 30%. There is, therefore, a significant advantage for having higher levels of SDA in ingested triglycerides to increase the EPA content in tissue at much lower intake levels as compared to ALA.

Although some microorganisms can synthesize FA with more than four double bonds, rarely is this seen at meaningful levels in terrestrial plant oils. Even where some plants synthesize very long chain FA such as erucic acid (C22:1ω-9) and nervonic acid (C24:1ω-9), those having more than two double bonds are unusual, those having more than three double bonds are extremely rare, and those having more than four double bonds are virtually unheard of.

This was the background against which our company, Technology Crops International LLC, sought to find a plant species that could produce high levels ω-3 polyunsaturated FA (C18:3 or C18:4) in an oil-rich seed suitable for commercial-scale oil recovery. We also needed a seed that would let us use traditional oilseed processing and oil refining techniques and equipment. Additionally, it had to meet all of our supply chain criteria for scalable and sustainable production. For ease of operational management, we broke the supply chain down into three pieces: *Grow, Make,* and *Sell.*

This case study in commercializing a new oilseed crop is a how-to guide to managing three critical pieces of the supply chain:

- **Growing a new oilseed crop**
- **Making the finished oil**
- **Selling a new product**

FIG. 1. A crop of *Bugglosoidies arvensis* in full flower in New Zealand.

GROW

In modeling a specialty crop supply chain from soil to oil, every step needs detailed consideration. For the *Grow* piece of the chain, getting grower buy-in is critical. Before considering cultivating a specialty crop, farmers demand good genetics; good agronomic support; a robust toolkit of herbicides, fertilizers, and pesticides; a risk management plan (unlike most commodity crops, specialty crops do not benefit from federally supported insurance programs); and the knowledge that they are investing in growing a crop that has a strong and profitable market to move into (Fig. 1).

Beyond the growers' control there are environmental matters; for example, is the species noninvasive? How does it fit into a crop rotation program? How does its quality change with climate (weather patterns greatly impact FA synthesis), and how does it integrate with other flora and fauna on the farm (e.g., insect pollination)? Neither scalability—going from small field trial plots to thousands of acres—or sustainability (let's define this as ensuring that the value delivered is greater than the value that's depleted) can be accomplished if the *Grow* model is wrong.

Many literature sources identify the FA composition of oil-containing plant seeds, which helped us to narrow down the search to a handful of plant families that (i) can be grown

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Cultivation challenges

Echium plantagineum has inherently low oil productivity (approximately 20 pounds per acre, or 22 kilograms per hectare), making it an expensive oil to produce, thereby limiting its application and inclusion. It has invasiveness issues and livestock toxicity associations that have resulted in its cultivation being prohibited in certain parts of the world, including several regions in North America. Despite significant investment in developing adaptation strategies to row crop agriculture, *Echium* still proves a challenging species to integrate into modern agricultural practices; however, a small yet robust market has developed for the oil in nutritional and skin care applications.

under temperate conditions, (ii) appear to be malleable in terms of possible domestication, thus removing reliance on wild crafting (the gathering or collecting of uncultivated material from the wild), and (iii) meet the commercial proposition intended. In the beginning, we screened hundreds of candidate species, mostly belonging to the Boraginaceae family, ranging from *Myositis* (the common forget-me-not) through to the many different members of the *Echium* species (such as *Echium plantagineum* also known unaffectionately in Australia as Paterson's curse or salvation Jane). We also considered other currently commercially available oils that have ALA and SDA content, most notably hemp and blackcurrant seed; however, neither met the criterion of scalability or having sufficiently elevated levels of these FA. In the late 1990s, we embarked upon commercializing *E. plantagineum* as the preferred candidate crop to deliver ALA and SDA, containing approximately 32% and 13%, respectively. This species had another benefit, namely, modest levels of γ-linolenic acid (GLA; C18:3 ω-6), present at approximately 5% of total FA. From the outset, Echium production presented major challenges in each of the *Grow, Make,* and *Sell* categories.

Therefore, our search continued and focused on the species *Bugglossoidies arvensis* (also a member of the borage family), a somewhat unp rolific wild species found growing in many regions of the world. While its *Grow* characteristics did not initially meet our criteria, intuitively we felt they might, if a concerted investment were made to understand its physiology and how to encourage it to adapt to modern row crop cultivation. After a global germplasm search, selection, and evaluation program that is in its sixth year, we have now registered the first varieties under Plant Variety Protection (PVP) protocols and have trademarked this new crop, which we call Ahiflower™. These varieties represent the most prolific or physiologically suited wild types that were found and we have now assembled and evaluated the world's largest repository of genetics of the species.

Understanding a plant's evolutionary mechanisms and then working with them to produce stable, reliable yields when cultivated is both a humbling and rewarding process. The very traits that enable its survival and competition as part of a biodiversity-rich wild environment are often the same ones that make it wholly unsuitable for cropping. Dormancy, low vigor, and poor uniformity as well as tolerance to climatic and environmental stimuli all need researching and understanding. These hurdles are inherent to the strategy of choosing biodiversity over biotechnology to deliver your target output. We chose biodiversity, largely driven by strong customer preference for a natural product, and our core competence within the life sciences is in bringing specialty crops to market, rather than being a genetics and plant breeding business.

Yield is king

In row crop agriculture, yield is invariably king. Increasing productivity drives price down and reduces risk. Lowering costs and managing risk enable scalability, which in turn provides significant market growth potential. Understanding demand elasticity with price is crucial to success.

After various setbacks that were more than offset by advancements, the crop is now being commercially cultivated under strict grower licensing agreements in both the Northern and Southern Hemispheres, to deliver two annual crop cycles. Field performance is highly respectable, with seed yields of 900 pounds per acre (1,000 kilograms per hectare) being achieved (approximately 250 pounds of oil per acre, or 280 kilograms per hectare). Our strategy is to work with best-in-class growers, those that want to become part of a fully integrated supply chain and to be innovative with their agronomic and business practices, and those that have a real passion for producing value-enhancing specialty crops. Interestingly, many of these same growers produce meadowfoam, echium, borage, and crambe oils under contract also and are willing to try other new species as the opportunity arises.

Crop Assured 365™

This is Technology Crops International's proprietary traceability and quality assurance program enabling the contents of every soft gel cap containing Ahiflower™ seed oil to be traced back to the field in which it originated. Growers, truckers, processors, and handlers are all required to keep records and follow documented procedures to ensure that the chain of custody is rigorously protected. Increasingly, the market for dietary supplements and skin care ingredients is demanding assurances about the authenticity and provenance of raw materials, which greatly benefits using a fully integrated supply chain, 365 days a year. Crop Assured 365™ operates as both a containment and exclusion tool by ensuring no leakage of the target product, so that intellectual property control is possible, while prohibiting the introduction of foreign material such as genetically modified organisms or maintaining quality criteria such as organic certification.

MAKE

Assuming the *Grow* piece can deliver a stable and reliable raw material, we move to *Make*. This captures everything from when the crop is harvested through to the manufacturing of the finished oil. Similar to other oilseeds, the process of oil recovery and refining must be modified to the characteristics of the seed and oil itself. Protocols for seed cleaning and drying, mechanical pressing (expelling), solvent extraction and oil refining—including neutralization, bleaching and deodorizing—have to be developed. Once manufactured, the development of analytical testing methodologies, oil stabilization strategies (to prevent deterioration through oxidation) and product formulation or oil delivery systems (such as soft gel capsules and functional food ingredients) are necessary so that a high-quality, safe, efficacious, and consumer-acceptable product can be delivered. Under correct storage conditions, Ahiflower™ seed can be held for 12 months

