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ABSTRACT  A functional food is defined as any food or food ingredient that may provide a health benefit beyond that conferred by the nutrients the food contains. As nutrition scientists move into this arena, they must build on the wealth of information that already exists in plant biology. In particular, the evolutionary and physiologic bases for the production of secondary plant chemicals in plants must be considered in order to plan meaningful experiments for testing the functionality of these chemical compounds for humans. One problem that may arise is that in using the term functional food, the meaning may be lost in the continued proliferation of related terms used in product marketing. The new National Institutes of Health Office of Dietary Supplements addressed some of these issues as it developed the operating definitions described in this report. *Am J Clin Nutr* 2000;71(suppl):1728S–34S.

KEY WORDS  Functional food, nutraceutical, NIH Office of Dietary Supplements

INTRODUCTION  A functional food is defined as “...any modified food or food ingredient that may provide a health benefit beyond that conferred by the traditional nutrients the food contains” (page 109:1). The discussion at this conference centered primarily on food or condiment (eg, garlic) plants that are being studied for their health benefits in disease prevention or overall health promotion. The research in this area is exciting and enticing because it continues the shift in the focus of nutrition science away from nutritional deficiency diseases to an understanding of the relation between diet and life span health. Of concern, however, as nutrition scientists move into this arena, is the need to carefully build on the wealth of information that already exists in plant biology. In addition, the question arises whether, in using the term functional food to help sharpen research focus on the health benefits of foods and food ingredients, the meaning may be lost in the continued proliferation of related terms used in product marketing. The new National Institutes of Health (NIH) Office of Dietary Supplements (ODS) addressed some of these issues as it developed the operating definitions discussed here.

FUNCTIONAL FOODS AS A CONCEPT  Participants at this conference understood the term functional food. Even so, the first speakers defined the term to ensure that everyone was working with a consistent definition. For nutrition scientists, dietitians, and most related disciplines there is a working concept of a functional food, but for the public and consumers there is not. For consumers, the term represents another in the recent proliferation of names related to foods and dietary supplements and falls in the same category as nutraceuticals, dietary supplements, botanical supplements, herbs, ergogenic aids, and medical foods. These diverse names seem synonymous to consumers and appear with various products as part of marketing strategies.

Are these terms based solely on regulatory issues and used to stake out a marketing or regulatory niche for a competitive advantage? Should the term functional food be viewed differently as a new key field of future research in nutrition? When is food not functional in the most basic sense of the term? In other words, do we have a situation in which there is an industry that is reluctant to fund research because of a lack of product exclusivity? This reduction in funding perhaps has led scientists to proliferate terminology to carve out more discrete scientific niches. Having such a niche could potentially confer a categorical value to an area of research delimited by that terminology. What is the goal in designating a segment of nutrition research as functional food research?

There are currently multiple approaches to research on functional foods. One approach is to focus on identifying the additional health-giving properties in foods. This knowledge is used to understand the synergism of interactions among various nutrients and other components within foods regarding specific health outcomes. These food components also can be extracted and marketed alone as dietary supplements. But are these extracts still effective outside of their food milieu? This question often remains untested in this particular research arena.

Another area in functional food research is the use of new technologies to enhance the healthful functionality of foods through selective breeding or enhancement of the plant substrate. Taken to the next step, some categories of foods with greater human taste or texture appeal could be enhanced further with healthful properties by adding the constituents of a less palatable plant relative. Taken

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ECOLOGIC PERSPECTIVE ON FUNCTIONAL FOODS

FUNCTIONAL FOODS AS PLANTS

The functional food research discussed in this conference was based on plant species or derivatives or extracts of members of the plant kingdom. Plants used by humans in the United States are typically placed in the categories below according to their end use and thus are studied and regulated by scientists with significantly different backgrounds and perspectives.

1) Domesticated food plants. These plant species were derived from wild plant species decades or centuries ago and have been highly cultivated and bred for specific characteristics that appeal to the culture where they are sold. Food plants are primarily of interest for their nutritive properties.

2) Wild food plants. These plants are gathered by peoples throughout the world. They tend to be highly seasonal in nature, difficult to cultivate for an economic advantage, and little known outside of a specific culture or subculture. Sometimes they are merely locally abundant in the wild and have never gained widespread popularity within a culture. For example, in the southern United States, pokeweed is viewed as a delicacy, but while available as a wild species throughout the East and Midwest, its popularity has not grown beyond its traditional southern cultural roots.

