Viewpoint

Fats and oils in the 1980s

For the first issue of the decade, JAOCS presents eight brief essays on what the coming decade may hold for various segments of AOCS-related specialties. Contributors were asked to review current concerns, to conjecture at what might happen during the next ten years, and, where appropriate, to conjecture as to what problems researchers might be asked to help resolve.

The essayists accepted the challenge, with most noting that predicting the future can be precarious. It also provides some interesting reading.

Forecast for soybean oil

Herbert J. Dutton

"Your young men shall see visions and old men shall dream dreams" – Acts 2:17.

Whosoever would prophesy the future would do well to consider not what is here and now – the large and established institutions, markets, and products – but rather the small but growing, the leading edge, the new idea, the growing tip, the recent product – for herein lies tomorrow. Nor can he who looks to the future of the oil industry ignore new socioeconomic thoughts, values, and trends. Concerns for energy, pollution, and human health and welfare may well outweigh or modify traditional criteria of economics and engineering feasibility in shaping tomorrow.

If we agree that the future of the oilseed industry lies in the small but growing tip, it behooves us to look beneath the surface to examine the cambial layer to assess what direction that advancing boundary is taking us.

Energy

One of the small but rapidly gorwing oilseed crops is palm, and it poses a threat to soybean oil, but not soybean meal. To mention palm oil under the heading of energy may at first seem irrelevant, because today's outlet for both soy and palm oils is essentially as an edible oil. However, if one reviews palm production of nearly 2 tons/acre, compared to soybean production at 300 lb, and its estimated cost refined and delivered to our shores of 10 cents/lb, one is looking at a potential annually renewable diesel fuel at 70 cents/gallon! Thus, with productive life from its third to its thirty-fifth year, photosynthesizing 365 days a year under tropical sun and rain and with its canopy continuously extended for solar energy capture, palm constitutes an oil-producing biomass crop that must compare to the current sugar cane plantations of Brazil. Now we learn that in Brazil, the addition of triglyceride oils and alcohol produced from sugar cane is being considered to extend diesel fuels. Is it too speculative to suggest whereas soybean oil of antiquity may have provided "oil for the lamps of China" that palm oil may offer an annually renewable energy source to tomorrow's world? At some time in the, we hope, distant future Homo sapiens must learn to stop squandering the fossil fuel reserves of photosynthetic energy of ages past and to live within the annual energy budget coming to earth – namely solar energy.

Renewable resources

The search for new annually renewable energy sources inevitably must be linked with the search for annually renewable sources of industrial raw materials. Vegetable oils in recent decades were replaced by the then less expensive petrochemicals, but vegetable oils now will need to be reconsidered. Linseed oil paints, now in water emulsion form but with all of their well-known performance advantages, may now need to be rediscovered! Sperm oil from the endangered whale can be replaced as extreme pressure lubricants for our auto transmissions by vegetable oil derivatives, sulfurized according to our growing knowledge of sulfur organochemistry. Rubber tires from soybean oil, demonstrated under the duress of World War II, and nylon 9 fibers made from soybean soapstock more recently may find their appropriate competitive outlet in a petroleum-deficient world.

Advanced Technologies

By analogy to vegetable oils' big brother, petroleum oil, we can expect more automation of processes to occur in our refineries. First, to complete the conversion of refineries to continuous process, the last of the batch unit operations, namely hydrogenation, must be replaced by continuous reactors. Concomitantly, new and instantly indicating transducers for *trans* isomers, iodine value, and thermal properties must be developed and their information fed to "closed-loop" or "process control" computers. In this way, operations can be made more flexible and a diversity of hardened products produced to meet the myriad of user specifications without recourse to the expense of bulk storage and the more or less empirical blending of stocks by human intervention.

Second, new energy-saving processes increasingly will find their way into production. Physical refining with its four-in-one unit operation will find its place among energy-saving (and less polluting) new processes. Low temperature palladium catalysts for hydrogenation, soluble or liquid metal catalysts, *cis*-producing catalysts, and heterogenized homogenous catalysts are on the horizon for energy saving or process simplification. Low temperature, specific enzymes will find their place; e.g., lipoxygenase, which is available in high activity in raw soybean meal, allows soybean soapstock to be reacted with atmospheric oxygen to give new oxygenated fatty acid derivatives and intermediates. Low temperature interesterification, directed or random, should become a common tool of the processor to impart desired melting and thermal properties to margarine and shortening products. The possibility of interchanging fats of diverse origin to make tailor-made fat products is still a viable concept well on its way to realization.

Human health and welfare

The impact of a small voice characterized as a "food faddist" subculture in our society is causing the food industry to rethink its premises. The search for "natural or organic" foods in its more reasonable aspects takes the form of reexamining the accepted practices for providing foods of highest nutritive value. It asks of antioxidant additives, are they really necessary? Do pesticides that enhance yield and lower cost find their way into human foods? What is the metabolic fate of isomers formed during hydrogenation? What can be done about processing wastes?

In response to these socioeconomically inspired questions, we can see increasing emphasis for the future in the development of rapid, sensitive, analytical methodology. Traces of heavy metals, processing aids, additives, and pesticides will need to be monitored.

We have faith that the ingenuity characteristic of the oilseed industry will continue to solve problems as they arise. If refining wastes are a pollution problem, ways of recovery and reuse will be found. Soap washings will be recovered and recycled in feed. New virtues inherent to the complex mixture from degumming, called lecithin, will be found and exploited. If hardening of oils by hydrogenation comes into question, blending of fat stocks with or without interesterification can fill the breach. If pesticide residues find their way into food oil products, ways of processing them out will be found or new crop production regimens will be developed.

