Omega-3-enriched foods are growing in popularity among consumers and producers. The fatty acids are essential for normal growth and function in humans and cows. They also have many health benefits, such as lowering blood cholesterol and reducing inflammation. Fish oils are the main source of omega-3s. However, global fish stocks are diminishing and demand is exceeding supply. University of Guelph researchers are studying novel sources of omega-3s and their integration into milk products and animal feed.

Food science professor Mansel Griffiths is researching whether omega-3 fatty acids, produced by bacterial organisms called microbial lipids, could be used as an alternative source. “Omega-3s are receiving considerable attention in terms of both human and livestock nutrition,” says Griffiths. “Our goal is to use microorganisms as novel sources of fatty acids through their incorporation into fermented food products, such as milk and yogurt.”

Eicosapentanoic acid (EPA) and docosahexanoic acid (DHA) provide the most health benefits within this class of omega-3 fatty acids. Most organisms can produce large amounts of EPA, but little or no DHA, says Griffiths.

Griffiths’ research team isolated genetic sequences in these microorganisms involved in generating high levels of EPA and DHA. Isolating genetic sequences in these microorganisms is novel in terms of microbial biosynthesis, he says. This discovery will make these microorganisms a viable source of omega-3s that can be used in prospective applications, he adds.

Griffiths and food science research associate Dr. Mitra Amiri-Jami streamlined the transfer of the isolated genetic sequences using constructed gene-transmitting organisms called vectors. The vectors shuttle the isolated genes into target cells, which paves the way for unassisted EPA and DHA production.

The researchers used E. coli to produce EPA and DHA and transferred the genes into lactic acid bacteria. “E. coli is a useful organism for microbial biosynthesis,” says Griffiths. “It’s easy to grow in the lab, and it allows for efficient extraction of fatty acids, leading to larger scale, commercial production of omega-3s,” he adds.

“We believe this to be the first successful transformation of EPA and DHA biosynthetic gene clusters into lactic acid bacteria,” says Griffiths. “We can now look more closely at expanding existing nutritional and commercial applications.”

For example, Griffiths is examining novel ways of incorporating these biosynthetic genes into probiotic strains, and providing a source of omega-3-enhanced probiotic cultures for the production of fermented dairy products, such as yogurt and fermented silage. As these probiotics become part of the normal gut microflora, they may promote EPA and DHA production in humans and animals, he says.

Griffiths believes this research will help the Ontario dairy industry advance the production of functional foods and animal feed. Microorganisms may allow more efficient production methods since they are a reliable and relatively inexpensive source of omega-3s, he says.

Future studies will examine the bioavailability of these novel foods by analysing the absorption and activity levels of omega-3s after consumption.

Alexandra Sawatzky is a student writer for the University of Guelph’s office of research. Mansel Griffiths is the director of the Canadian Research Institute for Food Safety, which funds a significant portion of this project. Additional funding is provided by Dairy Farmers of Ontario and the Natural Sciences and Engineering Research Council.