3) Medicinal plants. These plants have traditional or cultural health attributes ascribed to specific parts of the plant.

4) Botanical supplements. These are derived from plants and may have both nutritive and medicinal properties, but they are viewed as supplemental to the basic diet for enhancing the structure and function of the body.

5) Plant parts and their derivatives used primarily as condiments. These include red pepper and additives such as peppermint.

6) Plants that have a wide variety of economic uses not typically associated with the diet in any way. These plants or plant parts may be toxic if ingested by humans or may have been used for hundreds of years for only one purpose and not fully explored with regard to the diet. This category can be subdivided by type of use, but for this discussion its use will be termed nondietary.

7) Plants for which there is no known human use.

In general, these categories can lead to marketing, production, and regulatory distinctions that may result in the end use becoming disconnected from the basic underlying biology. This disconnect and the distinction and separation of the various scientific disciplines that study plants can lead to duplication of research efforts or misinterpretation of results. Setting aside the functional food concept and the various categories into which the plant kingdom may be divided for human use, all plants can be viewed from a more basic perspective as members of plant families that share similar structural and chemical properties. In particular, plants can be viewed as chemical entities in which we, as human omnivores, are interested for their abilities to provide specific chemicals for growth, development, and health.

In Western societies, such as the United States, the focus of research into the 1980s was on identifying and understanding those chemicals in plants, termed nutrients, that are essential for survival and health (2). There has been extensive discussion about the essentiality of nutrients (3) and this discussion is reflected in the changing approach to the establishment of human nutrient reference standards (4, 5). In China and the Far East, emphasis has been directed toward using the nonnutrient chemicals in plant parts for medicinal treatment. In the past 2 decades, these 2 concepts have begun to merge, as Western countries examine nonnutritive plant constituents as sources of health benefits. Herbal medicines tend to be single ingredients or mixtures of ingredients or plant parts from nonfood plants. Research on the nonnutrient chemicals in food plants or modified foods that provide a health benefit has moved food plants into the health outcome arena. This has been reflected in the deliberations of the Food and Nutrition Board Standing Committee on the Scientific Evaluation of Dietary Reference Intakes (DRI), which will be convening a DRI panel to address other food components, such as phytoestrogens, fiber, and phytochemicals. These components will be selected by whether there is sufficient evidence that they contribute to reducing the risk of disease and to promoting health (5).

AN ECOLOGIC PERSPECTIVE

This section is not meant to be a primer on plant ecology or plant-animal interactions but instead to increase awareness of the importance of these fields to the study of nutrition and, especially, functional foods. There are ≈308,000 species of terrestrial plants, which constitute 21% of all species on the earth. Herbivorous insects account for ≈361,000 additional species, or another 26% (6). Thus, roughly half of the species on earth consist of terrestrial plants and their primary predators, insects. Saprophagous and predacious insects (ie, insects that feed from decaying matter of live animals) (431,000 species, 31%), other invertebrates (213,000 species, 15%), protozoa (30,000 species, 2%), and vertebrates (54,000 species, 4%) make up the rest (6). If we look at the species of herbivorous insects, we find that many have evolved a high degree of specificity to one or a few closely related food plants (6). This specificity is not to the entire plant but to particular parts of these food plants. As Janzen (7) wrote in 1979, herbivores do not eat Latin binomials, they eat plant parts. Correspondingly, Latin binomials do not contain secondary compounds, plant parts do. An example of this type of monophagous insect are the many species of North American butterflies (Lepidoptera), 81% of which have diets restricted to plants belonging to one plant family (8). Some butterfly caterpillars, such as the swallowtail butterfly (Papilio glaucaus), which are polyphagous, are locally monophagous in a certain part of the geographic range of the species. Thus, this butterfly uses 13 plant families but only one or a subset of plant species in any one area within its geographic range (9).
Specific associations, like these between plants and insects, have evolutionary origins. Insects were believed to have first colonized dry land 320–280 million years BP (before the present) during the Carboniferous period, at which time terrestrial plants were well established. However, evidence from fossil feces found in Wales that predate the Carboniferous period by 90 million years indicates that the earliest example of herbivory of higher plants by the plant spore eaters may have occurred in the Siluro-Devonian period (10). This evidence can be viewed as indirect, but the earliest known fossils of flying insects show structures of feeding on plant tissues (11).