As a final thought, we have come to accept change as the only constant factor of our life and living. Our commitment, to paraphrase another, is "to change what needs to be changed, accept that which cannot be changed, and be wise enough to know the difference." Throughout the coming pages of the *Journal of the American Oil Chemists' Society* and of *Lipids*, changes will be proposed by authors, evaluated by peers, and disseminated in the printed word. In this process of "winnowing and sifting," all of us – researcher, producer, processor, and consumer – will have a stake. By understanding how changes in the cambial layer affect the growing tip, we shall be able to see the shape of things to come.

"Where there is no vision, the people perish" – Prov. 29:18.

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Food applications of soy proteins

Morton S. Cole

In somewhat over 50 years, the soybean has achieved a pre-eminent position in American agriculture. While soybeans have been primarily an oil crop, high protein residues from oil extraction processes have helped fuel the development of intensive animal agriculture. The American consumer has benefitted from abundant supplies of poultry, eggs and red meats that have been made available as a result.

The use of soy proteins as direct foods and food ingredients goes back almost as far as the advent of the soybean as a commercial crop in the U.S. Soy flours and grits were the first commercial soy protein products. These have been available for about 40 years. Very significant growth and improvement have been made in soy protein foods and ingredients in the intervening years. The range of products produced by the edible soy protein industry now includes flours, concentrates, isolates and various textured protein products that are produced in a range of solubilities, compositions, and functionalities. This product array comes from over a dozen U.S. companies plus many foreign sources. A very large technological base has been established dealing with the chemical and physical properties of soy proteins, methods of processing soy products, nutritional properties of soy protein and its complimentary

Continued on next page.

blends with other proteins, and the technology for applying soy proteins to a wide variety of food products.

The major current outlets for soy protein foods and ingredients are found in the baking, meat processing and processed foods industries. A large portion of our production of bread and rolls, sweet goods and fried goods uses from 1 to 5% or more of blends of soy flour plus a dairy ingredient such as dried sweet whey. This application represents a major outlet for edible soy flours that was formerly dominated by non-fat milk solids that became too costly for the market.

Processed meats, particularly ground or comminuted processed meat products, provide a substantial market for soy concentrates, isolates and texturized soy proteins. Americans consume close to half of their beef in the form of group meat, which is readily adaptable to incorporation of soy proteins. Soy protein ingredients find use in meats as economic extenders of animal protein. They provide desirable functional properties such as texture improvement, water and fat binding, gelling and emulsifying properties. Soy proteins also fit into nutritional and dietary foods, including so-called analogues or complete replacements of animal protein by vegetable proteins in food forms that simulate animal protein products.

Many processed foods found in both the consumer and institutional areas utilize soy proteins at relatively low levels for both functional and economic reasons. Soy proteins are found in pizza topping, Mexican and other ethnic foods, chili and virtually all foods in which ground meat or poultry is a characterizing ingredient.

Evolution of regulations would be benefitted by development of a simple, reliable analytical method for differentiating between animal and vegetable proteins. There has already been substantial research along these lines using varied approaches. These have included microscopic, immunological. fluorescence and electrophoretic techniques. These methods are thus far more suitable for research than for control purposes and further work is needed.

The use of vegetable proteins in conjunction with meat is governed in the U.S. by the U.S. Department of Agriculture. There is some flexibility in U.S.D.A. regulations in that there are options that permit the processor to use higher concentrations of vegetable proteins in some products at the cost of more stringent label declarations. The Food and Drug Administration is also closely involved in regulations governing food labeling. Recently proposed regulations govern a category of so-called substitute foods that are composed of both animal and vegetable protein sources. These regulations establish nutrient profiles for various categories of substitute foods such as breakfast and luncheon meats, seafood, poultry and eggs. Limits on levels of vegetable proteins and protein quality are provided. Combinations of animal and vegetable protein which do not meet the nutrient profile requirements must be labeled as imitations. These are complex regulations whose ultimate implementation will be the responsibility of U.S.D.A. The uncertainties surrounding such regulations and their interpretation have a restrictive effect on expanding usage of vegetable proteins.

The regulatory aspects of vegetable proteins have been considered at the international level as well. The E.E.C. is a major user of vegetable proteins and E.E.C. commissions have carefully considered the role of vegetable proteins within that body of nations. At the moment, the use of vegetable proteins is regulated by each country on an individual basis.

There has been an effort to obtain international conformity on regulations governing vegetable proteins. A subcommittee of Codex Alimentarius has been established to permit international consideration of key issues. A central issue is the ability of soy proteins to be incorporated into many traditional animal protein foods, sausages for example, to provide fully acceptable products that can scarcely be distinguished from the original product. The successful performance of vegetable proteins has led to reaction among competing agricultural interests and among consumers. Obviously there is the necessity to distinguish between products comprising traditional ingredients from those that look and perform the same but differ in protein type and composition. The regulation that set forth how this differentiation is to be made clear to the consumer will have an important impact on the marketing of vegetable protein foods and ingredients. These problems ultimately will find solutions. A basis will be found for incorporating vegetable proteins in animal protein foods because of the significant economic incentive to producers and consumers alike. Government regulations can have strong positive effects as well. Such was the case with the Food and Nutritional Service Regulation FNS 219 in 1971 permitting the incorporation of vegetable proteins in the school lunch program. Additional positive actions such as this one should be encouraged.

