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Montreux keynote address from Henkel's Kasper Rorsted

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Algae as a renewable feedstock

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

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March

March 30–31, 2011. BioEnergy World Africa 2011, Sandton Convention Centre, Johannesburg, South Africa. Information: www.terrapinn.com/2011/bioenergyza.

March 31, 2011. Allergen-Free Foods 2011: Formulation and Labelling for the Future, Royal Garden Hotel, London, England. Information: www.fn-allergenfree.com.

March 31–April 1, 2011. Practical Short Course: Algae Harvesting and Processing for Value Added Applications, Brussels, Belgium. Information: http://home.scarlet.be/~tpm12374/smartshortcourses/algae1.

April

April 5–6, 2011. Global Algae Biodiesel World India 2011, Jaipur, India. Information: phone: +91 9413343550 or +91 9829423333; e-mail: info@biodieselacademy.com or jatrophatraining@gmail.com; http://biodieselacademy.com/course-details.php?cid=24.

April 6–7, 2011. 41st C.E.D. [Comité Español de la Detergencia Tensioactivos y Afines] Annual Meeting, Barcelona, Spain. Information: www.ced.org.es.

April 9–13, 2011. American Society for Biochemistry and Molecular Biology, Washington, DC, USA. Information: www.asbmb.org/Meetings_01/2011mtg/Annualmtghome.aspx.

April 10–11, 2011. 4th SCS Annual Scientific Symposium: Sustainability—a Cosmetic Paradox, Tortworth Court Four Pillars Hotel, Wotton Under Edge, South Gloucestershire, UK. Information: phone: +44 (0)1582 726661; www.scs.org.uk/symposium-2011.

April 10–12, 2011. 15th International Conference on Hydrocolloids, Hyatt Regency Mission Bay, San Diego, California, USA. Information: phone: +1 858-451-6080; email: dseisun@hydrocolloid.com.

April 10–13, 2011. 2nd Latino-American ICC [International Association for Cereal Science and Technology] Conference, W Hotel, Santiago, Chile. Information: www.lacerealconference.com.

April 12–13, 2011. OFI Middle East 2011, InterContinental Citystars, Cairo, Egypt. Information: email: oilsandfats@quartzltd.co.uk; www.oilsandfatsinternational.com.

April 13–14, 2010. Ninth International REACH Conference, Holiday Inn Atlanta Capitol Conference3 Center, Atlanta, Georgia, USA. Information: www.ismithers.net/conferences/XRUS11/reach-usa-2011.

April 19–21, 2011. Advanced Biofuels Leadership Conference, Capital Hilton, Washington, DC, USA. Information: http://advancedbiofuelssummit.com.

April 25–29, 2011. World Congress of Bioenergy, World Expo Center, Dalian, China. Information: www.bitlifesciences.com/wcbe2011.

April 30, 2011. Basics of Edible Oil Processing and Refining—AOCS Short Course, Hyatt Regency Hotel, Cincinnati, Ohio, USA. Information: email: meetings@aocs.org; phone: +1 217-693-4821; fax: +1 217-693-4865; http://annualmeeting.aocs.org.

April 30–May 1, 2011. Functionality of Lipids in Foods—AOCS Short Course, Hyatt Regency Hotel, Cincinnati, Ohio, USA. Information: email: meetings@aocs.org; phone: +1 217-693-4821; fax:

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April 30, 2011. Basics of Edible Oil Processing and Refining—AOCS Short Course, Hyatt Regency Hotel, Cincinnati, Ohio, USA. Information: email: meetings@aocs.org; phone: +1 217-693-4821; fax: +1 217-693-4865; http://annualmeeting.aocs.org.

April 30–May 1, 2011. Functionality of Lipids in Foods—AOCS Short Course, Hyatt Regency Hotel, Cincinnati, Ohio, USA. Information: email: meetings@aocs.org; phone: +1 217-693-4821; fax: +1 217-693-4865; http://annualmeeting.aocs.org.

May 1, 2011. New Technologies in Oilseed Extraction and Edible Oil Refining—AOCS Short Course, Hyatt Regency Hotel, Cincinnati, Ohio, USA. Information: email: meetings@aocs.org; phone: +1 217-693-4821; fax: +1 217-693-4865; http://annualmeeting.aocs.org.

May 1–4, 2011. 102nd AOCS Annual Meeting & Expo, Duke Energy Convention Center, Cincinnati, Ohio, USA. Information: phone: +1 217-359-2344; fax: +1 217-351-8091; email: meetings@aocs.org; http://annualmeeting.aocs.org.

June 18, 2011. Sensory Evaluation of Olive Oil Short Course, Hilton Hotel, Izmir, Turkey. Information: email: meetings@aocs.org; ; phone: +1 217-683-4821; fax: +1 217-693-4865; www.aocs.org/goto/Turkey2011.

June 18–19, 2011. Basics of Oilseed Processing Short Course, Hilton Hotel, Izmir, Turkey. Information: email: meetings@aocs.org; phone: +1 217-683-4821; fax: +1 217-693-4865; www.aocs.org/goto/Turkey2011.

June 19, 2011. Edible Oil Refinery and Optimization and Maintenance Short Course, Hilton Hotel, Izmir, Turkey. Information: email: meetings@aocs.org; phone: +1 217-683-4821; fax: +1 217-693-4865; www.aocs.org/goto/Turkey2011.

June 20–21, 2011. Oils and Fats World Market Update 2011, Izmir Hilton, Izmir, Turkey. Information: email: meetings@aocs.org; phone: +1 217-683-4821; fax: +1 217-693-4865; www.aocs.org/goto/WorldMarket.

June 21–23, 2011. World Conference on Oilseed Processing, Fats & Oils Processing, Biofuels & Applications, Izmir Hilton, Izmir, Turkey. Information: email: meetings@aocs.org; phone: +1 217-683-4821; fax: +1 217-693-4865; www.aocs.org/goto/Turkey2011.

September 16–18, 2011. 10th Phospholipid Congress of The International Lecithin and Phospholipid Society (ILPS): Phospholipids—Sources, Processing and Application, Congress Centre "De Doelen," Rotterdam, the Netherlands. Information: e-mail: ilps@lecipro.nl; www.ilps.org/10th%20Congress.htm.

October 10–13, 2011. World Congress on Oleo Science and 29th ISF Congress—JOCS/AOCS/KOCS/ISF/ISBB Joint Meeting, Tower Hall Funabori, Tokyo, Japan. Information: www2.convention.co.jp/wcos2011.

October 17–21, 2011. 14th Latin American Congress on Fats and Oils, Hotel Cartagena, Cartagena, Colombia. Information: email: meetings@aocs.org; www.aocs.org/lacongress/en/index.cfm.

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

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May

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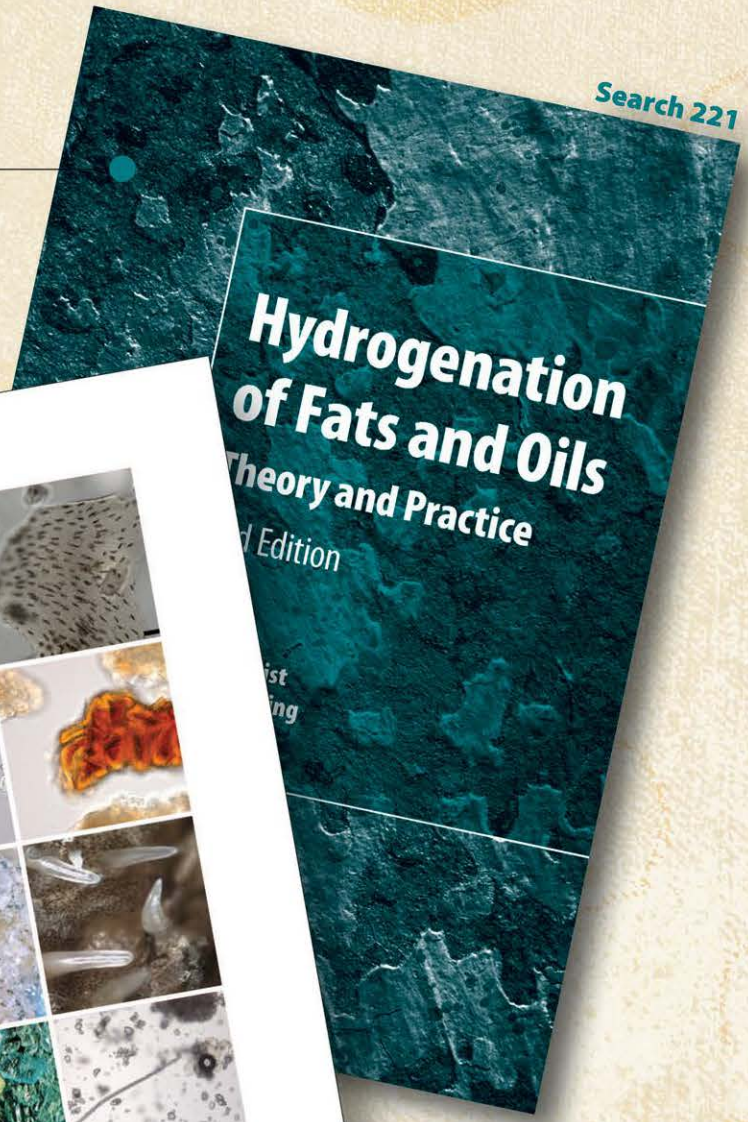

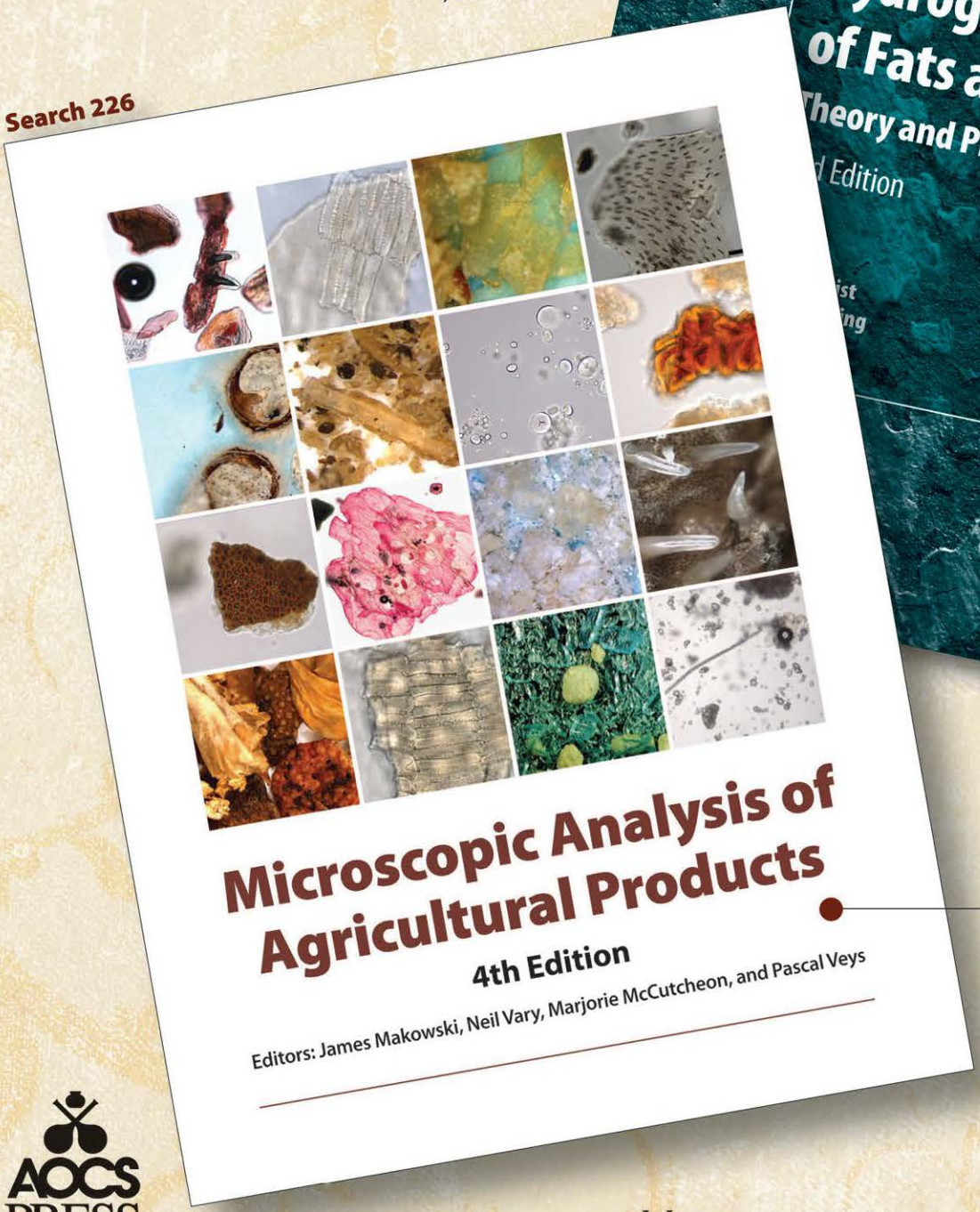

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May 2–3, 2011. LIPID MAPS Meeting 2011: Lipidomics Impact on Systems Biology, Cancer, and Metabolic Disease, La Jolla, California, USA. Information: www.lipidmaps.org/meetings/2011annual.

May 2–5, 2011. 4th International Biomass Conference & Expo, America's Center, St. Louis, Missouri, USA. Information: www.biomassconference.com.

May 8–11, 2011. World Congress on Industrial Biotechnology & Bioprocessing, Metro Toronto Convention Center, Toronto, Ontario, Canada. Information: www.bio.org/worldcongress.

May 13–15, 2011. Globoil International 2011 and Expo, Hyatt Regency Hotel, Dubai. Information: www.globoilinternational.com; www.teflas.com.

May 15–19, 2011. STLE [Society of Tribologists and Lubrication Engineers] Annual Meeting and Exhibition, Atlanta Hilton, Atlanta, Georgia, USA. Information: www.stle.org.

May 15–20, 2011. Lipid Biology and Lipotoxicity, INEC-Ireland's National Events & Conference Centre, Killarney, Co. Kerry, Ireland. Information: www.keystonesymposia.org/Meetings/ViewMeetings.cfm?MeetingID=1113.

May 17–19, 2011. BIT's 2nd Annual World Congress of Well Stimulation and EOR, Chongqing University of Science and Technology, Chongqing, China. Information: www.bitpetrobio.com/wseor2011.

May 20–21, 2011. Symposium: Vitamin D and Analogs in Cancer Prevention and Therapy, Schlossberg Hotel, Homburg, Germany. Information: http://tinyurl.com/Vit-D-cancer.

May 22–25, 2011. Practical-Short Course on Biodiesel/Biofuel from Algae and Other Feedstocks, Food Protein Research & Development Center, Texas Engineering Experiment Station, The Texas A&M University System, College Station, Texas, USA. Information: http://foodprotein.tamu.edu/fatsoils/scbiodiesel.php.

May 22–27, 2011. Bioenergy III: Present and New Perspectives on Biorefineries, Lanzarote, Canary, Islands, Spain. Information: www.engconfintl.org/11aa.html.

May 26–27, 2011. Practical Short Course: Algae Harvesting and Processing for Value Added Applications, Bedford Hotel, Brussels, Belgium. Information: http://home.scarlet.be/~tpm12374/smartshortcourses/algae1.

May 26–28, 2011. 10th Yeast Lipid Conference, Oulu, Finland. Information: www.yeastlipid2011.org.

May 26–28, 2011. China International Cleaning Industry Expo 2011, China National Convention Center, Beijing, China. Information: www.clean-expo.com.

June

June 5–9, 2011. 13th International Groupe Consultatif International de Recherche sur le Colza (GCIRC), Prague Congress Centre, Prague, Czech Republic. Information: www.irc2011.org.

June 6–8, 2011. 8th World Surfactant Congress and Business Convention (CESIO 2011), Austria Center Vienna, Austria. Information: www.cesio2011.com.

June 6–9, 2011. 19th European Biomass Conference and Exhibition, International Congress Center (ICC) Berlin, Germany. Information: www.conference-biomass.com.

June 11–15, 2011. Institute of Food Technologists' Annual Meeting and Expo, New Orleans, Louisiana, USA. Information: www.ift.org.

June 13–16, 2011. Clean Technology Conference and Expo 2011, Hynes Convention Center, Boston, Massachusetts, USA. Information: www.techconnectworld.com/Cleantech2011/sym/bio_energy.html. ■

Innovative, sustainable consumption:
A challenge for the entire value chain

Kasper Rorsted

Editor's note: Subtitled "New Strategies in a Dynamic Global Economy," the 7th World Conference on Detergents, held in Montreux, Switzerland, in October 2010 brought together nearly 900 participants from almost 60 countries. The heads of the three largest detergents companies—Henkel, Unilever, and P&G—provided keynote presentations. Having all three speak was a first for the conference. In inform*'s continuing coverage of the event, Henkel's Kasper Rorsted presents his keynote address. Rorsted is CEO of Henkel AG & Co. KGaA, Germany.*

Sustainability is probably one of the biggest challenges that we have to address over the next five, 15, or 20 years. And it is something confronting many companies. But, I am convinced that we can make a difference; we can change things for the better and make an impact on the future while still creating economic value.

The precondition: partnering along the entire value chain for innovative, sustainable consumption. It is our common challenge!

The challenge

The macro-challenge that we are speaking about derives from a population that is still rapidly increasing. Meanwhile, consumption and life expectancy are also rising. So, how can the discrepancy between a growing population, increasing consumption, and rising life expectancy on the one hand, and decreasing availability of resources on the other, be overcome? When applied to us as an industry, this means balancing the needs of our employees, consumers, and society with economic sustainability, based on all stakeholders respecting the limitations of natural resources and the vulnerability of our planet. This is a key challenge for us as Henkel, as well as all other players in our industry. The primary question is: How can we achieve this within our business model so that we can shape our industry and move toward innovative, sustainable consumption? The undesirable but only remaining alternative is abdication.

A company's DNA as the driving force for the future

Henkel has a history that goes back more than 134 years. The company was founded and built by the Henkel family. Sustainability has always played an integral role in its history. Of course, the word "sustainability" had not yet really been coined back then. Our chief executive officer (CEO) in 1972, Konrad Henkel, said, "I believe the times are over when an entrepreneur can solely concentrate on maximizing profits and on the well-being of the company." That was the first statement, almost 40 years ago, that significantly impacted the direction of the company. I would argue that this is engraved in our DNA. He was one of the first CEOs to take a public stand on where his company needed to move to.

Daring to pioneer, Henkel has built up a genome over time that now is not only an asset for the company but also a force driving the agenda for the future. Over time, we have reached many milestones:

- *1972.* Konrad Henkel stated: "I believe the times are over when an entrepreneur can solely concentrate on maximizing profits and on the well-being of the company." Today, we view this statement as a clear commitment to sustainability and its place right at the heart of our way of doing business.
- *1986.* The first phosphate-free detergent was launched, sparking change for the whole industry.
- *1991.* Henkel was one of the first companies to sign the International Chamber of Commerce's Business Charter for Sustainable Development.
- *2005.* Henkel was the first company to sign the AISE (International Association for Soaps, Detergents and Maintenance Products) Charter for Sustainable Cleaning.
- *2008.* Henkel set a new standard in the use and acceptance of certificates for sustainable palm kernel oil in cooperation with Greenpalm and the RSPO (Roundtable on Sustainable Palm Oil).

Moreover, in 2007 Henkel defined five focal areas: Water and wastewater, health and safety, social progress, materials and waste, and energy and climate. We also established a set of sustainability performance targets for 2012: A reduction in energy consumption of 15%, a reduction in water consumption of 10%, a reduction of 10% in the amount of waste generated, and a further reduction in occupational accidents by 20%. This constituted a seminal moment because we actually took a very assertive stand and said that this is where we are going to go.

There are three additional objectives that are central to our commitment to sustainability: All employees to receive training and

continuing education to ensure that they are appropriately qualified for their duties; all of our strategic suppliers to satisfy our expectations with regard to corporate ethics; and all new products to contribute to sustainable development in at least one focal area.

The Henkel focal areas have been systematically anchored in our innovation process since 2008. This means that at a given point our researchers must demonstrate the specific advantages of their project—besides product performance and added value for customers—in regard to resource efficiency and social criteria. If it does not, then the innovation process will be stopped. We take this very seriously. Every quarter, along with considering our financial metrics, we scrutinize the innovation process as part of the quarterly performance review. Which products are in the pipeline and how do they each comply with our five focal areas?

information

- Those who were unable to attend Montreux 2010 may purchase a DVD of presentations from the conference. The DVD includes video synchronized with the PowerPoint presentations of the three CEOs of Henkel, P&G, and Unilever. The DVD also features audio synchronized with PowerPoint talks from a number of the other presenters. The list price is $195 (AOCS member price: $175). Visit www.aocs.org/store for more information.

This pioneering approach can lead to significant changes in how an industry deals with balancing economic goals with environmental awareness and responsibility toward society.

We are convinced that sustainability has to be approached from a holistic standpoint, linking three main dimensions of human existence—economy, ecology, and social responsibility—based on the understanding that none of these can be optimized without influencing the other. Improving sustainability therefore means balancing all three aspects, obtaining equilibrium at a higher level. This approach is often referred to as the 3P Model: People, Planet, Profit:

People: Creating a deep understanding of people's expectations toward a company, and influencing a company's role as an employer and contributor to social progress have to be the priorities when looking at sustainability in the context of human capital. Constantly improving health and safety for employees as well as behaving as a good corporate citizen is among the obligations that derive from this dimension of sustainability.

Planet: Understanding the impact of a company's business on the planet and shaping the innovation pipeline and value chain in such a way as to reflect identified current and future challenges are probably the most urgent and compelling aspects of sustainability from an industry standpoint.

Profit: A sustainable value proposition toward customers and consumers can be developed by defining sustainability as part of a company's business model, taking it from the level of a mere "license to operate" to a key differentiator in the marketplace. Defining quality in a new way, by combining performance and sustainability in the products a company offers, will contribute to long-term success.

Based on our experience we are also very aware of two major watch-outs:

- Sustainability is not a fashion trend. It is not about quick wins or opportunistic goals, but rather a long-term process of building knowledge, trust, and understanding. So, it is important to find the right balance, to keep doing the right thing, and to stay credible.
- Sustainability is not a one-man show: True impact can only be achieved if all employees, players, and partners are involved; this task cannot be delegated.

As an industry, we need to have the courage to allow innovation to drive progress. The improvements of a single aspect within the value chain can represent a major step forward for the entire chain. A holistic understanding of the impact of our industry is crucial. Only by taking the entire value chain into consideration can a true picture of the causes, effects, and potential improvements be painted. From the sourcing of raw materials and the

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transportation and manufacturing of our products, to their distribution, usage, and final disposal, every stage along the value chain has to be taken into account. Only by partnering along this value chain can we as a manufacturer, together with suppliers, service partners, the retail trade, and the appliance industry, achieve real impact.

Partnering for improvement along the entire value chain

To achieve improvements, the different partners along the value chain within our industry need to contribute in the following fields:

- *Raw material and feedstocks*: Higher yields from plantations and processing, developing nonfood feedstocks, and providing business opportunities for smallholders. At the same time, biodiversity and rainforest protection need to be ensured, as does reducing water consumption, energy consumption, and waste volumes. Labor rights and health and safety must also be guaranteed.
- *Logistics*: Covering long distances with reduced costs, reducing nonutilized transportation capacity, and increasing the use of more sustainable transportation modes as well as renewable energy in transport and warehousing.
- *Suppliers of raw materials and product packaging*: Improving low-temperature efficacy and providing higher performance per unit volume as well as allergy-friendly and sanitizing properties. Increasing the share of renewable and recycled materials. Biodegradability in chemicals and packaging is also of key importance. Process efficiency likewise needs to be improved, e.g., through the wider application of biotechnology.
- *Formulators*: Need to focus on core aspects such as stain removal, cleanliness, and hygiene, as well as convenience and the development of multifunctional products. Improvements in consumer education and empowerment are also essential. Compaction and dosage reduction, low-temperature and low-water efficacy, the use of renewable energies, and recycling all need to be increased if we are to achieve a smaller footprint.
- *Retailers*: Have to offer improved access to and an increased share of sustainable products, plus an enhanced shopping experience. Greater focus on consumer education and empowerment also required. To achieve a reduced footprint, logistics pooling with manufacturers, as well as the recycling of packaging materials and the promotion of green building techniques are important.
- *Home appliances*: Need to improve cleaning efficacy and fabric care as well as convenience (intelligent dosing and washing time settings). Reductions in energy and water consumption also required (e.g., through smart cycle technology).
- *Consumers*: Need to change their habits and attitudes, with more willingness to opt for full machine loads, make smart detergent and machine choices, and generally embrace sustainability in their daily lives. This means using low-temperature and water-saving programs and following dosage recommendations.

