

Moving Whole Grains Forward: The Case for a Whole Grain Collaborative

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INTRODUCTION

Current scientific evidence, policy statements (2005 Dietary Guidelines, MyPyramid, Healthy People 2010), and regulatory guidelines (for health claims regarding fiber-containing grain products and cancer [§21 CFR 101.76] and soluble fiber from certain foods, such as whole grain oats and whole grain barley, and the risk of coronary heart disease [§21 CFR 101.81]) all support increasing whole grain intake in the United States to reduce the risk of chronic disease (2,3,7,16,17). In response, more than 650 new whole grain foods have been introduced to the marketplace over the past year. Yet there exists a gap between the recommended consumption of three servings of whole grains daily and the current consumer intake of just one serving per day.

In an attempt to help bridge the whole grain consumption and knowledge gaps, the University of Minnesota held a Whole Grains & Health Global Summit in Minneapolis, Minnesota, in May 2005. The Summit assessed current data on whole grains and health, reviewed knowledge and research gaps, identified barriers and motivators to consumption; and explored development technologies along with public policy, food labeling issues, and a long-term agenda for whole grains and health (11).

The conference showed that a systematic and multidisciplinary approach throughout the grains supply chain is needed to address the numerous issues facing consumers and the grain industry. To date, there is no group or organization to lead this extensive research as an integrated and unified North American effort. What follows is a discussion about creating a whole grain collaborative to coordinate grains research in the United States and Canada. Such a collaborative would allow a core group of experts and stakeholders to prioritize, facilitate, and deliver innovative

research to scientists and disseminate a pipeline of findings to health-related organizations and consumers. At present, no such program exists.

Whole Grains and Health

Hundreds of foods and food components, including whole grains, are linked to health and preventing disease (7,16,17). Whole grains contain bioactive components that are purported to benefit human health. Given the staggering economic impact of chronic disease in the United States, eating healthy foods (such as eating whole grains) has the potential to improve the health of the population.

Chronic diseases, specifically cardiovascular disease, diabetes, and cancer, account for nearly two out of every three deaths in the United States (1,12). In 2003, the economic costs of these three diseases combined comprised 32% of the \$2,256.5 billion in total cost of illness in this country (1,12). The consumption of whole grains is linked to a reduced risk for each of these diseases. Whole grain consumption is believed to:

- Lower cholesterol;
- Improve glycemic control;
- Slow digestion and improve satiety; and
- Improve bowel function.

Results from a study published in the *American Journal of Public Health* (8) indicate that postmenopausal women (age 55–69 years), as part of the Iowa Women’s Health Study, who ate at least one serving of whole grain foods daily showed reduced total and cause-specific death rates (8). Extrapolating from that study and using current U.S. census data, it is estimated that if all Caucasian postmenopausal American women (ages 55–69 years) ate just one serving of whole grain foods each day, as part of a healthy diet, all-cause mortality would be reduced by an estimated 15% (15).

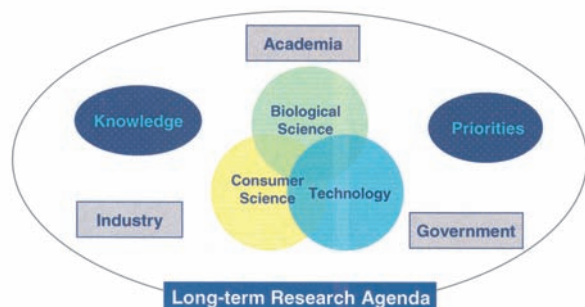


Fig. 1. Collaboration model.

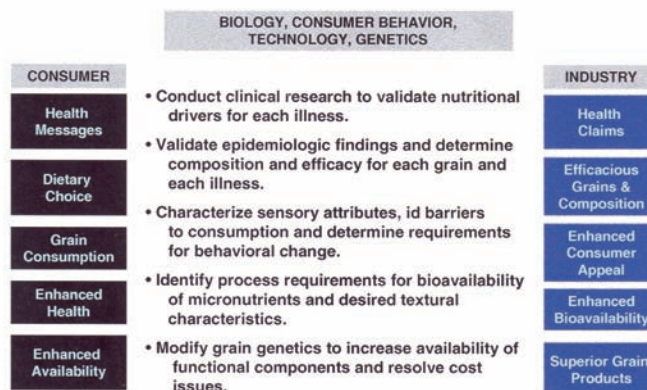


Fig. 2. Grains, whole grains, and functional parts.