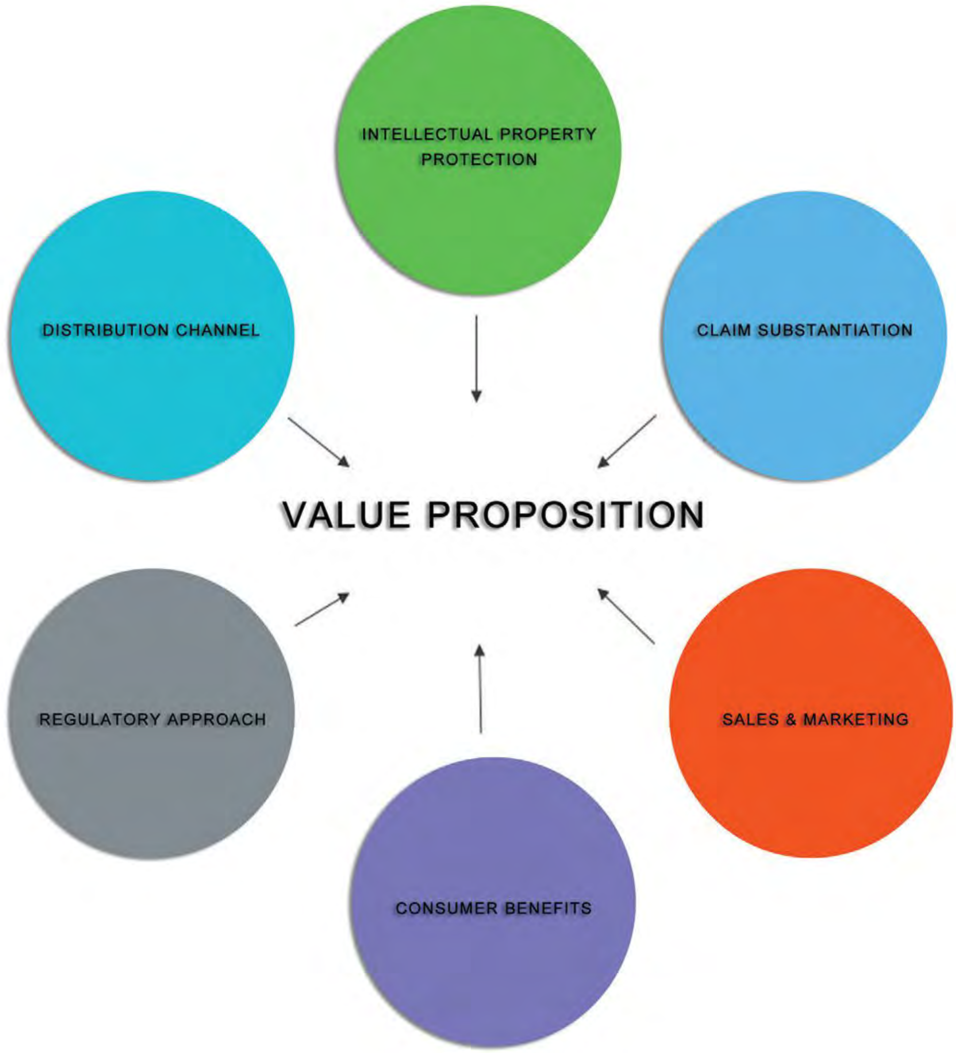

FIG. 2. In developing a value proposition, the major contributing factors need to be identified and understood. They change, subject to the end use application. For example, Ahiflower™ will feature in dietary supplements, skin care products, animal feed ingredients and as a functional ingredient in human food products. Each market has its own unique language and communication channels.

before crushing and oil stored for six months after refining by using suitable protective antioxidant measures.

Bearing in mind that the percentage of oil in most oil-containing seeds is between 20% and 50% (*B. arvensis* has 25%), a significant amount of biomass co-product remains to be managed once the oil is removed. Invariably this goes into animal feed, which in itself is an entirely different market development process, with different regulatory and performance criteria, yet one that greatly drives the overall commercial success of the oil.

SELL

This is where reality dawns and you find out whether cash flow generation and an acceptable margin structure for investors can be accomplished. This is probably the hardest of the three pieces to really get right. The somewhat classical approach to selling a new product is asking the "So what?" question, which invariably looks at whether your product is better or cheaper than current alternatives. Of course this is simplistic, but nonetheless it's a good start when developing a value proposition and planning how to communicate it. This article can't do justice to all of the considerations and planning that go into the sales process, but they are summarized in Figure 2.

Developing a value proposition is a multifaceted challenge, and recognizing your strengths and weaknesses should be central to developing a sales and marketing strategy. The first question we asked ourselves was, "Are we demand creators or demand fulfillers?" Needless to say, as a natural products supply chain management business we are a fulfillment-focused organization. Therefore, we immediately looked for strategic marketing, sales, and distribution partners who would grow demand for us to fulfill.

CONTINUED ON NEXT PAGE

Omega-3s are called "essential" fatty acids because they are vital for metabolism, yet the human body cannot manufacture them on its own, so they must be obtained from dietary sources. However, not all sources of omega-3 fatty acids are created equal. The following chart compares various plant and marine sources to fish oil.

Sources of Omega-3 Fatty Acids →	Fish oil	AHIFLOWER™ oil	Echium oil	Blackcurrant and hemp oils	SDA-enhanced soybean oil	Flaxseed oil	Microalgae oil	Krill oil
Environmentally Sustainable	?	✓	✓	✓	✓	✓	✓	-[1]
Non-genetically modified organism (non-GMO)	✓	✓	✓	✓	-	✓	✓	✓
Vegetarian and Vegan	-	✓	✓	✓	✓	✓	✓	-
No concerns for heavy metals, PCBs, or other toxins	-	✓	✓	✓	✓	✓	✓	-
Rich in GLA[2]	-	✓	✓	✓	✓	-	-	-
Produced under *Crop Assured 365®* system of identity preservation and quality assurance[3]	-	✓	✓	-	-	-	-	-
Pathway to EPA	EPA[4]	SDA[5]	SDA	SDA	SDA	ALA[6]	EPA	EPA
Contains >18% SDA	-	✓ One of the **richest** non-GMO plant-based sources of SDA known	-	-	✓	-	-	-

[1] Depletes a primary food source for marine animals.
[2] Gamma-linolenic acid (GLA), an omega-6 fatty acid
[3] *Crop Assured 365®* is Nature's Crops proprietary system of identity preservation and quality controls
[4] Eicosapentaenoic acid (EPA)
[5] Stearidonic acid (SDA). Approximately 20-30% of SDA converts to EPA in the body, or up to 5 times that of ALA.
[6] Alpha-linolenic acid (ALA). Less than 6% of ALA converts to EPA in the body.

Table 1. Comparison of omega-3 sources.

Delivering value to partners and stakeholders is vital; however, maximum value must ultimately be delivered to the consumer through the product and its identity. Ahiflower™ oil is the result of over 10 years of effort and investment. Self-affirmed Generally Recognized as Safe Status was achieved from the US Food and Drug Administration in 2013. In the European Union, novel food approval and New Dietary Ingredient processes are underway, with approvals anticipated in 2014. Table 1 summarizes the value proposition being communicated for Ahiflower™ oil.

Through a collaborative partnership model where the principle was "shared risk, shared reward," Ahiflower™ oil has gone from an idea to a commercial reality and will be featured as a retail branded product in North America in 2015. It presents a value-creating opportunity for multiple stakeholders from soil to oil and addresses the much-needed market challenge of finding a sustainable, scalable, safe, and efficacious solution to support the growth in demand for natural and cost-competitive omega-3 FA.

Fail fast, fail cheap

Contemplating how to avoid failure is equally important as determining how to be successful, and employing or investing in sound failure-avoidance strategies is a wise policy. Bringing a new crop product all the way through the supply chain only to find the market doesn't exist, the forecast prices aren't achievable, growers won't embrace its production, or the co-product fails to realize a sustainable value can signify the loss of years of research and development and the loss of millions of dollars. An accurate and realistic assessment of the market, its size, and price expectations matched by a robust business plan detailing the costs of building and managing a supply chain are the first investments to make.

Andrew Hebard is the founder, president and CEO of Technology Crops International (TCI), based in NC. After studying as an agricultural scientist, his career has been focused on specialty crop development and merchanting. TCI has developed and manages multiple global supply chains for many specialty and high value crops for the dietary supplement, specialty food and oleochemical markets. ahebard@techcrops.com

AOCS 2014 award recipients announced

AOCS awards have a rich history of honoring those individuals and teams who have taken the industry to the next level, who have advanced the quality and depth of the profession, and who have leveraged their knowledge for the benefit of the society.

These individuals from around the world will be recognized during the 105th AOCS Annual Meeting & Expo to be held May 4–7, 2014, in San Antonio, Texas, USA. The following list includes awards for whom recipients had been named by the deadline for this issue of *Inform*.

Ahmad

Harwood

Mailer

Malcata

Nes

Purtle

SOCIETY AWARDS

AOCS Fellows

Weselake

MOGHIS U. AHMAD, Jina Pharmaceuticals Inc., USA
JOHN L. HARWOOD, Cardiff University, United Kingdom
RODNEY J. MAILER, Australian Oils Research, Australia
F. XAVIER MALCATA, University of Porto, Portugal
W. DAVID NES, Texas Tech University, USA
IAN PURTLE, Consultant, USA
RANDALL J. WESELAKE, University of Alberta, Canada

A plaque and Fellow membership status

Fellows are selected for exceptional recognition for achievements in science as well as for unusually important service to AOCS or to their profession.

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Marangoni

SCIENTIFIC AWARDS

Supelco/Nicholas Pelick–AOCS Research Award

ALEJANDRO G. MARANGONI, University of Guelph, Canada

$10,000 honorarium, $1,500 travel stipend, and a plaque

The Supelco/Nicholas Pelick–AOCS Research Award is for accomplishment of outstanding original research in fats, oils, lipid chemistry, or biochemistry, the results of which have been presented through publication of technical papers. The award is funded by Supelco Inc., a subsidiary of Sigma-Aldrich, and Nicholas Pelick, an AOCS past president.