These areas need improvement, as only the synergistic combination of all factors will lead to the full exploitation of potentials.

Ultimately, it all boils down to two main objectives: increasing performance and reducing footprint:

When we look at the footprint of a product, we have two options. We can either abdicate or innovate—and need to consider

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Maybe we don't know beans…

Greater media attention is being paid to the health benefits of beans and legumes, but how much do we really know about the topic?

Donna M. Winham

News articles, cooking magazines, and science features are recommending beans for lowering cholesterol, improving glycemic control, increasing dietary fiber, and providing a gluten-free alternative to cereal grains. The trend is not surprising, given the rise in chronic disease incidence, consumer interest in functional foods, renewed interest in sustainable agriculture, and economic hard times. Beans can be part of the solution for many of these issues. Beans are a familiar and culturally important food, inexpensive, easy to prepare, and have great menu versatility. Yet, the scientific evidence to support many of these health claims is often generalized from a few original studies limited in scope and based on a few bean types. While the health benefits from beans are likely true, what remains unknown invites the question, "Just how much do we know about beans?"

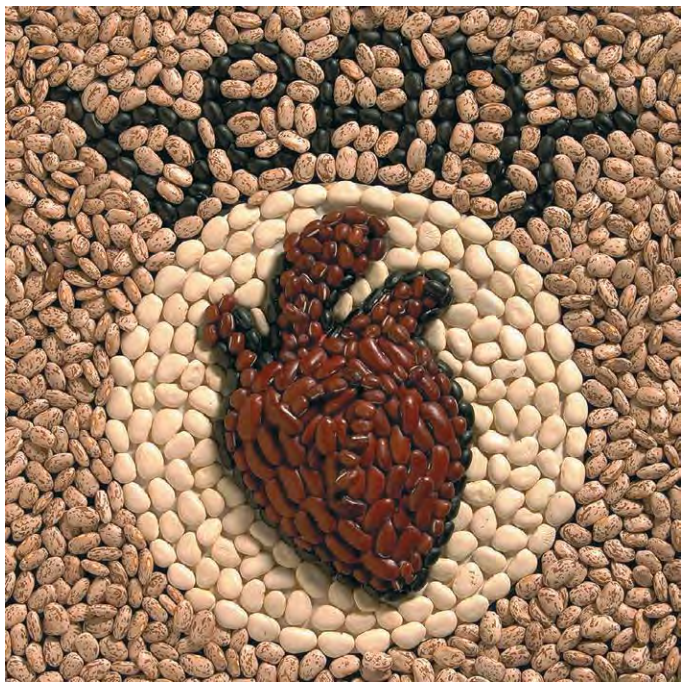

Image courtesy Michael Hagelberg, art director (retired), ASU Research Magazine.

What is a bean or legume?

The legume family, or Fabaceae (Leguminosae), encompasses a wide range of plants, including the oil seeds (peanuts, soybeans), animal foods (clover, alfalfa), and the dry grain pulses (lentils, peas, chickpeas, beans). In the United States, varieties of the common bean or *Phaseolus vulgaris* are the dominant crops produced for domestic consumption and export. These include pinto, black, red kidney, white kidney, and navy beans. Wax beans, string beans, or green beans are the young or vegetative stage of *P. vulgaris* varieties. They have a different nutrient profile and are bred to be eaten whole before they have advanced to dried seed pods. Research on soybeans (*Glycine max)* has been more extensive than with *P. vulgaris* species, but this evidence does not directly translate across bean species.

Cardiovascular benefits of legume/bean consumption

The health-promoting properties of diets, such as the traditional "Mediterranean" diet, that are high in legumes have been recognized since the early 1960s. After high intakes of fruits, vegetables, grains, and pulses, to name a few components, followers of this dietary pattern have exhibited decreased levels of chronic disease. Individuals who live in other cultures characterized by traditional diets rich in pulses have showed similar results. Darmadi-Blackberry *et al.* (2004) found that general pulse consumption was linked with greater longevity for elderly in several different countries (Japan, Sweden, Greece, Australia) even though dietary patterns varied. In contrast, deviations from the traditional Mediterranean eating pattern due to immigration or cultural change have been associated with increased cardiovascular risk. Large-scale epidemiological studies such as the National Health and Nutrition Examination Survey (NHANES) and cross-cultural surveys have observed that cardiovascular disease (CVD) risk is lower among adults who frequently consume beans. Results from the NHANES I Epidemiologic Follow-up Study indicated that men and women who reported consuming pulses four or more times per week had a 22% reduction in coronary heart disease risk compared with those who consumed pulses less than once a week. Higher intakes were associated with lower body mass index (BMI), blood pressure,

serum total cholesterol value, and a lower incidence of diabetes mellitus, compared with lower intakes (Bazzano *et al.*, 2001).

Case of cholesterol

At least 100 million Americans have high cholesterol and are at increased risk of CVD, the leading cause of death in the United States. The National Cholesterol Education Program and the American Heart Association recommend dietary and lifestyle changes as the first intervention step to reduce CVD risk by improving blood lipid profiles (i.e., cholesterol). Some of the behavioral interventions used to prevent or treat CVD include smoking cessation; weight loss; exercise; dietary reductions of saturated fat, trans fat, and sodium; and increased consumption of fiber, fruits, and vegetables. Dietary and lifestyle changes have the added benefit of reducing inflammation and risk factors for other chronic diseases such as cancer, diabetes, and hypertension.

If a person is unable to meet treatment goals with diet and lifestyle changes alone, prescription medication therapy is typically the next resort. Although statins are frequently dispensed and effective at lowering low-density lipoproteins (LDL), they are not without risk; side effects may include muscle pain or weakness (myopathy). Statins are also contraindicated in persons with conditions such as hypothyroidism and impaired liver function. Furthermore, statins or other medications do nothing to alter behavior or diet from a broader perspective.

On the other hand, dietary modifications such as the inclusion of beans can improve overall nutrition and reduce the risk of other nutrition-related chronic diseases such as type 2 diabetes mellitus, hypertension, and cancer. Bean consumption has been associated with improvements in dyslipidemia, triacylglycerides, metabolic syndrome, inflammatory markers such as high sensitivity C-reactive protein, and folate status, all risk factors or biomarkers of CVD risk.

Several studies have examined cholesterol reduction with mixed types of cholesterol-lowering foods. A portfolio diet containing a variety of functional foods, including legumes (beans), showed additive effects in reduction of CVD markers. The experimental diet was

information

For further reading:

- Albala, K. *Beans: A History*, Berg Publishers, New York, New York. USA, 2007, 256 pp.
- Bazzano, L.A., M.T. Tees, and D.M. Winham, Non-soy legume consumption lowers cholesterol levels: a meta-analysis of randomized controlled trials. *Nutr. Metab. Cardiovasc. Dis. 21*:94–103 (2011).
- Darmadi-Blackberry, I., M.L. Wahlqvist, A. Kouris-Blazos, B. Steen, W. Lukito, Y. Horie, and K. Horie, Legumes: the most important dietary predictor of survival in older people of different ethnicities, *Asia Pac. J. Clin. Nutr. 13*:217–220 (2004).
- Winham, D., D. Webb, L Marr, and A. Barr, Beans and good health: Compelling research earns beans expanded roles in dietary guidance, *Nutr. Today 43*:201–209 (2008).

able to lower low-density lipoprotein cholesterol (LDL-C) as successfully as earlier versions of statins or in excess of 20%. Several single-food dietary interventions (e.g., almonds, garlic, oatmeal, walnuts, pomegranates) have been shown to reduce cholesterol, improve endothelial function, and reduce inflammation biomarkers. Beans, with their rich contents of fiber and micronutrients, are likely to have similar physiological effects. While cholesterol reduction will be the outcome best recognized by consumers, it is a surrogate marker of CVD risk. Endothelial function and systemic inflammation are increasingly recognized in the scientific community as significant predictors of CVD risk. Endothelial dysfunction is now recognized as the first step in the cascade of processes that lead to atherosclerosis. Endothelial function as measured by brachial artery flow-mediated vasodilatation (FMD) is a comprehensively validated, reproducible test that has been shown to predict cardiovascular risk in several clinical trials.

To fulfill its purpose of helping to prevent chronic disease, the 2005 Dietary Guidelines for Americans (DGA) recommended intake of 3 cups or six servings per week for all legumes. The new 2010 DGA calls for a greater emphasis on "a more plant-based diet that emphasizes vegetables, cooked dry beans and peas, fruits, whole grains, nuts, and seeds." However, the 2010 DGA has backed off on the amount of beans recommended, citing limited evidence to support the relationship of cooked dry beans and peas—including soy—in lowering lipids. The 2010 recommendation is 0.21 cups or ~50 grams of beans per day, or 360 grams per week. While this turn-around was unexpected to those of us who conduct bean research, it underscores the needs for further well-designed and well-funded studies to provide strong evidence or refute the epidemiological associations and research trends.

Research gaps and needs

Although consumers and health professionals tend to think all beans are alike, the available research to support health claims and beneficial effects varies across species. With the 2010 DGA concerns about the strength of the evidence, more scientific research on the health benefits of beans is needed for several reasons.

1. Not all beans are created equal. Different types of beans have variable amounts of fiber and nutrients. Although the message "eat more beans" is simple, it overlooks the diversity among beans, which affects the potential health benefits derived from consuming different types. For example, the amount of fiber in ½ cup of black-eyed peas is roughly half the amount of fiber in an equivalent amount of pinto beans. One cup of black beans contains four times the amount of folate as one cup of chickpeas, but the protein content of black beans is similar. Only a few types of beans have been examined for their effects on cholesterol reduction or postprandial glycemic response effects as part of meals. Most cholesterol studies have been done with navy or white beans.

2. Appropriate intake amounts or dose-response. Most retrospective or prospective epidemiological studies have relied on nonspecific frequencies of legume or bean consumption, rather than on controlled or known intakes. Although researchers have found associations with reduced CVD risk, they are often vague on details about the actual amount or type of bean consumed. With the 2010 DGA emphasis on

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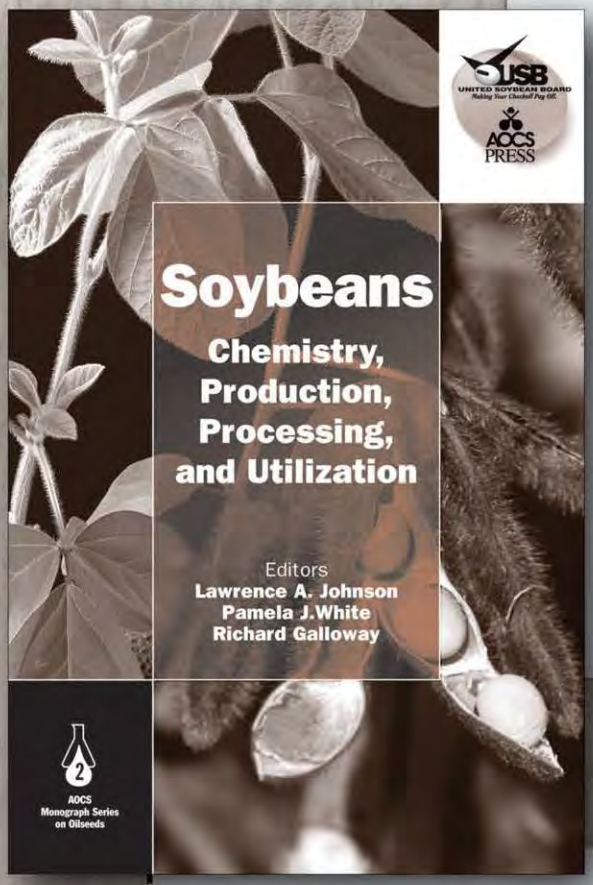

Soybeans

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2008. Hardbound. 850 pages. ISBN: 978-1-893997-64-6. Product code 223

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Briefs

The purchase of Martek Biosciences Corp. by Royal DSM NV stayed on track during February 2011, when DSM announced the expiration of the mandatory waiting period under the Hart-Scott-Rodino Antitrust Improvements Act of 1976. The acquisition was first announced in December 2010, when Royal DSM of Heerlen, the Netherlands, offered more than $1 billion for Martek (Columbia, Maryland, USA). Martek's business is based primarily in the United States, where it manufactures and sells long-chain polyunsaturated fatty acids derived from microalgae, primarily for infant nutrition products.

■■■

The draft olive oil standards for Australia/New Zealand were released to local industry in late December 2010. Copies are available free of charge from SAI Global (requires registration). If they are made final, the new standards will adopt the internationally recognized free acidity benchmark of 0.8% for extra virgin olive oil. The draft standard also would eliminate labeling such as "pure," "light," and "extra light" for olive oils. Public comment was accepted by Standards Australia/Standards New Zealand through February 25, 2011.

■■■

Cargill has expanded its cocoa and chocolate business in Europe through the acquisition of Schwartauer Werke GmbH & Co. KG Kakao Verarbeitung Berlin (KVB), an integrated chocolate company based in Germany. KVB has two production plants in Berlin, with a combined capacity of over 75,000 metric tons of chocolate per year.

■■■

Archer Daniels Midland Co. (ADM) has acquired all of the outstanding capital stock of Alimenta (USA), Inc., from Alimenta SA, an international trading company based in Geneva, Switzerland. Alimenta (USA) is ADM's 50% partner in Golden Peanut Co., LLC, of Alpharetta, Georgia, USA. As a result of this transaction, ADM now controls 100% of Golden Peanut, which ADM says is the largest US handler, processor, and exporter of peanuts (groundnuts), peanut oil, and peanut-derived ingredients.

CONTINUED ON NEXT PAGE

News & Noteworthy

DuPont acquires Danisco

DuPont's January 2011 $6.3 billion acquisition of Danisco "is one of the largest if not the largest transactions in the history of hydrocolloids," said Dennis Seisun of the IMR consultancy in San Diego, California, USA.

The transaction, when completed, "will put another major hydrocolloid powerhouse under US control," noted Seisun. "Hydrocolloid production in the United States has been declining in recent decades, but US ownership of such capability outside the US has increased significantly," he added.

Seisun summarized the US presence in hydrocolloids as follows:

- Cargill bought Degussa's food ingredients unit in 2005.
- JM Huber is owner of CP Kelco, the world's largest pectin and carboxymethylcellulose producer with production in Europe and elsewhere.
- FMC BioPolymer is owner of Pronova of Norway, now the largest alginate producer in the world.
- Dow Wolff Cellulosics is a global cellulosic powerhouse formed recently by the acquisition by Dow of Bayer's Wolff Cellulosics division.
- Corn Products International has become a major producer of functional food starch outside the United States through its acquisition of National Starch Food Innovation.
- Tate & Lyle is a British company, but its hydrocolloid activities have a strong US base in A.E. Staley and include the acquisition of European hydrocolloid companies G.C. Hahn and Cesalpinia.

According to Seisun, the acquisition of Danisco by DuPont took many industry observers by surprise. "For such a major acquisition, there are usually market indications that a transaction is being sought or under discussion," he said, adding that it is seldom possible for a bidding process to take place without outside indications. "This acquisition by DuPont is an exception. The acquisition of Danisco will take DuPont from a nonentity in hydrocolloids to a global powerhouse with one of the largest portfolios of single hydrocolloids and blends," he concluded.

CONTINUED ON NEXT PAGE

In other company news, ADM announced in January 2011 that it had founded the ADM Institute for the Prevention of Postharvest Loss with a $10 million grant to the University of Illinois at Urbana-Champaign. The global institute will work with smallholder farmers in the developing world to help preserve millions of metric tons of grains and oilseeds lost each year to pests, disease, mishandling, and other factors.

■■■

Semences Prograin Inc., a Candian soybean trader, announced in January 2011 that it will build a new molecular marker laboratory at its headquarters in St-Césaire, Québec. The facility is expected to be completed by April 2011.

■■■

The biggest soybean importer and consumer in the world recently agreed to purchase nearly $7 billion worth of US soybeans during 2011. A delegation of Chinese buyers signed contracts for a total of about 11.5 million metric tons of US soybeans in late January. The United States exports every other row of its soybeans, according to the United Soybean Board. In 2010, China imported one out of every four rows. ■

Germany approves anti-dioxin action plan

The discovery of dioxin in animal feed in Germany on January 3, 2011, has culminated in new governmental controls on feed producers.

Reuters reported that the German cabinet has approved a plan that would require a new licensing system for producers of oils and fats for animal feed, as well as mandatory separation of oils and fats output for use in industrial and animal feed. Also required: that feed producers take out extra insurance and test their ingredients themselves.

"Prosecutors in Germany are investigating the cause of the contamination and specifically whether industrial fats and feeds company Harles and Jentzsch distributed fatty acids meant for industrial paper production to animal feed processors," Reuters said.

Meat and eggs from farms in eight German states that purchased contaminated feed were shipped as far as Britain, the Czech Republic, the Netherlands, and Poland, according to the Deutsche Welle news service.

US food safety bill signed into law

A bill that will overhaul US food safety laws for the first time since the Great Depression was signed into law by President Obama on January 4, 2011.

The legislation, known as the Food Safety Modernization Act, establishes a food tracing system through which consumers can be rapidly identified and deaths and illnesses minimized in the event of a contamination outbreak. It will also allow the Food and Drug Administration (FDA) to require importers to certify the safety of their foods before entering the US food supply.

The bill gives the US government far-reaching authority to establish food safety standards for farmers and food processors, and gives the FDA the authority to recall food. The current food safety policy depends on government inspectors discovering contamination. Also, in outbreaks of contamination, the FDA has in the past had to count on food companies to voluntarily remove their products from stores.

"In addition to inspection and recall powers for the FDA, it requires food producers to develop food safety plans, including identifying potential risks of contamination or other hazards, and identifying the mechanisms through which those risks would be controlled," said Debra M. Strauss, a professor of business law at Fairfield University in Fairfield, Connecticut, USA. "The legislation establishes a food tracing system through which consumers can be rapidly identified and deaths and illnesses minimized in the event of a contamination outbreak. Strengthening restrictions on imported foods, the FDA will be empowered to deny entry to foods that do not comply with US food safety requirements or requests for inspections."

Strauss pointed out that this is the first time in 70 years that food law has been changed significantly.

"It is also significant to note that the Senate bill received widespread support from the US Chamber of Commerce and trade groups of food producers and grocery stores, who have realized that food safety is ultimately in their best interest," she continued. "However, small farmers opposed this legislation fearing the increased costs and paperwork of regulation. Concessions were made to accommodate their interests, including exemptions from FDA registration requirements for farms that market more than 50% of their product directly from the farm or from farm stands or farmer's markets, as well as less costly alternatives to HACCP (Hazard Analysis Critical Control Plans) and a competitive grant program for food safety training with priority to small and mid-sized farms."

Strauss noted, "As stated by the National Sustainable Agriculture Coalition, '[a]s a result of grassroots mobilization and much negotiation this bill now provides scale-appropriate food safety rules for small farms and mid-sized farms and local processors that sell to restaurants, food co-ops, groceries, wholesalers and at farm stands and farmers markets.' "

"But the new law does not deal with meat safety, which is in the purview of the US Department of Agriculture," she emphasized. "The scope and powers of the USDA were not addressed in this legislation."

Biobased label debuts in US

In January 2011, the US Department of Agriculture (USDA) introduced a new product voluntary labeling system for consumer and industrial products that have been completely—or, more likely, partially—produced from farm crops or forestry materials, rather than fossil fuels. Products bearing the label are expected to begin hitting the market by the second quarter of 2011.

At issue, however, is what *The New York Times* (*NYT*) called the program's "generous threshold . . . . When it comes to certifying lip balms, household cleaners, or any other product as 'USDA certified biobased,' the agency will mandate that only 25% of the item derive from renewable materials. The agency, in its initial proposals, had set that threshold at 51%, but nearly unified industrial opposition saw the agency lower its standards."

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2011

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Briefs

The Sime Darby Plantation Sdn. Bhd. (Kuala Lumpur, Malaysia) is collaborating with Mitsui Engineering and Shipbuilding Co. Ltd. of Japan to construct and operate a demonstration plant for the production of bioethanol. Oil palm empty fruit bunches (EFB) will serve as the feedstock. EFB are considered a good choice owing to their abundant supply and year-round availability. The plant will be erected next to Sime Darby Plantation's Tennamaram palm oil mill at Bestari Jaya, Selangor, Malaysia. The plant is being designed to process 1.25 metric tons of EFB per day via hydrothermal pre-treatment and enzymatic hydrolysis technology. Data will be collected to determine the technical feasibility of commercial-scale production of bioethanol from EFB.

■■■

In January, India's Ministry of New and Renewable Energy and the Confederation of Indian Industry jointly recommended increasing the price for biodiesel made from jatropha from the present price of Rs26.5 ($0.58) per liter, as per the Government-declared biodiesel policy, to Rs36 ($0.79) per liter to make it sustainable and to stimulate growth of the Indian biodiesel industry. Their joint study also suggested an average purchase price of Rs6000 ($132.42) per metric ton to ensure that people use agricultural land to grow food, not biofuel feedstocks.

■■■

A recent study considered the effects on US grassland birds of growing dedicated bioenergy crops. Plantings of corn, switchgrass, and mixed-grass prairie were compared. Results suggested that, unlike corn, perennial biomass feedstocks may provide benefits to grassland bird populations if the grasses are cultivated in large patches within relatively unforested landscapes. The authors suggest, however, that improved feedstock genetics and crop management techniques—designed to maximize biomass production and simplify crop vegetation structure—will likely reduce the value of peren-

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Biofuels News

ALGAE

Shell Oil withdraws from algae

On January 31, 2011, HR BioPetroleum, Inc. (HRBP), a Hawaii-based and -founded renewable biofuels company, acquired the shares of Royal Dutch Shell plc in Cellana, a joint venture between Shell and HRBP. The acquisition included Cellana's six-acre (2.4 hectare) demonstration facility in Kona, Hawaii (USA).

Cellana was formed in 2007 as a separate joint venture between the two companies to build and operate a demonstration facility to grow marine algae and produce vegetable oil for conversion into biofuel.

In a company statement, Ed Shonsey, HRBP chief executive officer, said, "We will continue to operate Cellana's Kona demonstration facility and to continuously improve the economics for growing marine algae using HRBP's patented process. Based on HRBP's and Cellana's results to date, we believe this technology holds great potential for the economical production of algae and algae-derived products for applications within the aquaculture and animal feed markets, as well as for the production of algal oil for conversion into biofuels."

To support the transition Shell has agreed to provide short-term funding to advance and focus the algae technology development program.

In Shell's announcement of the break-up of this joint venture, the company said (http://tinyurl.com/Shell-HRBP), "In keeping with Shell's portfolio approach to the research, development and commercialisation of advanced biofuels, this decision will allow Shell to focus on other options that have shown a better fit with Shell's biofuels portfolio and strategy."

OriginOil focuses on algal extraction

OriginOil announced in Los Angeles, California, USA in January that it had adopted an operating plan that focuses on commercializing its algae extraction technology platform. This single focus positions the company to provide a critical connection between algae growers and refiners.

nial biomass plantings to grassland bird populations. The original article is available at http://tinyurl.com/BirdsCornGrasses.