Applications technology for employing soy protein products has advanced at a rapid rate. The proceedings of the 1978 World Conference on Vegetable Food Proteins that was published in the March 1979 issue of JAOCS provides a recent review of these advances. Food processors can find in the vegetable protein processing industry an extensive reservoir of new product concepts and applications technology. One of the most interesting areas of activity has been the fabrication of simulated whole muscle meats based on combinations of animal and vegetable protein.

The nutritional values of meat and vegetable proteins have received considerable attention and are certain to attract even more in the future. The basic finding is in diets that are not limiting in protein nitrogen, soy protein is comparable to beef in providing a positive nitrogen balance.

The question of the measurement of protein quality and its interpretation remains an issue that is, as yet, unresolved. This is of obvious importance where regulations governing the use of vegetable proteins have a protein quality requirement.

A number of other nutritional issues are relevant to increasing usage of vegetable proteins in the human diet. There is a growing body of demographic and experimental research relating vegetable protein diets to reduction in serum cholesterol and associated circulatory diseases. Similarly, a point of view has been expressed that a majority of cancers are caused by environmental factors, including diet. We are seeing the beginnings of new approaches to nutritional science that may one day relate diet and disease more directly. The preliminary indications are that vegetable proteins are likely to have an increasing role in the diet.

The marketing of vegetable protein food ingredients on the basis of their functional properties and economies as extenders has been pursued throughout the 1970s. We are likely to see increases in costs of key food ingredients such as meat and dairy products where appropriate vegetable protein products can be utilized. In addition, greater emphasis in the future on nutrition and diet may enhance the role of vegetable protein ingredients. It is felt that vegetable protein ingredient usage will continue to grow at a moderate rate. There are opportunities for substantial growth in the future if significant breakthroughs in performance, applications technology or nutritional implications of vegetable proteins occur.

Continued on page 24A.

Viewpoint

Dr. Morton S. Cole is director of research for the Archer Daniels Midland Co. of Decatur, Illinois. He has been active the past twenty years in developing various types of food products, concentrating in recent years on the use of soybeans as food and as a functional ingredient in the wholesale baking industry.

Cottonseed looks to the 1980s

Lynn A. Jones

The decade of the '80s will bring an ever-increasing reliance on renewable resources due to our world's dwindling supply of finite raw materials. This trend should support a continued resurgence in the production of cotton grown for fiber. For every 580-pound bale of cotton produced, 780 pounds of seed are removed in the ginning process; use of more cotton fiber will result in more seed and more products from that seed.

Although the fortunes of cotton fiber will exert the primary influence on the cottonseed crop, there are other factors that will affect seed use in the United States. The shift in cotton acreage from the traditional areas of the Mid-South and Southeast to ever larger crops in Western states will likely continue. Land values, production economics, transportation, and world market development, among other factors, play a part in this movement. The cotton that is grown will be influenced also by development of knowledge of how to use different farming practices to control insect pests and aflatoxin growth, which recently has become a great concern to the industry. The possible use of varieties adapted to shorter growing seasons will mean plants are exposed to insect attack for a shorter time span, will require less valuable water, and may reduce the extent of field contamination by aflatoxin.

The cottonseed crop will likely see a compositional change in oil as well as shifts in geography and time. Unless we reverse current trends, the percentage of oil in the seed will fall to 17% in the next decade, a full percentage point below that observed in the previous three decades. This change may be due to a change in cotton varieties being planted. Increased awareness of the importance of seed by some breeders in parts of the Cotton Belt may arrest this trend. There should be no change in present levels of protein in cottonseed or of free fatty acids in the oil.

One unknown factor is the prospect for glandless or low-gossypol varieties of cotton. These varieties are genetically devoid of, or have fewer, tiny gland packets in the kernel that contain the biologically active terpenoid called gossypol. This yellow pigment has had a great influence on the history and use of the protein from cotton. Cultivars are now available of glandless cotton that produce lint, the primary economic reason for cotton, at levels equal to the traditional glanded lines of cotton. Whether plantings of glandless cotton will develop significantly during the next decade depends on many circumstances, the primary one of which is the eventual world requirements for protein for people. The flours, concentrates, and isolates that can be derived from the gland-free varieties cannot be produced from glanded cottons unless the gossypol is removed in processing. The present technology involved for such removal must be further refined to be economically attractive. Gossypol free varieties of cotton could contribute much to a world faced with inevitable population growth; cotton has the ability to thrive in those climates where human population is likely to rise most rapidly, thus providing a readily available supply of high quality protein.

The next ten years will see a continuation of research that will increase the value of cottonseed products. Investigations into the nature of cotton plant constituents similar to gossypol which act biologically to discourage insect attack already have proved promising and may lead to a decreased dependence on chemical insecticides. At the same time, it is hoped that the gossypol level in the seed can be kept to a minimum. As information on the family of terpenoids, of which gossypol is but one, continues to grow, we may see breeder selection for plant lines with terpenoids that act as natural insecticides in plant leaves and stems, and with fewer unwanted terpenoids including gossypol.

The concern with gossypol likely will lead to an improvement in the techniques for its quantitation. The importance of the compound on cottonseed protein use and the sophistication of scientific instrumentation will likely result in methods to determine more precisely the levels of gossypol and to allow more careful examination of factors that control those levels.