Shahidi

Stephen S. Chang Award

FEREIDOON SHAHIDI, Memorial University of Newfoundland, Canada

$3,000 honorarium and a jade horse

The Stephen S. Chang Award recognizes a scientist, technologist, or engineer who has made decisive accomplishments in basic research for the improvement or development of products related to lipids. The award was established by former AOCS President Stephen S. Chang and his wife, Lucy, for individuals who have made significant contributions through a single breakthrough or through an accumulation of publications.

London

George Schroepfer Medal

ERWIN LONDON, Stony Brook University, USA

$5,000 honorarium and a bronze medal

The George Schroepfer Medal recognizes significant and distinguished accomplishments in the steroid field, which is defined to encompass sterols and other natural and synthetic compounds incorporating the tetracyclic gonane ring system. The award is presented every two years and was established to honor the memory of George J. Schroepfer, Jr., a leader in the sterol and lipid field for more than 40 years.

Ngo

AOCS Young Scientist Research Award

HELEN L. NGO, US Department of Agriculture, USA

$1,000 honorarium, $1,500 travel stipend, and a plaque

The AOCS Young Scientist Research Award recognizes a young scientist who has made a significant and substantial research contribution in one of the disciplines represented by AOCS Divisions. Vijay K.S. Shukla and the International Food Science Centre A/S of Denmark sponsor the award.

Ratnayake

DIVISION AWARDS

Analytical Division: Herbert J. Dutton Award

W.M. NIMAL RATNAYAKE, Health Canada, Canada

$1,000 honorarium, $1,000 travel stipend, and a plaque

The award is presented for significant contributions to the analysis of fats and oils or to improvement in the understanding of the processes used in the fats and oils industries. The award is named for Dr. Dutton, a long-time research leader at the US Department of Agriculture facility in Peoria, Illinois, USA.

Student Awards

SARA E. SHINN, University of Arkansas, USA

HANJIANG ZHU, University of California Davis, USA

$250 honorarium, $500 travel stipend, and a certificate

Biotechnology Division: Student Awards

Greer

Ifeduba

1st place—**MICHAEL S. GREER**, University of Alberta, Canada

$300 honorarium and a certificate

2nd place—**CHAKRADHAR DASAGRANDHI**, Kyungpook National University, Korea

$200 honorarium and a certificate

3rd place—**EBENEZER A. IFEDUBA**, University of Georgia, USA

$100 honorarium and a certificate

Rousseau

Edible Applications and Technology Division: Timothy L. Mounts Award

DÉRICK ROUSSEAU, Ryerson University, Canada

$750 honorarium and a plaque

The award is for either basic or applied research accomplishments relating to the


Wu

science, technology, or application of edible oils in food products. It memorializes the former AOCS president, who was a distinguished research scientist with the US Department of Agriculture. The award is sponsored by Bunge North America.

Student Award

BICHENG WU, University of Massachusetts Amherst, USA

$500 travel stipend and a certificate


Kris-Etherton

Health and Nutrition Division: Ralph Holman Lifetime Achievement Award

PENNY KRIS-ETHERTON, The Pennsylvania State University, USA

$500 honorarium, $1,000 travel stipend, and an orchid print

The award recognizes outstanding performance and meritorious contributions to the health and nutrition interest area. The award is named after Ralph Holman in recognition of his lifetime service to the study of essential fatty acids.


Wah

Student Award

DARREN GOUK SHIOU WAH, University of Malaya, Malaysia

$500 honorarium and a certificate

Industrial Oil Products Division: ACI/NBB Glycerine Innovation Award

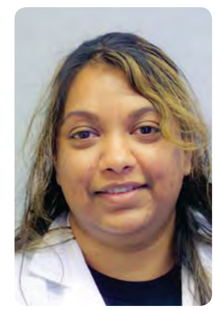

Ye

XIAOFEI (PHILIP) YE, University of Tennessee, USA

$5,000 honorarium and a plaque

The ACI/NBB Glycerine Innovation Award, sponsored by the American Cleaning Institute and the National Biodiesel Board, recognizes achievements in research relating to new applications for glycerine, particularly those with commercial viability.

Student Award


Raghunanan

$500 travel stipend and a certificate

LATCHMI C. RAGHUNANAN, Trent University, Canada

Lipid Oxidation and Quality Division: Edwin Frankel Best Paper Award

Comparison of Antioxidant Capacities of Rosmarinate Alkyl Esters in Riboflavin Photosensitized Oil-in-Water Emulsions (JAOCS 90:*225–232, 2013*)

JAE HWAN LEE[1], **ATIKORN PANYA**[2], **MICKAËL LAGUERRE**[3], **CHRISTELLE BAYRASY**[3], **JÉRÔME LECOMTE**[3], **PIERRE VILLENEUVE**[3], and **ERIC A. DECKER**[2]

[1]Sungkyunkwan University, Korea; [2]University of Massachusetts, USA; and [3]CIRAD UMR IATE, France

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Plaques and certificates for all authors

The award recognizes the best paper relating to lipid oxidation or lipid quality published during the previous year by AOCS Press. Kalsec Inc. sponsors the award.

Phospholipid Division: Best Paper Award

Effect of Antioxidant Properties of Lecithin Emulsifier on Oxidative Stability of Encapsulated Bioactive Compounds (International Journal of Pharmaceutics 450:*129–137, 2013*)

YUANJIE PAN[1], **ROHAN V. TIKEKAR**[2], and **N. NITIN**[1]

[1]University of California-Davis, USA; and [2]Drexel University, USA

Plaques and certificates for all authors

The award recognizes an outstanding paper related to phospholipids published during the previous year. The International Lecithin & Phospholipid Society (ILPS) sponsors the award.

Dijkstra

Processing Division: Distinguished Service Award

ALBERT J. DIJKSTRA, consultant, France

$500 travel stipend and a certificate

The award recognizes outstanding, meritorious service to the oilseed processing industry or to the Division over a substantial amount of time.

Student Award

ONYINYE EZEH, University of Reading, United Kingdom

$1,000 honorarium and a certificate

Protein and Co-Products Division: ADM Best Paper Award

Chemistry/Nutrition

Flaxseed Cyclolinopeptides: Analysis and Storage Stability (JAOCS 90:*419–428, 2013*)

FELIX ALADEDUNYE, EWA SOSINSKA, and **ROMAN PRZYBYLSKI**

University of Lethbridge, Canada

Engineering/Technology

Enzymatic Demulsification of the Oil-Rich Emulsion Obtained by Aqueous Extraction of Peanut Seeds (JAOCS 90:*1261–1270, 2013*)

SHAO BING ZHANG, XIANG JUN LIU, QI YU LU, ZI WEI WANG, and **XIANG ZHAO**

Henan University of Technology, People's Republic of China

Plaque and certificates for all authors

The awards are presented annually for the outstanding paper related to protein and co-products appearing in an AOCS publication during the previous year. Archer Daniels Midland Company sponsors the awards.

Surfactants and Detergents Division: Samuel Rosen Memorial Award

Tucker

CHRISTOPHER J. TUCKER, Dow Chemical Co., USA

$2,000 honorarium and a plaque

The award recognizes a significant advance in, or application of, the principles of surfactant chemistry by a chemist working in the industry. The award is sponsored by Milton Rosen in honor of his father, Samuel, who worked as an industrial chemist on the formulation of printing inks for more than four decades.

American Cleaning Institute (ACI) Distinguished Paper

Protocol for Studying Aqueous Foams Stabilized by Surfactant Mixtures (JSD 16:*1–12, 2013*)

JULIA BOOS[1], **WIEBKE DRENCKHAN**[2] and **COSIMA STUBENRAUCH**[1]

[1]Universität Stuttgart, Germany; and [2]Université Paris-Sud, France

Glass plaques for all authors

The award is presented annually to the authors of the best technical paper published during the preceding year in the *Journal of Surfactants and Detergents*. The award is sponsored by the American Cleaning Institute (ACI).

Student Award

JUN LU, University of Texas, Austin, USA

$500 travel stipend and a certificate

SECTION AWARDS

USA Section: Alton E. Bailey Award

Shahidi

FEREIDOON SHAHIDI, Memorial University of Newfoundland, Canada

$750 honorarium and a plaque

The award recognizes outstanding research and exceptional service in the field of lipids and associated products. The medal commemorates Alton E. Bailey's great contributions to the field of fats and oils as a researcher, as an author of several standard books in the field, and as a leader in the work of the Society. Archer Daniels Midland Company and Kraft Foods Inc., USA sponsor the award.

Hans Kaunitz Award

Attaphong

CHODCHANOK ATTAPHONG, The University of Oklahoma, USA

$1,000 honorarium, $500 travel allowance, and a certificate

The award recognizes the outstanding performance and merit of a graduate student within the geographical boundaries of the USA Section.

Green

AAOCS Lipid Research Award

ALLAN GREEN, CSIRO Plant Industry, Australia

Plaque and travel allowance for the biennial AAOCS meeting and the AOCS Annual Meeting & Expo.