■■■

Algae.Tec Ltd., with offices in Atlanta, Georgia, USA, and Perth, Western Australia, was listed as of January 13, 2011, on the Australian Stock Exchange. Company Chief Executive Officer Roger

Stroud said Algae.Tec is the first algae company in the world to list on a main board stock exchange. The company claims its highly efficient photobioreactor system can produce algae in one-tenth of the land surface needed for the current pond system and generate four revenue streams: (i) oils that can be refined into biodiesel; (ii) carbohydrates that can be used to produce ethanol; (iii) proteins that can be used in animals feeds; and (iv) protein and carbohydrate biomass that can be combined to produce jet fuel.

■■■

Australia's Qantas Airlines was reported in mid-January to be in conversations with an unnamed algal biofuels producer to negotiate an agreement for algal jet fuel. Furthermore, there was speculation that Qantas would take a financial stake in the venture. ■

In a company statement, Riggs Eckelberry, company chief executive officer, said, "It's becoming clear the algae industry will be massive—as you'd expect a true petroleum alternative would be." He added, "No one company is going to do it all, and that's why we have decided to focus on extraction, a highly specialized technology that we can embed in algae production systems worldwide."

OriginOil said extraction is a critical bottleneck in commercial algae production. Conventional extraction of algae, suspended in large volumes of water, is far too energy intensive for large-scale uses such as fuel and chemicals. Eckelberry commented, "Extraction is relatively less capital-intensive than growth or refining, and can generate very high returns on investment."

BIODIESEL

Biodiesel use curtailed by city of San Francisco

In late 2007, Gavin Newsom, mayor of San Francisco, California (USA) announced that every diesel-power vehicle owned by the city had been converted to running on B20 (20% biodiesel + 80% petrodiesel). By early December 2010, however, only about half of the city's 507 diesel and hybrid buses were using B20. The remainder were running on B0–B1.

Of the rest of the city's fleet (Department of Public Works, San Francisco Public Utilities Commission, Fire Department, and so on), only about 40% were using B20. The rest have been using B5.

The *San Francisco Examiner* newspaper reported that Nathaniel Ford, executive director of the San Francisco Municipal Transportation Agency (SFMTA), indicated that about half of the vehicles running on B0–B1 would revert to B20 once underground fuel storage tanks had been upgraded to comply with stricter regulations of the State Water Resources Control Board. Ford said the remaining vehicles will stay with B0–B1 for the foreseeable future.

Canadian firm to make biodiesel from flax

Energy Innovation Corp. (EIC), a Canadian startup company headquartered in Toronto, is preparing to open a biodiesel plant in the second quarter of 2011 that will produce biodiesel from flax seed. The process for which the company has acquired rights uses 40% of the seed for fuel, with the remainder turned into meal.

Initially, EIC plans to make up to 10 million liters of biodiesel annually at its Toronto plant. The meal, which is rich in omega-3 fatty acids, will be marketed as chicken, cattle, shrimp, and fish feed. EIC is also marketing a high-protein, gluten-free flax flour for human consumption.

According to Reuters (http://tinyurl.com/Reuters-flaxEIC), EIC plans to open a "minimum" of eight more plants in the province of Ontario in the next three years. The plants will be constructed on a smaller scale, "to ensure a secure supply of flax seed from local farmers."

Canadian demand for biodiesel is anticipated to rise considerably in 2011 in response to the government mandate requiring 2% renewable content in all diesel fuel this year. The start date for the mandate has not been set yet.

ETHANOL

RFA proposes alternative E15 label

In October the US Environmental Protection Agency (EPA) agreed to allow refiners to add as much as 15% ethanol to gasoline, up from the previous 10%, for use in vehicles manufactured in 2007 or later. In conjunction with this action, the EPA proposed a label to be affixed to E15 gasoline pumps indicating that this fuel is supposed to be dispensed only into late-model cars and light trucks.

The Renewable Fuels Association (RFA; Washington, DC, USA) commented to the EPA on January 3 that the proposed label (reproduced in *inform 21*:761, 2010) "will do little, if anything, to promote the successful introduction of a new fuel to the marketplace."

Instead, the RFA proposed the accompanying label to more accurately provide consumers with the information they need without unnecessary alarm. The RFA contends that the label proposed by the EPA "will unnecessarily promote skepticism and concern over any future approval for E15 and create the misperception that E15 is an inferior fuel." Furthermore, RFA does not support the inclusion of words such as "Warning," "Danger," or "Caution," contending they

convey "an urgency and alarm that are generally reserved for alerting consumers to personal health and safety risks. Such risks are not supported by the record in this case."

E15 approved for older vehicles

The US Environmental Protection Agency (EPA) on January 21 granted a waiver to allow fuel and fuel additive manufacturers to sell gasoline containing up to 15% ethanol (E15) for use in model year 2001 and newer light-duty motor vehicles, that is, cars, light duty trucks, and medium-duty passenger vehicles. The EPA had already granted a partial waiver for E15 for use in model year 2007 and later light-duty vehicles on October 13 (*inform 21*:761).

These decisions were based on test results provided by the US Department of Energy and other information regarding the potential effect of E15 on vehicle emissions.

No waiver is being granted, however, for E15 use in any motorcycles, heavy-duty vehicles, or nonroad engines because current testing does not support such a waiver.

Taken together, the two actions allow, but do not require, E15 to be introduced into commerce for use in model year 2001 and newer light-duty motor vehicles if provisions for mitigating misfueling are implemented and the appropriate steps are taken to ensure fuel quality are taken.

Brian Jennings, executive vice president of the American Coalition for Ethanol (Sioux Falls, South Dakota, USA), released the following statement: "Practical hurdles must still be overcome, particularly E15 labeling, yet this decision should someday result in additional market access for ethanol-blended fuel and will have a more meaningful impact on moving the demand needle since vehicles 2001 and newer represent nearly 60% of the US vehicle fleet."

Environmental impact of bioethanol plant

Vivergo Fuels, a joint venture between BP, Du Pont, and British Sugar, is constructing a new £200 million ($310 million) bioethanol plant in Saltend, Hull, UK. Once fully operational, it will be the largest single point of delivery for wheat and the largest animal feed producer in the UK. Fears are being raised, however, about the environmental impact of this facility.

According to *This Is Hull and East Riding* newspaper (January 1, 2011), Steve Sloan, who represents South West Holderness on the East Riding Council, expressed the following reservations: "We are talking about 1.1 million tonnes of wheat being transported to Saltend every year, all of it by road. Vivergo has said there will be 50,000 lorry movements a year just to get the wheat into the site." He added, "There are only three roads that can be used and one of them, Staithes Road, is already in a state of near collapse."

Alan Menzies, the director of planning and economic development for East Riding, countered that the planning process had solved road infrastructure and congestion problems.

ePURE speaks for European bioethanol

In November 2010, two European bioethanol associations—UEPA (European Union

of Ethanol Producers) and eBIO (European Bioethanol Fuel Association)—joined to form ePURE, the European Producers Union of Renewable Ethanol. The new organization covers all uses of bioethanol, including beverages and industrial applications as well as fuel.

ePURE initiated an investigation in January 2011 of US exports of ethanol to Europe for use in gasoline. The issue was whether ethanol was leaving the United States as a chemical or as ethanol. ePURE believes that subsidized US ethanol is entering the European Union (EU) in the form of E90 (90% ethanol + 10% gasoline), undermining the manufacture of ethanol in Europe for use in fuel. Customs departments of the EU do not consider E90 to be ethanol.

Rob Vierhout of ePURE said in November, "The European ethanol industry is very concerned about the growing volume of US ethanol exports to Europe."

US exports of ethanol—denatured, undenatured, and nonbeverage—were expected to end 2010 at 330–350 million gallons (1,200–1,300 million liters), up from about 110 million gallons (420 million liters) in 2009 (http://tinyurl.com/EtOHexports).

The EU imposed anti-dumping and countervailing duties for biodiesel from the United States in March 2009 (*inform 20*:219, 2009), perhaps serving as a precedent for possible import tariffs on ethanol from the country.

Qteros, Praj enter partnership

Qteros, Inc., of Marlborough, Massachusetts, USA, and Praj Industries Ltd., of Pune, India, announced in early January their entrance into a strategic partnership to speed up commercialization efforts for industrial-scale cellulosic ethanol production.

Qteros' contribution to the partnership is its patent-protected platform for making ethanol from anaerobic growth on cellulose-containing materials of its Q microbe (*Clostridium phytofermentans*), first described in 2002 (*Int. J. Syst. Evol. Microbiol. 52*:1155–1160). Praj brings research capabilities and technology, process design, engineering and construction expertise for producing ethanol from a broad range of non-food-based feedstocks.

Initially, the companies say they will focus their efforts on developing process design packages for feedstocks including sugarcane, corn, and wheat residuals with the goal of achieving commercial readiness by the end of 2012. In a joint statement, the companies said that their "initial commercial plans will focus on Praj's existing base of ethanol customers seeking to add co-located cellulosic ethanol facilities to their existing ethanol infrastructure."

RENEWABLE DIESEL

Airlines team up with Solena Group

Early in January, Qantas Airlines Ltd., the national airline of Australia, and Solena Group Inc., headquartered in Washington, DC, USA, announced their agreement to examine the feasibility of building a waste-based aviation fuel plant in Sydney, Australia. The project could create 1,200 jobs. The companies expect their study of the question will take 12 months.

Solena's systems can convert almost any kind of organic materials, including waste, into energy. Solena's plasma gasification vitrification (SPGV) technology produces a synthetic fuel gas that can then be converted into synthetic liquid biofuels, such as biodiesel or biojet fuel.

Solena is not a newcomer to the field of aviation fuel. In July 2010 British Airways announced it would work with Solena to construct a self-contained plant in east London to convert 500,000 metric tons of waste per year into 16 million gallons (60 million liters) of fuel. From 2014 onward, British Airways intends to power some of its aircraft using fuel derived from waste materials otherwise headed for landfill.

And on February 3, 2011, Italian carrier Alitalia and Solena signed an agreement to start a similar study. According to GreenAirOnline.com (www.greenaironline.com/news.php?viewStory=1051), the Italian algae biofuel company Enalg, a partner company of Solena Group, also will be involved in the study.

The Guardian newspaper reported on January 2 that Solena is also in negotiations with easyJet, Ryanair, and Aer Lingus about building a plant in Dublin.

GENERAL

Land available for biofuel crops

Ximing Cai and students, of the Department of Civil and Environmental Engineering at the University of Illinois (Urbana-Champaign, USA) used detailed land analysis to determine that biofuel crops cultivated on available land could produce up to half of the world's current fuel consumption, without affecting food crops or pastureland.

Many studies on biofuel crop viability have focused on biomass yield, or how productive a crop can be regionally. As part of the study, however, these researchers identified land around the world available to produce grass crops for biofuels.

Cai's team assessed land availability from a physical perspective, focusing on soil properties, soil quality, land slope, and regional climate. Data were collected from some of the best data sources available, including remote sensing maps. Only marginal land, that is, land that has been abandoned or degraded or is of low quality for agricultural uses, was considered for inclusion in this study. Furthermore, the team assumed any biofuel crops would be watered by rainfall, not irrigation.

Using fuzzy logic, the researchers considered (i) only idle land and vegetation land with marginal productivity; (ii) the land described in (i) plus degraded or low-quality cropland; and (iii) land in (i) and (ii) plus marginal grassland growing low-impact high-diversity perennial grasses. An estimated land area of 1,107 million hectares globally was identified, even after subtracting possible pasture land. This area would produce 26–56% of the world's current liquid fuel consumption.

The study appeared in *Environmental Science and Technology 45*:334–339 (2011).

USDA, DOE fund biofuel projects

On January 20, 2011, US Department of Agriculture (USDA) Secretary Tom Vilsack announced funding for biofuels and biomass energy projects across the country. Among

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Ad hoc biodiesel industry review

Editor's note: In light of changes in the biodiesel industry worldwide, AOCS surveyed the program committee that planned the 2nd International Congress on Biodiesel, held in November 2009, about the current and future state of the biodiesel industry. We asked: (1) What is going on in the industry? (2) Are there new developments and growth projected? (3) How are China and Latin America affecting the industry? Except where indicated in the text, their responses came in the fourth quarter of 2010, before the $1/gallon blenders tax credit was renewed in the United States.

Bob McCormick, National Renewable Energy Laboratory, USA

(1) In the United States the industry is significantly hindered by low petroleum prices, the expiration and non-renewal of the $1/gallon blenders tax credit, and overbuilt production capacity relative to market demand and feedstock supply. Low petroleum prices are likely to continue for a few years because of the weak global economy and because of two policy actions in the United States: the renewable fuel standard and the implementation of stricter vehicle fuel economy standards. These will both hold down demand for petroleum products, keeping prices low until demand from other places (such as China) picks up. The blenders tax credit may be renewed by the end of this year, but who knows? I think that the problems in renewing it stem from all of the unjustified negative press coverage of biofuels in general over the past couple of years (related in life cycle environmental impacts and the "red herring" food vs. fuel debate), and all of the negative press from problems that some biodiesel users have encountered. The problems that biodiesel users encounter are mainly caused by biodiesel that fails to meet the quality specification, but not entirely. There were/are some quality issues that we do not understand very well yet and so are not covered in the quality spec[ification] (effects of saturated monoglycerides on low-temperature operability, in particular). Lack of demand is partly related to the $1/gallon credit expiring. Feedstock supply is something that demand might ultimately fix, and there has been a lot of innovation on this in recent years.

(2) In the United States, the renewable fuel standard will require 1 billion gallons (3.8 billion liters) per year of biomass-based diesel by 2012—I think this is about 3× more biodiesel than has ever been used in the United States before. Today only biodiesel is poised to meet this, but that will change and there are significant investments being made to build commercial-scale facilities to make renewable diesel (basically, hydrogenated and cracked fat or oil, likely palm oil). If biodiesel/renewable diesel is working well, the petros could choose to blend more than 1 billion gallons of biomass-based diesel to meet renewable fuel standard. But really it is going to require a renewal of the $1/gallon credit for big growth to occur.

(3) I do not see China affecting the US market today. Latin America does affect the US market because both Brazil and Argentina are large global producers and exporters—impacting the US market potentially because we could import, but also because they affect global markets and the largest US producers have historically exported on the order of 50% of their production.

Paolo Bondioli, Stazione Sperimentale per le Industrie degli Oli e dei Grassi, Italy

(1) The biodiesel industry is actually in a deep crisis. From one side, high request to fulfill European Union targets. From the other side, high prices of starting material. There are also problems with sustainability, rules for import from extra EU countries, and general economic crisis.

(2) Activity is oriented toward new uses of glycerol to improve the economics; research for new feedstocks, algae included; improvement of biodiesel quality (reduction of content of monoglycerides and steryl glucosides).

(3) No information from these countries.

Tim Kemper, Desmet Ballestra North America, USA

(1) Globally, reasonable production continues across Europe due to mandates. Production in Asia, dependent upon palm biodiesel, is virtually stopped. Production in the United States is limited to the most efficient operators due to weak mandates and inconsistent government support for the blenders tax credit. Production in South America is strong and growing, used internally in both Brazil and Colombia with Argentina exporting virtually all of its production. Overall, there is very low global utilization of capacity and only modest production growth.

(2) Outside Brazil and Argentina, virtually no one else is able to get funding for commercializing new biodiesel facilities due in large part to low capacity utilization.

(3) China is having very little impact on the global biodiesel industry. Latin America is growing in production, and specifically Argentina, with its favorable differential export tax, is exporting large quantities of biodiesel, presumably to Europe.

Marcel S.F. Lie Ken Jie, University of Hong Kong, Hong Kong

(3) My comment on China biodiesel (BD) is that production is mainly from used cooking oil and some talk of a new hybrid of rapeseed (Yangzte River valley) and half-hearted attempts about jatropha in Guangdong area. Pure research is lacking. China instead went looking for international money in the past few years to shore up the production—a business venture approach rather than a BD venture. (If property prices are going through the roof in China, as it is today, it is hard to expect accessible land to be used for a BD crop.)

The attention has gone into solar energy in the arid areas of China on a grand scale.

Take the case of Hong Kong, where we have two minuscule producers. The HK Government went public this year by legislating the "specifications for biodiesel" after 10 years of "monitoring" the biodiesel issue. They adopted the European standard and tried to work out a standard for B5 [5% biodiesel blended with 95% petrodiesel]. HK has little or no BD to affect the environment.

Mainland China's BD quality is poorly controlled—as long as the BD produced is cheaper than diesel fuel, in it goes.

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them were three guaranteed loans. Each company must meet specified conditions to complete the loan.

1. Coskata (headquartered in Warrenville, Illinois): $250 million to construct and operate a cellulosic biorefinery in rural Greene County, Alabama. Feedstock will be woody biomass.
2. Enerkem (headquartered in Westbury, Québec, Canada): $80 million to build and operate a biorefinery in Pontotoc, Mississippi, to produce 10 million gallons (38 million liters) of cellulosic ethanol annually, through a thermochemical cellulosic process, from 100,000 metric tons of dried and post-sorted municipal solid waste.
3. INEOS New Planet BioEnergy, LLC (a joint venture of INEOS Bio and New Planet Energy): $75 million to construct and operate a biorefinery in Vero Beach, Florida, capable of producing 8 million gallons (30 million liters) per year of cellulosic ethanol, and 6 megawatts of gross electricity production. Feedstock will include vegetative waste (citrus and agricultural wastes), yard wastes, wood waste, and municipal solid waste.

The USDA also selected projects in 33 states to receive payments to expand production of advanced biofuels. Payments will be based on the amount of advanced biofuels a recipient produces from renewable biomass other than corn kernel starch.

Sixty-eight study grants nationwide also are being funded by USDA Rural Development to determine the feasibility of renewable energy projects.

On the same day as the USDA announcement, the US Department of Energy (DOE) Secretary Steven Chu announced the offer of a conditional commitment to Diamond Green Diesel, LLC—the proposed joint venture between Valero Energy Corp. and Darling International Inc.—for a $241 million loan guarantee to support the construction of a renewable diesel facility in Norco, Louisiana. Scheduled capacity is 137 million gallons (520 million liters) renewable diesel per year, which is expected to nearly triple the amount of renewable diesel produced in the United States. Fuel will be produced primarily from animal fats, used cooking oil, and other waste grease streams using a hydrotreating/isomerization process from Universal Oil Products and a pretreatment process from Desmet Ballestra Group. ■

There is an interest in BD, no doubt, as China has a great demand for energy. As for the other FE countries, I leave views on Malaysia, Indonesia and India to our more able colleagues to comment. Little progress from Philippines, Vietnam, Taiwan, Korea, and Japan.

Michael J. Haas, US Department of Agriculture, Agricultural Research Service, Eastern Regional Research Center, USA

(1) My perceptions mirror those of Tim Kemper and Bob McCormick in many ways: The industry in the United States is weakened by the absence of long-term tax incentives that would support capital investment. The global recession remains.

The question now in 2011 is—okay, we have a tax credit and the recession seems to be ending—are things different?

Well, the tax credit is, as I understand it, for one year only. Longer-term reliable support is what leads investors to invest in new construction; it is unclear whether a one-year lifetime tax credit helps the industry expand, whereas a longer lifetime credit gives the security that investors need in order to act. At any rate, the credits available to the industry through the Renewable Fuels Standard are in place and reliable, and running near a dollar a gallon in value (though as a researcher I am less familiar with that realm). Some producers have commented to me that these credits are of almost more value to them than the tax credit structure has proven to be.

The industry already has a lot more capacity to produce than it is using, and so new construction may not be the first thing to look for as an indication of industry health. Perhaps the number of plants that keep the doors open, and the degree to which they are running near capacity, are important parameters at this stage. Overcapacity in the industry did not prevent overexpansion in the past; maybe people will pay more attention to such things now.

Refined oil prices have risen quite high. It is probably difficult to make money on biodiesel under such conditions unless one can use lower-quality, lower-cost feeds.

The Renewable Fuels Standard has been put in place, mandating national use of definite, known volumes of biobased fuel. This establishes significant volume targets for the consumption of "advanced biofuel," of which biodiesel is presently the only approved domestically produced representative. This establishes demand and should energize the industry. In addition, within the past year the home heating oil industry, which moves substantial amounts of liquid fuel in the Northeast sector of the United States, has come to strongly support the use of biodiesel blends. This also provides a market pull that should encourage biodiesel production.

Perhaps as a barometer of the current and near-term mindframe, I felt that the mood at the meeting of the National Biodiesel Board, held in February 2011 in Phoenix, was less grim, a bit more optimistic, than last year's similar meeting.

Martin Mittelbach, University of Graz, Austria

(1) Because of the European Directive on Renewable Energy and the mandatory goals of up to 10% biofuels until 2020, regulated in national laws, there will be a constant and rising demand for biofuels and biodiesel. Also there are mandates for developing B10 and B30 specifications, which additionally will raise the demand for biodiesel. After stagnation in 2009 and 2010, the production will go up slowly, but constantly.

(2) Because of the possibility of counting double for the goals, biodiesel from used frying oil and other waste material will be promoted in the future. Biodiesel plants will have to adapt their processes for those feedstocks.

Also the whole production chain has to be evaluated according to the sustainability criteria. A minimum of 35% GHG (greenhouse gas) savings has to be reached during the whole production chain, so the biodiesel production process also has to be optimized.

Also hydrotreated vegetable oil will come onto the market, especially for the aviation industry.

(3) China: No big developments can be seen, only used frying oil as feedstock, no food oils. Latin America: Argentina is still the major player, but Brazil is following up. Argentina has been concentrating on exports, but will use biodiesel also in the near future in their own country. For Brazil, biodiesel could be the same success story as bioethanol.

Today, still, a lot of biodiesel from Argentina is exported to Europe, therefore in Europe there is an overcapacity. ■

Health & Nutrition News

Briefs

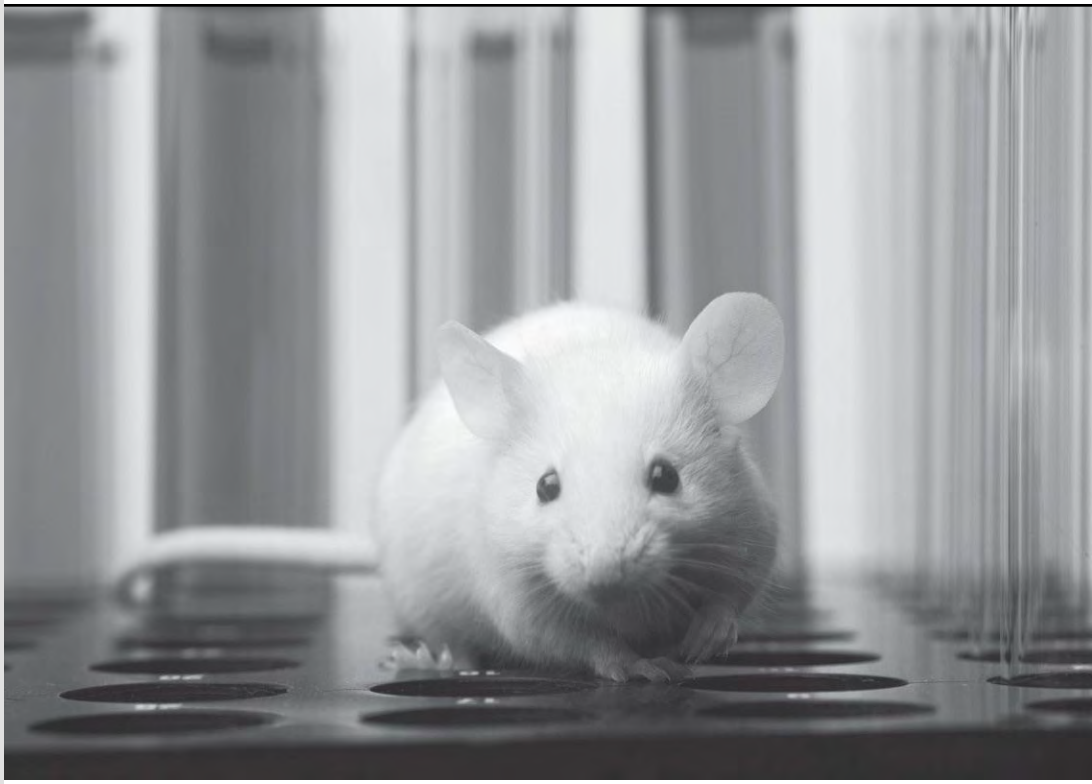
Previous work has shown that tomatoes contain a number of beneficial compounds that improve abnormalities of lipid metabolism. Now scientists in Japan, led by Teruo Kawada of Kyoto University, say they have new information about the molecular mechanism underlying the beneficial effect. The research, published in the journal *Molecular Nutrition & Food Research* (doi: 10.1002/mnfr.201000264), reveals that an extracted compound, 9-oxo-octadecadienoic, has produced anti-dyslipidemic results.