Along with greater control on gossypol, which is the primary natural antinutrient in cottonseed, there is likely to be more control of aflatoxin, the most troublesome adventitious toxicant. This mycotoxin within the past few years has shown itself to be an especially bothersome contaminant in some cotton grown at low elevations in parts of the American Southwest. Restricing aflatoxin, which proliferates while the crop is still in the field, and detoxifying the meal produced from infected seed will be of great importance in the 1980s. Ultimate control likely will result from the simultaneous employment of a number of techniques that already have shown promise. Techniques such as (1) changing the cultural practices under which cotton is grown so there is less mold proliferation, (2) different treatment of the seed during processing, and (3) the detoxification of the meal after it is produced, all could eventually combine to provide control of the problem. Development of rapid, reliable, and efficient aflatoxin detection procedures is sorely needed.

Use of both cottonseed oil and meal will continue to expand. Presently about 50% of the domestic cottonseed oil production is exported to specialty markets and to the Middle East where it enjoys a preference over other oils. Cottonseed oil consumed in the U.S. is used mainly in salad oil blends and as a deep fat frying oil, especially by potato chippers. Its ability to resist oxidation upon repeated heating makes it a favorite in this usage. Both the export and domestic market demand is expected to continue strong into the '80s.

Increased use of cottonseed meal will be aided by the development of more information on its employment in the diets of ruminants and monogastrics. Use of the meal as part of mixed diets for pets and for an ever increasing number of pleasure horses will continue along with its growing use in mixed rations for ruminants. Its use in the long familiar form of "cake" to feed beef cattle will be almost completely replaced by compounded feeds in which cottonseed meal contributes a valuable share to a totally balanced ration. Genetic manipulation may play a role in improving cottonseed quality. The USDA has established a program to improve cotton quality generally, and seed will receive its share of attention.

The coming decade also will see changes in how products are derived from cottonseed. Energy supplies, environmental considerations, and legislative programs have had pronounced effects on the cottonseed crushing industry in the '70s and these forces are likely to increase in the '80s. Such pressures are likely to mold the industry into one which is more energy efficient and less dependent on petroleum products. This latter factor could result in extraction methods less reliant on hexane, presently used in all solvent mills in the industry, to one which uses alternate extraction methods and solvents. An ideal oil extraction medium would produce a better product more economically, be less dependent on petroleum for its sources, and also remove objectionable components of the seed. The forces that have prompted such needs are likely to exert even greater pressure in the future.

Cotton, as one of nature's renewable resources, will continue to have a vital role to play in the '80s, not only in providing cotton fiber, but in providing high quality vegetable oil and protein for use in an ever increasing array of product applications.

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Whither nutrition research?

Raymond Reiser

To forecast future events in any field of science one has to be highly presumptuous and a little mystical. Obviously, the problems an investigator explores tomorrow depend on the unpredictable discoveries announced today. All too often future direction is determined by the available funds, the popularity of subjects, and national and international politics directed by ideas of transient bureaucrats instead of scientists.

In spite of that, it is reasonable to expect advances in understanding and controlling the basic mechanisms of action of essential nutrients, the anomalies of nutrient metabolism in diseased states such as diabetes, and the many nutrition-related inborn errors of metabolism such as phenylketonuria. We can even see the beginnings of understanding in nutrition-related areas of socio-behavioral science.

There is a long list of unpredictable specifics in broad areas that must be considered because of current momentum. A leading example is interest in toxic food substances, whether natural or synthetic, and food additives. The nontoxic but questionable nutritive value of substitutes and synthetics such as filled dairy products, microbial-produced proteins, or of modified foods such as hydrogenated vegetable oils, can be predicted to be subjects for exploration, although the specific foods and additives to be studied are in the hands of the gods. Related to these one can expect developments in food fads and phobias. Other broad areas of continuing nutrition and nutrition-related research that we can be confident will receive attention in the 1980s are the suspected relationships between normal nonessential macronutrients and the genesis of degenerative diseases. Examples are: animal fats, atherosclerosis; and vegetable oils, cancer. Again the specific problems await developments and imagination. In spite of all these uncertainties, one can venture some guesses, based on the history of nutritional science and ongoing studies.

The science of nutrition has undergone a series of metamorphoses rather than an evolving continuum during its development. It may be said to have started with the problems of supplying energy to farm animals, followed by a period of studies on human needs for, and functions of, fats, carbohydrates and proteins. When it became apparent that these macronutrients alone cannot support life and reproduction, pursuit of the missing factors led eventually to the discovery of the essential micronutrients.

Finally, investigators were able to chemically identify the individual micronutrients and quantify, to a limited degree, domestic animal and human requirements for them. This search culminated in the so-called "recommended dietary allowances." Suffice it to say here that these recommendations are not, and are not intended to be, fixed alike for everyone. Needs differ with age, sex, previous dietary status, disease, and individuality. The recommendations constantly are undergoing reassessment.

After the discovery of the essential nutrients, research slowed to catch its breath. It was predicted that further nutrition research would be along the lines of mechanisms of action of the essential nutrients and their interrelationships. However, not enough was known about the details of intermediary metabolism to open the door to the design of such experiments. Indeed, the science and art of biochemistry had to await the advent of isotope tracer methodology, chromatography, and a myriad of instrumentation microtechniques before biochemistry could advance far enough to entertain nutritional-biochemical problems.

Continued on next page.

Viewpoint

While nutritional science was awaiting the science of metabolism to reach a level where it could tackle the problems of essential nutrient mechanisms, the pragmatic art of dietetics developed, using what had been found relating to foods and health. The levels of nutrients, macro as well as micro, essential and nonessential, in foods had been collated, and considerable experience obtained to use that knowledge to design diets both for health maintenance and for some diseased states. Today this knowledge is, and will continue to be, exploited in many sociological areas: nutritional assessment, maternal and child care, school lunches, food selection for the nutritional care of the elderly and food stamp recipients, and public health in general. It has been used and abused in correction of obesity, feeding the athlete, treating persons in various diseased states, criticism of snacks, and sponsoring "natural" foods.