Looking Back

In early times, as we learned to harvest grains and process them to bake breads and make cooked cereals, porridge, and other early grain foods, the United States relied wholly upon whole grains. With the invention of the roller mill in the 1850s and its greater ability to remove the bran and germ from the grain during milling, the U.S. food supply transitioned to one that utilized mostly refined grain products. Washburn-Crosby and Pillsbury, key players in grain milling and flour making of the time, ramped up to larger scales and capacities so that more refined flour was milled and made available for most commercial grain products, including crackers, biscuits, and cereals. Taste appeal, appearance, and broad acceptance of refined grains were enjoyed by consumers for several generations (4,9,10,13,14).

Grain-based foods developed by food manufacturers nearly a century ago continue to maintain a significant share of market as evidenced by the list of historical brands still in existence (see below). With the current return to the whole foods and whole grains of more than a century ago, we enter a new paradigm. As we make this shift, food manufacturers must choose either to proactively develop nutrient-rich whole grain foods or to maintain their stake in current refined grain product offerings.

As the grain industry chooses to develop whole grain foods, it must learn to grapple with and solve new and unfamiliar issues inherent in milling and processing of whole grains. New techniques are needed to move wholesome grains through the supply chain—from growing to milling and from processing to distribution. As an example, manufacturers must take great care in protecting whole grain products from the rancidity that affects flavor, nutrition, and overall appeal. This represents an opportunity for food manufacturers to improve technology and thereby to capture a larger share of market with whole grain foods. That way, more healthy grain foods, such as those containing whole grains, added fiber, or functional components, will capture the health-interested consumers' palate and reap market benefits similar to those gathered more than a century ago.

Historical Look at Grain Product Introductions

- 1876 Premium Saltines (soda crackers)
- 1880 Gold Medal Flour
- 1881 Pillsbury Flour
- 1889 Aunt Jemima Pancake Mix
- 1891 Fig Newtons
- 1891 Quaker Oats
- 1893 Cream of Wheat Cereal
- 1895 Triscuits
- 1896 Cracker Jack
- 1897 Grape-Nuts cereal
- 1898 Nabisco Graham Crackers
- 1898 Nabisco Shredded Wheat Cereal
- 1900 Barnum's Animal Crackers
- 1906 Kellogg's Corn Flakes
- 1912 Oreo (Biscuit)
- 1915 Kellogg's Bran Flakes

Sources: 4,9,10,13.

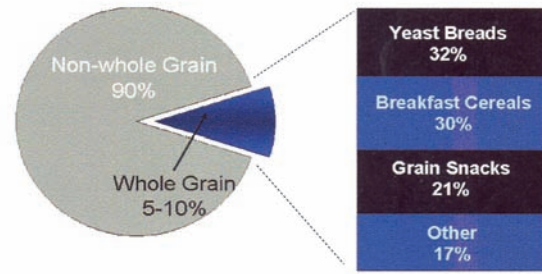


Fig. 3. Whole grain consumption.

Worldwide Efforts

The interest in improving grain food quality by building a better research model and developing new technologies to create better grain-based foods is reflected in some of the models being employed in Europe and around the globe. Beginning in 2005 and lasting through 2010, the European Union is conducting an integrated project titled “Exploiting Bioactivity of European Cereal Grains for Improved Nutrition and Health Benefits,” or HEALTHGRAIN (6). This project aims to improve well-being and reduce the prevalence of insulin resistance syndrome in the European population by increasing the intake of whole-grain components. HEALTHGRAIN develops a technology and nutritional expert base to identify health-relevant cereal food quality criteria and enables the production of foods tailored to contain health-promoting grain constituents, such as dietary fiber, oligosaccharides, and phytonutrients. HEALTHGRAIN has 43 research and development partners in multiple institutions and companies. Already 40 companies have joined the project's industrial platform to participate in its dissemination and communication program.

In Australia, the Grain Foods Cooperative Research Centre (5) has been established to act as a collaborative forum between academia, government, and industry, and to assist in developing healthy, consumer-friendly grain foods.

By improving the ability to move whole grains “from the field to the fork,” great strides can be taken in reducing risk for chronic disease. What's needed is a new collaborative model—not unlike those currently being employed successfully in Europe and Australia. Such a collaborative would advance knowledge and enhance the utilization of health-improving foods, both effectively and efficiently.

Rationale for a Whole Grain Collaborative

The adage “The whole is greater than the sum of its parts” has been applied to whole grains and their health benefits, but it also pertains to what constitutes a successful collaborative. Though individual efforts in research, product development, and even messaging for consumers is a given, they can be the Achilles' heel of a collaborative venture. Interest in and commitment to the mission of the collaborative must be equally shared so as to be certain that individual interests do not supersede that of the group and hinder progress.