■■■

A new analysis predicts older adults' median life expectancy based on their walking speed. The research, which appeared in the *Journal of the American Medical Association* (*305*:50–58, 2011), found that walking speed was a predictor of survival length across age, race, and height categories. Stephanie Studenski, a professor at the University of Pittsburgh's Division of Geriatric Medicine, led the study. She and her colleagues analyzed nine cohort studies of community-dwelling adults 65 years of age and older. Of the 34,485 adults in the studies, persons with average life expectancy walked at about 0.8 meters per second. For those with a gait speed of one meter per second or faster, "survival was longer than expected by age and sex alone," the researchers noted in their article.

■■■

Resveratrol, a compound in grapes, displays antioxidant and other positive properties. Now researchers at the University of Texas Health Science Center at San Antonio (USA) describe a novel way in which resveratrol exerts these beneficial health effects. Resveratrol stimulates the expression of adiponectin, a hormone derived from cells that manufacture and store fat, the team found. Adiponectin has a wide range of beneficial effects on obesity-related medical complications, said senior author Feng Liu. The study appeared in the *Journal of Biological Chemistry* (*286*:60–66, 2011). ■



How to control eating behavior—in mice

By illuminating key nerve cells that regulate feeding behavior, researchers at the Howard Hughes Medical Institute's (HHMI) Janelia Farm Research Campus in Ashburn, Virginia, USA, have discovered how to prod mice to eat voraciously—or sparingly—thanks to a "radiant" new technology.

The scientists created mice whose brain cells can be activated with a beam of light. Hitting one type of neuron drives the animals to their food bowls within minutes, whereas targeting a different type makes them abstain, the researchers found. The findings were published in the journal *Nature Neuroscience* (doi: 10.1038/nn.2739).

"Eating and hunger and the motivations associated with food—they're all derived from the activity of neurons in the brain," says lead investigator Scott Sternson, a group leader at Janelia Farm. By unraveling the complex circuits involved in eating, he adds, researchers might better understand why some people eat too much or too little.

Compared with, say, a reflexive shiver, sneeze, or muscle twitch, feeding behaviors are quite complex. They are influenced by a variety of motivations and sensory stimuli—from food smells to body temperature—and require perceptual and motor skills. Unsurprisingly, dozens of brain regions and hundreds of cell types are involved in eating.

A type of nerve cell called agouti-related peptide (AGRP) neuron crops up in the hypothalamus, an evolutionarily ancient brain area that controls many automatic body functions. AGRP cells are so-named because they secrete the AGRP protein. Previous studies showed that when injected into the brains of healthy mice, AGRP triggered the animals to start eating. In contrast, mice engineered to lack these neurons starve.

In the same brain area, pro-opiomelanocortin (POMC) neurons release the POMC protein. It has the opposite effect of AGRP: When injected into the brain, a peptide derived from POMC curbs eating. Mice lacking POMC are obese.

The downside of the older work on these cells is that the experiments could not mimic the natural amounts or precise distribution of AGRP and POMC in the brain. Sternson says his group used a different strategy to overcome those limitations. "We set out to directly test the capacity of these neurons to give rise to feeding behavior," he explains.

Sternson's group took advantage of a recently developed technique that lets researchers manipulate the activity of nerve cells with light. The technique, developed in part by HHMI Early Career Scientist Karl Deisseroth, has helped initiate the new field of optogenetics for studying the brain. First, Deisseroth and his team used a virus to insert a light-sensitive protein called channelrhodopsin-2 (ChR2) into the cell membrane of either AGRP or POMC neurons. The researchers could then trigger the ChR2-expressing cells to fire by exposing them to blue light streaming into a surgically implanted shunt in the skull.

Because the virus does not infect every single ARGP cell or POMC cell, the researchers end up making mice in which different numbers of neurons are sensitive to the blue light. Sternson and colleagues found that the more AGRP neurons there are that are stimulated, the more food the animals eat—even in the morning, when mice are typically resting. "The animal wakes up, rubs its face, stretches its legs, walks over to its food cup and all of a sudden starts eating with this remarkably voracious intensity—[as if] it had been starved," Sternson says.

Over a one-hour stimulation period, the animals eat about 20 times more food than do controls. Their intake correlates with the frequency of the light pulses, and as soon as the light goes out, the mice stop eating.

In contrast, over one day of POMC neuron activation, mice lower their food intake by nearly 40% and lose 7% of their body weight. "This would be like a 200-pound adult losing 14 pounds in just one day, simply by activating a specific neuron population in their brain," Sternson says.

Researchers had hypothesized that AGRP neurons might control food intake by blocking the "stop eating" signals of POMC neurons. The new study suggests otherwise. Sternson found that AGRP activation leads to overfeeding even in mice that carry genetic abnormalities that effectively shut off POMC pathways.

Sternson is currently investigating what lies downstream of the AGRP neurons to incite this gluttony. The culprit could be other chemicals produced by the cells, such as neuropeptide Y or the neurotransmitter GABA (γ-aminobutyric acid).

"These neurons' ability to fully orchestrate feeding behavior is just a remarkable thing to see," Sternson says. "It is really quite unusual that a small population gives rise to such complex behaviors."

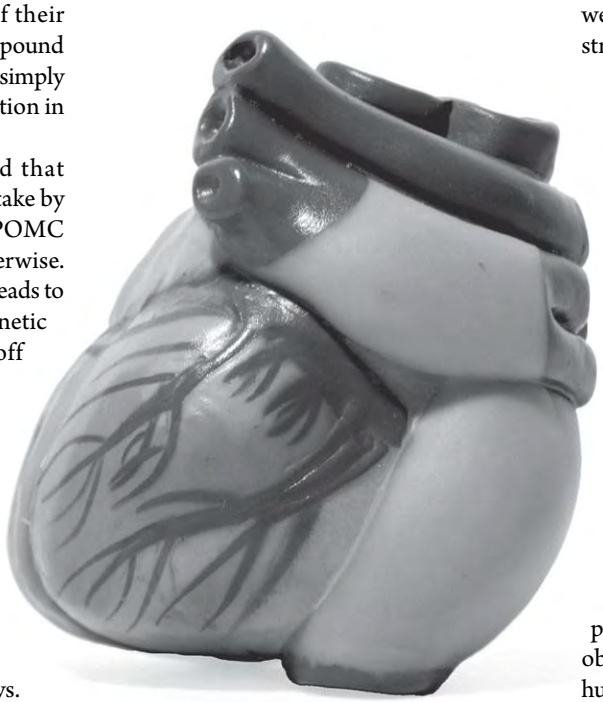
The findings raise provocative questions about possibly targeting these cells to spur weight loss in obese people or weight gain in people with anorexia. This sort of mind control is not so far-fetched: A method called deep-brain stimulation, in which surgeons insert metal electrodes into the brain of a person who is awake, has proven somewhat effective in treating depression and obsessive compulsive disorder, for example.

"Such an approach is conceivable, however it is quite invasive," Sternson says. "My hope is that a better understanding of the mechanism of eating behavior would facilitate the design of less invasive approaches, whether they are pharmacological or even behavioral."

A different path to fat-related heart disease

In lipotoxic cardiomyopathy, heart function is disrupted by fat accumulation in heart cells.

A team led by Rolf Bodmer of the Sanford-Burnham Medical Research Institute (La Jolla, California, USA) recently unraveled an alternative pathway to lipotoxic cardiomyopathy in fruit flies—a genetic mechanism that occurs independently of a diet high in fat. Their study, published in *Genes & Development* (25:189–200, 2011), lays the foundation for the development of new ways to combat lipotoxic cardiomyopathy and other types of heart disease.



"It is a well-accepted notion that if you eat too much fatty food and your body can't metabolize it properly, you can become obese, and this can lead to lipotoxic cardiomyopathy. Our study shows that there is also an alternative cause of obesity and associated heart problems—an imbalance in the fats that normally make up the basic structure of our cells," explained Hui-Ying Lim, a postdoctoral researcher and lead author of the study.

In this study, researchers analyzed mutant fruit flies (called easily shocked mutants) that have abnormally low levels of phosphatidylethanolamine (PE), a phospholipid that is a major component of cellular membranes in both flies and mammals. They found that these flies compensate for low PE levels by initiating a mechanism for synthesizing fat. In this mechanism, sterol regulatory element-binding protein (SREBP) turns on genes encoding metabolic enzymes that synthesize more fat.

As a consequence of high SREBP, these PE-deficient mutant flies also had high levels of triglycerides, which are commonly associated with obesity and type 2 diabetes in humans. The disruption in cell membrane fat synthesis and consequent triglyceride accumulation added up to heart problems for flies lacking PE-producing enzymes. Compared to their genetically normal counterparts, they were especially prone to cardiac arrest under stress and other heart problems.

Since excessive levels of SREBP seems to be the cause of heart disease in this system, can it be targeted to reduce heart disease? The researchers addressed this question by inhibiting SREBP or its fat-synthesizing target genes through genetic manipulation. In doing so, they were able to restore fat balance and rescue PE-deficient flies from heart malfunction. These beneficial effects were also achieved by reducing SREBP in just the heart, rather than the whole fly. As a result, the flies were still obese, but their hearts functioned normally. These findings further underscore the importance of SREBP in excess fat-related heart diseases such as lipotoxic cardiomyopathy.

"Here we identified a new metabolic pathway that exhibits striking similarities to obesity- and diabetes-related heart failure in humans," said Bodmer, professor and director

of the development and aging program at Sanford-Burnham and senior author of the study. "This information might now allow us to interfere with the toxic effects of high fat in the heart by directly manipulating these genes in the heart muscle."

The study was funded by the American Heart Association, the Ellison Medical Foundation, and the National Heart, Lung and Blood Institute (NHLBI) at the National Institutes of Health (NIH).

Safety of NSAIDs and COX-2 inhibitors questioned

Commonly used painkillers for treating inflammation can increase the risk of heart attacks and strokes, according to an analysis of the evidence published in the *British Medical Journal* (doi: 10.1136/bmj.c7086). The drugs include traditional nonsteroidal anti-inflammatory drugs (NSAIDs) as well as new-generation anti-inflammatory drugs, known as COX-2 inhibitors. The researchers say that doctors and patients need to be aware that prescription of any anti-inflammatory drug must take cardiovascular risk into account.

NSAIDs have been the cornerstone of managing pain in patients with osteoarthritis and other painful conditions. In 2004, the COX-2 inhibitor rofecoxib was withdrawn from the market after a trial found that the drug increased the risk of cardiovascular disease. Since then, there has been much debate about the cardiovascular safety of COX-2 inhibitors and traditional NSAIDs, which several further studies have not been able to resolve.

Therefore, researchers in Switzerland performed a comprehensive analysis of all randomized controlled trials comparing any NSAID with other NSAIDs or placebo. They included 31 trials and 116,429 patients taking seven different drugs (naproxen, ibuprofen, diclofenac, celecoxib, etoricoxib, rofecoxib, and lumiracoxib) or placebo to provide a more reliable estimate than previous studies of the cardiovascular risks of these drugs.

Overall, the number of harmful outcomes that could be compared for placebo vs. treatment was low. In 29 trials, there were a total of 554 heart attacks; in 26 trials, there were 377 strokes; and in 28 trials, there were 676 deaths. So the absolute risk of cardiovascular problems among people taking painkillers was low, but the researchers did find that, relative to placebo, the drugs carried important risks.

For instance, compared with placebo, rofecoxib and lumiracoxib were associated with twice the risk of heart attack, while ibuprofen was associated with more than three times the risk of stroke. Etoricoxib and diclofenac were associated with the highest (around four times) risk of cardiovascular death. Naproxen appeared least harmful in terms of cardiovascular safety among the seven analyzed preparations.

Although the number of cardiovascular events in the trials was low, the authors say, "Our study provides the best available evidence on the safety of this class of drugs." They conclude: "Although uncertainty remains, little evidence exists to suggest that any of the investigated drugs are safe in cardiovascular terms. Cardiovascular risk needs to be taken into account when prescribing any nonsteroidal anti-inflammatory drug."

An accompanying editorial says these cardiovascular risks are worrying because many patients have both cardiovascular disease and musculoskeletal disease and suggests that it is time for an evaluation of a broader range of alternatives. ■

People News/ Inside AOCS

Courduroux becomes Monsanto CFO

Pierre Courduroux, a 20-year veteran of Monsanto (St. Louis, Missouri, USA) assumed the position of chief financial officer (CFO) for the company on January 1, 2011, replacing **Carl Casale** (*inform 22*:60, 2011), who moved to CHS Inc. (Minneapolis, Minnesota, USA). Most recently Courduroux had overseen the finances of the company's global business operations.

He is a native of France.

Industrial sales manager for CPM Roskamp

Scott Switzer was named industrial sales manager for CPM Roskamp Champion (Waterloo, Iowa, USA) in January. His responsibilities include sales and marketing of Roskamp Champion products and services to industrial markets.

CPM Roskamp Champion is a manufacturer and designer of pelleting and particle size reduction equipment and automation systems for the animal feed milling and oilseed processing industries.

Qteros initiates VP of R&D position

Qteros, Inc., a developer of low-cost cellulosic ethanol, announced from its Marlborough, Massachusetts, USA headquarters the appointment on January 10 of **Christopher J. Dale** as its first vice president (VP) of research and development (R&D). He comes to Qteros with almost 30 years of background in bacterial- and yeast-based fermentations, bacterial microbiology, and industrial biotechnology.

John A. McCarthy, Jr., Qteros president and chief executive officer, commented, "Chris' proven service-oriented approach to partnership management combined with his expertise managing bio-industrial technology project lifecycles from concept to commercialization will be invaluable as we embark upon our newly formed partnership with Praj. . . ." (See *inform 22*:142, 2011).

Sapphire Energy appoints Wang to new position

In mid-January Sapphire Energy appointed **Xun Wang** to the newly created position of vice president of research and development (R&D). The company, based in San Diego, California, USA, says Wang will focus on the lab-to-commercial mechanics and lead development through the next stage of commercialization. Sapphire is developing algae-based crude oil into marketable fuel.

Wang's career has been in agricultural biotechnology, much of it with Syngenta, where he led the first plant genomic project. He also worked for Pioneer Hi-Bred International.

AAK announces management changes

AAK (Malmö, Sweden) announced management changes in January that are intended to strengthen the company's internationalization. The following four persons were appointed to group management: **Edmond Borit,** currently managing director for AarhusKarlshamn Latin America; **Jean-Mark Rotsaert**, presently president for AarhusKarlshamn USA; **Octavio Diaz de León**, currently managing director for AarhusKarlshamn Mexico; and **Karsten Nielsen**, presently director of application of product development in the business area Chocolate & Confectionery Fats.

Arne Frank, who assumed the presidency of Aarhus Karlshamn in April 2010, said, "These changes are a natural step in the preparations for taking AAK to new levels." He added that these changes will "lead to an efficient organization that better takes advantage of our product portfolio on a global scale and creates clear conditions for global growth."

In conjunction with these changes, **Ian McIntosh**, president UK and Americas, left to pursue other opportunities.

The company is involved in products and applications related to confectionery fats, fatty acids, and glycerine, food ingredients, and beauty and personal care, among others.

Changes at ISSFAL

Ray Rice retired in 2010 after 12 years as secretary/treasurer of the International Society for the Study of Fatty Acids and Lipids (ISSFAL). His role was then divided into three: **Peter Clough** (Technical Director, Efamol Ltd, Leatherhead, Surrey, UK) became secretary of the organization, **Seth Baum** (of Integrative Health Care, Boca Raton, Florida, USA) the treasurer, and **Graham S. Hauck** the new administrator

Also during this transition, the home office of ISSFAL moved from Exeter, UK, to Washington, DC, USA, where Hauck is based.

Gundersen chosen to direct NSRL

Craig Gundersen was selected to be the director of the National Soybean Research Laboratory (NSRL) at the University of Illinois, Urbana–Champaign, USA, in January. As executive director, Gundersen will provide leadership and strategic direction regarding soybean research, outreach, and education efforts from production through consumption. He will serve as a liaison between the University and industry stakeholders, forming affiliations and alliances that dynamically respond to the evolving technological and marketing conditions of the soybean industry. Gundersen's priorities will be to expand the scope and size of the soybean industry and the profitability of soybean farmers, both in the United States and internationally.

Eurofins appoints new chief scientific officer

Eurofins Scientific (Des Moines, Iowa, USA) hired **Douglas Marshall** as chief scientific officer, Microbiology, in January. Marshall will lead technological development and have scientific oversight of the US microbiology division that encompasses multiple microbiology testing centers in North America.

Marshall has over 20 years of experience in academia and industry. He has been Associate Dean of the College of Natural and Health Sciences at the University of Northern Colorado; and, in a joint venture with Eurofins Central Analytical Laboratory, he served as cofounder, director of technical services, and president of the Food Safety Institute, LLC.

In a company statement, Eurofins said it is focusing on bolstering its portfolio of support services with analytical technologies and developing scientific solutions for food safety compliance, in light of the new demands that will be placed on food producers, processors, and importers as result of the newly enacted Food Safety Modernization Act (S.510).

Grease stars on History Channel

Environmental Lubricants Manufacturing (ELM) of Grundy Center, Iowa, USA was featured on the History Channel's *Modern Marvels* series in an episode entitled "GREASE." ELM's microwave grease manufacturing technology formed the subject of the program, which aired on January 21, 2011.

ELM teamed with researchers at the University of Northern Iowa National Ag-Based Lubricants Center (NABL) and AMTek, a Cedar Rapids, Iowa-based industrial microwaves manufacturer that built and tested a scaled-up reactor to make production-quantity batches of grease.

AOCS member **Lou Honary** has done considerable research at NABL on the commercialization of soy-based lubricants, and it is this technology that forms the basis of the bio-based products ELM is producing today.

The program may be viewed at www.history.com/shows/modern-marvels/videos/modern-marvels-grease#modern-marvels-grease. ■

2010 Annual Meeting of Asian Section of AOCS held jointly with 6th ISBB

Suk Hoo Yoon

The 6th International Symposium on Biocatalysis and Biotechnology (ISBB) was held in Seoul, Korea, November 17–19, 2010, in conjunction with the annual meeting of the Asian Section of AOCS. The meeting was organized by AOCS members Suk Hoo Yoon (principal research scientist, Korea Food Research Institute, Seongnam, Korea), Ching T. Hou (lead scientist, US Department of Agriculture, Agricultural Research Service, National Center for Agricultural Utilization Research, Peoria, Illinois, USA), and Yung-Sheng Huang (vice president, National Chung Hsing University, Taichung, Taiwan).

The meeting was composed of a two-day scientific program and one-day study tour. For the scientific program, 59 oral and 58 poster papers were presented by about 100 authors representing fats and oils organizations worldwide. Altogether, more than 300 attendees from 10 countries shared and discussed technical and professional information.

The ISBB has published four books based upon its first four years of symposia (2005–2008), and has published its own journal initially as ISBB Special Issues in *New Biotechnology* by Elsevier since October 1, 2009. The goal is to launch its own journal entitled *Journal of Biocatalysis and Agricultural Biotechnology (JBAB).*

The Asian Section of AOCS is composed of members from China, India, Japan, Korea, Malaysia, and Taiwan. The Section is recruiting new members from Asian countries, and plans to continue to have annual meetings in conjunction with ISBB.

The Section will rotate the meeting place in tandem with ISBB. In 2011, the meeting will be held from October 10–13 in Tokyo, Japan, jointly with the World Congress on Oleo Science and the 29th ISF (International Society for Fat Research) Congress. For more information about 7th ISBB, please contact: Ching T. Hou (ching.hou@ars.usda.gov). For more information about the Asian Section of AOCS go to http://www.aocs.org/Membership/content.cfm?ItemNumber=947.

Suk Hoo Yoon is chair of the Organizing Committee of 6th ISBB, as well as secretary of the Asian Section of AOCS.

Patents

Published Patents

Lipid metabolism improving agent

Hori, G., *et al.*, Kyowa Hakko Bio Co., Ltd., US7790702, September 7, 2010

The present invention relates to a protein/phospholipid or protein hydrolyzate/phospholipid complex containing 10 wt% or more of bound phospholipid, a lipid metabolism improving agent comprising the complex, and a functional food comprising the complex. The present invention provides a lipid metabolism improving agent and a functional food containing the complex.

Patent family members: AT253927 E, AU199668902 A1, AU200056551 A5, AU721852 B2, AU721852 C, AU764747 B2, CA2204406 AA, CA2204406 C, CN1136007 C, CN1161001 A, DE69630666 D1, DE69630666 T2, EP0790060 A1, EP0790060 A4, EP0790060 B1, JP2004337177 A2, JP3599347 B2, US2002182250 AA, US2006160725 AA, US7790702 BB, WO9709059 A1

Process for preparing glyceryl carbonate

Schmitt, B., *et al.*, Evonik Roehm GmbH, US7790908, September 7, 2010

The present invention relates to a process for preparing highly pure glyceryl carbonate by transesterifying dialkyl carbonates or cyclic carbonates in the presence of a basic catalyst.

Patent family members: AU2006328838 AA, CA2630242 AA, CN101287720 A, DE102005060732 A1, EP1963301 A1, JP2009519286 T2, KR20080078835 A, NZ566676 A, RU2008128560 A, TW200732318 A, US2008255372 AA, US7790908 BB, WO07071470 A1, ZA200802049 A

Process for the preparation of 1, 2-propanediol

Henkelmann, J., *et al.*, BASF SE, US7790937, September 7, 2010

The present invention relates to a process for the preparation of 1,2-propanediol, in which a glycerol-containing stream, in particular a stream obtained on an industrial scale in the production of biodiesel, is subjected to a hydrogenation.

Patent family members: CA2642592 AA, CN101395113 A, EA200801936 A1, EP1993985 A1, JP2009528392 T2, US2009216050 AA, US7790937 BB, WO07099161 A1

Frying fats and oils

Cain, F.W., *et al.*, Loders Croklaan USA LLC, US7794773, September 14, 2010

Compositions suitable for use as a frying fat or oil may be derived from palm oil by a process comprising interesterification and comprise triglycerides. The compositions may have a content of saturated fatty acids having from 12 to 24 carbon atoms (SAFA) of at least 53% by weight, and a content of unsaturated fatty acids having 18 carbon atoms of less than 47% by weight. The compositions may be used to prepare fried foods such as donuts.

Patent family members: US2006105090 AA, US2007207250 AA, US7611744 BB, US7794773 BB

Sequestering of glycoprotein molecules and oligosaccharide moieties in lipo-glycoprotein membranes and micelles

Mullen, E.H., The MITRE Corp., US7786276, August 31, 2010

Spontaneous formation of a coherent membrane at the interface between a nonpolar liquid and an aqueous solution of glycoprotein can be used to separate proteins and carbohydrates from tissue fluid and other complex mixtures. When volatile hydrocarbons are used to induce membrane formation, evaporation of organic and aqueous solvents leaves behind a delicate film or powder. The method for extracting glycoprotein from solution and sequestering it in floating membranes can be used to study environmental conditions or to remove carbohydrates from proteins in the tissues of living organisms. This technique can also be used for detecting proteins in solutions.