Elucidation of the intermediary metabolic changes in the essential nutrients themselves, and their biochemical modes of action, are areas in which nutrition can be predicted to develop in the 1980s and beyond. The recently revived interest in mineral metabolism, especially iron, copper and zinc, is an example of this. These elements' role in the maintenance of healthy tissues and organs, and as enzyme cofactors, especially their interrelationships, is and will continue to be, under intense study. Evidence of the broadness of the role of these nutrients is in the variety of scientific journals in which one finds publication of research results, from strictly nutrition journals to very esoteric biochemical ones. Thus, nutrition definitely has made the steps from science to art to science again.

Another area of development has been the discovery that some food constituents may be deleterious, and actually disease producing. That there are natural carcinogens in foods and that some previously used food additives are carcinogenic is true. Some currently or future ones may prove to be. Additionally, demographic relationships have been found between the kinds of foods consumed and the incidence of diseases in those areas. These could be natural deficiencies or excesses in the soil of the areas such as selenium, or unproven cause and effect relationships such as animal fats and coronary heart disease. Even greater is the liklihood of genetic variability in susceptibility of regional or ethnic groups to diet factors. (Though not dietary, note the regional differences in incidence of cystic fibrosis and the ethnic differences to incidence of Tay Sachs disease). These areas of study are certain to be under intense investigation during the next decade and beyond, especially diet and cancer and coronary heart disease.

In spite of the desire of the Competitive Research Grants Program to support only basic nutrition research, as explained below, the sociological-behavioral aspects of nutrition research, though tangential to rather than in the mainstream of nutrition research, will attract growing attention. Much of this is the "bandwagon" effect. Much of it is due to growing consumer interest, exaggerated and unknowledgeable as that may be. But people are worried. They hear that sugar is bad for their children's teeth and is just "empty" calories, that snack foods are going to produce malnutrition, and that Food Stamp money is being wasted. They come out swinging blindly. But because of the consumer activitsts, more and more effort and money will be put into these areas, much of it wasted, or worse, misleading.

Half-knowledge of the possible harm of some natural food constituents and additives, supported by limited data and by testimonials of prestigious sounding titles and credentials of both individuals and groups, has resulted in broad rationalizations and inferences that raise irrational phobias in the minds of concerned by uninformed consumers who give credence to it all. This is taken advantage of by opportunists who write books, form consumer groups, establish reducing clinics, sell "natural foods," influence legislators (the Delaney Amendment and the "Dietary Goals" of the Senate) and place irresistable pressure on the US Department of Agriculture, the Food and Drug Administration, and the Federal Trade Commission to go to excesses in the regulation of labeling and advertising. But one must credit these agencies for constraints in some areas such as the effort, though unsuccessful, to limit megavitamins in the over-the-counter drug market. In the meantime, healthy, nutritious foods are banned or get bad reputations, making it increasingly difficult to design acceptable balanced diets, hurting agribusinesses, and generating unhealthy food fads.

Food fads and phobias are approaching the ridiculous, and it is an anomaly that the more highly educated groups, who are the most concerned about their health, are the most gullible. This is evidenced by the membership in consumer and activist groups such as the Center for Science in the Public Interest, and the Nader group. Unsophisticated in applicable biochemistry, some persons get overconcerned, start at shadows, and are misled by rationalizations and half-truths. It is an old phenomenon that otherwise able scientists are themselves often carried along with popular opinion so often repeated as to be accepted as fact. More facts are needed to dispel these fads and phobias. Hopefully the 1980s will clarify and correct these distortions and return sanity to the food-nutrition-public health interrelationships.

It is predictable on the basis of recent studies with normal people consuming customary foods that the Senate Select Committee's Dietary Goals for the United States must be modified so as to limit the target of the saturated fat and cholesterol (red meat and eggs) recommendations to those of the American Medical Association: ". . . persons falling into risk categories on the basis of their plasma profiles be given individualized dietary advice. . . ."

In the past, subjects investigated in nutrition research have been those of the investigator who saw problems and pursued them. Dictated, mission-oriented research was considered second class, not because of its quality, but because it was not free. It is becoming more and more evident that government agencies, through the control of funds, and on the advice of favorite "experts" are beginning to dictate, even in the universities, not only the areas of research but even the recipients of the funds. This statement is not a criticism of peer review, but of control from above. In this connection it is of interest to note that the USDA Competitive Grants Program for 1980 will not entertain proposals in the socio-behavior area. The program asks for proposals on human requirements for nutrients: "The objective is to support basic, creative research that will help fill gaps in knowledge about nutrient requirements, bioavailability, the interrelationships of nutrients,

Continued on page 28A.

and the nutritional value of foods that are consumed in the U.S. as these relate to requirements. Special attention will be given to requirements for trace constituents. Innovative approaches designed to improve methods of research and investigation that will increase reliability of research results will be given special consideration."

