New studies in fish oils: 'Molecular Nutrition Research'

(The following report on the "Seafood and Health '85" conference was prepared for JAOCS *by Dr. Robert Ackman, professor at the Technical University of Nova Scotia, Canadian Institute of Fisheries Technology, in Halifax, Nova Scotia, Canada. Dr. Ackman will be chairman of the AOCS Short Course on Marine Lipids to be held May 11-14, 1986, in Hawaii.)*

Dr. Artemis P. Simopoulos, chairman of the Nutrition Coordinating Committee of the National Institutes of Health, used the novel terminology "molecular nutrition research" in announcing that the NIH would issue a joint program announcement on Dec. 1, 1985, calling for proposals for research on "Biological Mechanisms of Omega-3 Fatty Acids in Health and Disease States."

This announcement, made during the Seattle "Seafood and Health '85" conference of Nov. 15-16, 1985, reflects the rapid accumulation of research data since 1978 on the effects of fish oils and lipids on the human cardiovascular system, and the need to extend and evaluate the effects of omega-3 fatty acids into eicosanoids, autoimmune and inflammatory diseases and other major health problem areas.

The National Marine Fisheries Service, a cosponsor of this conference on "issues, questions and answers" in the seafood-public health interaction, supplied materials for the NIH program. This participation was emphasized by W. G. Gordon of the NMFS as a further recognition by government that the research and clinical data on omega-3 fatty acids had achieved a critical mass. Thomas F. Billy of the NMFS noted that, in addition to research to clarify the precise roles of the omega-3 fatty acids found in all seafood, more effort must go into educating consumers who are health-oriented but not comfortable with seafood.

The registration included many dieticians as well as technical and marketing representatives of the seafood industry. Sponsoring agencies such as the West Coast Fisheries Development Foundation and the Alaska Seafood Marketing Institute participated actively. The wider interests of the seafood industry were shown by the additional sponsorship of the National Fisheries Institute, the North Atlantic Seafood Association and *Seafood Business Report* magazine, and the active interest of food industries such as General Mills of Minneapolis.

Overviews of the role of fats and fatty acids, especially of the omega-3 series, in the field of public health were provided by distinguished clinical researchers such as G. S. Onenn, W. P. Castelli, E. L. Bierman, W. E. Connor, S. H. Goodnight and R. A. Darmali and were up-to-date. These fatty acids and associated fats were related to the nutritional needs of consumers by E. R. Monson and M. T. Childs. The long-standing view that risk of cardiovascular disease is associated with high serum cholesterol levels was well-documented by several speakers and levels were extended into the ranges previously thought to be "normal" (180-220 mg/dl). The increase in the proportion of HDL lipoproteins, the "good" cholesterol, was discussed in terms of the need for greater fish and shellfish intake by most North Americans. Particular attention was paid to the long-term study in Zutphen, The Netherlands (Kromhout et al., N.E.J. Med. 312:1205-1209 [1985]), on fish-eating and non-fish-eating population groups. The 50% reduction in mortality from coronary heart disease on the basis of a few meals of fish per week was hailed as a major opportunity to extend the current view of seafood as a "healthy" food into a more specific dietary benefit. This favorable image of seafood has already been recognized and publicized by the American Heart Association and other bodies, but only in terms of low fat content, low saturated fatty acid content and high polyunsaturated fatty acid content. The increase in the proportion of HDL lipoproteins and the decrease in serum triglycerides, both associated with an intake of fish lipid fatty acids, now are thought to be clinically significant.

The administration of fish oils in capsule form was reported to be an effective means of lowering blood lipids in severe cases of hyperlipidemia. This was not thought to be as suitable a source of omega-3 acids for the general public as simply increasing fish and shellfish meals to two or three a week. Food is a self-limiting form of diet therapy. There also was discussion of the positive need for selenium and other trace elements to be available as possible cofactors or synergists with omega-3 fatty acids.