Patent family members: US2002048604 AA, US2003032770 AA, US2007141694 AA, US5824337 A, US6528092 BB, US7148031 BB, US7786276 BB

Hydrolysis-resistant multilayer polyester film with hydrolysis stabilizer

Kliesch, H., *et al.*, Mitsubishi Polyester Film GmbH, US7794822, September 14, 2010

The invention relates to a multilayer polyester film comprising a hydrolysis stabilizer, wherein the hydrolysis stabilizer is an epoxidized alkyl ester of fatty acid or is a mixture of epoxidized alkyl esters of fatty acid or is an epoxidized fatty acid glyceride or is a mixture of epoxidized fatty acid glycerides, and at least one external layer of the film does not comprise the hydrolysis stabilizer. The form in which the hydrolysis stabilizer is added to the polyester can be that of dry liquid, absorbed by a carrier material.

Patent family members: DE102006016156 A1, EP1842662 A1, JP2007276478 A2, KR20070100165 A, US2007237972 AA, US7794822 BB

Base for electric insulating oil

Takei, M., *et al.*, Lion Corp.; Japan AE Power Systems Corp., US7795193, September 14, 2010

A base for electric insulating oil comprising an esterification product from a C_8–C_{20} higher fatty acid and a C_6–C_{14} branched aliphatic monohydric alcohol; or a base for electric insulating oil comprising an esterification product from a mixed fatty acid derived from palm oil and/or mixed fatty acid derived from soybean oil and a C_1–C_5 aliphatic monohydric alcohol or C_6–C_{14} branched aliphatic monohydric alcohol. The thus provided base for electric insulating oil excels in viscosity, fluidity, chemical stability, etc. and is capable of satisfactorily exhibiting electrical characteristics of electric insulating oil.

Patent family members: CN100533604 C, CN1856843 A, DE602004013166 D1, DE602004013166 T2, EP1662513 A1, EP1662513 A4, EP1662513 B1, KR20070015103 A, TW200515430 A, US2007069188 AA, US7795193 BB, WO05022558 A1

Composition and method of use of soy-based binder material

Blackmon, D., and S. Walther, Enviroad, LLC, US7798743, September 21, 2010

A composition and method for use of a soy-based material binder is provided. One example method for increasing road stabilization with a soy-based material binder may include determining road base attributes of the road base for application. The method may further include creating a soy-based material binder comprising at least one of a soy protein isolate with a concentration in the range of 1 to 20% of soy protein isolate based on road base attributes. The method may further include determining an amount of soy-based material binder for a volume of application based on the concentration of soy protein isolate in the soy-based material binder and the road base attributes. Further still, the method may include combining the soy-based material binder and the road base wherein the resultant mixture includes soy-based material binder in a range of 0.0001–5 gallons per pound of road base.

Patent family members: US2009103979 AA, US7798743 BB

Pharmaceutical compositions for lipophilic drugs

Bhalani, V.T., and S.P. Patel, Watson Laboratories Inc., US7799340, September 21, 2010

Stable solutions of lipophilic drugs, such as cyclosporin, forming a polar lipid self-emulsifying drug delivery system. The solutions can include lipophilic drugs, such as cyclosporin, dissolved in a polar lipid, such as having a C_6–C_{12} fatty acid monoglyceride content of at least about 50%, surfactants and triglycerides. The composition forms a fine emulsion on exposure to water. The encapsulated dosage form of this composition needs neither a hydrophilic component nor air-tight blister packaging, and is particularly suitable for oral administration.

Patent family members: AT309087 E, AU199956416 A1, AU759223 B2, CA2342823 AA, CA2342823 C, DE69928295 D1, DE69928295 T2, DK1171286 T3, EP1171286 A2, EP1171286 B1, ES2253908 T3, GB200022467 A0, GB2341166 A1, GB2341166 B2, GB2350599 A1, GB2350599 B2, GB9819361 A0, GB9921020 A0, HK1043340 A1, IL141783 A0, IL141783 A1, JP2002524301 T2, JP3802759 B2, NZ510674 A, PL190824 B1, PL347124 A1, US2006188561 AA, US2007259810 AA, US5858401 A, US6617000 BA, US7070802 BA, US7452552 BB, US7799340 BB, WO0013884 A2, WO0013884 A3, ZA200102706 A

Compositions which can be used as biofuels

Schörken, U., *et al.*, Cognis IP Management GmbH, US7799544, September 21, 2010

A composition comprising alkyl esters with a C_1–C_8 alkyl group, and partial glycerides, with a free glycerol content of, at most, 2%, by weight, based on the weight of the composition, derived in an enzymatically-catalyzed reaction from saturated or unsaturated, straight or branched C_8–C_{22} fatty acids of vegetable oils, and useful, *inter alia*, in biofuels, such as biodiesel, and as an additive for improving the lubricating performance of fuel compositions.

Patent family members: BRPI0606422 A2, CA2595007 AA, CN101479372 A, DE102005002700 A1, EP1838822 A2, JP2008527154 T2, MX2007008658 A1, US2008153143 AA, US7799544 BB, WO06077023 A2, WO06077023 A3

Nut butter compositions and methods related thereto

Garter, B.L., *et al.*, Kellogg Co., US7803418, September 28, 2010

In general terms, this invention provides nut butter compositions and methods for preparing the disclosed nut butter compositions. In preferred embodiments, the nut butter composition or method is a peanut butter. In another preferred embodiment, the present invention provides a method of preparing a gelled peanut butter composition comprising the steps of: blending peanut butter, emulsifier, sugar alcohol, and triglyceride-based stabilizer so as to create a first blend; blending starch with the first blend to create a second blend; resting the second blend until a gel is formed, wherein the peanut butter is not more than 85°F (29.4°C) and 65–85%, the emulsifier is 0.15–0.5%, the sugar alcohol is 5–30%, the triglyceride-based stabilizer is 1–5%, and the starch is 1–5%.

Patent family members: US2008081092 AA, US7803418 BB, WO08042836 A2, WO08042836 A3

Cheese compositions and related methods

Huang, V.T., *et al.*, General Mills Marketing, Inc., US7807207, October 5, 2010

The present invention relates to cheese compositions and methods of making cheese compositions, including methods of formulating cheese compositions. Cheese compositions of the present invention include casein protein, non-casein protein, and non-pregelatinized, modified starch. Methods of making cheese compositions according to the present invention relate to making cheese compositions that include casein protein, non-casein protein, and non-pregelatinized, modified starch. Methods of formulating cheese compositions of the present invention include reducing an amount casein protein by replacing it with an amount of non-pregelatinized, modified starch and an amount of non-casein protein.

Patent family members: CA2542252 AA, CA2542534 AA, US2005106303 AA, US2006159825 AA, US7807207 BB, US7815957 BB, WO05048725 A2, WO05048725 A3

Trans-free hard palm oil fraction, *trans*-free non-hydrogenated hard structural fat and fat blends and methods

Ullanoormadam, S.R., Premium Vegetable Oils Berhad, US7807208, October 5, 2010

A *trans*-free hard palm oil fraction, a *trans*-free non-hydrogenated hard structural fat and a fat blend using the *trans*-free non-hydrogenated hard structural fat and liquid oils suitable for the manufacture of low SAFA (saturated fatty acid) high poly/mono unsaturated margarine and spreads, wherein the *trans*-free non-hydrogenated hard structural fat is made from a selectively fractionated non-hydrogenated high melting palm oil fraction which is interesterified with dry-fractionated non-hydrogenated lauric fat, such as a palm kernel oil or its fractions the resultant interesterified fat is obtained with high yield ratios that can be economically and commercially used as *trans*-free non-hydrogenated hard structural fat for the aforesaid manufacture.

Patent family members: AT300186 E, AU200148050 A5, AU770403 B2, CA2315464 AA, CA2315464 C, CA2512632 AA, CN1263387 C, CN1325630 A, DE60112179 D1, DE60112179 T2,

DK1159877 T3, EP1159877 A2, EP1159877 A3, EP1159877 B1, EP1552751 A1, ES2246287 T3, IN00611DE2001 A, IN03323DE2005 A, IN03324DE2005 A, IN230369 B, JP2002017255 A2, SG115376 A1, US2002001662 AA, US2005069620 AA, US6808737 BB, US7807208 BB

Pesticide for insect control

Newman, W.A., Remediation and Natural Attenuation Services Inc., US7807717, October 5, 2010

A method for the control of insects breeding on water surfaces and particularly mosquitoes, comprising blending in a high shear mixer water, the ester of a fatty acid of 10 to 25 carbon atoms and a low molecular weight alcohol, such as methanol or ethanol, an emulsifying agent and a thickener until an emulsion containing the ester with droplet sizes ranging from 1 to 20 microns in diameter is obtained and applying such to the surface of insect-infested water in sufficiently diluted form, to break the emulsion and form a thin continuous film.

Patent family members: US2006008495 AA, US7807717 BB

Crosslinked oil droplet-based cosmetic or pharmaceutical emulsions

Schreiber, J., and K.H. Diec, Beiersdorf AG, US7811594, October 12, 2010

The invention is a crosslinked water-in-oil emulsion that is useful in cosmetic and pharmaceutical applications. The emulsion includes a water phase, oil phase, water-in-oil emulsifier, and one or more crosslinkers. The crosslinkers that are useful in the invention include molecules having at least one hydrophilic region and at least one hydrophobic region. The invention also includes a process for preparing the crosslinked emulsion.

Patent family members: DE10213956 A1, EP1492491 A2, US2005106199 AA, US7811594 BB, WO03082223 A2, WO03082223 A3

Lipid mixtures for synthetic surfactants

Johansson, J., *et al.*, Chiesi Farmaceutici S.p.A., US7811988, October 12, 2010

The present invention provides novel lipid mixtures for synthetic surfactants. In particular, the invention provides a specific lipid mixture containing a specific amount of polyunsaturated phospholipids to be used for the preparation of synthetic surfactants. Said surfactants and pharmaceutical compositions thereof are useful for the treatment of surfactant deficiencies like respiratory distress syndrome (RDS).

Patent family members: AT452624 E, BRPI0411259 A, CA2527419 AA, CN100482207 C, CN1809338 A, DE602004024780 D1, EA008039 B1, EP1481665 A1, EP1628634 A1, EP1628634 B1, ES2337145 T3, JP2007500199 T2, US2008045449 AA, US7811988 BB, WO04105726 A1

Process for the production of derivatives of saturated carboxylic acids

Bastioli, C., *et al.*, Novamont S.p.A., US7812186, October 12, 2010

A process for the production of carboxylic acids and their derivatives comprising the steps of: (iii) reacting a derivative of an unsaturated fatty acid with an oxidizing compound in the presence of a catalyst capable of catalyzing the reaction of oxidation of the double olefinic bond of the derivative of the unsaturated fatty acid so as to obtain as intermediate product of reaction a vicinal diol; and (iv) reacting said intermediate compound with oxygen, or a compound containing oxygen, in the presence of a catalyst capable of catalyzing the reaction of oxidation of the hydroxyl groups of the vicinal diol to carboxylic groups, characterized in that both of the steps (i) and (ii) are carried out in the absence of added organic solvent and in that the water/diol ratio in the reaction of step (ii) is less than 1:1.

Patent family members: AU2006298786 AA, CA2621962 AA, CN101273005 A, EP1926699 A1, IN01995CN2008 A, ITMI20051779 A1, JP2009508913 T2, RU2008114623 A, US2008245995 AA, US7812186 BB, WO07039481 A1

Production of biofuels and biolubricants from a common feedstock

Miller, S.J., Chevron USA Inc., US7815694, October 19, 2010

The present invention is directed to methods and systems for processing triglyceride-containing, biologically-derived oils, wherein such processing comprises conversion of triglycerides to free fatty acids and the separation of these fatty acids by saturation type. Such separation by type enables the efficient preparation of both lubricants and transportation fuels from a common source using a single integrated method and/or system.

Patent family members: US2009084026 AA, US7815694 BB

Process for conversion of biomass to fuel

Roberts IV, W.L., *et al.*, North Carolina State University, US7816570, October 19, 2010

A process for the direct conversion of lipid biomass fuel stock to combustible fuels includes the steps of hydrolyzing a lipid biomass to form free fatty acids, catalytically deoxygenating the free fatty acids to form *n*-alkanes, and reforming at least a portion of the *n*-alkanes into a mixture of compounds having the correct chain length, conformations and ratio to be useful as transportation fuels. The process exhibits an overall energy efficiency of at least about 75%, wherein energy efficiency is calculated as the lower heating value of the produced transportation fuel over the sum of the lower heating value of the process reactants and the total energy input into the process.

Patent family members: AU2007347654 AA, CA2670985 AA, CN101595203 A, EA200900728 A1, EP2097496 A2, EP2097496 B1, IN02208KN2009 A, JP2010511750 T2, KR20090095631 A, MX2009005723 A1, US2009069610 AA, US7816570 BB, WO08103204 A2, WO08103204 A3, ZA200904021 A ■

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

NEWS & NOTEWORTHY (CONTINUED FROM PAGE 136)

The compromise should encourage consumer acceptance of the label, with threshold standards likely to rise as industries mature, according to a USDA spokesperson.

Also at issue is the fact that the program does not require life cycle assessment of biobased products. Instead, the agency will use what *NYT* called "simple physical tests to determine whether the organic materials in a product derive from plant life or fossilized carbon."

USDA estimates that 20,000 biobased products already are being manufactured in the United States. To see an example of USDA's new voluntary biobased product label, visit www.biopreferred.gov.

Mintel: Private labels are expanding

The private label market in North America has enjoyed sales growth in recent years that is not likely to decrease in the near future, according to Mintel International, a market research firm based in Chicago, Illinois, USA. Private label companies continue to introduce better-for-you products and more attractive packaging, all while being easier on consumers' budgets. Recent Mintel research found that 44% of grocery shoppers believe store brand products are of better quality today than they were five years ago.

Moreover, 39% of respondents who identify themselves as the primary grocery shoppers of their households say they would recommend a store brand product. Meanwhile, 34% say they do not feel as if they are giving anything up (such as flavor or prestige) by using store brands. Only 19% believe it is worth paying more for name brand products.

"With the exceptions of drinks and personal care products, most consumers believe that private label options are of equal quality to nationally branded products," says Fiona O'Donnell, senior analyst at Mintel. "The lack of perceived difference can be attributed, in part, to the fact that many retailers have introduced premium private label products in recent years that rival their branded counterparts in flavor and nutritional value, as well as the packaging design and shelf placement."

In fact, 62% of consumers believe there is no difference in quality between name and store brand dairy products. Similarly, 61% say there is no difference when it comes to canned or shelf-stable food products, and 56% think private label and name brand household cleaners are of equal quality.

"Private label brands are overcoming the stigma once associated with 'generic' products," adds O'Donnell. "Even though the recession has ended, and consumers may be in a better position financially to return to name brands, it's likely that many will continue to buy store brand staples that are of equal quality."

According to Mintel, 60% of primary grocery shoppers usually or sometimes purchase private label bread or baked goods and 58% usually or sometimes purchase store brand cheese.

Palm oil fractions minus 3-MCPD

According to the abstract posted by the World Intellectual Property Organization (WO 2011/002275), Malaysia's Sime Darby has patented "a process for manufacturing palm oil fractions containing virtually no 3-monochloropropanediol fatty acid esters" (3-MCPD esters).

The patent application notes that the process involves "fractionating a crude palm oil having a free fatty acid content of less than 1.5% and a diglyceride content of less than 5.5 wt% to produce at least one crude palm oil fraction, said crude palm oil fraction being selected from crude palm olein having an iodine value of at least 55 and crude palm stearin having an iodine value of less than 48; and deodori[z]ing the crude palm oil fraction to produce a deodori[z]ed palm oil fraction having a 3-MCPD-ester content of less than 1 part per million. The invention further provides a method of preparing a food product, said method comprising incorporating into said food product 3–99 wt% of a palm oil fraction obtained by the aforementioned process."

Esters of both 3-MCPD and glycidol are of continuing interest to the oils and fats community. They are process contaminants formed during production. To learn more about them—and about the AOCS Expert Panel on Process Contaminants—see http://tinyurl.com/ProcessContaminants. ■

INNOVATIVE, SUSTAINABLE CONSUMPTION (CONTINUED FROM PAGE 128)

environmental pressures, legislative and *de facto* standards as well as consumers' attitudes in our decision. We have seen that those who do not innovate tend to disappear over time. The CD player replaced compact cassettes, and now we have MP3 standards. It is the same in our industry. If we do not innovate, we will cease to exist.

In considering footprint, we must also look at another dimension. It is not only a reduction in footprint that we need to strive for but also an increase in performance. Increasing performance is just as important as decreasing footprint. The role of technology here is very important. The products we bring to the market offer much better performance than did the products of in the past.

One of our dishwashing products provides a very basic example. It actually delivers the same level of performance but at 40°C instead of the 60°C required by its predecessor, leading to a substantial reduction in energy consumption. Pure technology is driving this innovation. By introducing new technology, we are capable of reducing the water temperature and generating energy savings. Annualized, these savings are equivalent to the amount of CO_2 captured by 150,000 hectares of forest, which is an area three times the size of Lake Geneva, or 5,000 times the size of the Oktoberfest site in Munich. These figures relate solely to Germany and show the huge impact we in industry can have.

Call for action: Factor 3

With all those involved pulling together as laid out above, new standards can be set and tangible, measurable improvements achieved.

Indeed, if we were to increase the performance of all the mentioned value chain elements by 50% and decrease the associated footprint by 50%, say by the year 2030, the sustainability of the associated activities would increase by a factor of three.

This Factor 3 is my vision for the kind of joint effort that we could put in place, making truly innovative, sustainable consumption a reality within a reasonable time frame, generating value for the industry, the consumer and society, and ultimately also for our planet. Now we must dare to take the next step and start acting! ■

Extracts & Distillates

Hollow fiber liquid-phase microextraction coupled with gas chromatography–flame ionization detection for the profiling of fatty acids in vegetable oils

Siang, G.H., *et al.*, *J. Chromatogr. A 1217*:8073–8078, 2010.

The development of a two-phase hollow-fiber liquid-phase microextraction technique, followed by gas chromatography–flame ionization detection (GC-FID) for the profiling of the fatty acids (FA) (lauric, myristic, palmitic, stearic, palmitoleic, oleic, linoleic, linolenic, and arachidic) in vegetable oils is described. Heptadecanoic acid methyl ester was used as the internal standard. The FA were transesterified to their corresponding methyl esters prior to the extraction. Extraction parameters such as type of extracting solvent, temperature, extraction time, stirring speed, and salt addition were studied and optimized. Recommended conditions were: extraction solvent, *n*-tridecane; extraction time, 35 min; extraction temperature, ambient; without addition of salt. Enrichment factors varying from 37 to 115 were achieved. Calibration curves for the nine FA were well correlated ($r^2 > 0.994$) within the range of 10–5,000 μg L^{-1}. The limit of detection (signal/noise, 3) was 4.73–13.21 ng L^{-1}. The method was successfully applied to the profiling of the FA in palm oils (crude, olein, kernel, and carotino [a blend of canola and red palm oils] cooking oil) and other vegetable oils (soybean, olive, coconut, rice bran, and pumpkin). The encouraging enrichments achieved offer an interesting option for the profiling of the minor and major FA in palm and other vegetable oils.

NMR measurement of free and esterified sterols

Dais, P., *Lipid Technol. 22*:274–276, 2010.

This short account describes a novel analytical technique for the determination of total, free, and esterified sterols in olive oil developed in our laboratory. This methodology is based on ^{1}H and ^{31}P nuclear magnetic resonance (NMR) spectroscopy. The latter spectroscopic analysis requires first the derivatization of the sterolic hydroxyl groups with a phosphitylating reagent. This NMR method shows a number of advantages over conventional methods for sterols determination, among which speed and simplicity are the most beneficial ones. The possibility of applying NMR spectroscopy to other food matrices is discussed.

Analysis of polar lipids in the serum from rats fed shiitake by liquid chromatography—mass spectrometry/mass spectrometry

Yu, S., *et al.*, *J. Agric. Food Chem. 58*:12650–12656, 2010.

Consumption of a shiitake mushroom diet has been reported to have effects on serum phospholipids. However, much less is known about the effect on serum polar lipids including lysophospholipids and free fatty acids. In the present study, the effects of a shiitake diet were evaluated on the basis of identification and quantification of individual polar lipid components in rat serum using liquid chromatography–mass spectrometry/mass spectrometry. By comparison with standards and published data, 50 lysophospholipids and 32 free fatty acids were identified, and the concentrations of 27 polar lipids in rat serum were determined. Shiitake diets decreased the levels of all individual polar lipid components in the serum of male rat. The total level of serum polar lipids in males fed 4% shiitake diets (1,365.71 mol/L) was significantly lower than that of the control (2,270.26 mol/L). However, shiitake diets did not significantly affect the levels of serum polar lipids in female rats.

Bioactivity and emerging role of short and medium chain fatty acids

Huth, P.J., *et al.*, *Lipid Technol. 22*:266–269, 2010.

Cardiovascular disease (CVD) and insulin resistance are directly linked to overweight and obesity. Thus, any dietary strategy capable of causing weight reduction will lower CVD and diabetes risk. Oils rich in medium-chain saturated fatty acids (MCFA) are among several dietary components that may have potential in the treatment of obesity. MCFA are less energy dense and highly ketogenic compared to long-chain saturated and unsaturated fatty acids (LCFA). MCFA also differ from LCFA in their digestive and metabolic pathways, since they are easily oxidized and utilized as energy, with little tendency to deposit as body fat. The dietary intake of short-chain saturated fatty acids (SCFA) and MCFA from natural food sources is approximately 2.4 g/day and accounts for about 9% of the total saturated fatty acid (SFA) intake. Although early clinical studies with high levels of MCFA resulted in increased levels of plasma triacylglycerols and low-density lipoprotein cholesterol, and reduced levels of high-density lipoprotein cholesterol compared to diets enriched in unsaturated LCFA, these adverse effects have not been observed in more recent studies with smaller, more realistic amounts of MCFA. The lower caloric value of SCFA and MCFA and their unique metabolic features form the basis for their clinical use in enteral and parenteral nutrition and for novel reduced-calorie lipids for use in conventional food products.

Camelina (*Camelina sativa* L.) oil as a biofuels feedstock: Golden opportunity or false hope?

Moser, B.R., *Lipid Technol. 22*:270–273, 2010.

Camelina (*Camelina sativa* L.) is a promising sustainable alternative energy crop belonging to the Brassicaceae (mustard) family. Camelina has several favorable agronomic characteristics that give it potential to significantly enhance domestic biofuels production. With high seed oil content as well as high yield of oil per hectare, camelina can be efficiently processed into high-quality renewable fuels such as biodiesel (fatty acid methyl esters) as well as renewable diesel and jet fuels using existing technologies. This review summarizes the attributes of camelina along with conversion of the lipid fraction into advanced renewable biofuels.

GC/MS-based metabolomics reveals fatty acid biosynthesis and cholesterol metabolism in cell lines infected with influenza A virus

Lin, S., *et al.*, *Talanta 83*:262–268, 2010.

Metabolomics is the downstream of systems biology and has drawn significant interest for studying the metabolic networks

from cells to organisms. To profile the metabolites in two different cell lines (A549 and AGS) infected with influenza A virus, gas chromatography coupled with mass spectrometry (GC/MS) was employed. Some differentiating metabolites in the cell lines were tentatively identified using reference library, interpreted. and visualized by applying principal components analysis (PCA) and cluster heat map. Consequently, metabolic flux profiling allowed the differentiation of fatty acid biosynthesis and cholesterol metabolism during viral replication in the cell lines. The change in fatty acid turnover was also observed. Metabolomics investigation also revealed the different responses between A549 and AGS cell lines to the virus infection. From the pattern recognition results, AGS cell line might be more susceptible to influenza A virus. Regarding the fact that AGS is a poorly differentiated gastric adenocarcinoma cell line whereas A549 is a relatively differentiated lung tumor one, it is speculated that viral replication might be associated with the cell differentiations.

Accumulation of oxygenated fatty acids in oat lipids during storage

Doehlert, D.C., *et al.*, *Cereal Chem. 87*:532–537, 2010.