Other examples of the trend to government dictation are evident in the Senate's Dietary Goals, in the preliminary policy statements of the Surgeon General and in the symposium *Translation of Scientific Findings to Social Policy,* given at the 1979 meetings of the Federation of American Societies for Experimental Biology and published in the November 1979 Federation Proceedings. The original intent of the symposium, as stated in the introduction, was to relate "how scientific knowledge can be transferred from the scientific community to those who must use the knowledge to make public policy." But inch by inch we are sliding toward a reverse situation in which, in the name of public health, government policy will dictate nutrition research, what the farmer will be allowed to grow, and what the grocer will be able to sell. Scientists and grocers already are showing signs of being brain-washed to believe that such dictation is proper. This has been happening in at least one grocery chain. The farmer is less easy to convince.

We can expect this slide to be accelerated during the 1980s. Uniform recommendations made in concert by the US Senate, the Surgeon General, the US Department of Agriculture, half-heartedly supported by the National Institutes of Health, will be accepted by the public as truths. The general public will not know that the same few people who formulated the recommendations for the American Heart Association are also the authors of the recommendations of the governmental agencies.

But in the meantime consumer fears fed by misleading half-knowledge could, and probably will, get worse. Nutrition education could be a double-edged sword. More and better data are needed, and hopefully will be forthcoming to reveal the whole, balanced truths.

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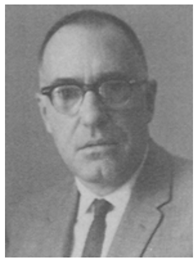
Codex Alimentarius



Rex Sims

The Codex Alimentarius Committee on Fats and Oils develops standards for edible fats and oils that move in international trade. The purpose is to facilitate such trade by ensuring the identity and quality of these products to consumers.

Under sponsorship of the Food and Agriculture Organization and the World Health Organization, two United Nations agencies, the committee meets annually in London with delegates from more than 30 nations and representatives of approximately 10 international organizations attending.

During the coming years, the U.S. delegation will be trying to obtain flexible standards that will permit export of U.S. products abroad. For example, in our country, low calorie margarines are prepared over a wide range of fat content whereas the European products are in the 39-41% fat content range.

Thus far, the standards developed by the committee apply only to edible oils and fats, and mixtures of these, that are used for direct human consumption and that are transported in retail size packages. The standards do not apply to bulk shipment or to any material that must undergo further processing to make it suitable for human consumption. This means, in effect, that most fats and oils moving in international trade are not covered by these standards. The U.S. delegation is trying to extend standards to cover more than goods ready for retail sale.

The U.S. delegation has been successful in broadening the list of permitted additives to include antioxidants. metal scavengers, crystal inhibitors, colors and flavors. Since it appeared unlikely that complete agreement would be reached on an acceptable additive list, a compromise was devised whereby each nation can accept standards with specified deviations. This provides only a partial solution since some nations will not accept shipments of any products with fats that contain any synthetic additives.

There also is a concern that adoption of these standards will increase the cost of goods because of the large number of analytical determinations required to assure identity and quality. The USDA Northern Regional Research center at Peoria has developed an identification system based upon fatty acid ranges as measured by gas liquid chromatography. This relatively simple procedure should supplant several classical tests that are expensive and often do not identify the sample unequivocally, e.g., saponification, iodine, Reichert, and Polensky values.

The committee had identified a sizeable list of permitted processing aids. Attempts will be made to determine typical residue levels for each material. If this proves feasible, then the committee may require determinations on each shipment to assure that residues, if present, are at substantially less than their acceptable daily intake value.

After each standard is adopted by the committee it is forwarded to the full Codex Alimentarius Commission for consideration. If approved by the commission, each standard is circulated to individual nations for adoption, rejection, or, as noted before, adoption with deviations. Fifteen standards thus far have been submitted to governments for consideration: soybean oil, peanut oil, cottonseed oil, sunflowerseed oil, rapeseed oil, corn oil, sesameseed oil, lard, rendered pork fat, premier jus, edible tallow, margarine, olive oil, mustardseed oil and a general standard for those products not covered by individual standards.

Standards nearing completion include: low erucic acid rapeseed oil, coconut oil, palm oil, palm kernel oil, grapeseed oil, and babassu oil.

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Margarine revisited

S.F. Riepma

An entire generation – nearly thirty years – has passed since Congress removed the ancient legal restrictions on margarine. The Act of March 23, 1950 concluded a long struggle and opened the way for the removal of state restrictions. By 1967 most of these had gone by the board. The whole effort took nearly a century.

Some things predicted when the federal law was changed have happened. Some have not. Yearly margarine consumption increased at a rapid rate; from 6.1 pounds per person national average consumption in 1950, it rose to 12.2 in 1976. It now seems to have stabilized between 11 and 13. Production during the same period expanded from 937 million to approximately 2,500 million pounds annually. Production is tantamount to consumption, there being no significant imports or exports.

A new pattern has been established. It probably will continue indefinitely.

So predictions have not come to pass. The dairy industry was not "ruined," as some told Congress would happen. Butter consumption remains at about 4.5 pounds per person, enjoying strong government price support. Federal and state governments did not make, as once it seemed reasonable to expect, a complete overhaul of their antique laws "regulating" margarine. Instead, these restrictive provisions persist, many concerned with elaborate special notices to patrons of public eating places who are served margarine. Meanwhile, the federal food regulatory system has produced many new regulations, not a few of which affect margarine and have been adopted by many states. More may be expected.

Three significant events have influenced the margarine situation in a way not forseeable a generation ago. The role of product innovation has been noteworthy. From the rather uniform product of pre-World War II days, margarine has proliferated into new features and types. The main new trends have been to soft margarine and to margarines specially composed to provide higher polyunsaturate content. Soybean, corn, safflower and, more recently, sunflower oils, liquid or partially hardened, have been adopted for margarine composition domain for this purpose. Thus, much soybean oil is now used. Undoubtedly the emphasis in scientific circles on polyunsaturates as a dietary factor has enlarged margarine consumption. Many consumers now buy margarine for the polyunsaturates component. It has been one of the food's examples of flexibility to meet new consumer requirements.