One collaborative model currently under development is The Institute for Grains and Health Research (IGHR). This North American whole-grain focused collaborative is dedicated to improving the health and well-being of the population through basic, applied, and translational research on grains and grain components.

The long-term objectives of the IGHR are to facilitate coordinated research to enhance the knowledge and utilization of healthful components delivered in grain-based food products.

An Example of Collaborative Whole Grain Research

In order to study whole grains “from field to fork,” much research and collaboration is necessary. For example, if a case is made for lower caloric density grain foods with enhanced nutritional value (i.e., phytonutrients) that taste good and meet consumer needs and wants, they might include some of the following steps and raise questions such as: Can this product be developed with available technology or do we need special tools or techniques to develop it?

In this example, research and development efforts would need to focus on developing a cereal or bread product that was reduced in calories but contained functional components that are bioavailable and could be used to make consumer-acceptable products. Perhaps, the food would contain no endosperm, yet three times the amount of bran and let’s say two times the amount of germ. One way to conduct research such as this is to develop a systematic approach to identify the health attributes of grain-based ingredients and products using a series of steps as shown in Figure 4.

Determining the types and forms of grains to utilize and then characterizing the functional components will facilitate learning how they might be beneficial to human health. More specifically, *in vitro* work may be helpful to discover what the active fractions are. Do the fractions contain antioxidants, phenolic compounds, phytosterols, and tocopherols? If so, which ones and in what amounts? Also needed are the appropriate sets of tools and methods to characterize these bioactive components.

Once the components are identified, the grains could be milled to the appropriate particle size to allow a good texture and bioavailability of phytonutrients, and then processed through baking, extrusion, or fermentation using optimized techniques for a good outcome. The effective dose must be established—either so many grams or so many servings per day—and then tested first through *in vitro* work with cells and then perhaps with animal studies. If results are promising, clinical studies may be used to test human consumption to determine if say, one serving of enhanced whole grain products could replace three servings of typical whole grains.

Studies must consider outcome variables for a host of diseases and conditions and determine endpoints for animal and clinical studies. Work conducted in the study of obesity, for example, could evaluate the satiety level of the food and determine if the innovative new food could be effective in preventing obesity or promoting weight loss. For other diseases, studies must look at risk factors and evaluate biomarkers specific for that condition.

Sensory studies would help determine the taste, texture, and acceptance of new products (with enhanced nutritional benefits) to allow for their optimization either by formula or process technology modifications prior to manufacturing and distribution.

The IGHR will achieve this through a collaborative of academic institutions with expertise in various areas of grain research. This collaborative, in partnership with government and industry, will identify, prioritize, and seek underwriting support for research projects. Results will be disseminated through university partners, health organizations, and industry trade groups.

Founding members of the IGHR include scientists from four universities with proven expertise in the science of grains and whole grains: 1) the University of Minnesota, for nutritional sciences, behavioral health, and grain genetics; 2) Kansas State University, for milling, baking, and feed science and chemistry; 3) Cornell University, for characterization of grain phytonutrients, grain health benefits, and bioavailability; and 4) the University of Manitoba, for experimental systems from grain biochemistry to traditional and novel extraction equipment using cell-culture models and animal and human studies. In addition, the Wheat Foods Council will be actively involved in the dissemination of research findings to health professionals, commodity groups, and consumers.

AACC International will be actively involved in gathering information through a variety of vehicles including task forces, conference calls, and portals as well as the dissemination and communication of research findings to educate those working in industry, government, and academia institutions within the grain-based food industry worldwide.

To further the scientific reach and to promote collaboration, the IGHR will be establishing industry partnerships with appropriate companies (including the General Mills Endowed Cereal Chair), trade and health associations, and government agencies and programs. Extending beyond these partners, IGHR will be seeking ad hoc partnerships with individual scientists, academic laboratories, departments, agencies, and private institutions to allow sharing or transfer of grant or contract monies as needed by specific projects. Because sustained involvement is critical, relationships between collaborators will be fostered through ongoing electronic communication, symposia, and annual meetings.

Additionally, the collaborative will seek to enhance its effectiveness through the appointment of a Research Advisory Committee comprised of 10–12 individuals from organizations, associations, and agencies with economic or scientific interest in the work of the IGHR. The advisory committee will provide strategic guidance based on research needs and will help establish protocols, methods, and project prioritization.