The award recognizes a scientist from within the Australasian Region that has made lifetime-significant research contributions toward fats and oils research. The award is presented every two years.

Flock

STUDENT RECOGNITION

Thomas H. Smouse Memorial Fellowship Award

MICHAEL FLOCK, The Pennsylvania State University, USA

$10,000 scholarship, $5,000 research funding, and bookends

The Archer Daniels Midland Foundation, AOCS, AOCS Foundation, and the family and friends of Dr. Smouse have established and assisted in funding a fellowship program designed to encourage and support outstanding graduate research in a field of study consistent with the areas of interest to the AOCS.

AOCS Foundation Honored Student Awards

The award recognizes graduate students at any institution of higher learning who are conducting research in any area of science dealing with fats and lipids and who are interested in the areas of science and technology. Supported by contributions from members as well as companies in the industry.

Travel stipend and a certificate

Manuchehr (Manny) Eijadi Award

The Eijadi Award recognizes outstanding merit and performance by an AOCS Honored Student. The award, established by Mr. Eijadi, is intended to help the recipient finance his or her studies.

$1,000 scholarship and a certificate

Peter and Clare Kalustian Award

The Kalustian Award recognizes outstanding merit and performance by an AOCS Honored Student. The award is supported by the Kalustian estate.

$1,000 scholarship and a certificate

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Akanbi


Falkeborg


Wah


Kittipongpittaya


Yang


Zhang

TAIWO AKANBI, Deakin University, Australia
MIA FALKEBORG, Aarhus University, Denmark [*Manuchehr Eijadi Award*]
DARREN GOUK SHIOU WAH, University of Malaya, Malaysia
KETINUN KITTIPONGPITTAYA, University of Massachusetts Amherst, USA [*Peter & Clare Kalustian Award*]
YING YANG, University of Massachusetts Amherst, USA
XIAOWEI ZHANG, Shanghai Jiao Tong University, People's Republic of China

Ralph H. Potts Memorial Fellowship Award


Floros

MICHAEL FLOROS, Trent University, Canada

$2,000 scholarship, travel stipend, and a plaque

The Ralph H. Potts Award is presented annually to a graduate student working in the chemistry of fats and oils and their derivatives. The award is sponsored by AkzoNobel to memorialize Ralph Potts, a pioneer in research on industrial uses of fatty acids.

Pathways
(cont. from page 253)

What are the opportunities for advancement in your career/field and how can someone qualify for such advancements?

Analytical chemistry is a great foundation for advancement in the oil industry. The foundational skills of an analytical chemist include knowledge of chemistry and the scientific method. Having a deep understanding of these two areas makes a strong chemist. As the chemist becomes more experienced, the application of the foundational skills can be a qualifier for advancement. Having foresight and critical thinking skills is important when pursuing a leadership role. The ability to communicate ideas with clarity and directness is also important in advancing a career. In industry, areas such as operations, sales, productivity, quality, research and development, technical service, or innovations can provide advancement for chemists.

How would you describe the culture in your field and how has it developed?

The culture of analytical chemistry continues to evolve. Rapidly changing technology makes vendor partnerships important. Staying current and advancing the industry requires continuous evaluation and application of new technologies.

In your area/field and considering today's market, is it more important to be well-rounded or a specialist?

This depends on the role being filled. For a scientist, being a specialist is more important, as a specialist qualifies as an expert to fellow scientists. However, if the role requires transmitting ideas to individuals unfamiliar with science, being a generalist is more important. Non-science people often do not understand technical terms. Typically, a generalist can better summarize and present complicated ideas in simple terms.

What is your opinion toward the value of obtaining or possessing a graduate degree during a challenging economy?

I believe the value of any degree depends on your career goals. If you wish to acquire theoretical knowledge, obtaining a degree is important. Realistically, your value in the oils industry is determined by your ability to apply acquired knowledge to a product line. For this, working knowledge and practical experience on the product line are critical.

Extracts & Distillates (cont. from page 249)

Performance of palm olein and modified rapeseed, sunflower, and soybean oils in intermittent deep-frying

Aladedunye, F., and R. Przybylski, *Eur. J. Lipid Sci. Technol. 116*:144–152, 2014, http://dx.doi.org/10.1002/ejlt.201300284.

The frying performance of rapeseed, soybean, and sunflower oils with modified fatty acid composition, and palm olein (PALMO) was compared during a rotational frying operation. The frying was conducted at 185 ± 5°C for 6 days where French fries, battered chicken, and fish sticks were fried in succession. At the end of the frying period, high-oleic rapeseed and sunflower oils exhibited a significantly higher frying stability than PALMO and other modified oils, based on total polar components (TPC), polymers, and non-volatile carbonyl compounds formation (anisidine value). The rate of TPC formation was 2.9, 2.9, 3.2, 3.2, and 3.4% per frying day for high-oleic low-linolenic rapeseed (HOLLRAP), high-oleic sunflower (HOSUN), mid-oleic sunflower (MOSUN), low-linolenic soybean (LLSOY), and PALMO, respectively. Although the contents of free fatty acids in the used oils were significantly below the regulatory discard level, in PALMO formation of these compounds was 1.7 times higher compared to the modified oils. Color component formation and tocopherol degradation were also observed to be the highest in palm olein. A 15-member consumer panel awarded HOLLRAP and HOSUN the highest overall sensory acceptance scores, while for LLSOY and PALMO the lowest.

Hemp (*Cannabis sativa* L.) seed oil: analytical and phytochemical characterization of the unsaponifiable fraction

Montserrat-de la Paz, S., *et al.*, *J. Agric. Food Chem. 62*:1105–1110, 2014, http://dx.doi.org/10.1021/jf404278q.

Non-drug varieties of *Cannabis sativa* L., collectively named "hemp," have been an interesting source of food, fiber, and medicine for thousands of years. The ever-increasing demand for vegetable oils has made it essential to characterize additional vegetable oil through innovative uses of its components. The lipid profile showed that linoleic (55%), α-linolenic (16%), and oleic (11%) were the most abundant fatty acids. A yield (1.84–1.92%) of unsaponifiable matter was obtained, and the most interesting compounds were β-sitosterol (1905.00 ± 59.27 mg/kg of oil), campesterol (505.69 ± 32.04 mg/kg of oil), phytol (167.59 ± 1.81 mg/kg of oil), cycloartenol (90.55 ± 3.44 mg/kg of oil), and γ-tocopherol (73.38 ± 2.86 mg/100 g of oil). This study is an interesting contribution for *C. sativa* L. consideration as a source of bioactive compounds contributing to novel research applications for hemp seed oil in the pharmaceutical, cosmetic food, and other non-food industries.

Silver ion solid-phase extraction chromatography for the analysis of trans fatty acids

Kraft, J., *et al., Lipid Technol. 26*:39–42, 2014, http://dx.doi.org/10.1002/lite.201400008.