Plants have evolved many adaptations to the selection pressures imposed by insect herbivores. For example, plants can use time to escape herbivory through a lack of coordination between the plant’s phenologic phases and critical insect developmental stages. Plants can also adapt to environmental conditions such as dense shade or dry areas that are not preferred habitats for specific insects and thereby use space to avoid herbivory (6). In addition, plants have evolved structural feeding deterrents such as thorns, spines, and coarse hairs; surface coverings that are highly adapted responses to specific predators.

In silicification, another adaptation, plants, especially grasses, accumulate silica around vulnerable plant parts such as flowers and new leaves. For herbivores, silica reduces the digestibility of plant parts and causes several long-term biological effects as well. Silicification appears to increase in some species in response to grazing pressure; in the Serengeti, silica concentrations were highest in the most heavily grazed species (12). To respond to repeated grazing, plant species have also adapted by developing resistant growth forms such as prostrate genotypes with large below-ground biomasses, which can then exhibit rapid regrowth of above-ground leaves after intense grazing (13). Plants have many additional types of adaptations that enable them to avoid herbivory; matching these are the parallel adaptations in the herbivores themselves.

From an evolutionary perspective, the plants we are studying to understand their functional role in human health evolved in a world where there were no humans and where the basic adaptation for survival was focused on insects and other herbivores. These plant survival adaptation strategies also extend to the chemical composition of plants.

A PLANT’S PERSPECTIVE

From the ecologic or evolutionary perspective, then, there are 2 types of plant chemical components. There are plant nutrients, which are produced by plants to function directly in primary metabolic processes that support the growth, development, and reproduction of the plants themselves. There are also the allelochemicals, or plant secondary compounds, which function in the interactions of plants with herbivores, pathogens, and competitors. These secondary compounds also protect plants from physical stresses such as ultraviolet radiation and desiccation. In summary, allelochemicals function in the role of plant chemical defenses.

To use these toxins as chemical defenses against herbivores, plants needed to develop methods by which they could poison biochemical and physiologic systems that are fundamentally similar to their own, yet not kill themselves. They have done this in a wide variety of ways and in close coevolution with their predators.

There are an estimated 12,455 allelochemicals. Allelochemicals are divided into 14 classes: 13 classes of compounds plus a 14th class consisting of an unknown number of tannin compounds. The distribution of secondary compounds in the plant kingdom is well studied, and specific classes of secondary compounds are limited to certain plant families. For example, those polyacetylenes that are phototoxic and neurotoxic are found mostly in the plant families Compositae and Umbelliferae (14). In addition to variation among families and species, plant secondary compounds vary qualitatively and quantitatively within populations and within individual plants. Variability can be seasonal or diurnal or can result from changes in environmental factors such as herbivory. The biochemicals that are typically present in plants in appreciable quantities are termed constitutive secondary compounds. Other secondary compounds, called “induced” compounds, can be synthesized in response to pathogens or herbivory. Humans have used the secondary compounds in plants for their pharmacologic and toxic properties in various world cultures for centuries. However, their functions in plants and their implications for humans were not a focus for research in the West until the early 1960s. The basic physiologic activity against mammals is now known for all 14 of the classes of allelochemicals (14).

Plant and herbivore coevolution and its influence on secondary compounds

In studying the health properties of chemicals in functional foods, we are studying those chemicals that have evolved in plants for use in chemical defense. To design well-controlled experiments on the functional effects of plant-based foods, it is important for nutrition scientists to understand the basics of diffuse coevolution of plants and animals. As mentioned previously, plants have developed many different types of adaptive mechanisms for their own protection. Herbivores that consume plants to survive have also, of necessity, had to adapt. A major problem for herbivores is how to transform plant tissues that are poor in protein and nutrients but rich in fiber, physical defenses, and chemical defenses into animal tissues rich in protein and nutrients but free of toxins. Herbivores have also evolved, in adaptation to their primary food sources, from those primitive fossil insects to gnashing, chemical-machinating, fermenting machines. Mammalian herbivores have evolved high-crowned and ever-growing molars as adaptations to diets high in silica and fiber (15).

Many mammalian herbivores possess specialized chambers for fermentation of plant materials. In addition, the gastrointestinal morphology of individual mammals may adapt to dietary availability. For example, high-fiber dietary content resulted in an increase in large intestine size in prairie voles (Microtus ochrogaster) (16). In short, plants and herbivores, including mammals, have evolved adaptations in response to the influence of each on the other.