Collaborative Research Focus

The IGHR collaborative will emphasize its leadership in three distinct basic research areas: 1) nutritional science and health, to

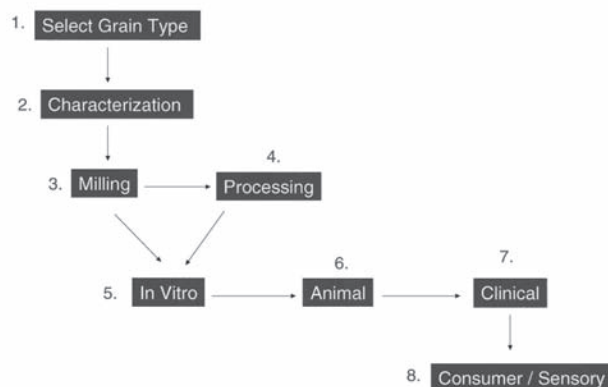


Fig. 4. Grains and health: research template.

study the unique substances in grains and the biological mechanisms by which grains affect health; 2) consumer research and education, to increase the learning and interest in grains and to communicate grain and health-related messages; and 3) grain science and processing, to understand the effect of processing on bioavailability and sensory characteristics of grains and the application of this knowledge to processing and product development.

Working together collectively, the IGHR collaborators are essential because of their ability to ascertain the effects of bioactive substances, as a whole or extracts, to fund research, set policy, and establish guidelines for food labeling, to provide acceptable products, to educate and communicate the group's efforts to bridge theory with reality, and to help translate whole grain messages and motivate purchase behavior. Changing whole grain consumption rests on making foods available that consumers will eat and enjoy.

Collaborative Funding

Start-up support for research at the four institutions as well as administration support at the host institution will be solicited actively from government, industry, and trade organizations.

Grant writing will be inclusive of the disciplines within the inter-university partnership and with expertise from other academic institution, government, and industry involvement. The collaborative would seek to attain funding for its initiation and sustainability from a broad range of sources such as NIH, USDA, various foundations, private donations, and industry.

In addition, the group will seek to obtain discretionary funds. If the Institute has discretionary resources, it can invest in new initiatives (seed grant projects) to keep programs contemporary, or these dollars can be used to develop new programs. Discretionary resources may be derived from university allocations, from surpluses generated by ongoing programs, or from other internal or external sources.

Collaboration Makes Sense

The benefits of bringing academia, government, industry, and educators together are many. The range of pluses inherent in a collaborative model includes:

- Research dollars are maximized. Funding efficiencies are realized, i.e., reduced duplication of research, research equipment, and necessary people power.
- Research is prioritized, resulting in a more effective approach to the study of whole grains.
- Research is accelerated due to improved efficiencies, centralized leadership, more connectivity between vested parties, and minimal redundancies in design.
- Efforts are strategically aligned with industry needs to encourage new ideas and an understanding that the research carried out will have practical significance and application.
- Product innovation and design are improved as a result of the academia and industry collaboration.
- Academia, government, and educators work together to yield a joint promotion of research findings and recommendations using a common voice and unified messages to consumers.

As an entity, a successful collaborative acts as a conduit and clearinghouse for research communication. A collaborative can serve as a virtual think tank for whole grains research, which will help to develop the network of resources that will be both essential and well-utilized as whole grain science expands and increases in complexity.

Measures of Success

Successful outcome measures for innovation processes may include some or all of the following:

- Frequency and impact of discoveries and publications;
- Diversity of collaborators;
- Funding garnered;
- Patents filled and issued;
- Products commercialized;
- Number and prestige of awards;
- Impact of collaborators on young scientists;
- Ability to attract newcomers to field;
- Frequency and duration of delays;
- Level of interpersonal trust;
- Extent of shared mental models;
- Degree of mutually consistent work practices; and
- Level of public interest.

Looking Ahead

The study of whole grains is at a pivotal point. Research nods toward the potential health benefits of whole grains, yet there is no coordinated system for advancing the research and working with industry to develop technologies and manufacture products that meet consumers' taste preferences. A whole grain collaborative would serve that end and likely accelerate progress toward increasing Americans' consumption of whole-grain foods.

A whole grain collaborative would set the foundation for basic and applied research. It would leverage research dollars, prioritize research, and achieve better research results, serve as a clearinghouse for whole grain information, and, over time, help address the burgeoning issue of chronic disease and escalating health care costs. In short, a whole grain collaborative could help connect the dots. Getting the dots connected will result in a clearer, more useful picture of whole grains, which can benefit the population at large.

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Marcia Scheideman is president of the Wheat Foods Council, where she administers all programming initiatives and serves as the Council's spokesperson to the media, government, trade organizations, and the grain industry.

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