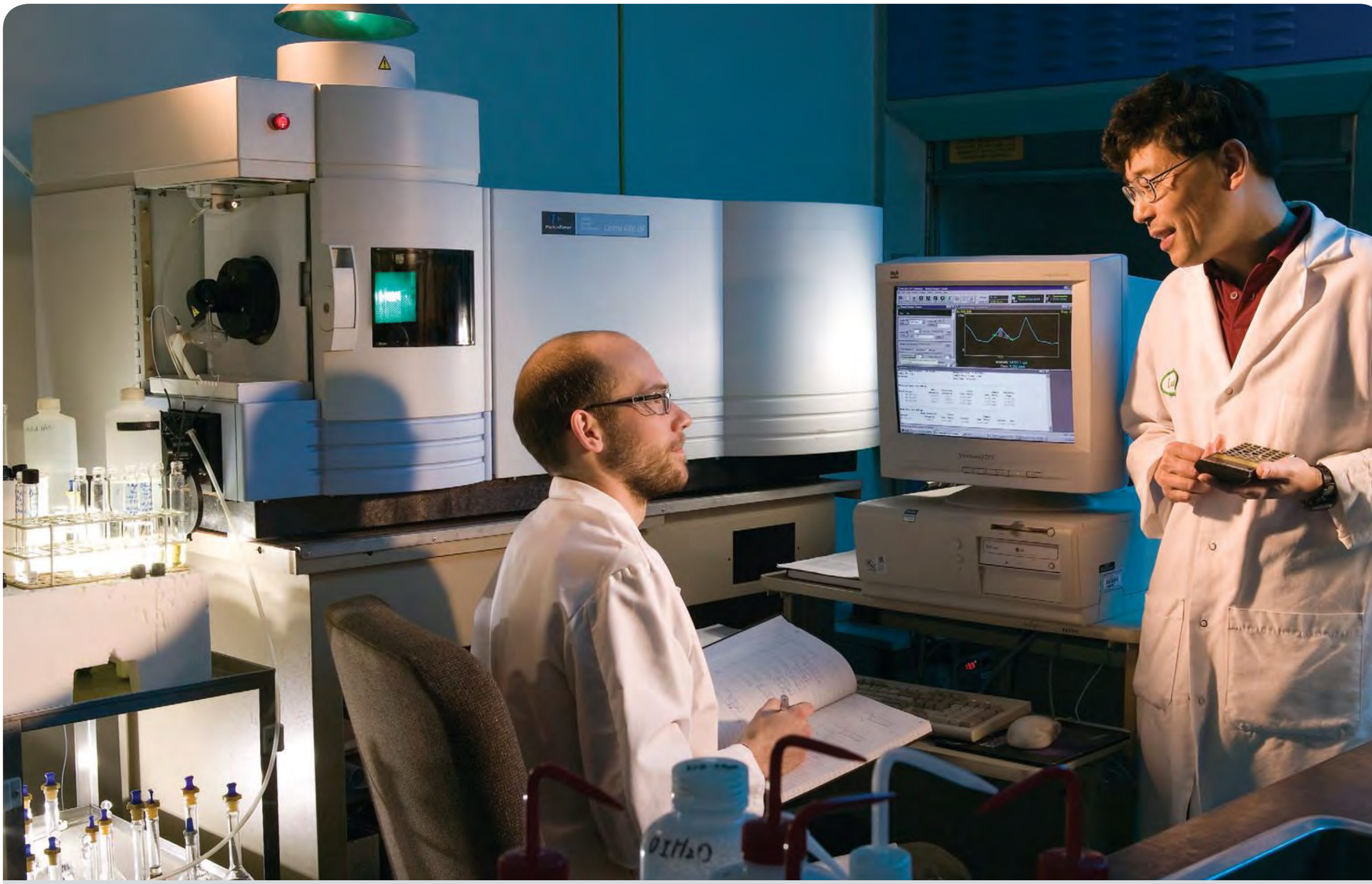
This article describes the application of silver ion solid-phase extraction (Ag^+-SPE) to the separation of the fatty acid methyl esters (FAME) prepared from a partially hydrogenated fish oil (PHFO) with a *trans* fatty acid (FA) content of 41%. The complex FAME mixture was resolved into the following FAME fractions: saturated FA, *trans*-monounsaturated FA (*trans*-MUFA), *cis*-MUFA, and several polyunsaturated FA (PUFA) fractions with mixed geometric and positional isomers. Fractions were analyzed by gas chromatography (GC) using a 100 m cyanopropyl polysiloxane (CPS) coated capillary column. The GC analysis of the Ag^+-SPE fractions allowed for the identification of the *trans*- and *cis*-MUFA and other FAME prepared from PHFO.

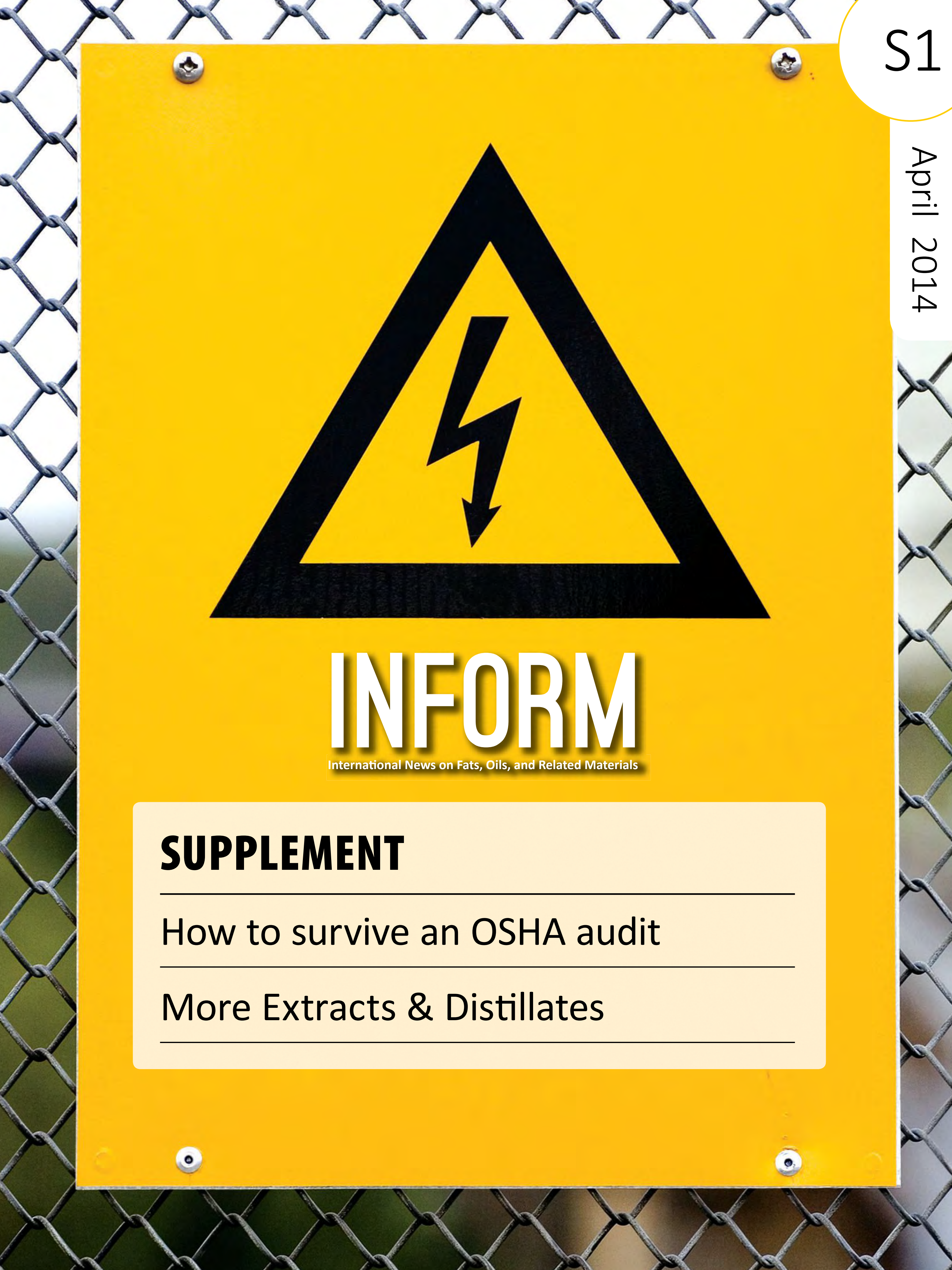
Comprehensive study of valuable lipophilic phytochemicals in wheat bran

Prinsen, P., *et al., J. Agric. Food Chem. 62*:1664–1673, 2014, http://dx.doi.org/10.1021/jf404772b.

Wheat bran, the major side-stream generated in the milling of wheat grains in the production of white flour, contains significant quantities of carbohydrate and proteins. While not interfering with flour utilization, the bran could be considered as an important feedstock within a biorefinery concept. Wheat bran also contains some amounts of lipids that can be used as a source of valuable phytochemicals. Gas chromatography and mass spectrometry analysis of the lipid composition of destarched wheat bran demonstrated that the predominant lipids found in wheat bran were free fatty acids (*ca.* 40% of total lipids), followed by acylglycerols (40%). Additionally, important amounts of alkylresorcinols (13% of total lipids) and steroid compounds (hydrocarbons, ketones, free sterols, sterol glycosides, sterol esters, and sterol ferulates) (7% of total lipids) were also present among the lipids of wheat bran. The use of wheat bran as a valuable source of phytochemicals of interest in the context of a wheat bran biorefinery is discussed.

More Extracts & Distillates can be found in this issue's supplement (digital and mobile editions only).





INFORM

International News on Fats, Oils, and Related Materials

SUPPLEMENT

How to survive an OSHA audit

More Extracts & Distillates

How to survive an OSHA audit

Jim Rhoad

"Hello. I'm from OSHA and I am here to help you."

If you own or operate a business in the United States, chances are very good you've heard these dreaded words before. Next to, *"Hello, I'm from the Internal Revenue Service,"* there are few greetings more inclined to make your knees weak. But it doesn't have to be that bad.

Even with the seven million workplaces they cover each year, the Occupational Safety and Health Administration (OSHA) will most likely find their way to your location. When they do, here are some tips to help you survive your OSHA audit.

Plan for an inspection by making sure you have three key items in place prior to the arrival of the OSHA compliance officer (CO):

1. A determination if you will ask for a warrant
2. A form to document what occurs during the inspection
3. All pertinent documentation such as written programs, training records, inspection records, etc.

We recommend you do not require the CO to obtain a warrant before entry unless you need to gain time, such as when a manager or counsel needs to be present. It is your legal right to ask for a warrant, but this might trigger a stricter audit (and raise possible red flags). It's wiser if you simply work with the inspector. Answer questions honestly and fully, but don't offer additional information unless it will help you avoid citations. Cooperate as long as the inspector remains ethical and reasonable.