The mechanism of this gradual evolutionary adjustment among complex assemblages of plants and animals continues to be debated and has been termed diffuse coevolution (14). Mammalian herbivores probably evolved in response to plant adaptations, which themselves evolved in response to insect herbivores. An example is the coevolution of herbivorous marsupials in Australia. In response to mammalian herbivory, several species of the family Leguminosae are said to have evolved fluoracetate, which inhibits the citric acid cycle. The Australian mammals counteradapted and are now resistant to fluoracetate. Specifically, kangaroos and bush rats, whose geographic ranges include plants with fluoracetate, are resistant. The same animal species and related species whose ranges do not encompass these plants are not resistant to fluoracetate (17).
Effect of herbivory on plant production of secondary compounds

Several different effects of herbivory on the production of allelochemicals have been documented. I have selected 2 examples to illustrate these diverse effects. First, herbivory can cause plants to revert to an earlier phenologic state with heightened secondary compound production. Four species of mature Alaskan trees responded to heavy browsing by snowshoe hares by producing adventitious shoots that were resistant to browsing because they had significantly higher concentrations of phenolic resins and terpenes than did the mature twigs (18). Second, herbivory can change the production of secondary compounds by inducing chemical production through physical or chemical signals. With herbivory simulation by repeat cutting, the saponin concentration of alfalfa was shown to increase, and phenolic concentrations have increased in tundra sedge (19, 20). Other studies showed changes in secondary compound production under conditions of heavy herbivory with mammalian population cyclicity in natural conditions (14). Rhoades (21) first documented airborne chemical induction of increased chemical production in undamaged willows when nearby trees were defoliated by insects. Chemical induction via pheromonal transmission in plants was subsequently shown in other species in various habitats.

These types of studies indicate the importance of understanding the totality of the biology of the plant species under study as a functional food. The natural history of the species and the environmental growth conditions of the plants from which samples may be taken for study are key to interpreting studies of plant secondary compounds.

Location of chemical defense in plants

In producing these chemicals for their own defense, plants, as noted earlier, must avoid poisoning their own tissues. How they do this has important implications for the design of experiments to study the effects of functional foods or their constituents on health outcomes. Two common ways of sequestering plant chemicals are through the location of the physical storage and the form of the chemical defense. To protect their own tissues, plants may physically sequester or localize secondary compounds in specialized vacuoles, plastids, glands, cell walls, or plant part surfaces. The compounds are then released when the plant part is crushed or punctured. Plants may also store the chemicals as inactive precursors that become activated only when the tissue is damaged (14). In plant parts containing cyanogenic glycosides, the glycosides and activating enzymes are spatially separated in plant leaf tissue. When the leaf is crushed, the chemical components mix, releasing free hydrogen cyanide (22).

Studies to investigate potential health contributions of allelochemicals in functional foods can benefit from an understanding of how these chemicals are stored and released by the plant in its own defense. Such information will aid in appropriate preparation of sample materials for testing of chemical concentrations and outcomes, particularly in preliminary and animal model studies.

FUNCTIONAL FOODS AND THE OFFICE OF DIETARY SUPPLEMENTS (ODS)

For the year 1996 alone, sales of dietary supplements in the United States totaled $9.8 billion, an increase of 9% over the previous year (23). The ODS was authorized by Congress as part of the Dietary Supplement Health and Education Act of 1994 (DSHEA (24), section 13.[a]) to promote the scientific study of dietary supplements in “maintaining health and preventing chronic disease and other health-related conditions.” The DSHEA placed the ODS at the NIH and mandated specific research and advisory duties for the office. The DSHEA legislation modified the Food, Drug, and Cosmetic Act with respect to a definition of dietary supplements. According to the act, dietary supplements are defined as follows: “a product (other than tobacco) intended to supplement the diet that bears or contains one or more of the following dietary ingredients: (A) a vitamin; (B) a mineral; (C) an herb or other botanical; (D) an amino acid; (E) a dietary substance for use by man to supplement the diet by increasing the total dietary intake; or (F) a concentrate, metabolite, constituent, extract, or combination of any ingredient described in clause (A), (B), (C), (D), or (E).”