The variety of seafoods available was a major interest of the audience, and it was pointed out clearly by several speakers that the total sterol in most mollusks includes roughly 50% of vegetable sterols, with only the other half being cholesterol. Many older tabulations of data often reported the total as cholesterol. Reports on clinical trials showed that most shellfish actually were beneficial in relation to blood lipids, with the vegetable sterols presumably blocking cholesterol absorption. The mollusks and crustaceans proved to be good sources of omega-3 fatty acids as well. There clearly are gaps in our knowledge of the sterol and omega-3 fatty acid contents of seafoods, especially crustaceans, and also of the role of various methods of food preparation, both in the fishing and seafood industries and at the consumer stage. Fatty fish were felt to be interesting additions to seafood meals, but by no means the only good sources of omega-3 fatty acids.

"Omega-3 fatty acids" is a blanket term which includes the C18 α-linolenic as well as the successor acids eicosapentaenoic acid (EPA, C20) and docosahexaenoic acid (DHA, C22). The latter acids make up 30-50% of marine fish cellular lipids and 10-30% of the oils produced from fish depot fats. The "Seafood and Health '85" conference had little to add to the question of whether α-linolenic acid is an "essential" fatty acid, as the cardiovascular role of EPA received the most attention. DHA, usually quantitatively nearly as important in fish lipids and oils as EPA, also received little attention. The functionality of DHA in the nervous and visual systems was cited by W. E. Connor as an area where it still is uncertain if the α-linolenic acid available from vegetable oils can supply the necessary DHA at certain life stages or in some disease states. In plasma phospholipids the levels of EPA and DHA can be influenced by the dietary α-linolenic acid of vegetable oils, but the conversion and clearing for these two acids are different. No adverse comment was made with respect to the DHA accompanying the EPA beyond the need for assessing the dietary levels of tocopherols and selenium if the highly unsaturated EPA and DHA were increased radically over normal dietary intakes.

A rapidly developing view current at the "Seafood and Health '85" conference was that the massive doses (up to 20 ml/day) of fish oils given in the past to demonstrate the effects of EPA in the circulating blood lipids were not actually necessary except for clinical therapy and certainly were not desirable for most of the North American population. Future research likely will be directed to assessing long-term benefits of lower daily intake levels of EPA, probably of the order of 120-150 mg/day, in a large section of the population. Given the lengthy gestation period of our present knowledge of blood cholesterol and triglycerides, the role of the omega-3 series of fatty acids in human health may take up to 10 years to mature.

The current level of recognition of the role of omega-3 fatty acids in human health, starting with the work of J. O. Bang and J. Dyerberg in 1978, is, however, a remarkable instance of the rapidity with which contemporary research can spread. Fats and oils are suffering from an adverse image as the cause of obesity and many associated health problems. A future positive role for the omega-3 group of fatty acids in human health seems certain, probably in its way as important as the linoleic acid family cascade of leukotrienes and prostaglandins. Although the seafood industry initially may be the main beneficiary, the fats and oils community should be prepared to participate actively in all aspects of its development.

New Nestec R&D facility

Nestec, the Nestle companies' wholly owned research and development arm, is building a basic research center in Vers-chez-les-Blancs, just outside Lausanne, Switzerland. The facility, to be staffed by 450 people, is expected to be ready for use by September 1986. Company officials project it will take three to four months after that date to move all operations into the facility.

Five departments will be in the new facility. The fundamental sciences department will include synthetic and organic chemistry, flavor chemistry, math, statistics, instrumentation and information technology. The food science department will focus on lipids, carbohydrates and proteins, including mechanistics, separation and compositional identification. The third and largest department will be nutrition, including basic and applied as well as clinical nutrition. Work here also will focus on proteins, carbohydrates, lipids, trace elements, water and vitamins, including psychobiology, examination of food and fluid intake, obesity, and metabolic and digestive diseases. The fourth department will be toxicology, including classical, genetic and carcinogenicity. This section will include the animal house, consisting of 52,000 to 70,000 small animals for research purposes. The final department will be biology, which includes immunology, molecular biology, biochemistry and fermentation.

A sixth department, developmental biology, will remain at the company's facility in Orbe, Switzerland, until further funds are available to expand the new facility. This department consists of neurobiology, neuropsychobiology, oncology and neurochemistry.

The estimated cost of the new facility is 250 million Swiss francs.