Be prepared. These inspections are without notice so you will want to have all information readily available *in anticipation of* an impending audit. Here are some items to have prepared:

- Assignment of responsibilities, to include a "greeting team" to meet the CO
- Documented training logs
- Recordkeeping
- Equipment inspection records
- Safety and health policies
- Review of insurance and third-party audits
- Hazard assessment and abatement
- Review of previous audits and citations.

It is also wise to have a form available to record the inspector's actions and comments during the inspection. This information will help you understand what transpired and will assist your attorney should you contest the citation or penalty. Items you should record on this form include:

- The inspector's name and office telephone number
- The documents that the inspector reviewed and copied
- The attendees at the opening and closing conferences
- The areas that were inspected
- The employees and union representatives who participated
- The dates and times when the inspector was on site.

Almost all OSHA inspections begin with a review of written documents. These documents include your injury and illness records, safety manual, OSHA-required programs, OSHA-implied programs, safety procedures, and training records. There are many records and written programs that OSHA does not specifically require to be in writing, but you should have them anyway. These documents are referred to as OSHA-implied records. For example, although OSHA requires every employer to conduct frequent ladder inspections, there is no specific requirement to keep a written record of ladder inspections. The written record in this case could be a log of all ladders with initials and dates of inspection or a tag attached to the ladder with spaces for the inspector to initial and date.

Just to get you used to what you're in store for, we'll walk through a mock OSHA audit:

1. *The knock at the door.* We recommend escorting the compliance officer (CO) to your office or waiting area. This will give you time to gather your documents and "greeting team" to accompany the CO through the inspection.

2. *The opening conference.* The officer will explain why OSHA selected your work place for inspection and describe the scope of the inspection. Have your "greeting team" here to accompany the CO during the inspection. Make sure you set ground rules for the inspection, get a copy of the complaint if applicable, treat the CO in a professional fashion, coordinate with on-site contractors and vendors, bring up any trade secret issues you may have, but don't volunteer any information unless asked.
3. *The walk-around/inspection.* Make sure you have an employee representative attend the entire inspection and take accurate notes on areas reviewed and all discussions and comments from the CO, as well as any photos, videos, air monitoring, etc. Keep in mind whatever is in the CO's sight is subject to inspection. But maintain control. Remember, it's your facility and you have rights. Don't be bullied. But also don't try to talk your way out of an apparent hazard. It will not help and probably make it worse. And above all, don't destroy evidence. The CO may also want to interview employees. Make sure to schedule these away from your work area. It's up to your hourly employees if they want company representation during the interview. Advise the employee of his/her rights, your appreciation of their cooperation, and to tell the truth. Be aware that employees do have whistleblower rights. As for management and supervisor interviews, always have another management/counsel present during the interview. If there is a fatality investigation your attorney should always be present. No tape recording is permitted and you will need a signed statement upon completion.
4. *The closing conference.* During the closing conference the CO will review any apparent violations and discuss possible methods for correcting the violations within a reasonable time period. The CO will explain that the violations found may result in a citation and a proposed financial penalty, then describe the employer's rights and answer all questions. Remember, this is not a time for debate. The law requires OSHA to issue citations for safety and health standards violations. The citations include:
    - A description "with particularity "of the violation
    - The proposed penalty if any
    - The date by which the hazard must be corrected.

Citations are usually prepared at the local OSHA office and mailed to the employer via certified mail. OSHA has up to six months to send a Notice of Penalty. Employers have 15 working days upon receipt to file an intention to contest OSHA citations, and/or to request an informal conference with the area director to discuss any citations issued. Common causes to dispute citations include:

- The citation is false
- The citation's dollar penalty is excessive
- You disagree with the citation's contention that the danger was real, serious, and that an accident was likely to occur
- You disagree with the contention that you are responsible for causing the unsafe conditions.

Finally, contesting may not relieve you completely of a penalty, but it may help you negotiate a lesser fine. Contesting is usually a good idea. OSHA typically negotiates with employers to a lesser penalty amount.

There is no way to avoid an OSHA audit, much as there is no way to avoid having a root canal. But, similarities aside, you can lessen the pain by being well-prepared.

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EXTRACTS & DISTILLATES

Minor polar compounds in extra virgin olive oil: correlation between HPLC-DAD-MS and the Folin-Ciocalteu spectrophotometric method

Alessandri, S., *et al.*, *J. Agric. Food Chem. 62*:826–835, 2014, http://dx.doi.org/10.1021/jf403104a.

Minor polar compounds of 88 extra virgin olive oils were analyzed by HPLC-DAD-MS (high-performance liquid chromatography–diode array detector–mass spectrometry) and by the Folin-Ciocalteu (FC) spectrophotometric method, to validate and evaluate, for olive oils, the linear association between FC and HPLC data. The Pearson correlation coefficients were calculated between HPLC and FC results. The highest, positive *R* were related with deacetoxyoleuropein aglycone ($R = 0.93$) and oleuropein aglycone ($R = 0.93$) as single compounds and with the sum of orthodiphenols ($R = 0.94$) and the sum of all compounds ($R = 0.95$), showing that both estimations of total phenols content are reliably correlated, regardless for the absolute contents and are independent of the relative composition of the phenolic fraction. On the other hand the HPLC quantifications of apigenin and lignans showed no significant correlation with FC. These results, supported also by principal component analysis, may suggest caution about the interpretation of FC results to compare olive oils with very different phenolic profiles.

Comparison of dietary tocotrienols from barley and palm oils in hen's egg yolk: transfer efficiency, influence of emulsification, and effect on egg cholesterol

Walde, C.M., *et al.*, *J. Sci. Food Agric. 94*:810–818, 2014, http://dx.doi.org/10.1002/jsfa.6484.

The main component in tocotrienols (T3) from barley (*Hordeum vulgare* L.) is α-T3, the vitamer with the highest bioavailability, while palm oil T3 is particularly rich in γ-T3. Unlike tocopherols, T3 are known for their cholesterogenesis-inhibiting, neuroprotective and anticarcinogenic properties. In this study the oral bioavailabilities of T3 from barley oil (3.98 mg day^{-1}) and T3 from palm oil (3.36 mg day^{-1}) in nanoemulsified formulations (NE) and self-emulsifying systems (SES) were compared using hens' eggs as a bioindicator. In addition, the transfer efficiencies of barley oil T3 and palm oil T3 into egg yolk were compared, as well as their effects on egg cholesterol levels. Nanoemulsification led to T3 levels (132.9 µg per egg) higher than with non-emulsified barley oil (112.8 µg per egg) and barley oil SES (116.7 µg per egg) owing to the high proportions of α-T3 (99–117 µg per egg), which has a particularly high transfer efficiency (4.32–6.75%). T3 contents of eggs from hens fed barley oil supplements (112–132 µg per egg) were significantly higher than those of eggs from hens fed palm oil supplements (70–78 µg per egg). Addition of barley and palm oils to laying hen feed decreased egg yolk cholesterol by 4 and 6%, respectively. Results from this animal study may help to establish T3 from barley as a dietary supplement and to develop nutritionally improved hens' eggs.

Saturated fatty acid (SFA) status and SFA intake exhibit different relations with serum total cholesterol and lipoprotein cholesterol: a mechanistic explanation centered around lifestyle-induced low-grade inflammation

Ruiz-Nuñez, B., *et al.*, *J. Nutr. Biochem.* 25:304–312, 2014, http://dx.doi.org/10.1016/j.jnutbio.2013.11.004.

We investigated the relations between fatty acid status and serum total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein (HDL) cholesterol, and total cholesterol/HDL cholesterol ratio in five Tanzanian ethnic groups and one Dutch group. Total cholesterol/HDL cholesterol ratio is a widely used coronary artery disease (CAD) risk factor. Fatty acid status was determined by measurement of fatty acids in serum cholesterol esters and erythrocytes. Data reflecting the influence of fatty acid intakes on serum total cholesterol and lipoprotein cholesterol were obtained from documented intervention studies. We found that 14:0, 16:0, and saturated fatty acid (SFA) status correlates positively with total cholesterol/HDL cholesterol ratio, while their intakes were unrelated. Linoleic acid (LA) and polyunsaturated fatty acid (PUFA) status and PUFA intake exhibited negative relations with the total cholesterol/HDL cholesterol ratio. These data suggest that a high SFA status, not a high SFA intake, is associated with increased CAD risk, while both high LA status and PUFA status are associated with reduced CAD risk. Consequently, the total cholesterol/HDL cholesterol ratio is a questionable risk marker since meta-analyses of randomized controlled trials show that partial dietary replacement of SFA for LA, the dominating dietary PUFA, does not change CAD risk. We conclude that many lifestyle factors, not SFA intake alone, determine SFA status and suggest that interaction with many other lifestyle factors determines whether SFA status has a relevant contributing effect in low-grade inflammation, lipoprotein changes, and CAD risk. The present outcome may teach us to consider the health effects of the entire diet together with many nondietary lifestyle factors, opposite to the reductionist approach of studying the effects of single nutrients, SFA and PUFA included.