To assist the office in meeting its Congressional mandates and developing a strategic plan to prioritize its scientific goals and objectives, the ODS enlisted the help of professionals from academia, government, industry, and public advocacy groups. These individuals have served as ad hoc advisors to the ODS in all activities. In particular, >150 persons assisted the ODS in developing its strategic plan, Merging Quality Science with Supplement Research: A Strategic Plan for the Office of Dietary Supplements (25). An important part of this plan was the development of an operating definition for dietary supplements that could be readily interpreted by scientists and the public. This definition included reference to the proliferation of terms currently used in the marketplace and is included as Appendix A.

Through this definition, the ODS has divided dietary supplements into 3 categories: nutrient supplement ingredients, botanical (plant-derived) supplement ingredients, and other dietary substances. Functional foods are not considered dietary supplements because they are whole foods and part of the diet. However, research that investigates the activity or health outcomes associated with chemical constituents derived from functional foods would be supported by the ODS and viewed as botanical ingredient research. More information about the ODS, its strategic plan, and its activities can be found at the ODS World Wide Web site (26).

EFFECT OF THE MARKETPLACE ON RESEARCH AND FUNCTIONAL FOODS

The marketplace is rapidly changing; dietary supplements are being incorporated into food products, plant foods are being genetically engineered to contain higher amounts of nutrients and other chemicals, and research on functional foods is changing the face of foods as we know them. As a result, the grocery aisles of tomorrow may look very different from those of today. We might expect to see various colors of asparagus arrayed in the vegetable counter, each representing a visual clue for the high-potency nutrient it contains. Purple asparagus might contain high-potency concentrations of zinc, yellow asparagus could contain added vitamin E, and orange asparagus might contain increased concentrations of β-carotene; green asparagus would indicate a product grown in carefully characterized “natural” conditions.

We could select our produce and diet based on our individual genome, with the objective of reducing genetic risk factors for specific diseases. Other new products might be available on the
shelves, such as breakfast cereal with added *Hypericum perforatum* for days when one is feeling low, or another cereal with added choline for extra energy on that morning before a tennis match. How would these products be categorized, studied, and regulated?

The current Food and Drug Administration approach to drugs, foods, additives, and supplements is based on the concept of intended use. This approach may be difficult to sustain as foods, supplements, and drugs continue to merge with multiple uses for each product or ingredient. Perhaps it is time for a new approach and a more integrated concept with respect to research, safety, and regulation.

In the 1997 WO Atwater Lecture, Sanford A Miller (27) stated that the issues surrounding our rapidly globalizing food supply are much broader than those of food safety alone. Miller proposed that what is needed is a more integrated approach through what he termed *food wholesomeness science*. He viewed this new scientific approach as growing out of the need to study interactions that are impossible to isolate by classic experimental designs. Miller suggested that science needs to keep pace with the marketplace and, therefore, food wholesomeness science would, of necessity, integrate toxicology, nutrition, microbiology, food science, genetics, and environmental science. He believed that such an effort would take place only in truly interdisciplinary research laboratories linked to a new government agency that would embody this broad approach (27). In addition to the disciplines mentioned by Miller, a movement toward a food wholesomeness science that is truly modern would need to incorporate the concept of functional foods, thereby adding the diverse disciplines of plant biology, ethnobotany, plant chemistry, and plant genetics to the list. Without incorporating the knowledge of these disciplines into research, some results of this modern discipline of nutrition might be misinterpreted or directionally flawed.

**CONCLUSION**

It is an exciting time in nutrition science. The links of diet and health are no longer questioned. We have moved from a truly interdisciplinary approach to research problems as shown in many areas of nutrition research (28, 29). We can only expect this to accelerate, and as proposed by Miller, we may be on the verge of an even greater integrative approach to meet the future challenges of our rapidly changing food market. In light of these changes, we cannot allow the proliferation of terms generated by market niches to cloud the view of underlying science. We must decide whether functional food research should become a subdiscipline of nutrition. If so, scientists entering this field will require broader training that reflects their specialty area. If epidemiologic studies are the first-line detective in human research, before human studies are undertaken with plants and plant constituents, careful explorations of plant biology and plant chemistry need to be a second line of detection. Is the secondary compound in question stored as a precursor? Isolated in a vacuole? What are the releasing mechanisms? Is the quantity highly variable, and can it be induced by simulated or real herbivory? As nutrition scientists, our partners in science must broaden even further if we are to advance understanding of the concept of food functionality.

