

INFORM

International News on Fats, Oils, and Related Materials

OMEGA-6 to OMEGA-3 via **GENE THERAPY**

ALSO INSIDE:

Designing tastier soy varieties

Cover crops engineered to make industrial lipids

Ingredient that improves gut health

624

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AOCS



FEATURES

8 One dose of *Fat-1* gene therapy eases osteoarthritis in mice

This article describes research showing a single dose of *fat-1* gene therapy eased osteoarthritis symptoms in mice by converting omega-6 fatty acids into anti-inflammatory omega-3s. The treatment reduced joint damage, inflammation, and signs of premature cellular aging tied to obesity. While promising, the therapy has only been tested in animals, and more work is needed before human trials can begin.

12 Removing off-flavors from soy

Scientists are developing new soybean varieties designed to eliminate the “beany” and “painty” off-flavors that turn consumers away from soy-based foods. By reducing polyunsaturated fatty acids and targeting key enzymes, they created high-oleic, flavor-null soybeans that retain nutrition without the unpleasant taste. Read about how these advances could make soy protein more appealing for use in snacks, beverages, and plant-based alternatives.



16 Metabolic engineering enables lipid redesign

Researchers have engineered cover crops like camelina and pennycress to produce acetyl-triacylglycerols (acetyl-TAGs), specialty plant oils with low viscosity and improved cold properties ideal for industrial uses. By optimizing enzymes, reducing competing pathways, and increasing precursor supply, they achieved nearly pure acetyl-TAG levels in seeds. The article describes how the cover crops were engineered as sustainable sources for biofuels, lubricants, and other biobased products.

22 Scientists study a valuable ingredient in olive oil

The compound 3,3-dimethyl-1-butanol (DMB) works in the human gut to inhibit some inflammatory diseases by preventing the formation of the trimethylamine enzyme. In animal models, this enzyme creates a compound in the liver that seems to facilitate a build up of fat and cholesterol in the arteries. An international research team developed a method that confirms DMB's presence in extra virgin olive oil and reliably measures the amount. The next step is to better understand the contribution DMB makes to improving human health.

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Biotechnology Division

2025 DIVISION ACHIEVEMENT AWARD WINNER

Xavier Malcata is a professor at University of Porto, in Porto, Portugal and a senior researcher at LEPABE, a faculty of engineering research unit operating in the fields of chemical, environmental and biological engineering at the university.

INFORM: *Can you share your journey into the field of biotechnology? What inspired you to pursue this path?*

Malcata: I was motivated from the very beginning by the prospect of working in biotechnology since it offers an array of engineering opportunities. My journey started with a bachelor's degree in chemical engineering from the University of Porto, followed by a chemical engineering doctorate with a minor in food science, biochemistry, and statistics from the University of Wisconsin, Madison.

The research program for my dissertation covered reactors with immobilized lipases aimed at tailoring edible fats. I eventually applied my background on modeling from first principles to optimize biochemical processes *in vitro*. From then on, I have focused on various fields of biotechnology, from characterization and improvement of Portuguese traditional foods, through identification and study of adventitious probiotic cultures from non-dairy sources, to design and optimization of photobioreactors for operations with microalgae.

INFORM: *Your work has had a substantial impact on the field of biotechnology. Can you discuss one or two key projects that you believe have made the most difference?*

Malcata: My studies of lipase immobilization on multiple supports helped pave the way for current industrial applications of immobilized lipases to engineer existing fats via inter- or trans-esterification with target fatty acids bearing a stronger nutritional role or a more pleasant sensory feature. Lipases were by that time seen as a solution in search of a problem. Their unique activation at the interface between aqueous media and hydrophobic materials (plastic polymers or insoluble lipids) had hampered deeper studies. The difficulties stemmed from simultaneously handling the interfacial chemical reaction and the mass transfer between the biphasic systems that nature designed. Later, I delved into the possibility of using lipases for reactive distillation to produce volatile esters with sensory notes and combining separations with *in situ* enzyme-catalyzed reactions.