Screening of impact factors on the enzymatic neutralization of Jatropha crude oil

Gofferjé, G., *et al.*, *Eur. J. Lipid Sci. Technol. 116*:185–192, 2014, http://dx.doi.org/10.1002/ejlt.201300177.

Due to the high oil content of the seeds, *Jatropha curcas* L. became a focus of interest in the last decades. In order to prepare the oil for technical applications a refining is essential. This study is concerned with the enzymatic neutralization of aqueous-extracted jatropha oil utilizing an immobilized lipase from *Rhizomucor miehei*. Free fatty acids were esterified with glycerol. Factors influencing the reaction were determined applying low acidic oil (acid number 4.2 mg KOH/g oil). Stirring rate of 300 rpm is adequate. The reaction rate was highest at 60°C. Free fatty acid content was reduced continuously with reaction time between 4 and 24 h. The variation of the free fatty acid content of jatropha oil had only marginal influence on the reaction time. The amount of glycerol added to the reaction system was found to be optimal between 0.15 and 0.25 mol/L. Three percent w/w of immobilized lipase was enough to saturate the reaction system. A strong interaction between enzyme and glycerol content is likely and will be evaluated in an experimental design. The process designed after parameter screening yields acid numbers around 0.2 mg KOH/g oil. Remaining fatty acids are easily removed during the subsequent refining steps.

Dietary intake of palmitate and oleate has broad impact on systemic and tissue lipid profiles in humans

Kien, C.L., *et al.*, *Am. J. Clin. Nutr. 99*:436–445, 2014, doi:10.3945/ajcn.113.070557.

Background: Epidemiologic evidence has suggested that diets with a high ratio of palmitic acid (PA) to oleic acid (OA) increase risk of cardiovascular disease (CVD). Objective: To gain additional insights into the relative effect of dietary fatty acids and their metabolism on CVD risk, we sought to identify a metabolomic signature that tracks with diet-induced changes in blood lipid concentrations and whole-body fat oxidation. Design: We applied comprehensive metabolomic profiling tools to biological specimens collected from 18 healthy adults enrolled in a crossover trial that compared a 3-wk high-palmitic-acid (HPA) with a low-palmitic-acid and high-oleic-acid (HOA) diet. Results: A principal components analysis of the data set including 329 variables measured in 15 subjects in the fasted state identified one factor, the principal components analysis factor in the fasted state (PCF1-Fasted), which was heavily weighted by the PA/OA ratio of serum and muscle lipids, that was affected by diet ($P < 0.0001$; HPA greater than HOA). One other factor, the additional principal components analysis factor in the fasted state (PCF2-Fasted), reflected a wide range of acylcarnitines and was affected by diet in women only ($P = 0.0198$; HPA greater than HOA). HOA lowered the ratio of serum low-density lipoprotein to high-density lipoprotein (LDL/HDL) in men and women, and adjustment for the PCF1-Fasted abolished the effect. In women only, adjustment for the PCF2-Fasted eliminated the HOA-diet effect on serum total- and LDL-cholesterol concentrations. The respiratory exchange ratio in the fasted state was lower with the HPA diet ($P = 0.04$), and the diet effect was eliminated after adjustment for the PCF1-Fasted. The messenger RNA expression of the cholesterol regulatory gene insulin-induced gene-1 was higher with the HOA diet ($P = 0.008$).

Lorenzo's oil inhibits ELOVL1 and lowers the level of sphingomyelin with a saturated very long-chain fatty acid

Sassa, T., *et al.*, *J. Lipid Res. 55*:524–530, 2014, http://dx.doi.org/10.1194/jlr.M044586.

X-linked adrenoleukodystrophy (X-ALD) is a peroxisomal disorder caused by impaired degradation of very long-chain fatty acids (VLCFA) due to mutations in the *ABCD1* gene responsible for VLCFA transport into peroxisomes. Lorenzo's oil, a 4:1 mixture of glyceryl trioleate and glyceryl trierucate, has been used to reduce the saturated VLCFA level in the plasma of X-ALD patients; however, the mechanism by which this occurs remains elusive. We report the biochemical characterization of Lorenzo's oil activity toward elongation of very long-chain fatty acid (ELOVL) 1, the primary enzyme responsible for the synthesis of saturated and monounsaturated VLCFA. Oleic and erucic acids inhibited ELOVL1, and, moreover, their 4:1 mixture (the FA composition of Lorenzo's oil) exhibited the most potent inhibitory activity. The kinetics analysis revealed that this was a mixed (not a competitive) inhibition. At the cellular level, treatment with the 4:1 mixture reduced the level of sphingomyelin (SM) with a saturated VLCFA accompanied by an increased level of SM with a monounsaturated VLCFA, probably due to the incorporation of erucic acid into the FA elongation cycle. These results suggest that inhibition of ELOVL1 may be an underlying mechanism by which Lorenzo's oil exerts its action.

Lipid antigens in immunity

Dowds, C.M., *et al.*, *Biol. Chem. 395*: 61–81, 2014, http://dx.doi.org/10.1515/hsz-2013-0220.

Lipids not only are a central part of human metabolism but also play diverse and critical roles in the immune system. As such,

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they can act as ligands of lipid-activated nuclear receptors, control inflammatory signaling through bioactive lipids such as prostaglandins, leukotrienes, lipoxins, resolvins, and protectins, and modulate immunity as intracellular phospholipid- or sphingolipid-derived signaling mediators. In addition, lipids can serve as antigens and regulate immunity through the activation of lipid-reactive T cells, which is the topic of this review. We will provide an overview of the mechanisms of lipid antigen presentation, the biology of lipid-reactive T cells, and their contribution to immunity.

Microbial lipids as a source of biofuels

Tkachenko, A.F., *et al., Cytol. Genet. 47*:343–348 , 2013, http://dx.doi.org/10.3103/S0095452713060054.

This review presents the main directions and experimental data aimed at searching for active producers of lipids among different species of microorganisms and ways to optimize the lipidogenesis process in the most promising stains. It was shown that enzymatic processes can be directed by maintaining the necessary cultivation conditions. The influence on the growth, development, and biochemical activity of the microbial medium composition and temperature and the aeration and oxidation reduction conditions was considered. Changes in these factors affected the biosynthetic activity of microorganisms and lipidogenic yeasts and the composition of synthesized lipids. The ability of lipidogenic yeasts, as well as the relatively rapid ability of changing the amount and composition of lipids by direct cultivation, leads to the conclusion that lipids obtained by microbial synthesis can be a source of commercial raw materials for biofuel.

Alternative sources of n-3 long-chain polyunsaturated fatty acids in marine microalgae

Martins, D.A., *et al., Mar. Drugs 11*:2259–2281, 2013, http://dx.doi.org/10.3390/md11072259.

The main source of n-3 long-chain polyunsaturated fatty acids (LC-PUFA) in human nutrition is currently seafood, especially oily fish. Nonetheless, due to cultural or individual preferences, convenience, geographic location, or awareness of risks associated to fatty fish consumption, the intake of fatty fish is far from supplying the recommended dietary levels. The end result observed in most Western countries is not only a low supply of n-3 LC-PUFA, but also an unbalance toward the intake of n-6 fatty acids, resulting mostly from the consumption of vegetable oils. Awareness of the benefits of LC-PUFA in human health has led to the use of fish oils as food supplements. However, there is a need to explore alternative sources of LC-PUFA, especially those of microbial origin. Microalgae species with potential to accumulate lipids in high amounts and to present elevated levels of n-3 LC-PUFA are known in marine phytoplankton. This review focuses on sources of n-3 LC-PUFA, namely, eicosapentaenoic and docosahexaenoic acids, in marine microalgae, as alternatives to fish oils. Based on current literature, examples of marketed products and potentially new species for commercial exploitation are presented.

Omega-3 fatty acids: new insights into the pharmacology and biology of docosahexaenoic acid, docosapentaenoic acid, and eicosapentaenoic acid

Davidson, M.H., *Curr. Opin. Lipidol. 24*:467–474, 2013, doi:10.1097/MOL.0000000000000019.