Oxygenated fatty acids were identified in oat grain by gas chromatography–mass spectrometry. We hypothesized that most of these were the results of lipoxygenase activity. This hypothesis was tested by measuring concentrations of these compounds after hydrothermal treatments and storage of oat groats or oat flour for 22 weeks at 37°C and 65% relative humidity. Steam treatments inactivated lipases, whereas roasting at 106°C did not. Free fatty acids accumulated quickly in untreated or roasted flour, but not in steamed flour or groats. A total of six hydroxy and epoxy fatty acids were identified. Oxidized fatty acids were found in both esterified lipids and free fatty acids, indicating that lipase action was not necessary for lipid oxidation. More oxidation products were found in flour than in groats, and less were found in the steamed treatments. Lipoperoxygenase appeared to be involved in the formation of oxidation products, although nonenzymatic mechanisms may also operate. Hydroxy-fatty acids are associated with strongly bitter flavors and are undesirable. Results indicate the importance of enzyme inactivation before storage of processed oat products.

Quantitative and qualitative determination of CLA produced by Bifidobacterium and lactic acid bacteria by combining spectrophotometric and Ag^+-HPLC techniques

Rodríguez-Alcalá, L.M., *et al.*, *Food Chem. 125*:1373–1378, 2011.

Bifidobacterium and lactic acid bacteria (LAB), especially from the genera *Lactobacillus* and *Lactococcus*, are commonly used in the production of fermented dairy products due to their potential probiotic characteristics. Moreover. some strains of these microorganisms also have the ability to produce conjugated linoleic acid (CLA) from linoleic acid (LA), which has attracted much attention as a novel type of beneficial functional fermented milk. In the present work 22 probiotic bacteria were tested for the production of CLA, using a UV (ultraviolet) screening method and HPLC (high-performance liquid chromatography) techniques. Five microorganisms, two strains of the genera *Bifidobacterium*, two *Lactobacillus* and one *Lactococcus* were selected for their ability to produce CLA after incubation in skim milk with free LA as a substrate. It was possible to quantify the production of CLA (in the range of 40–50 µg CLA/mL) and identify the CLA isomers produced as C18:2 *cis* 9,*trans* 11 (60–65%), C18:2 *trans* 10,*cis* 12 (30–32%), C18:2 *trans* 9,*trans* 11, and C18:2 *trans* 10,*trans* 12 (2–5%).

Efficacy of omega-3 fatty acids in mood disorders—a systematic review and metaanalysis

Kraguljac, N.V., *et al.*, *Psychopharmacol. Bull. 42*:39–54, 2009.

Existing efficacy trials of Omega-3 (omega-3) fatty acids in mood disorders have yielded inconsistent results. The current paper is an effort to provide a systematic review and meta-analysis to evaluate efficacy of omega-3 fatty acids in treatment of mood disorders. We searched Medline, Embase, PsychInfo, and the Cochrane Controlled Trials registry up to June 2008 for randomized trials investigating efficacy of omega-3 fatty acids in mood disorders. We conducted random effects meta-analyses. We used the I2 statistic to quantify between-study inconsistency, and conducted pre-specified subgroup analyses to explore potential explanations for inconsistency. We included 21 trials in our systematic review and found 13 trials to be eligible for meta-analysis. The pooled standardized mean difference in depressed mood states ($n = 554$ in 12 trials) was –0.47 (95% CI [confidence interval]: –0.92, –0.02., I2 = 82.7, $p = 0.07$) and in manic mood states ($n = 126$ in 4 trials) was 0.22 (95% CI: –0.21, 0.65., I2 = 40.5, I = 0.31). We did not identify any treatment-subgroup interaction across forms of omega-3 fatty acids preparations ($P = 0.99$) or patient diagnosis (bipolar vs. unipolar depressive disorder, $P = 0.96$); there was a significant correlation between omega-3 fatty acids dose and treatment effect on depressive symptoms ($r = 0.5$, $p = 0.04$), but not on manic symptoms ($P = 0.3$). The available evidence suggests that omega-3 fatty acids are a potential treatment of depressive disorders, but not mania. The unexplained between-study inconsistency and imprecision of the pooled estimates mitigate this suggestion. Large randomized placebo-controlled trials are needed to better estimate the value of this intervention for patients with depression.

Old and new generation lipid mediators in acute inflammation and resolution

Stables, M.J., and D.W. Gilroy, *Prog. Lipid Res. 50*:35–51, 2011.

Originally regarded as just membrane constituents and energy-storing molecules, lipids are now recognized as potent signaling molecules that regulate a multitude of cellular responses via receptor-mediated pathways, including cell growth and death, and inflammation/infection. Derived from polyunsaturated fatty acids (PUFA), such as arachidonic acid (AA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), each lipid displays unique properties, thus making their role in inflammation distinct from that of other lipids derived from the same PUFA. The diversity of their actions arises because such metabolites are synthesized via discrete enzymatic pathways and because they elicit their response via different receptors. This review will collate the bioactive lipid research to date and summarize the findings in terms of the major pathways involved in their biosynthesis and their role in inflammation and its resolution. It will include lipids derived from AA (prostanoids, leukotrienes, 5-oxo-6,8,11,14-eicosatetraenoic acid, lipoxins and epoxyeicosatrienoic acids), EPA (E-series

resolvins), and DHA (D-series resolvins, protectins and maresins).

Docosapentaenoic acid (22:5n-3): A review of its biological effects

Kaur, G., *et al.*, *Prog. Lipid Res. 50*:28–34, 2011.

This article summarizes the current knowledge available on metabolism and the biological effects of n-3 docosapentaenoic acid (DPA). n-3 DPA has not been extensively studied because of the limited availability of the pure compound. n-3 DPA is an elongated metabolite of EPA and is an intermediary product between EPA and DHA. The literature on n-3 DPA is limited; however, the available data suggest it has beneficial health effects. *In vitro* n-3 DPA is retro-converted back to EPA; however, it does not appear to be readily metabolized to DHA. *In vivo* studies have shown limited conversion of n-3 DPA to DHA, mainly in liver, but in addition retro-conversion to EPA is evident in a number of tissues. n-3 DPA can be metabolized by lipoxygenase, in platelets, to form 11-hydroxy-7,9,13,16,19- and 14-hydroxy-7,10,12,16,19-DPA. It has also been reported that n-3 DPA is effective (more so than EPA and DHA) in inhibition of aggregation in platelets obtained from rabbit blood. In addition, there is evidence that n-3 DPA possesses 10-fold greater endothelial cell migration ability than EPA, which is important in wound-healing processes. An *in vivo* study has reported that n-3 DPA reduces the fatty acid synthase and malic enzyme activity levels in n-3 DPA-supplemented mice and these effects were stronger than the EPA-supplemented mice. Another recent *in vivo* study has reported that n-3 DPA may have a role in attenuating age-related decrease in spatial learning and long-term potentiation. However, more research remains to be done to further investigate the biological effects of this n-3 very long chain polyunsaturated fatty acid.

Vegetable oils as platform chemicals for polymer synthesis

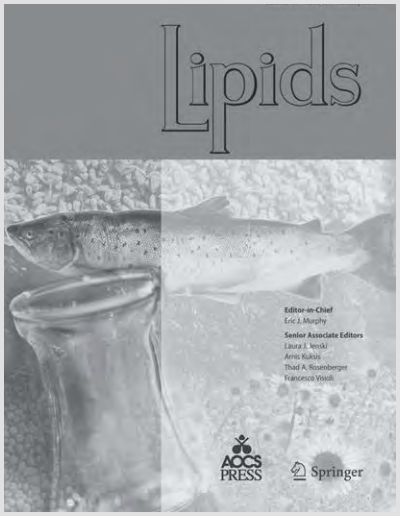
Ronda, J.C., *et al.*, *Eur. J. Lipid Sci. Technol. 113*:46–58, 2011.

Natural vegetable oils have been transformed in polymers following three main routes. The first is the direct polymerization through the double bonds of the fatty acid chain. The cationic copolymerization

AOCS Journals

Journal of the American Oil Chemists' Society (February)

- Waterborne coatings based on renewable oil resources: An overview, Athawale, V.D., and R.V. Nimbalkar
- Differentiation of lard from other edible fats and oils by means of Fourier transform infrared spectroscopy and chemometrics, Man, Y.B.C., A. Rohman, and T.S.T. Mansor
- Physical properties and fatty acid profiles of oils from black, kidney, great northern, and pinto beans, Sutivisedsak, N., B.R. Moser, B.K. Sharma, R.L. Evangelista, H.N. Cheng, W.C. Lesch, R.R. Tangsrud, and A. Biswas
- Volatile profiles of rapeseed oil flavored with basil, oregano, and thyme as a function of flavoring conditions, Adams, A., Z. Kruma, R. Verhé, N. De Kimpe, and V. Kreicbergs
- β-Cyclodextrin-mediated removal of soy phospholipids from the air–water interface, Arora, A., and S. Damodaran
- Phase equilibrium and optimization tools: Application for enhanced structured lipids for foods, dos Santos, M.T., G.A.C. Le Roux, and V. Gerbaud
- Acceptability and digestibility of emulsions in a rat model: Effects of solid fat content and lipid type, Wang, Y., R. Corwin, D.P. Jaramillo, F.J. Wojnicki, and J.N. Coupland
- Determination of acid number of biodiesel and biodiesel blends, Baig, A., and F.T.T. Ng
- Synthesis and characterization of poly(N-isopropyl acryl amide)-g-poly(linoleic acid)/poly(linolenic acid) graft copolymers, Alli, A., and B. Hazer
- Protein, lipid, aliphatic and triterpenic alcohol content of caper seeds "*Capparis spinosa*," Tlili, N., T. El Guizani, N. Nasri, A. Khaldi, and S. Triki
- Soy protein adhesive blends with synthetic latex on wood veneer, Qi, G., and X.S. Sun
- Crab and cockle shells as catalysts for the preparation of methyl esters from low free fatty acid chicken fat, Boey, P.-L., G.P. Maniam, S.A. Hamid, and D.M.H. Ali
- Supercritical carbon dioxide extraction and characterization of Argentinean chia seed oil, Ixtaina, V.Y., F. Mattea, D.A. Cardarelli, M.A. Mattea, S.M. Nolasco, and M.C. Tomás



Lipids (February)

- The health promoting properties of the conjugated isomers of α-linolenic acid, Hennessy, A.A., R.P. Ross, R. Devery, and C. Stanton
- Lipid classes and fatty acid patterns are altered in the brain of γ-synuclein null mutant mice, Guschina, I., S. Millership, V. O'Donnell, N. Ninkina, J. Harwood, and V. Buchman
- COX-2 inhibition and inhibition of cytosolic phospholipase A2 increase CD36 expression and foam cell formation in THP-1 cells, Anwar, K., I. Voloshyna, M.J. Littlefield, S.E. Carsons, P.A. Wirkowski, N.L. Jaber, A. Sohn, S. Eapen, and A.B. Reiss

- Short term dietary fish oil supplementation improves motor deficiencies related to reserpine-induced parkinsonism in rats, Barcelos, R.C.S., D.M. Benvegnú, N. Boufleur, C. Pase, A.M. Teixeira, P. Reckziegel, T. Emanuelli, J.B.T. da Rocha, and M.E. Bürger
- Low levels of the omega-3 index are associated with sudden cardiac arrest and remain stable in survivors in the subacute phase, Aarsetoey, H., R. Aarsetoey, T. Lindner, H. Staines, W.S. Harris, and D.W.T. Nilsen
- Increasing DHA and EPA concentrations prolong action potential durations and reduce transient outward potassium currents in rat ventricular myocytes, Li, H.-X., R.-X. Wang, X.-R. Li, T. Guo, Y. Wu, S.-X. Guo, L.-P. Sun, Z.-Y. Yang, X.-J. Yang, and W.-P. Jiang
- Maternal intake of fish oil but not of linseed oil reduces the antibody response in neonatal mice, Lauritzen, L., T.M.R. Kjær, T. Porsgaard, M.B. Fruekilde, H. Mu, and H. Frøkiær
- Arachidonic acid induces production of 17,20β-dihydroxy-4-pregnen-3-one (DHP) via a putative PGE2 receptor in fish follicles from the Eurasian perch, Henrotte, E., S. Milla, S.N.M. Mandiki, and P. Kestemont
- Insulin stimulates lipogenesis and attenuates beta-oxidation in white adipose tissue of fed rainbow trout, Polakof, S., F. Médale, L. Larroquet, C. Vachot, G. Corraze, and S. Panserat
- Stereochemistry of hydrogen removal during oxygenation of linoleic acid by singlet oxygen and synthesis of 11(*S*)-deuterium-labeled linoleic acid, Hamberg, M.

of soybean oil with styrene, divinylbenzene, and different amounts of styrenic monomers containing Si allows producing materials with improved mechanical and flame-retardant properties. The second route is the functionalization of the triglyceride double bonds to introduce readily polymerizable groups: The singlet oxygen photoperoxidation–dehydration of the allylic positions of the high-oleic sunflower oil allows producing enone-containing triglycerides that are chemically crosslinked with aromatic diamines through aza-Michael reactions. At high temperatures, this curing reaction proceeds through a complex mechanism leading to quinoline moieties. This new crosslinking approach can also be applied to aldehyde-containing triglycerides. The third route consists of using plant oil-derived chemicals such as 10-undecenoic acid to produce tailor-made monomers. Acyclic diene metathesis polymerization has been applied to allyl 10-undecenoate, 10-[2′,5′-bis(10-undecenoyloxy)phenyl]-9,10-dihydro-9-oxa-10-phospha-phenanthrene-10-oxide, and 1,3-bis(10-undecenoyl)glycerol to prepare a set of polyesters with different phosphorus and hydroxyl contents. Moreover thiol-ene "click" coupling of allyl 10-undecenoate with mercaptoethanol, 3-mercaptopropanoic acid, and 3-mercaptopropyl-trimethoxysilane has been used to produce difunctional telechelic polyesters.

Green synthesis routes toward triglycerides of conjugated linoleic acid

Busch, S., *et al.*, *Eur. J. Lipid Sci. Technol. 113*:92–99, 2011.

The classical chemical synthesis of CLA (conjugated linoleic acid) triglycerides starting from the free fatty acids and glycerol leads to the formation of additional CLA isomers not suited for applications in the field of human nutrition. Greener methods for a more selective production of CLA triglycerides under gentle reaction conditions were evaluated. The enzymatic synthesis works well under vacuum conditions with a clear preference for free fatty acids as substrates in comparison to alkyl esters. The reaction velocity was enhanced significantly by the addition of basic additives into the reaction mixture. A combined one-pot synthesis was designed starting from ethyl esters consisting of an enzymatic ester hydrolysis followed by a re-synthesis of the fatty acids with glycerol. Additionally, a new chemical interesterification reaction with triacetin (triacetyl glyceride) as synthon was developed, which avoids the formation of undesired CLA isomers.

Serum LDL- and HDL-cholesterol determined by ultracentrifugation and HPLC

Dong, J., *et al.*, *J. Lipid Res. 52*:383–388, 2011.

Simple and precise methods for low density lipoprotein-cholesterol (LDL-C) and high density lipoprotein-cholesterol (HDL-C) measurements are essential for assessment of cardiovascular disease (CVD) risks and for lipid and lipoprotein studies. We report here an ultracentrifugation (UC) and high-performance liquid chromatography (HPLC) method that requires substantially less specimen volume and provides the necessary reliability and throughput required by large-volume, high-quality research and clinical studies. 2-Mercaptoethanol (ME) was used to dissociate serum lipoprotein [a] (Lp[a]) into apolipoprotein [a] and Lp[a] remnant (Lp[a–]) and eliminated the contamination of Lp[a] in HDL separated by UC. Serum aliquots were centrifuged at a density of 1.006 kg/L for the separation of HDL plus LDL, and in the presence of ME at a density of 1.063 kg/L for the separation of HDL. Cholesterol concentrations of the bottom fractions were analyzed by HPLC. LDL-C and HDL-C determined using this method were equivalent to those with β-quantification and the designated comparison method of the Centers for Disease Control. The total coefficients of variation for LDL-C and HDL-C were 0.65–1.12% and 0.96–2.07%, respectively. This method requires a small amount of specimen and is easy to operate. This method may be used in research or in clinical laboratories where precise and specific lipoprotein cholesterol analysis is needed.

Reversed-phase analysis of triacylglycerols by ultra performance liquid chromatography-evaporative light scattering detection (UPLC-ELSD)

Ross, K.L., *et al.*, *Lipid Technol. 23*:14–16, 2011.

An improved reversed-phase (RP) method has been developed for the analysis of triacylglycerols (TAG) in fats and oils.

This method has shown superior performance over traditional reversed-phase liquid chromatographic (LC) methods in speed and resolution, and equivalent to superior performance in quantification accuracy (101–109%) and reproducibility (1.3–5.8% relative standard deviation). The method can easily be adjusted for use with different oils by simple modification of the gradient and run time. Additionally, a mobile phase is used that is compatible with liquid chromatography/mass spectrometry (LC/MS) that, when required, can aid in identification of TAG, for which many standards do not exist. This method is suited to a broad number of applications including (but not limited to) research and development of new oils, quality control, production of industrial or edible oils, and seed strain selection.

Lard-based fats healthier than lard: Enzymatic synthesis, physicochemical properties and applications

Cheong, L.-Z., and X. Xu, *Lipid Technol.* 23:6–9, 2011

Lard has long been deemed superior to vegetable oils for culinary purposes due to its exceptional properties such as wide plastic range and special flavor values. Nevertheless, its usage over the years has seen a marked decrease due to awareness of its negative nutritional values such as high calorific content (see below) and saturated fatty acids. This paper looks into the possibilities of producing healthier lard-based fats through "green" biocatalysis methods with particular attention given to the technical challenges of the process and their possible solutions. Alterations in physicochemical properties and application practicability of the modified lard-based fats are also carefully elucidated.

Castor oil-based lubricant reduces smoke emission in two-stroke engines

Singh, A.K., *Ind. Crops Prod.* 33:287–295, 2011.

Smoky emissions from two-stroke gasoline engines (2T) are a problem for the environment. Use of vegetable oil (oxygenate) is one solution. A biodegradable 2T-oil was developed from castor oil, which consisted of tolyl monoesters and performance additives but no miscibility-solvent. Evaluation revealed that on one hand it reduced smoke by 50–70% at 1% oil/fuel ratio and on the other hand it was at par with standard product specification. Starting problems, piston-seizer, or any other driving problems were not observed during the test. There is excellent potential for castor oil-based biodegradable 2T-lubricant as a smoke pollution reducer.

Effect of different environmental stresses on the expression of oleate desaturase genes and fatty acid composition in olive fruit

Hernández, M.L., *et al., Phytochemistry* 72:178–187, 2011.

The regulation of microsomal and plastidial oleate desaturases by low and high temperature, darkness, and wounding was investigated. To this end, their gene expression levels and the fatty acid composition were determined in the mesocarp tissue of olive fruit from the Picual and Arbequina varieties subjected to the corresponding stress treatments. Firstly, a plastidial oleate desaturase from olive was cloned and its functional identity was confirmed by overexpression in *Escherichia coli*. The results showed that temperature and light regulate olive oleate desaturase genes at transcriptional level. However, no correlation between their expression levels and the linoleic acid content in microsomal and plastidial lipids was found. In addition, the involvement of microsomal but not plastidial oleate desaturases in the wounding response of olive fruit mesocarp is demonstrated. The fatty acid analysis revealed the appearance of palmitolinoleic acid only in microsomal lipids, reaching a maximum 3 h after wounding.

Supercritical carbon dioxide extraction of cuphea seed oil

Eller, F.J., *et al., Ind. Crops Prod.* 33:554–557, 2011.

Cuphea seed oil (CSO) is a potential domestic source of medium-chain fatty acids. Although CSO has been obtained using solvent extraction and screw pressing, both methods suffer from disadvantages. Supercritical carbon dioxide (SC-CO_2) extraction is a promising alternative extraction technology. It is a very effective means to extract vegetable oils—non-toxic, non-flammable, easy to separate from extracts (i.e., no solvent residues), and no solvent disposal costs. This research compared SC-CO_2 and petroleum ether for the extraction of CSO. The CSO yield for the petroleum ether was 29.7% while the SC-CO_2 was 28.1%. The free fatty acid content for the SC-CO_2 extract was only 8.8% while the petroleum ether extract was 15.0%. The acid values were also much higher for the petroleum ether extract (i.e., 29.8) than for the SC-CO_2 extract (i.e., 17.4). The Gardner color of the SC-CO_2 extract was determined to be 2+ while the color of the petroleum ether Soxtec extract could not be determined because it was very dark due to the presence of chlorophyll. Although the two methods produced extracts differing slightly in their individual fatty acid compositions, the magnitudes of the differences were inconsequential. This research demonstrated that CSO can be effectively extracted using SC-CO_2 at a relatively low temperature and pressure (i.e., 50°C and 20.7 MPa) to give a very high quality oil. Cuphea seed oil's status as a specialty oil and its corresponding higher value make its extraction using SC-CO_2 an economically viable option.

Dose-response effects of omega-3 fatty acids on triglycerides, inflammation, and endothelial function in healthy persons with moderate hypertriglyceridemia

Skulas-Ray, A.C., *et al., Am. J. Clin. Nutr.* 93:243–252, 2011.

Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) have been shown to reduce cardiovascular mortality at a dose of ≈1 g/day. Studies using higher doses have shown evidence of reduced inflammation and improved endothelial function. Few studies have compared these doses. The objective of this study was to compare the effects of a nutritional dose of EPA + DHA (0.85 g/d) with those of a pharmaceutical dose (3.4 g/day) on serum triglycerides, inflammatory markers, and endothelial function in healthy subjects with moderately elevated triglycerides. This was a placebo-controlled, double-blind, randomized, 3-period crossover trial (8 wk of treatment, 6 wk of washout) that compared the effects of 0.85 and 3.4 g EPA + DHA/day in 23 men and 3 postmenopausal women with moderate hypertriglyceridemia (150–500 mg/dL). The higher dose of EPA + DHA lowered triglycerides by 27% compared with placebo (mean ± standard error of the

mean: 173 ± 17.5 compared with 237 ± 17.5 mg/dL; $P = 0.002$), whereas no effect of the lower dose was observed on lipids. No effects on cholesterol (total, low density lipoprotein, and high density lipoprotein), endothelial function [as assessed by flow-mediated dilation, peripheral arterial tonometry/EndoPAT (Itamar Medical Ltd., Caesarea, Israel), or Doppler measures of hyperemia], inflammatory markers (interleukin-1β, interleukin-6, tumor necrosis factor-α, and high-sensitivity C-reactive protein), or the expression of inflammatory cytokine genes in isolated lymphocytes were observed. The higher dose (3.4 g/day) of EPA + DHA significantly lowered triglycerides, but neither dose improved endothelial function or inflammatory status over 8 wk in healthy adults with moderate hypertriglyceridemia. The trial was registered at clinicaltrials.gov as NCT00504309.

Phospholipidic signaling and vanillin production in response to salicylic acid and methyl jasmonate in *Capsicum chinense* J. cells

Altúzar-Molina, A.R., *et al.*, *Plant Physiol. Biochem. 49*:151–158, 2011.

The phospholipidic signal transduction system involves generation of second messengers by hydrolysis or changes in phosphorylation state. Several studies have shown that the signaling pathway forms part of plant response to phytoregulators such as salicylic acid (SA) and methyl jasmonate (MJ), which have been widely used to stimulate secondary metabolite production in cell cultures. An evaluation was made of the effect of SA and MJ on phospholipidic signaling and capsaicinoid production in *Capsicum chinense* Jacq. suspension cells. Treatment with SA inhibited phospholipase C (PLC) (EC: 3.1.4.3) and phospholipase D (PLD) (EC: 3.1.4.4) activities *in vitro*, but increased lipid kinase activities *in vitro* at different SA concentrations. Treatment with MJ produced increases in PLC and PLD activities, while lipid kinase activities were variable and dose-dependent. The production of vanillin, a precursor of capsaicinoids, increased at specific SA or MJ doses. Preincubation with neomycin, a phospholipase inhibitor, before SA or MJ treatment inhibits increase in vanillin production, which suggests that phospholipidic second messengers may participate in the observed increase in vanillin production. ■

MAYBE WE DON'T KNOW BEANS . . . (CONTINUED FROM PAGE 133)

a plant-based diet, and legumes in particular, there is greater urgency for prospective controlled efficacy trials to clarify which beans are effective and in what dosage. There have been **no dose-response data** for beans on CVD risk in humans.