**REFERENCES**

APPENDIX A
The following is an excerpt from *Merging Quality Science With Supplement Research: A Strategic Plan For The Office Of Dietary Supplements* (1).

Operating definition of dietary supplements
Meetings with NIH Institute Directors and individuals from other agencies indicated that the definition stated in DSHEA required clarification so that scientists and administrators could readily interpret whether compounds of interest to them would fall within the ODS mandate.

Further, the DSHEA definition encompassed such a wide array of compounds that some type of categorization was required to promote science in a systematic fashion. The ODS, therefore, enlisted the assistance of participants in the strategic planning meetings to develop an operating definition and broad categories within which to group dietary supplements to help focus ODS activities.

ODS approach to dietary supplements
The ODS accordingly has determined that its research focus will be on the types and quantities of ingredients that may be contained in commercially marketed dietary supplements and their role in maintenance and promotion of health. Thus, two basic assumptions govern ODS activities: 1) compounds that are under consideration currently have an intended use as dietary supplements or ingredients in dietary supplements and 2) compounds or ingredients, therefore, must meet the method of delivery and other statutory definitions for dietary supplements described in DSHEA. Ingredients or chemical constituents derived from items that may be termed *functional foods* [“any modified food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains” (2)], or some compounds that may be termed *nutraceuticals* [“any substance that may be considered a food or part of a food and provides medical or health benefits, including the prevention and treatment of disease” (3)] may also be dietary supplements if they fall within the statutory definitions of DSHEA. The ODS considers solutions that are used to provide total parenteral or full enteral nutrition (by tube feeding) to be outside the scope of the office.

However, research on the health effects of specific supplement ingredients that may be added experimentally to these solutions may be considered within the scientific scope of the ODS depending on the ingredient and study design.

Therefore, the ODS will identify and foster research on the health benefits and risks of substances based on the merit of the underlying scientific evidence regardless of how they might be currently incorporated into the different categories of commercial products or their regulatory status in the commercial marketplace. This approach allows the ODS flexibility to address the scientific questions relevant to the role of specific substances in promoting health without being unnecessarily constrained by the nuances that bear on whether a substance may be lawfully used in a dietary supplement, or whether specific information on the label/labeling causes a product to be marketed under regulatory frameworks other than as a dietary supplement.

Operating definition
Following DSHEA, a *dietary supplement* is viewed by the ODS as any substance that is consumed in addition to the regular diet—that is, in addition to meals, snacks, and beverages—and follows the methods of delivery clauses outlined in the Act. Food items, in any physical form (such as a liquid or a powder intended to be added to a liquid) that are intended to be a sole source of nutrition, meal replacements, or conventional foods are not dietary supplements as defined in DSHEA, and thus are outside of the scope of ODS.

Categories of dietary supplement ingredients
Dietary supplements may contain one or more ingredients whose health benefits and risks are of interest singly and in combination. To simplify the ODS management of information and activities pertaining to the broad and heterogeneous spectrum of ingredients that are included in dietary supplements, it will group dietary supplement ingredients into three categories: botanicals, nutrients, and other dietary substances.

Botanical ingredients include all plant-derived materials whether fresh, preserved, or dried full plants, plant parts, plant species mixtures, plant extracts, and compounds found in such materials. Thus, items commonly termed *herbs or herbal products*, regardless of whether they meet the dictionary definition of herb [“flowering plant whose stem above ground does not become woody” (3)] or that are comprised of parts, extracts, or preparations of woody plants will be included as botanical ingredients.

Nutrient ingredients include all essential and nonessential nutrients and other food constituents typically described in standard nutrition reference texts or that fall within the review parameters of the Food and Nutrition Board, National Academy of Sciences in consideration of Dietary Reference Intakes (DRIs). Thus, this category would include substances recognized as essential nutrients (eg, iron, vitamin C, essential amino acids) and substances not generally recognized as being essential but that have or may have a dietary or nutrient role in humans.

*Other dietary substances* comprises a broad and diverse group of substances that are neither of plant origin nor alone could be viewed as “nutrients” within the common-sense meaning of the term. Such substances could include animal or plant metabolites or constituents, microorganisms and certain of their constituents. The substances subject to inclusion in this category are limited by the statutory definition of “dietary supplement” in the DSHEA (eg, not an approved or investigational drug, not a conventional food or meal replacement, and intended to be used to supplement the diet).
REFERENCES