Purpose of review: Fish oil contains a complex mixture of omega-3 fatty acids, which are predominantly eicosapentaenoic acid (EPA), docosapentaenoic acid, and docosahexaenoic acid (DHA). Each of these omega-3 fatty acids has distinct biological effects that may have variable clinical effects. In addition, plasma levels of omega-3 fatty acids are affected not only by dietary intake but also by the polymorphisms of coding genes fatty acid desaturase 1-3 for the desaturase enzymes that convert short-chain polyunsaturated fatty acids (PUFA) to long-chain PUFA. The clinical significance of this new understanding regarding the complexity of omega-3 fatty acid biology is the purpose of this review. Recent findings: FADS polymorphisms that result in either lower levels of long-chain omega-3 fatty acids or higher levels of long-chain omega-6 polyunsaturated fatty acids, such as arachidonic acid, are associated with dyslipidemia and other cardiovascular risk factors. EPA and DHA have differences in their effects on lipoprotein metabolism, in which EPA, with a more potent peroxisome proliferator-activated receptor-alpha effect, decreases hepatic lipogenesis, whereas DHA not only enhances very low density lipoprotein (VLDL) lipolysis, resulting in greater conversion to low density lipoprotein (LDL), but also increases high density lipoprotein (HDL) cholesterol and larger, more buoyant LDL particles. Summary: Overall, these results emphasize that blood concentrations of individual long-chain PUFA, which reflect both dietary intake and metabolic influences, may have independent—but also complementary— biological effects and reinforce the need to potentially provide a complex mixture of omega-3 fatty acids to maximize cardiovascular risk reduction.

Dietary polyunsaturated fatty acids and inflammation: the role of phospholipid biosynthesis

Raphael, W., and L.M. Sordillo, *Int. J. Mol. Sci. 14*:21167–21188, 2013, http://dx.doi.org/10.3390/ijms141021167.

The composition of fatty acids in the diets of both human and domestic animal species can regulate inflammation through the biosynthesis of potent lipid mediators. The substrates for lipid mediator biosynthesis are derived primarily from membrane phospholipids and reflect dietary fatty acid intake. Inflammation can be exacerbated with intake of certain dietary fatty acids, such as some ω-6 polyunsaturated fatty acids (PUFA), and subsequent incorporation into membrane phospholipids. Inflammation, however, can be resolved with ingestion of other fatty acids, such as ω-3 PUFA. The influence of dietary PUFA on phospholipid composition is influenced by factors that control phospholipid biosynthesis within cellular membranes, such as preferential incorporation of some fatty acids, competition between newly ingested PUFA and fatty acids released from stores such as adipose, and the impacts of carbohydrate metabolism and physiological state. The objective of this review is to explain these factors as potential obstacles to manipulating PUFA composition of tissue phospholipids by specific dietary fatty acids. A better understanding of the factors that influence how dietary fatty acids can be incorporated into phospholipids may lead to nutritional intervention strategies that optimize health.

The relationship of docosahexaenoic acid (DHA) with learning and behavior in healthy children: a review

Kuratko, C.N., *et al.*, *Nutrients 5*:–2777–2810, 2013, http://dx.doi.org/10.3390/nu5072777.

Childhood is a period of brain growth and maturation. The long chain omega-3 fatty acid, docosahexaenoic acid (DHA), is a major lipid in the brain recognized as essential for normal brain function. In animals, low brain DHA results in impaired learning and behavior. In infants, DHA is important for optimal visual and cognitive development. The usual intake of DHA among toddlers and children is low, and some studies show improvements in cognition and behavior as the result of supplementation with polyunsaturated fatty acids including DHA. The purpose of this review was to identify and evaluate current knowledge regarding the relationship of DHA with measures of learning and behavior in healthy school-age children. A systematic search of the literature identified 15 relevant publications for review. The search found studies which were diverse in purpose and design and without consistent conclusions regarding the treatment effect of DHA intake or biomarker status on specific cognitive tests. However, studies of brain activity reported benefits of DHA supplementation and over half of the studies reported a favorable role for DHA or long-chain omega-3 fatty acids in at least one area of cognition or behavior. Studies also suggested an important role for DHA in school performance.

Systematic review of omega-3 enriched foods and health

Lane, K.E., and E. Derbyshire, *Brit. Food J. 116*:165–179, 2014, http://dx.doi.org/10.1108/BFJ-05-2012-0118.

The purpose of this paper is to review evidence from high-quality randomized controlled trials reporting links between omega-3 enriched functional foods and health. Using MEDLINE, a search was made for all randomized controlled trials published between 2002 and 2012 that met defined inclusion criteria. Studies had minimum durations of 28 days, clearly stated the food vehicle, dose and type of long-chain omega-3 polyunsaturated fatty acids (LC3PUFA) used, and did not include studies where participants only took LC3PUFA supplements. Findings: A total of 11 studies were located, 10 of which reported potential health benefits linked to omega-3 functional food consumption. Five studies reported significant improvements in markers of cardiovascular (CV) health, while 10 bioavailability studies reported increases in omega-3 blood levels when doses of 460 mg or more were integrated into food vehicles. In the future a meta-analysis would be useful in terms of determining the dose of LC3PUFA associated with overall health benefits. The present review concludes that omega-3 enriched functional foods are a useful way to improve LC3PUFA status and have been linked to improved health outcomes, namely, markers of CV health. More work is now needed to determine whether particular population groups could benefit from consumption of these foods, for example vegetarians and children, in relation to a range of health outcomes, such as cognitive function. This review provides evidence that integrating omega-3 enriched functional foods within the daily diet could be an effective strategy for helping to improve LC3PUFA status and attenuating CV disease risk.

Fatty acidomics: global analysis of lipid species containing a carboxyl group with a charge-remote fragmentation-assisted approach

Wang, M., *et al.*, *Anal. Chem. 85*:9312–9320, 2013, http://dx.doi.org/10.1021/ac402078p.

Charge-remote fragmentation has been well recognized as an effective approach for dissociation of long aliphatic chains. Herein, we exploited this approach for structural identification of all fatty acids including saturated, unsaturated, and modified ones by using electrospray ionization tandem mass spectrometry after one-step derivatization of a charge-carried reagent through an amidation reaction. We tested the approach with different charge-carried reagents with respect to the hydrophobicity, charge strength, and distance from the charge to the carboxyl group. We found that all of the derivatives with these reagents could yield informative charge-remote fragmentation patterns regardless of the different chemical and physical properties of the reagents. These informative fragmentation patterns all could be effectively used for structural elucidation of lipid species containing a carboxyl group. We further found that the distinguished charge-remote fragmentations of fatty acid isomers enabled us to determine the composition of these isomers without any chromatographic separation. Finally, the abundant fragments yielded from an individual derivatized moiety enabled us to sensitively quantify the individual species containing a carboxyl group. The described approach was a great extension to the multidimensional mass-spectrometry-based shotgun lipidomics for global

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analysis of fatty acids including isomers and modifications. We believe that this approach could greatly facilitate identification of the biochemical mechanisms underlying numerous pathological conditions.

Analysis of oil-biodiesel samples by high performance liquid chromatography using the normal phase column of new generation and the evaporative light scattering detector

Fedosov, S.N., *et al.*, *J. Chromatogr. A 1326*:56–62, 2014, http://dx.doi.org/10.1016/j.chroma.2013.12.043.

Conversion of vegetable oil to biodiesel is usually monitored by gas chromatography. This is not always convenient because of (i) an elaborate derivatization of the samples; (ii) inhibition of this process by methanol and water; and (iii) low stability of the derivatives under storage. High performance liquid chromatography (HPLC) methods are apparently more convenient, but none of the described variants has won a wide recognition so far. This can be ascribed to the problems of reproducibility (in the case of normal-phase chromatography) and limited separation of some analytes (in the case of reverse-phase chromatography). Here we report an HPLC procedure suitable for separation of biodiesel, free fatty acids, glycerides, glycerol, and lecithin. The normal-phase column of new generation (Poroshell 120 HILIC) and the novel gradient were used. The method was tested on both the artificial mixtures and the crude reaction samples. Elution of the analytes was monitored by an evaporative light-scattering detector. This method is usually confined to a very limited range of masses, where only a part of the complex calibration curve is used. We have analyzed the light-scattering signal within a very broad range of masses, whereupon the calibration curves were produced. The data were approximated by the appropriate equations used afterward to recalculate the signal-to-mass in a convenient way. An experimental conversion of rapeseed oil to biodiesel was performed by a liquid lipase formulation. This process was monitored by HPLC to illustrate advantages of the suggested registration method.

Plastids with or without galactoglycerolipids

Botté, C.Y., and E. Maréchal, *Trends Plant Sci. 19*:71–78, 2014, http://dx.doi.org/10.1016/j.tplants.2013.10.004.

In structural, functional, and evolutionary terms, galactoglycerolipids are signature lipids of chloroplasts. Their presence in nongreen plastids has been demonstrated in angiosperms and diatoms. Thus, galactoglycerolipids are considered as a landmark of green and nongreen plastids, deriving from either a primary or secondary endosymbiosis. The discovery of a plastid in *Plasmodium falciparum*, the causative agent of malaria, fueled the search for galactoglycerolipids as possible targets for treatments. However, recent data have provided evidence that the *Plasmodium* plastid does not contain any galactoglycerolipids. In this opinion article, we discuss questions raised by the loss of galactoglycerolipids during evolution: how have galactoglycerolipids been lost? How does the *Plasmodium* plastid maintain four membranes without these lipids? What are the main constituents instead of galactoglycerolipids? ■