One interesting reflection of rising edible oil costs has been the successful introduction of margarine-type products labeled "spread," which differ from standard margarine in having from 50 to 60% instead of 80% fat. Already there existed "diet" margarine, 40% fat, and whipped margarine, which offers the same fat content with extended volume so that the total fat in each serving is less. All told these products now account for a significant share of margarine products' consumer sales. "Regular" margarine, however, made under the federal standards in stick, soft, or other forms, continues to dominate the field.

A second major event has been in costs and resultant consumer prices. The inflated costs of domestic and world fats and oils during 1974-75 caused margarine prices to climb to unprecedented heights. At one time some premium margarines had to be priced close to or even just below the current price of butter, and the effect on margarine sales was marked. Margarine prices to consumers fell back after the oils situation eased in 1976. Consumption that year set a record, but, like most foods, margarine now costs consumers more than before the inflation of the 1970s.

This appears to have contributed to a third condition, the leveling off, approximately, of total consumption. For three years production has been fairly stable, although some increase may be recorded for 1979. This development of course is of great significance for the industry and its marketing. The always intense competition between margarines is bound to go on, and innovation may also be expected to be characteristic of the industry.

Besides the impact of new cost and consumer price levels, many observers believe an important influence has been that of the many-faceted "campaign" agsinst too much fat in the diet. That influence, too, is impossible to measure. The anti-fat crusade is a prominent feature of our times. With the publication last year of the McGovern Committee's well-publicized and controversial "Dietary Goals" the attack on fat has led to demands, encouraged by the federal government, for specific fat labeling. (Margarine has long labeled each ingredient.)

The "Goals" did distinguish between saturated and polyunsaturated forms, to the advantage of the latter. Application of this goal would seem to ask the consumer to take this table spread and cooking fat largely if not altogether in the form of polyunsaturated or soft margarine. The longer-term outcome of the mounting concern about obesity, heart disease, and other health problems that have been in part identified with the Americans' consumption of fat generally will be interesting to watch. Probably it will not significantly curtail margarine usage. Margarine has been shown to be fairly adaptable to wanted functions and compositions.

The quality factors entering into margarine production today are far ahead of those prevailing years ago. Indeed, product and quality advancement have for some time replaced the emphasis on legislative breakthroughs of a generation ago. Quality control programs are well-established. They involve high quality ingredients and sophisticated controls over manufacture, packaging and distribu-

Continued on next page.

tion. These not very dramatic but exceedingly important developments have been the foundation for margarine's high acceptance level and for its identification as a table spread with qualities of composition, adaptation, and keeping that put it into an entirely different class from that of the dairy spread.

Margarine's base likely will continue to be the enormous American soybean crop, its main ingredient source. In 1978 margarine alone used nearly 1,600 million pounds of refined soybean oil. Corn oil rated second with 200 million pounds. Other ingredient oils trailed far behind.

In sum, the margarine outlook promises no big surprises. There will be new products, strong marketing, and some new formulations. The food will continue to keep its place as the leading table spread. Its growth will be much more gradual than in former years; and it should acquire increasing usage in the food service field, especially as the obsolete restrictions on that usage are modified or swept away by the forces of change.

Dr. S.F. Riepma is president of the National Association of Margarine Manufacturers in Washington, DC, a post he has held since 1951. He is a member of the American Historical Association, Phi Beta Kappa and the Association of Foods and Drug Officials of the United States.

New challenges for Lipids

Ralph Holman

Lipids is now beginning its fifteenth year as a scientific periodical under the sponsorship of the American Oil Chemists' Society. Our journal has grown from a bimonthly periodical of less than 500 pages annually to a monthly journal of over 1,000 pages annually. The Editorial Advisory Board and the Board of Associate Editors has striven to encourage a balance of subject matter to maintain a high scientific standard and yet to avoid rigid or discriminatory policies. The response by the community of lipid scientists indicates a permanent place for *Lipids* in our field, for manuscripts are being received at an increasing rate covering a widening spectrum of subject matter from all parts of the world.

The decade we now enter will continue many trends already apparent in lipid research and other fields of science. We should expect our field to broaden and become more interdisciplinary in nature. The emphasis will continue to change from fatty acids to the more complex lipids containing them. With the availability of new and sophisticated means of measurement, the emphasis will continue to shift from chemistry to include physics, and for biochemistry to include biology. Synthesis for its own sake will yield to synthesis for characterization. The focus will shift from description of isolated lipids to characterization of lipids *in situ*. Attention will shift from determining lipid structures to study of interactions between lipid structures and other biological molecules. Stepwise study of metabolic reactions will be followed by study of regulation and control. When the involvement of lipids in metabolism and in disease problems becomes more fully appreciated, biology and medicine will make increasingly important contributions to lipid research. Hand calculations may remain the commonest computation, but the computer will increasingly make possible collection and digestion of data in magnitudes beyond man's limited time and memory. As our analytical techniques become more sensitive, our experimental models will shift from whole animals and organs to cells and membranes. Nevertheless the need will continue to test the results gained at the micro level on the intact organism. The principles gained rapidly by study of membranes will need extrapolation to the cell, and predictions derived from enzymology must be tested under nutritional conditions. The search for acute changes involving lipids will shift to long term studies of subcellular lipid changes and their meaning in disease processes.