INFORM: *What are some of the biggest challenges you have faced in your research, and how did you overcome them?*

Malcata: The biggest challenges faced during my research were probably similar to those faced by most researchers. The need to find sustained sources of funding to cover the



Xavier Malcata

expenses incurred, as well as sophisticated analytical and processing equipment; and to find graduate students available to pursue an academic career, motivated in advancing the state-of-the-art, autonomous in their performance, curious in their approach, thorough in their analysis, and resilient in their work. Research is a passionate game where one works at the edge of knowledge but never knows what will be found ahead. As Thomas Edison once said, "I never failed in research; I just learned one thousand ways that do not work."

INFORM: *How has your research evolved over the years, and what emerging trends do you see in biotechnology that excite you?*

Malcata: I started from a classical background in chemical engineering supported by thermodynamics, chemical kinetics, transport phenomena, and process control as structural pillars. As I became more proficient at handling and understanding viable microorganisms and their enzymes to bring about reactions with rates and selectivity at will, I realized that those same areas of knowledge applied at the microscale. But the phenomena take place simultaneously and are subjected to complex interactions that guarantee the best use of envi-

ronmental resources available in the medium. It was indeed a challenge to mechanistically model such microorganisms or their enzymes because the same laws of nature apply there that also apply to chemical processes at industrial scale. At present, I am considering specific yet integrated changes in the metabolic pathways of photosynthetic microorganisms to enhanced the production of commodities that may serve as cleaner fuels in the near future.

INFORM: *How do you believe this recognition will influence your future work in biotechnology?*

Malcata: I must confess that, whenever selected as a recipient of an award, especially if granted by a respected international scientific or professional society, I feel an indescribable amount of pride to have my work recognized by peers worldwide, and a unique sensation of accomplished duty. Over several decades, I have pursued a consistent and integrated research program to help advance the state-of-the-art in topics motivated by my scientific curiosity, and the possibility of transferring that knowledge to undergraduate and graduate students. The track record I have built has also made a difference in my performance in the classroom. My lectures have plenty of “war stories,” coming from real life and actual experience—prone to emphasize practical applicability of advanced knowledge, and rational application of first principles to understand and solve whatever situations and problems arise.

INFORM: *What role do you see AOCS playing in fostering collaboration among scientists and industry professionals in biotechnology?*

Malcata: AOCS addresses the interface between many distinct disciplines within the core field of fats and oils. It has established itself as an invaluable stakeholder, with complementary and unique expertise spread throughout its membership. Biotechnology is one of the best examples of how tools inspired by our surroundings (namely, biochemical processes established in nature) can be used to our advantage to improve oils and fats, in both nutritional, functional, and envi-

ronmental terms. In addition, both the fundamental issues of science and the applied issues of technology are included in the portfolio of activities AOCS offers—from topic-oriented workshops to the annual meeting with many thematic sessions, from advanced books meant for professionals and the scientific community to a membership magazine covering daily issues of wide interest. Furthermore, its awards designed for public recognition of exemplary careers and outstanding performance in academia, industry, or government contributes to the level of excellence it has consistently pursued.

INFORM: *What advice would you give to young scientists and researchers aspiring to make an impact in biotechnology?*

Malcata: My advice to young scientists at the beginning of their careers is simple and straightforward, be tenacious with your approaches, but humble with your results. Research is a double-edged sword, in that it will eventually yield some useful results—from either the understanding or the application points of view—but typically at the expense of many failures along the way. Therefore, a strong character is a must, be able to overcome misfortunes and poor outcomes while already looking for the next move and maintain an optimistic attitude. On the other hand, research (especially in biotechnology) is rather expensive, and thus only possible at the expense of public money that might be used otherwise. This means that whatever successes are attained, they would have been hardly possible without the anonymous support of your fellow citizens. They deserve consideration for their implicit input, well beyond the fame earned by the researcher himself. In fact, lasting impacts may come out of a fortunate breakthrough but are usually the outcome of long paths of consistent, resigned, incremental work, building on the results by peers and relying on multi-tasked teams holding complementary expertise. Finally, research cannot be blindly developed. It should ultimately aim at improving the quality of life of mankind and the preservation of our common home called Earth—otherwise it will be meaningless and devoid of social value.