



# Bioactive Dietary Chemicals

This project advanced our understanding of bioactive dietary chemicals that can be either beneficial or harmful to human health, thus identifying ways to improve food safety, prevent common diseases, and ensure that consumers have a safe, healthy food supply.

## Who cares and why?

Bioactive chemicals can be found naturally in foods or introduced during food processing. These chemicals can have both beneficial and undesirable effects on human health. For example, certain fungal compounds found in corn, ground nuts, and tree nuts can damage DNA and promote cancer. Conversely, omega-3 fatty acids produced by plants and algae and concentrated in certain fish species can promote cardiac health. In recent years, the herbal products and food supplement industry, valued at an estimated \$20 billion per year in the U.S., has taken off. Effective products could reduce medical costs and provide farmers with new specialty crop opportunities; however, inadequate quality control and understanding of potential toxicity could allow harmful substances to enter the food supply. Therefore, understanding the complex relationship between bioactive dietary chemicals and human health is a paramount concern to consumers, agricultural producers, food processors, health professionals, and policymakers charged with maintaining a safe and nutritious food supply.



## What has the project done so far?

This multidisciplinary group of scientists from 15 U.S. universities and the USDA-Agricultural Research Service has been collaborating since 1971 to improve food safety and human health worldwide. Their most recent efforts have investigated how food-borne bioactive chemicals can protect against human diseases such as cancer, inflammation, birth defects, and microbial infections, as well as how food-borne toxins are created by processing, preparation, and other post-harvest activities. Project scientists have also discovered bioactive chemicals that have adverse effects on human health. Using this information, W-2122 researchers have developed approaches to increase beneficial—and decrease adverse—effects of bioactive food chemicals and microbial contaminants. Research has also led to improved understanding of how changes to the human body's natural collection of bacteria and other microorganisms are related to chronic metabolic diseases. W-2122 extension experts have shared research results with stakeholders using multimedia materials.

Salmon is a source of omega-3 fatty acids, bioactive chemicals that promote cardiac health (photo by Andrea Pokrzywinski). On the other hand, *Aspergillus* species of fungi produce mold toxins that are potent carcinogens and can lead to serious human health problems when consumed (bottom left, photo courtesy of IITA). Another common fungal disease on corn ears, fusarium ear rot, can produce fumonisin, a mold toxin that is suspected to contribute to birth defects in Hispanic women who eat large amounts of corn (bottom right, photo by Thomas Lumpkin).

## Impact Statements

Shed light on possible dietary strategies for preventing and treating metabolic syndromes (including type 2 diabetes, hypertension, high cholesterol, and cardiovascular diseases) that afflict over 47 million Americans.

Helped consumers make more informed, healthier choices about whether to take dietary supplements. For example, University of Illinois researchers found that the estrogen-like compounds (isoflavones) in some soy supplements can stimulate growth of estrogen-dependent breast cancer and can negate the effectiveness of breast cancer therapies (e.g., tamoxifen and aromatase inhibitors), depending on dosage.

Developed ways to increase beneficial effects of bioactive chemicals so they are more active but have fewer adverse side effects for consumers.

Improved food safety by identifying how to prevent contamination from food-borne toxins during processing, preparation, and other post-harvest activities.

Found ways to assess and reduce harmful levels of aflatoxin B1 (a carcinogenic mold toxin) in turkey and grain. This information helps ensure safe food products for consumers and is useful in parts of Asia and Africa where 10% of adults may die of aflatoxin-related liver cancer.

Advanced strategies for protecting and treating individuals exposed to bioactive toxins through deliberate use in chemical terrorism or warfare or natural contamination of foods.

Saved taxpayers millions of dollars by simplifying risk assessments for fumonisin, a carcinogenic mold toxin.

Characterized the fetus stage that is most susceptible to carcinogens to which the mother is exposed, leading to better prevention protocols for pregnant women.



Studies found that consuming dry bean or rice bran (the outer layer of the rice grain) increases beneficial bacteria that produce food for cells lining the colon, while also reducing the growth of harmful bacteria that can cause intestinal inflammation. Photo courtesy of Rob Qld, Flickr. Other studies showed that bitter melon prevents obesity-associated metabolic disorders like diabetes. Studies also linked the bioactive chemicals in bitter melon to improved glucose, insulin, triglyceride, and cholesterol levels. Bitter melon is widely cultivated throughout the year in Asia, eastern Africa, and South America and is used extensively in folk medicines. Thus, it provides a cost-effective treatment or preventive strategy that is widely acceptable, especially among culturally sensitive populations and developing nations. Photo courtesy of Lao Foods Flickr.

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### What research is needed?

Despite significant progress in this field, much remains unknown about the impact of bioactive dietary chemicals on human health and food safety. Researchers are continuing to explore ways to increase the beneficial impacts and minimize the risks of bioactive dietary chemicals. Continued collaboration and communication of results among consumers, agricultural producers, food processors, health professionals, and policy makers is needed to maintain food safety and improve human health worldwide.

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### Want to know more?

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