The broadening of the field of lipid research will bring with it narrowing specialization, and communication may become more difficult. It will be the task of *Lipids* to keep abreast of these developments, to serve all elements of lipid research, and remain flexible in facilitating communication. Decades have passed since the prediction that visual aids and electronic media would supplant the printed page in science communication. These modern aids have found their place but the printed page is still needed. It would appear that in the coming decade the need will remain for the more traditional mode of science communication. It will still be necessary for scientists to digest their volumes of computer generated data, distill from them the essence and translate that to understandable and concise language. We cannot clearly foresee the distant future and all it will bring, but we believe that for the next decade there will be a need for open communication by conventional means. The American Oil Chemists' Society, our Board of Editorial Advisors and our Board of Associate Editors will continue to facilitate such communication, and will remain flexible to allow *Lipids* to develop with the times.

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Continued on page 32A.

Detergents: a new regulatory matrix

Theodore Brenner

There is general agreement that profound lifestyle changes will occur in the 80s. Some of these are already evident. More and more, married women are entering or returning to the workplace and, as a result, are seeking more efficient, convenience-type goods and services. Family demographics are changing as well with the growth of one- and two-person households and households of unrelated persons. This, too, has resulted in changed buying and use patterns.

As producers of consumer products, soap and detergent manufacturers are well aware of the importance of innovation in adjusting to changing realities. New products and systems, unheard of today, will find their way to the marketplace while other current super market favorites will fade into obscurity. But these are the challenges that progressive industries welcome in meeting the changing needs of the consuming public. It is the kind of challenge that the soap and detergent industry has responded to so well in the past that the changes of the 80s should be an opportunity for expanded and imaginative product development and marketing.

This optimistic view must be tempered, however, by some of the realities that face us, both in the near- and long-term. Clearly, government intervention in the process of innovation is one such reality. Another is that chemicals – all chemicals – are seen in the public eye as dangerous. As mass users of chemicals, the soap and detergent industry must be sensitive to this reality.

These two factors lead to a third reality: the evaluation of product safety, which has several parts – all of which must be resolved if the 80s are to be truly a period of innovation and growth.

Product safety includes human ecology and environmental effects. Given the broad reach of regulating authority in these areas, product safety creates a most intimate interface between government and industry. It is an area in which the most effective cooperation between the public and private sectors can occur, but it is also a new field in which regulatory agencies have had the least experience.

In this setting, it is easier for a regulator to say no than yes. It is simpler to seek absolutes – a material either is safe or it is not – than it is to assess risks. It is more popular to ban than it is to conduct arduous evaluations of complex interrelated factors.

These generalities lead to some specific questions that demand resolution. In the consumer product field, it is imperative to develop better epidemological procedures so that actual field experience will be recognized as the ultimate determinate of product safety. While laboratory studies are helpful, too often they result in more questions than answers. As an example, the federally mandated use of rabbits in the measurement of the eye injury potential of products is well recognized as being deficient. The same is true of some short-term tests being considered to determine carcinogenicity. If a positive result is obtained, a potentially useful material may be tainted permanently because of the use of a questionable test procedure.

While safety testing for acute health effects is relatively straightforward, much work needs to be done in developing short-term, simple methods for chronic effect assessment. For the soap and detergent industry, this need is particularly critical as its products fall in the broad-use-low-toxicity category.

In regard to the environment, better methods and a more complete understanding of the toxicological and metabolic interaction of product residues are needed. During the last decade, significant advances have been made in both areas which have led to major changes in thinking. Only recently, for example, has the practice of universal chlorination of drinking and wastewater been challenged. More sensitive and precise analytical procedures led to the conclusion that potentially toxic materials may be formed in the chlorination process. How many other comparable situations will be found in the future is a function of the advances made in environmental science.

Perhaps the most complex, perplexing and far-reaching imponderable is risk assessment. Clearly there is a risk in everything we do. But to what extent are these risks acceptable in light of offsetting societal gains? This question raises philosophical, political and scientific uncertainties that must be resolved if we are to meet the needs of the 80s.

This whole question has been brought to the fore with the implementation of the Toxic Substances Control Act and publication of the proposed OSHA generic carcinogen standard. For industry, risk assessment is a way of life. But for government, decision-making of this kind is a new experience.

Clearly, if this nation is to maintain its technological pre-eminence, risk assessment must become an accepted regulatory tool. Perhaps the most notable recent experience in this regard has been the furor that developed over saccharin. Existing law left the Food and Drug Administration no option to banning this material from foods. But the American public, through appropriate political channels, did its own risk assessment and determined that the benefits outweighed the hazard. A less dramatic, but probably more significant, risk-benefit analysis conducted by the public has been that concerning cigarette smoking. After more than a decade of intensive education by the government on the demonstrated hazards of cigarette smoking, millions of American continue to smoke.

While these examples have received national prominence, they do not provide the rational, ordered scientific approach toward risk assessment that is so urgently needed. It is a prime area for government/industry cooperation and if achieved, can have important benefits for the nation as a whole.

The recent legislative trend to give broad authority to regulatory agencies (particularly in technical matters) underscores the need for new initiatives in analytical methodology and assessment techniques. But these are largely background for the regulatory matrix. The real challenge of industry in the coming decade will be to work with the regulators in shaping their actions. This calls for a better understanding of the bureaucratic process and an acknowledgment of government involvement in the chemical industry. While not easy, it offers the greatest opportunity for the technical arm of industry to provide the foundation for the new products and services needed by a changing America.

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