3. Measurement of additional effects of beans beyond cholesterol. Also lacking are trials that have investigated endothelial function or inflammatory markers as a result of prolonged bean consumption.

4. Improving on the designs of previous bean and cholesterol studies. Additional research on the relationship of beans and CVD risk reduction is needed to overcome design flaws that are apparent in previous studies.

a. Use of multiple types of beans and inconsistent dosing in previous studies. Different market classes have wide-ranging nutrient contents. Most CVD reduction studies have used white bean varieties. Phytonutrient content, for example, varies in white beans from that of the colored bean varieties, including pinto beans. Previous studies vary in treatment amount, ranging from 80 grams or slightly less than ½ cup to over 300 grams or ~2 cups per dose; one can of drained beans is ~280 grams. Still needing confirmation are what dose sizes and bean varieties lead to optimal cholesterol reduction.

b. Study sample diversity. Few previous bean intervention studies have included sufficient numbers of women to determine possible gender differences. Since CVD is increasingly common among women, interventions that reduce risk in women will allow researchers to reach more solid conclusions and prevent the need to make assumptions that results will be similar to those with men. Furthermore, women often have a strong influence on household food choices and control most of the meal decisions and preparation. They are in a good position to enact dietary changes for CVD prevention through their intergenerational spheres of influence. Thus, if women realize the benefits of beans, they would be able more effectively to promote bean consumption. Over half of our participants have been women in our pilot pinto bean study (53%) and baked bean study (56%). Other bean intervention studies have not always reported the ethnic background of participants, making comparisons between trials difficult.

c. Needed study design improvements. Most previous studies have been conducted in metabolic wards or other controlled research environments. The ability to generalize results and augment external validity is enhanced by using free-living participants. Several previous studies have not noted the usual intakes of beans by participants prior to the intervention. Persons who routinely consume beans before an intervention study may show less of an effect than persons who do not eat beans at all.

Summary

The available evidence points to the value of beans in traditional diets and the benefits of adding them in our modern "grab-and-go" diets. More research on their nutritional value will only add to the benefit consumers perceive alongside the realization of how inexpensive they are when it comes to improving a major health problem—elevated cholesterol. Further studies using consistent and contemporary methodologies are critical to substantiate the benefits of beans. In addition, the mechanisms by which beans, such as pinto, black or kidney, reduce cholesterol and may modulate FMD and inflammation have not been fully identified. These beneficial changes likely occur via increased fiber and micronutrients, reduced glycemic load, and anti-inflammatory phytochemicals. It is essential that funding for bean research come from national health research organizations and federal research agencies, not just industry. While we still may not know a lot about beans, like Jack and his beanstalk, a treasure of nutritional benefits awaits discovery.

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2010 saw a healthy oleochemicals market, but rising feedstock costs pose a challenge for 2011

Doris de Guzman

The oleochemical market, even glycerin, saw a significant improvement last year in terms of demand and operating rates compared with the 2009 slump.

The fatty acids sector, often seen as an indicator for the economy, saw improved worldwide demand, while fatty alcohols, which were predicted to be oversupplied because of huge Asian capacity rises in the past few years, was anything but in 2010, notes Norman Ellard, director of Singapore-based consulting and trading company Rohen (see Table 1). "Likely estimates of average capacity utilization would be 85% in fatty acids and closer to 90% for fatty alcohols, not including some unplanned shutdowns in the industry," says Ellard. "Market growth was healthy, driven by rapidly increasing demand in the large growing economies of China and India."

Many attribute the demand turnaround to the broad global economic recovery. Demand for most chemical products last year was substantially ahead of 2009, particularly in the automotive sector and even in residential construction, says Neil Burns, managing partner for US-based consultancy Neil A. Burns.

"Oleochemicals was no exception with demand being pulled through the value chain by the detergents, personal care, industrial, food, and fuels market," he notes.

Demand was also fueled by low inventory levels early last year, says Klaus Nottinger, managing director of Germany-based OleoConsult. Some consumers even refilled beyond their usual orders because of lower prices in early 2010.

"It is fair to believe that all oleochemical companies returned to profitability in 2010. Higher capacity usage resulted in a better cost position for producers while continuous price increases for fatty alcohols, fatty acids, and glycerin as well as their derivatives allowed margin improvements, in some cases to record highs," adds Nottinger.

Changing European landscape

With a raft of acquisitions and consolidation across the European oleochemical sector, 2010 was a good year for the region because of increasing demand coming from Eastern Europe, as well as decreased supply competition (Table 2).

UK-based producer Croda permanently shut down its Bromborough plant, in the United Kingdom, in December 2009. The plant had capacity to produce 55,000 metric tons (MT)/year of fatty acid, 17,000 MT/year of refined glycerin, and 24,000 MT/year of esters. The closure came when European demand was strongly picking up, notes Timothy Rush, vice president and general manager of US-based Oleon Americas, a subsidiary of Belgium-based oleochemical producer Oleon.

TABLE 1. *Global fatty acid/detergent alcohol capacity[a] (operating basis—2010)*

Country/region	Fatty acid '000 metric tons/year	Detergent alcohol '000 metric tons/year
China	1,300	480
Europe	1,250	720
India	325	125
Indonesia	1,000	290
Malaysia	2,250	460
Others	710	200
Rest of Asia	200	497
USA	1,000	635
TOTAL	8,035	3,407

[a]Note: Includes synthetic alcohol capacity. Excludes "mothballed" capacity.
Source: Neil A. Burns.

"Tallow was also much cheaper than palm stearine so imports from Asia were also ultimately reduced. On top of these factors, demand in Asia picked up, which reduced imports to Europe. This led to a stressed supply-demand situation," says Rush.

Last year, Croda also sold its 150,000 MT/year fatty acids and glycerin production facility in Emmerich, Germany, to Malaysian palm plantation owner and oleochemical producer Kuala Lumpur Kepong (KLK).

With former power players Croda and Germany-based Cognis divesting most of their oleochemical assets, Oleon now claims to be the largest oleochemical company in Europe, with a total capacity of 500,000 MT/year of fatty acids, esters, and dimers production. Cognis itself was acquired by German chemical company BASF last year. Cognis sold most of its global base oleochemicals business in 2008, which is now known as Emery Oleochemicals, with headquarters in Malaysia.

"We do not expect any major further consolidation in Europe as there are only about 25 other small family-owned companies left next to Oleon, KLK, Emery, and Croda. We don't expect them to sell, as they are now benefiting from the strong recovery after surviving the

big global economic crisis," notes Oleon's Rush. He adds that Oleon benefited most from the recovery last year, being positioned as a stable big local player in Europe.

Oleon is looking to expand globally and is investigating further investments in Asia. The company is currently producing esters at its expanding 18,000 MT/year Malaysian plant, which will nearly double in capacity by fourth quarter (Q4) of 2011.

Asian expansion spree continues

For many Asian oleochemical players, especially those vertically integrated with palm plantation owners, expansion through acquisitions or capacity increases is a major goal for 2011.

Aside from KLK's acquisition of Croda's Emmerich plant, Singapore-based Wilmar International acquired Malaysian oleochemical player Natural Oleochemicals (NatOleo) last year. The acquisition positions Wilmar as a dominant Asian oleochemical producer, with a market share of 35% in Asian fatty acids production capacity, according to a report from Malaysian investment firm CIMB Group. NatOleo has total fatty acids and glycerin capacity of 393,000 MT/year.

"Low interest rates and low profitability in 2009 made 2010 an attractive year for acquisitions and consolidations," says Nottinger. "For 2011, I would expect less activity as higher multiples on higher profits will probably make deals less attractive. Nevertheless, I would expect further downstream acquisitions by oleochemical feedstock companies and the entry of traditionally non-oleochemical companies into the fields of oleochemical derivatives."

Burns agrees, noting palm plantation companies as major drivers for continued consolidation in 2011. "The more progressive companies are looking not only to increase scale of operations in plantations but are also looking to capture more of the downstream value in oleochemicals and derivatives," he says.

Emery Oleochemicals not only intends to invest in downstream operations but also plans to expand its fatty acids capacity to provide value chain integration either by building its own plant or through acquisition within the next five years. Emery currently has around 1 million MT/year of total oleochemical capacity. The company is also building a 15,000–25,000 MT/year plant that will produce specialty oleochemicals in Telok Panglima Garang, Malaysia.

TABLE 2. *Estimated oleochemical and detergent alcohol capacity additions*

Country/region	Estimated capacity addition[a] 2011–2015 ('000 metric tons/year)
Africa/Mid East	200
China	300
India	200
Indonesia	450
Malaysia	350
TOTAL	1,500

[a] Note: Includes debottlenecking and expansions.
Source: Neil A. Burns.

"Major players are growing with vertical integration, where Asia will continue to be the major growth area for oleochemicals—both basics and downstream. For Emery Oleochemicals, 2011 will be another exciting year. We see many opportunities," says CEO Kongkrapan Intarajang.

He notes that Emery Oleochemicals' business recovered to pre-recession levels in 2010, predominantly driven by brisk downstream demand for higher-value products.

"Our higher-value products supply the personal care, automotive and construction industries, which were doing exceptionally well. Capacity utilization from top ASEAN [Association of Southeast Asian Nations] producers [was] above 95%, whereas the European and US

oleochemical industries operated around [the] mid-70% [range]," adds Intarajang.

The challenges the company faced last year were volatility of feedstock costs, mixed market sentiment projections, and the comeback of the biodiesel industry. "The oleochemical industry will likely see similar challenges, and our ability to stay very close to our customers and business partners will allow Emery to ride through these uncertainties," says Intarajang.

Bumpy ride for the United States

US industry players and observers agree that the market will be bumpy in 2011 as producers cope with feedstock price volatility and uncertainty in glycerin, mostly because of the reinstated $1/gallon biodiesel tax credit extension signed by President Barack Obama in December.

The expiration of the federal tax credit in December 2009 drove several biodiesel plant closures in the United States, which significantly reduced supply of biodiesel co-product glycerin. Biocrude glycerin from the biodiesel process typically contains methanol, while glycerin from oleochemical production, often referred to as splitter crude, is of a higher purity with no methanol residues.

Ready glycerin supply last year was soaked up by improving demand amid a recovering US economy, driving tight crude and refined glycerin supply/demand fundamentals in Q4. If US biodiesel production rises with the reinstated tax credit, another oversupplied glycerin situation could emerge, prompting similar price volatility as that seen in 2008–2010.

"The decline of biodiesel created major concerns for us as we buy and sell by-products from that industry and we had to shift emphasis more toward oleochemicals," says one US oleochemical trader. "The biggest challenge the industry faces for 2011 is raw-material cost and availability. If biodiesel returns, even more pressure will be placed on a limited and seasonal supply of fats and oils, further pressuring price and creating supply and price unpredictability."

Major US oleochemical player Vantage Oleochemicals agrees that the rising prices for fats and oils, and competition with the global biodiesel industry for raw materials, will be the major challenge in 2011.

"As a consequence of government mandates and subsidies around the globe, our industry and our customers will have to pay more for their basic raw materials. Unless the full cost is passed on to end-consumers, the value chain and subsequent profitability will get squeezed," says Don Ciancio, Vantage Oleochemicals vice president.

He describes the US oleochemical market in 2010 as better than expected in terms of demand, although high glycerin prices continue to be a negative factor, along with the rapid increase in triglyceride prices in Q4 2010.

"Certainly 2010 was a better year with demand probably up by 10–20% from 2009 for most companies, depending on the market mix. This moved utilization rates to a better level from the very low levels in 2009. Most market segments rebounded in 2010, with the exception of the housing market, which has greatly affected demand for plastic materials and in particular stearic acid," says Ciancio.

Recovery in the housing sector is not expected for another few years. "When recovery does occur, we expect a rise in demand for oleochemicals. In the meantime, we are working on several projects that could increase demand for fatty acids," Ciancio adds. The company also expects new applications for glycerin to begin to take root in Q2.

2011 market outlook

Many expect the fats and oils price increases seen in late 2010 to continue through the first half of this year. Prices of many oleochemicals are said to have risen substantially above the commodity peaks seen in June/July 2008.

Burns estimates lauryl alcohol prices increased between 125% and 150% to $3,100–3,500/MT (€2,400–2,700/MT) during the course of 2010—up by more than 60% from the June/July 2008 peak. "Back in the summer of 2008, all chemicals and commodities peaked, including crude oil. This time around, oleochemicals are out there setting a record pace of their own," notes Burns. "Buyers and sellers are in standoff mode, but so far, no one is daring to predict when the bubble will burst or even when prices will revert to the mean."

With lauryl alcohol a key surfactant feedstock, large sulfonators and ethoxylators have followed suit, pushing their own price increases throughout 2010.

"Driving oleochemical prices to high levels will undoubtedly cause customers to look for efficiencies in formulations that could impact demand, which is in fact apparently already taking place," says Ellard. "This effect could also impact consumer trends, opening up opportunities in lower price formulations, especially in the developing markets, and perhaps even with surfactants such as methyl ester sulfonates."

Burns expects demand growth in developed economies at 2–3% and higher growth in the BRIC countries (Brazil, Russia, India, China). Nottinger attributes rising consumer demand for fabric, home and personal care products in Asia and Latin America as major drivers supporting growth in oleochemical demand.

US-based surfactant and oleochemical producer Evonik Goldschmidt notes that continued consumer interest in green and sustainable products is a positive trend for the industry. Many oleochemical products sold in the past 25 years already fit the bill in general, says David Del Guercio, senior vice president and general manager for household care at Evonik Goldschmidt. "The problem is there have not been any industry-sponsored education programs to point this out. One of the challenges now is to educate consumers to enable them to make informed choices when purchasing products that fit their own definition of what is green or sustainable," Del Guercio says.

He points out opportunities for innovation and customization as consumer product companies intensively search for ways to improve their products' environmental profiles and performance without having to raise selling prices.

"Going forward, it will become more difficult to improve margins with the current products we and our competitors offer. A key route to upgrade margins is with new product and new technology introductions, which is a process that needs to be thought out with consistent and persistent execution," Del Guercio adds.

Additional reporting by Judith Taylor in Houston and Serena Seng in Singapore.

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Giants of the Past: David Kritchevsky (1920–2006)

David M. Klurfeld

David Kritchevsky, a biochemist by training, arguably contributed as many "firsts" to the field of lipid nutrition as anyone, including:

- First radioactive labeling of cholesterol with tritium
- Production of ^{14}C-labeled cholesterol by feeding labeled acetate to hens and isolating it from eggs
- First study of the metabolic fate of labeled-cholesterol following ingestion by humans
- Methods for separation and detection of steroids by reverse-phase paper chromatography
- First demonstration that unsaturated fat was less atherogenic than saturated fat
- Publication of the first books on cholesterol and β-sitosterol
- First evidence that specific fatty acids and triglyceride structure play roles in modulating serum cholesterol levels
- First finding that dietary fiber reduced serum cholesterol
- First observation that conjugated linoleic acid (CLA) feeding led to reduced atherosclerosis.

Kritchevsky was born on January 25, 1920, in Kharkov, Russia and came to the United States in 1923. He received B.S. and M.S. degrees from the University of Chicago in 1939 and 1942, respectively, in chemistry and organic chemistry. Kritchevsky described his need to get a job as a genetic problem—his father was poor and his mother was poor—and homozygous poor meant a job rather than a higher degree! He worked as a chemist at Ninol Laboratories in Chicago from 1940–1946. Subsequently, he earned his Ph.D. in organic chemistry from Northwestern University in 1948.

Kritchevsky obtained a postdoctoral fellowship with Leopold Ruzicka, Nobel laureate in chemistry, at the Federal Institute of Technology in Zurich, Switzerland, where he became interested in the metabolism of cholesterol. Melvin Calvin, another Nobel laureate in chemistry, hired him into the Radiation Lab at the University of California, Berkeley, where he worked from 1950 until 1952. He joined Lederle Laboratories in Pearl River, New York, and subsequently The Wistar Institute (Philadelphia, Pennsylvania) in 1957, where he remained for the rest of his career.

In addition to his position at Wistar, Kritchevsky held many positions at the University of Pennsylvania (Philadelphia). He was professor of biochemistry in the School of Veterinary Medicine, professor of biochemistry in Surgery in the School of Medicine, and a member of the Graduate Group in Biochemistry in the Graduate School of Arts and Sciences, which he chaired for 12 years.

Medical and dental students at Penn learned mnemonics for the Krebs cycle through Kritchevsky's version of "Tiptoe Through the Tulips." He was frequently invited to play the piano and sing lyrics he had written to the music of popular tunes. These included the "Cholesterol Biosynthesis Song," sung to the tune of "Jingle Bells," and "If I Had a Big Grant," to the tune of "If I Were a Rich Man" from the musical *Fiddler on the Roof*. And yet he did not read music, and played by ear! AOCS Press published a book of his songs, *Parodies and Commentaries*, in 2003—unfortunately it is now out of print.

Cholesterol, fats, and atherogenesis

Kritchevsky became interested in the physiologic and pathologic roles of cholesterol while studying its synthesis early in his career. He conducted the first large-scale biosynthesis of radio-labeled cholesterol by feeding ^{14}C-acetate to hens, collecting the eggs, and isolating high specific activity cholesterol from the yolks (Kritchevsky *et al.*, 1951). The labeled cholesterol was subsequently fed to animals and humans to trace the metabolic fate and estimate absorption and plasma half-life. He cooperated in this work with Max Biggs, a physician working for John Gofman, who had developed the ultracentrifugation technique of separating serum lipoproteins.

In 1954 Kritchevsky published the first observation that unsaturated fat was less atherogenic for rabbits than saturated fat (Kritchevsky *et al.*, 1954); this observation became the basis for much of the

subsequent work on type of fat and risk for heart disease. At that time, most of the field was still focused on total fat rather than type of fat.

In 1958, he published *Cholesterol*, the first book on that subject, which is now considered a classic. Fittingly, the week that the state of Pennsylvania increased the number of digits on automobile license plates from six to seven, he got a personalized tag that read C27H46O—the chemical formula for cholesterol. He produced many papers in the area of how triglyceride structure affects atherogenesis. He was a leader in the study of CLA with papers on its inhibition of both cancer and atherosclerosis. He coauthored the first book on β-sitosterol with O.J. Pollak in 1981.

With George Rothblat, he conducted early studies of cholesterol metabolism in cell culture that characterized cholesterol influx and efflux. He was a major figure in early studies of cholesterol metabolism and atherosclerosis in non-human primates; this work was carried out primarily in Africa over a span of 20 years with National Institutes of Health support.

Dietary fiber

In the early 1960s, Kritchevsky realized that dietary saturated fat was atherogenic for rabbits when added to a purified diet but not when added to a standard alfalfa- and grain-based diet. This set the stage for his publication in 1968 of the discovery of the cholesterol-lowering property of dietary fiber, when fiber was still known as roughage (Kritchevsky and Tepper, 1968). He said getting this publication accepted was the most difficult in his career, in part because it challenged the dogma that fiber was inert, indigestible material. This led to his ascendancy in the dietary fiber field for decades and friendships with the other leaders in this area.

In 1986, he and Denis Burkitt were featured on the cover of *Cancer Research* for their advancement of the study of dietary fiber and colon cancer. The latter was well known for his discovery of Burkitt's lymphoma, but in later years Burkitt directed considerable medical and popular attention to the lack of fiber in Western diets as a cause of various illnesses.

Kritchevsky was co-organizer with George Vahouny, of George Washington University, of a series of dietary fiber meetings that became the premier gatherings for the field and were published as a series of books on fiber. Work that he did with Jon Story on the binding of bile acids by dietary fiber led to new areas of research relating those observations to cholesterol-lowering and risk of colon cancer. It also stimulated Kritchevsky's concept of the ratio of primary to secondary bile acids being a risk factor for colon cancer.

Purified diets in research

In the early 1960s, Kritchevsky perfected the use of the cholesterol-free purified diet for studies of lipid metabolism and atherosclerosis (Kritchevsky, 1964). Although he gave credit to the few who had used such diets before him, Haqvin Malmros of University Hospital, Lund, Sweden, who was the first to feed such diets to rabbits, stated that Kritchevsky deserved most of the credit for the diet's utility.

This diet causes endogenous hypercholesterolemia when saturated fat and the correct types of protein (casein) and fiber (cellulose) are included—no cholesterol is needed in the diet, and the serum concentrations, while elevated, are only a fraction of those observed when cholesterol is fed to herbivorous rabbits. Observations with these diets led to Kritchevsky's lifelong emphasis on nutrient interactions, which many nutrition researchers are only now realizing may be as important as individual nutrient differences.

SELECTED EDITING

- *Advances in Experimental Medicine and Biology*
- *Advances in Lipid Research*
- *The Bile Acids*
- *Monographs in Atherosclerosis*
- *Atherosclerosis,* Western Hemisphere editor

Soy protein

Kritchevsky was one of the earliest investigators to study the health benefits of soy protein. In addition to his well-known work on soy, serum cholesterol, and atherosclerosis, he also studied it in relation to gallstones.

After he published a paper on inhibition of cholelithiasis in hamsters in the *American Journal of Clinical Nutrition* in 1979, he received a phone call from an irate individual who had read an article in the tabloid *National Enquirer* that stated doctors had the secret to curing gallstones but were keeping it to themselves in order to keep the medical business lucrative. His response to the caller—"For a hamster, you speak English very well"—put an abrupt end to their conversation.

Publication history

Kritchevsky published more than 1,000 papers, chapters, and books during his career; his 420 research papers have been cited over 11,000 times. His first paper, on the synthesis of a new compound, diethyl acetal of 3-methylbuten-3-al-1, was based on his M.S. work (Kritchevsky, 1943). He is listed as one of the 250 most highly cited authors in the field of agricultural sciences by the Institute for Scientific Information (see "Selected editing" sidebar).

Kritchevsky's 10 most highly cited papers, published from 1952 to 1997, reveal his ability to make significant contributions in a variety of areas over an extended period of time. Each of these papers was cited more than 148 times, as of March 2011. The earliest reported a method for detecting steroids in paper chromatography and the latest, on inhibition of atherosclerosis by CLA, has been cited more than 650 times. Other topics in his top 10 include *in vitro* binding of bile acids by dietary fiber, effects of soy protein on serum lipids and atherosclerosis, and the inhibition of tumors by caloric restriction.

His first paper in the *Journal of Nutrition* dealt with the compositional effects of heating fats (Kritchevsky *et al.*, 1962) and his last in that journal in 2003 called on scientists to avoid a reductionist approach in the field of diet and cancer (Kritchevsky, 2003). In his last several years, he continued actively contributing to science, even though he no longer ran a lab. By sharing ideas with colleagues, he was coauthor on four original research papers that appeared in 2006, when he was 86.

He was well known for research on a variety of factors affecting atherosclerosis: thyroid hormone, mitochondrial oxidation, and the lysine/arginine ratio of the diet. He tested many pharmaceutical agents for inhibition of atherosclerosis and published early studies

that D-thyroxine, probucol, lovastatin and other commonly used drugs were efficacious against atherogenesis. Kritchevsky was awarded many grants to support his research over the years from the government, nonprofits, and the food and pharmaceutical industries. He was adamant that industry support would not color his opinion of whatever was being studied and is to be admired for providing an example of how an ethical approach to science can coexist with private funding.

Reflecting Kritchevsky's interest in free exchange of scientific ideas, he was willing to share his thoughts with anyone in the field and was not worried about being preempted. He gave advice freely to people in academics, government, and industry and expressed disappointment that most large meetings had become places to present work that had already been published (see "List of selected awards and memberships" sidebar).

The composer Irving Berlin said, "Life is 10% of what you make it and 90% of how you take it." This captures the spirit reflected in David Kritchevsky. Scientific disagreements never became personal; he respected colleagues even when he disagreed with them—even when that feeling was not reciprocated. He was a mentor for many scientists, not just those who worked directly with him.

Work with the National Academy of Sciences (NAS)

During Kritchevsky's service on the Food and Nutrition Board of the NAS, he was part of a panel that authored a short report entitled "Toward Healthful Diets," which evoked tremendous controversy among scientists, the news media, and the general public. The panel found no conclusive evidence that dietary modification could reduce both blood cholesterol and heart disease; it pointed out that almost all the data were circumstantial, there was an absence of long-term safety information on low-fat, low-cholesterol diets, and there was a lack of evidence relating diet with cancer in 1980.

The report concluded: "Good food that provides appropriate proportions of nutrients should not be regarded as a poison, a medicine, or a talisman. It should be eaten and enjoyed." The panel recommended eating a variety of foods, adjusting energy intake and expenditure to avoid obesity, reducing intake of nutrient-poor foods if energy requirements are low, and moderating intake of sodium. The panel was excoriated for these conclusions by many. Yet the conclusions are still valid and could continue to be the basis for most dietary advice offered today.

Kritchevsky served on an NAS committee that wrote the first report on Diet, Nutrition and Cancer (1982). Afterward, he described the process as deliberate regarding all nutrients except when it came to fat; he said at that point the committee became a lynch mob. When literature from the 1940s that demonstrated reduced food intake inhibited cancer growth in rodents was reviewed, most of the committee dismissed those studies because they believed fat explained the observations and because not all required nutrients had been supplied in the diets of the time. In response, Kritchevsky and colleagues conducted a series of studies using carefully crafted diets that reawakened interest in caloric restriction as a cancer preventive and dissociated the effect of dietary energy from fat, which are highly correlated in human diets. The studies were also the first to implicate insulin-like growth factor I as a tumor growth factor responsive to chronic caloric deprivation, to show body fat was not driving the dietary fat effect, and to determine the degree of caloric restriction needed to inhibit tumorigenesis. Kritchevsky also proposed that the calorie-restricted animal was closer to normal than a freely-fed, sedentary control that should be viewed as the equivalent of a morbidly obese human.

LIST OF SELECTED AWARDS AND MEMBERSHIPS

AOCS awards

- Supelco-AOCS Research Award (1996)
- Alton E. Bailey Award (2006)

Nutrition awards

- Borden Award (1974) from the American Institute of Nutrition
- Outstanding Achievement Award (1978) from the American College of Nutrition
- Robert H. Herman Memorial Award (1992) from the American Society for Clinical Nutrition
- The inaugural recipient of the David Kritchevsky Career Achievement Award (2006) from the American Society for Nutrition

Other

- St. Ambrose Medal (1968) from the City of Milan
- Philadelphia Award (1977) from the American Chemical Society
- Professional Achievement Award (1979) from the University of Chicago
- Auenbrugger Medal (1994) from the University of Graz, Austria
- Special Recognition Award (1999) from the International Soybean Symposium
- Honorary D.Sc. (2001) from Purdue University, West Lafayette, Indiana, USA
- Lifetime Achievement Award (2005) from the International Whole Grains Symposium
- The American Heart Association established the David Kritchevsky memorial lecture, presented at its annual meeting.

Memberships

American Society for Nutrition; recognized as a Fellow
American Oil Chemists' Society; recognized as a Fellow
American Association for the Advancement of Science; recognized as a Fellow
American Institute of Nutrition; president 1979–1980
Society for Experimental Biology and Medicine; president 1984–1986
National Institutes of Health, study sections and committees
National Academy of Sciences Food and Nutrition Board, 1976–1980
Dietary Guidelines Advisory Committee of the US Department of Agriculture and US Department of Health and Human Services, 1983–1985

Attitudes toward life

One of Kritchevsky's central characteristics was skepticism about scientific ideas. He wanted data to back up suppositions, which was often the problem with dietary recommendations to prevent chronic disease. He quoted the late playwright, Wilson Mizner, as saying, "I respect faith, but it is doubt that gets you an education."

Another of his characteristics was immense energy. He said that if hyperactivity had been a recognized condition when he was a child, he probably would have been labeled that way. Fortunately he directed his energy and intellect into scientific research. He was more interested in getting the facts correct than proving a hypothesis. Kritchevsky was fond of quoting 19th century biologist Thomas Huxley, who said, "The tragedy of science is the slaying of a beautiful hypothesis by an ugly fact." This attitude explains, in part, why he did not prefer taking a problem and exploring it in greater and greater depth (which he likened to going down rabbit holes) and why he was more interested in understanding the big picture of nutrition and disease prevention.

An annual highlight in the lipid field was the December arrival of Kritchevsky's Christmas poem. For decades, he incorporated the names of many dozens of the best known scientists into rhyming verse that ran for several typed pages. Michael Brown, Nobel laureate in physiology or medicine, said, "You really know you've arrived when you make it into Dave's Christmas poem." Despite his seeming ease in putting all those names into verse, he said he had repeated trouble with only one name even using a rhyming dictionary—Kritchevsky. As a result he ended each edition by finding a name that rhymed, ranging from obscure Russian poets to former University of Iowa football coach Forest Evashevski, and providing a footnote identifying the person. The poems always ended with, "Good luck, good health from Dave Kritchevsky."

Kritchevsky was an extraordinary teller of stories and jokes. In addition, his ability to communicate sometimes esoteric scientific points was unparalleled. Not only could he explain difficult concepts to people without much formal education, he often expressed his views in subtle, or not so subtle, fashion that caught the attention of his colleagues. Quotations such as "moderation, not martyrdom" reflected his emphasis for dietary advice, and "we tortured the data until they confessed" pointed out that statistics should be used to confirm what should be obvious—if not, maybe the effects were too subtle for everyone to change their diets.

Appreciation

Kritchevsky's career in lipids was marked by many achievements in science, but he is equally well remembered for his easy demeanor and encouragement of younger scientists. It was common to find him in a hotel lobby surrounded by a large group of attendees from a scientific meeting where he was like a celebrity—greeting senior scientists by their first names while younger ones waited their turn to tell him about their work or to be told a joke or story about names that, until then, were just from a textbook or a classic paper. David Kritchevsky died at the age of 86 on November 20, 2006, in Bryn Mawr, Pennsylvania.

David M. Klurfeld is national program leader, Human Nutrition, at the US Department of Agriculture Agricultural Research Service (Beltsville, Maryland, USA). Contact him via email at David.Klurfeld@ars.usda.gov.

*inform*ation

For further reading:

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"The value of AOCS is a pretty simple equation for me: AOCS has given me an excellent conduit for keeping up with technologies and people throughout my career, and involvement in AOCS committees and activities has allowed me to grow as an individual, and to have a lot of fun in working with a lot of interesting and talented folks."

—MICHAEL F. COX

-standing members.

"AOCS has provided me international exposure in lipid research, and without the Society, I would never have achieved my goals no matter how hard I worked. AOCS is like an extended family to me. I can connect up and rely on my fellow members, be they the young or the famous; together we move the boundary of lipid research further."

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"My involvement in AOCS has provided unique leadership and mentoring opportunities in addition to helping me establish an international network of colleagues and friends I've come to depend upon. Within the Society, I obtain timely technical information and sharpen my leadership skills while having the freedom to try out new ideas and to positively contribute to the Society."

—JIM KENAR

Two meetings in one gorgeous location

AOCS is organizing two meetings, preceded by three short courses, in İzmir, Turkey, in June 2011. Both meetings and the short courses will be at the Hilton İzmir. All meetings and short courses will be presented in English, with simultaneous translation into Turkish.

Turkey's economy is notable for achieving one of the highest sustained rates of growth in the world, according to the US Department of Agriculture (USDA), having grown an average of 6% per year from 2002 through 2007. As a net importer of oilseeds, the country consumes roughly 1.5 million metric tons/year of oils and fats, and had an annual per capita consumption of 21.2 kilograms in 2008, the Economic Research Service of the USDA says.

Sunflower oil is the market leader, although olive oil production and usage are increasing. In fact, Turkey aims to become the world's second-largest producer of olive oil, after Spain, in the next 15 years, according to the Turkish Olive and Olive Oil Publicity Committee.

The first of the two meetings, Oils and Fats World Market Update 2011, has been developed for senior executives of companies that trade, supply, produce, and process oils and fats for both edible and nonedible uses. There, industry leaders will present global market updates on most major oilseeds in addition to discussing various aspects of oils and fats production, trading, transportation, and regulations.

This meeting is scheduled for June 20–21, 2011. See www.aocs.org/goto/WorldMarket for the latest program details.

The second meeting goes beyond market realities to examine the science and technology of oilseed processing. Titled "World Conference on Oilseed Processing, Fats & Oils Processing, Biofuels & Applications," the conference will run June 21–23, 2011.

Topics range from supercritical fluid technology and enzyme-aided extraction to the latest on the production of liquid transportation fuels from lipids. No review of science and technology would be complete, however, without delving into the processing and applications for value-added products such as omega-3 oils and other specialty oils.

Other topics at the conference include food, feed, and plant safety as well as lipids as feedstocks for industrial materials. A final session will focus on the analysis and mitigation of esters of both 3-MCPD (3-monochloropropane-1,2-diol) and glycidol in vegetable oils.

For the latest program details, visit www.aocs.org/goto/Turkey2011.

Three short courses will be held at the Hilton İzmir prior to the meetings. Basics of Oilseed Processing will be held June 18–19 and will cover the chemistry of oils and fats and all unit operations dealing with seed preparation, dehulling, pressing, solvent extraction,

Meetings at a glance

Oils and Fats World Market Update 2011
June 20–21, 2011
Hilton İzmir
İzmir, Turkey
www.aocs.org/goto/WorldMarket

World Conference on Oilseed Processing, Fats & Oils Processing, Biofuels & Applications
June 21–23, 2011
Hilton İzmir
İzmir, Turkey
www.aocs.org/goto/Turkey2011

desolventization, meal handling, partial degumming of crude oil, and other related unit operations.

The second short course is on the Sensory Evaluation of Olive Oil and will be held on June 18. Lecture topics may include:

- The mechanics of formally tasting olive oil,
- The identification of sensory defects in olive oil,
- The role of maturity and variety in oil flavor, and
- An overview of processing alternatives and their effects on oil types.

The final short course will be held June 19 and is entitled Edible Oil Refinery Optimization and Equipment Maintenance. Speakers will review critical issues related to refinery optimizations and maintenance. This program also will cover the chemistry of oils and fats, and every step of unit operations dealing with degumming, neutralization, bleaching, dyeing, hydrogenations, interesterification, and deodorization.

For the latest information on all three short courses, see the conference website.

The general chairperson of both conferences is Sefa Koseoglu, chief executive officer of Bioactives World Forum in College Station, Texas, USA. Program chair of the World Conference is Sevim Erhan, center director, USDA, Agricultural Research Service (ARS), Eastern Regional Research Center (ERRC), Wyndmoor, Pennsylvania, USA. Local chairpersons include Metin Yurdagul, chairman of the board, Culinary Products and Margarine Industrialists Association, Turkey, and Umit Ersoy, deputy chairman of the board, Vegetable Oils and Fats Industrialists Association, Turkey.

S. Koseoglu

The International Advisory Committee, as of January 18, 2011, was composed of Mark Andersen, regional industry relations director, European Union and Western Asia, American Soybean Association–International Marketing, Amsterdam, the Netherlands; Lanfranco Conte, chairman, Italian Society for Fat Research, and professor, University of Udine, Italy; Ignace Debruyne, president, Ignace Debruyne & Associates VOF, Izegem, Belgium; Mercedes Fernández-Albadalejo, head, Olive Oil Chemistry and Standards Unit, International Olive Council, Madrid, Spain; Michael Haas, research biochemist, USDA, ARS, ERRC, USA; Mark Matlock, senior vice president, Research, Archer Daniels Midland Co., Decatur, Illinois, USA; Hiroshi Nabetani, head, Reaction and Separation Engineering Laboratory, National Food Research Institute, Tsukuba, Japan; Ian Purtle, vice president and director of Process Solutions Technology Development, Cargill, Minneapolis, Minnesota, USA; Mustafa Tan, chairman of the board, National Olive and Olive Oil Council, İzmir, Turkey; Mohammed Basri Wahid, former director general, Malaysian Palm Oil Board, Kuala Lumpur, Malaysia; and Scott White, vice president and commercial manager, Bunge Oils, St. Louis, Missouri, USA.

Also as of January 18, 2011, sponsoring organizations for the World Conference included the Culinary Products and Margarine Industrialists Association of Turkey and the Turkish Vegetable Oils and Fats Industrialists Association. ■

AOCS Short Courses— Available Around the Globe in 2011

102nd AOCS Annual Meeting & Expo
Cincinnati, Ohio, USA

Function of Lipids in Foods
April 30–May 1, 2011

Basics of Edible Oil Processing and Refining
April 30, 2011

New Technologies in Oilseed Extraction and Edible Oil Refining
May 1, 2011

Learn more on each short course at **http://AnnualMeeting.aocs.org**.

World Conference on Oilseed Processing, Fats & Oils Processing, Biofuels & Applications
Izmir, Turkey

Basics of Oilseed Processing
June 18–19, 2011

Sensory Evaluation of Olive Oil
June 18, 2011

Edible Oil Refinery Optimization and Equipment Maintenance
June 19, 2011

Learn more on each short course at **www.aocs.org/goto/Turkey2011**.

14th AOCS Latin American Congress and Exhibition on Fats and Oils
Cartagena, Columbia

Basics of Edible Oil Processing and Refining
October 17, 2011

Oilseed Processing and Solvent Extraction
October 17, 2011

Oils and Fats Modification
October 18, 2011

SODEOPEC: Soaps, Detergents, Oleochemicals, and Personal Care Products
October 18, 2011

Learn more on each short course at **www.aocs.org/LACongress**.

Call for Papers and Posters

14th AOCS Latin American Congress and Exhibition on Fats and Oils

The Resource for the Ibero-American Market

October 17 –21, 2011 | Hilton Cartagena | Cartagena, Colombia | www.aocs.org/goto/LACongress

Call for Papers and Posters

The organizing committee is welcoming abstract submissions for oral and poster presentations. The technical program will feature invited presentations by leading experts as well as volunteer oral and poster presentations.

Simultaneous translation for Spanish/English will be provided for all oral presentations.

Deadlines

April 1, 2011 – Abstracts submitted prior to this date will be published in the registration brochure

May 16, 2011 – Abstract submissions close

Exhibition

Book your stand early and save! Stand rental fees increase on May 1, 2011.

Organized by LA-AOCS
Latin American Section of AOCS

Potential for algae as a renewable feedstock

Interview: Gregory L. Bafalis, CEO, Aurora Algae

David Schwartz

Since June of 2010, Greg Bafalis has been chief executive officer (CEO) of Aurora Algae, formerly Aurora Biofuels, overseeing the Company's strategy, operations, and high-level relationships. Prior to joining Aurora Algae, Bafalis founded and served as CEO of Green Earth Fuels, LLC, where he raised $168 million in capital and grew the company from zero to $250 million in revenue in under three years. Bafalis has more than 25 years of global experience in the energy sector—where he has successfully closed, financed, and operated over $3 billion worth of projects.

An outgrowth of post-graduate minds at the University of California–Berkeley (USA), Aurora has operated a pilot facility on the Florida coast that has consistently produced algae biomass since August of 2007. From their research and business headquarters in Alameda, California, Bafalis is now orchestrating a corporate transformation, one that will expand Aurora's hot zone of activities to another continent.

This interview was conducted in November 2010 by *Algae Industry Magazine*.

Q. The company seems to have repositioned itself recently—a new name, expansion into Australia. How do you describe the company's evolution at this stage?

A. Aurora was founded in 2006 by three gentlemen from UC Berkeley. Two were pursuing their master's degrees and one was getting his Ph.D. They established the company based on work done by a Berkeley professor named Anastasios Melis, who had some theories on photo-inhibition of algae.

Based on that work, and what Aurora scientists have done in the last several years, they've expanded on that to create what we call a pale green cultivar algae modification. In simplified terms, it lets light penetrate farther into the water. We're finding that we get much higher yield from the algae. We've also done a lot of work on our photosynthetic-based platform using open raceway ponds.

The initial focus of the company was to produce biofuels, so you have to be a very low cost producer. One of the things that they found out with our selected strain of algae is that it has a lot of other interesting characteristics. So while they pursued low-cost production methods, they started looking into the possibility of producing higher-value products.

I joined the company back in June with the concept of transforming the company from the biofuel focus into what it is now, a platform for growth based on growing algae. The main focus for us right now is omega-3 EPA (eicosapentaenoic acid) oil.

And the name change from Aurora "Biofuels" to Aurora "Algae" represents the change in focus from what I call the lowest-value product, which is the biofuel, into really where we should be—which is always pursuing the highest-value product we can produce. So we have been actively working over the past four months on transforming the company from an R&D focus to a commercial focus based on producing high-value products. Also, earlier this year, the company acquired a site in northwestern Australia to build its first demonstration facility.

When you look at the necessities for our algae, you need vast quantities of CO_2 and vast quantities of saltwater, since our algae

are saltwater based. You need great solar radiation, and a minimum amount of rain. And you really would prefer to be on non-productive land so you aren't competing with agricultural crops. When you consider all those factors and look around the world, there are a few locations that work very well, and northwestern Australia had all of the elements that we needed.

We are actively in construction now on a demonstration facility, comprised mainly of six one-acre (0.4 hectare) ponds that we believe will be able to prove our ability to grow algae outdoors at the yields we need. Since late August, we have had 38 micro-ponds, 2 m^2, almost laboratory size, but outside. And those have been growing algae to test various strains we have developed, to see how they will act in that climate. We've gotten very good data that seem to prove out all of the reasons why we went to Australia. The demonstration facility, the six one-acre ponds, will be completed by December of this year [2010]. We'll start growing algae on a large scale at the end of the year, or beginning of next year.

Q. Do you plan to scale up in this country as well, or are you looking to Australia as a production base of operations?

A. Australia right now is our base of operations, so we're doing the demonstration facility at the same time we are securing a large parcel of land for a commercial facility. We are in the permitting process for that and are planning to have everything in place by the end of 2011 to begin construction of our first commercial facility, about 15 miles (24 km) from the demonstration facility.

Q. Still seems like you went a long way from home to grow the next phase of the business. Any other reasons?

A. I came out of the biodiesel business and looked at a lot of different algae companies when I had my previous company. One of the things that always troubled me was it seemed like expedience was always driving these companies. What was the easiest, fastest thing to do? One thing about Aurora that really attracted me to coming here was that they were doing everything based on the science.

You really need to go to the optimal climate in order to grow algae at its highest productive rate. And we looked at Texas, places in Mexico, and while the conditions were good, they weren't optimal. Texas might have great sun, but it also gets a lot of rain, a lot of clouds, and is too cold certain times of the year. The same can be said of New Mexico—there are optimal times of the year, but you get into the winter and it's basically too cold to grow. We liked the west coast of Mexico, but there wasn't a good source of concentrated CO_2 there, so it was going to be very expensive.

We really wanted to develop this business on fundamentals: Where can we build the business at the lowest cost with the optimal conditions? So that really drove us to look at places around the world. Northwestern Australia happens to be the onshore landing point for North West Shelf natural gas, so there are large LNG [liquefied natural gas] facilities there, fertilizer facilities there, all that had very good concentrated CO_2 streams, and that were willing to enter into a very attractive business relationship with us for using their CO_2.

Q. You are quoted (on your website, www.aurorainc.com) as saying, "For the past four years we have focused on developing high-performance, versatile strains of algae in preparation for full-scale commercialization—and to be able to say we have reached the end of that development process is exciting." What is the "end of that development

process" specifically? What is the milestone that you are referring to?

A. The ability to grow on a consistent basis at the yields that we require to make our company profitable. That's really what it's about. As far as my comment, I don't want to say we've hit the end of our science, but we've gotten to that milestone that allows us to produce on a commercial scale.

Q. What parts of the algal production process does Aurora plan to pursue at commercial-scale level?

A. We're going to go from inception, from the cultivation of algae, all the way through the backend processing and refining. We will make products that we can sell out into the marketplace. We're not going to just sell our algae strains or sell our technology. Our basis is to be a vertically integrated business, just like a palm producer, who grows palm trees, and produces the oil, and produces biodiesel and oleo chemicals and other consumer products. That's the model we are pursuing.

Q. What is the basic process for cultivation at Aurora?

A. We use open raceway ponds. We've done some enhancement on those ponds to make them much more energy efficient in moving and mixing the water, and in the harvesting process. One of the things I like here is that we haven't gone out and tried to create cutting edge science that's never been tried before.

Our engineering side has actually taken a lot of equipment and processes used in other applications and modified them to use in our backend processing. So, for instance, in oil extraction, it is based on technology used to extract oil out of soybeans, or out of nuts—just a simple hexane extraction process. On the harvest side, we're using existing wastewater treatment techniques that we've adapted to harvest our algae, which are about 5 microns across. We've also come up with a flocculation process for harvesting.

I think the way we've packaged our back end together is unique, and there are patents around many of those processes. But most of the production is really not anything new—mainly processes that have been tried and true and just used in other industries.

Q. What are your first commercial products going to be?

A. We will produce three products in our first facility. One is the omega-3 EPA oil, in a relatively concentrated form. There are a lot of very interesting applications for omega-3 EPA. It's a great anti-inflammatory, it's great for the heart. With those applications, there are a number of customers who want to start putting it into their products.

We will also produce biodiesel. And we will produce a biomass fishmeal replacement. There are a lot of fish farms developing around the world, and the price for fishmeal has skyrocketed over the last couple of years. And then we'll continue to evolve the technology to bring out the proteins and carbohydrates and go after other higher-value markets as they appear.

Q. What do you think Aurora does better than anyone else out there currently?

A. I think that the best thing that Aurora has done is build a business based on fundamentals and not based on subsidies. I think everything that we've done and focused on is building this business based on being cash flow positive in a relatively short time frame. There are things that we have done scientifically that I think are at the forefront

of the industry. And there are things that we've done on the engineering side that I think allow us to harvest and process at a relatively low cost. We've got 27 patents filed at this point, and those patents are split nearly equally among the science and the technology.

Q. In this, and previous, ventures you have been able to raise a significant amount of development capital. How do you see the venture capital (VC) community participating in the algal industry at this time?

A. It's a very interesting sector right now. I think the VC community is having an epiphany on their future, because in the past they could put $5 million into some virtual reality company that was going to do something on the Internet and make a lot of money. Now, if you look at the solar sector, look at the algae sector, these are large infrastructure types of businesses where a $5 or $10 million check doesn't cut it.

From our standpoint, where we are trying to attract capital from many sources, we're still talking to a lot of VCs. But more and more where our real funding is going to come from is from larger funds, such as private equity funds or commonwealth funds. I think that is more of our focus going into the future. We're talking about hundreds of millions of dollars to build large-scale commercial facilities. That's not generally in the VC world—it's more in the private equity world. If you are going to build thousands of acres of farms, I don't think there are many VC firms that can play at that level.

Q. What do you think about the state of the algal production industry?

A. I guess I'm more concerned with the industry than I am with my business. I think we have a solid business model. I think the industry itself isn't necessarily focused in the right area, and I think it is taking great leaps of faith in its ability to overcome huge obstacles to service what I consider very low value markets. I think if you have a fuel-based focus and you're raising money against that, and you're going to commercialize it on today's basis, it's just not going to happen. Not unless you are being funded by the government. And that is a very big concern for me, that some of these are going to be massive failures and put a black eye on the industry.

Q. Your advice to the start-ups in the industry?

A. I would love to not have a bunch of new competitors! But at the end of the day, everybody's going to gravitate to where there's success, and so to the extent we are successful in building out our commercial facilities and selling into these marketplaces people are going to gravitate this way.

I think that it's a natural evolution, and that folks in this industry will look at what is logical, which is, you're producing algae. What can you do with algae that nets you the highest value? So then why would you pursue something you're going to sell for $3 a gallon when you can do something different with it and sell it for $50 or $100 a gallon?

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