



The taste you love, the nutrition you want.

**FY 2015 Research Plan Narrative
National Processed Raspberry Council
For the period October 1, 2014 – September 30, 2015**

Nutrition Research

Dietary guidelines around the world recommend daily consumption of 5 to 9 servings of fruits and vegetables for the prevention and/or management of chronic illnesses like cardiovascular disease, cancer and neurological diseases, such as Parkinson's, Alzheimer's disease and Rheumatoid Arthritis. Red raspberries, in addition to their attractive color and appealing flavor contain several essential phytochemicals and beneficial polyphenols that are believed to contribute to good health. They are considered a healthy food choice since they are low in total calories and fat, are high in dietary fiber (one of the highest fiber berries), and are a good source of vitamin C, folate, potassium and magnesium

Studies have demonstrated that polyphenols are absorbed into the body in their bioactive form. Rather than consuming extracts of individual components of foods, nutritionists and other health professionals recommend that people eat whole foods because the complimentary and synergistic effects among their components far outweigh consuming individual nutrients or bioactive compounds.

In addition to meeting important dietary recommendations, regular consumption of raspberries provides several additional and unique health benefits. A growing body of research suggests that red raspberries, a rich source of bioactive polyphenols, have anti-inflammatory properties and may offer beneficial effects against inflammatory-related diseases. The general consensus is that chronic inflammation is at the root of all chronic illness, and food with anti-inflammatory properties may play an important role in preventing chronic illness and/or helping to manage a whole host of health issues.

There is growing interest in diet and how it can fight inflammation. While inflammation is the body's natural protective response to illness, stress and infection, inflammation can become harmful when the body's immune system malfunctions resulting in chronic inflammation.

Raspberries are a significant source of Vitamin C and other important health promoting bioactive compounds, including anthocyanins. They are a particularly rich source of cyanidin and are unique among the berries for their high ellagitannin content, which can be hydrolyzed to yield ellagic acid.

The dense nutritional profile of raspberries and the presence of beneficial phytochemicals that are absorbed by the human body influence several mechanisms and can thereby affect health. For example, the low energy, low fat, no cholesterol and high fiber content of raspberries is consistent with nutritional profiles of foods that support healthy heart function and promote



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improved glucose response. Fiber helps reduce both hunger and may lead to a feeling of satiety. The potassium and low sodium content of raspberries may also help reduce hypertension. Research findings to date suggest that moderate consumption of raspberries may help to prevent the development of early atherosclerosis and alleviate the symptoms of arthritis in animal studies.

The goal of funded research is to establish a link between red raspberry consumption and its anti-inflammatory potential. Wellness communication programs use these research results to increase public awareness about the health benefits of raspberries to increase demand for raspberries.

During Roundtable meetings with leading scientists, a series of priorities for future research for raspberries were identified and subsequently adopted to guide solicitation of research proposals.

Those priorities are:

1. General Chronic Inflammation as it relates to diabetes, cancer, or CVD
2. Diabetes, to include vascular diseases and metabolic syndrome
3. Cardiovascular Disease
4. Osteoporosis
5. Cancer, including breast, esophageal, and colon
6. Cognitive Function/Motor Skills

Using these often inter-related priorities, discussions were held and proposals were solicited from scientists who had presented findings at the Berry Health Benefits Symposium, a biennial conference of scientists from around the world conducting research on the health benefits of berries.

Post-Harvest Research

Recently the Council recognized post-harvest research could also drive increased demand by delivering value added new products, product innovation, or enhanced microbial control utilizing cutting edge technology. To drive the evaluation process for post-harvest proposals in future years, a Task Force has been formed to develop a set of research priorities.

FY 2015 Research Budget: Total recommended: \$699,917

The FY 2015 research budget has multiple components:

1. Program management and services expenses. These annual administrative expense items are necessary to support nutrition research projects.
2. FY2015 Nutrition Research Projects. A Request for Proposal (RFP) was sent to leading scientists who had presented and/or attended the 2013 Berry Health Benefits



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Symposium. Proposals were received, evaluated, and recommended for inclusion in the FY 2015 Budget. Also included are second year expenses of previously approved multi-year projects.

3. FY 2014 Nutrition Research Projects. With researchers having less than a full year to complete their projects, this budget represents the balance remaining on FY 2014 contract expenses which have yet to be invoiced.
4. FY2015 New Technology Research Projects. These are second year expenses of previously approved multi-year projects.
5. FY 2014 New Technology Research Projects. With researchers having less than a full year to complete their projects, this budget represents the balance remaining on FY 2014 contract expenses which have yet to be invoiced.

1. Program Management and Services: Total recommended: \$61,950. Included is part of the Executive Director's time and expenses to complete activities that might otherwise be conducted by a research director, Council travel to attend and participate in Council and committee meetings to discuss nutrition and post-harvest research, and an allocation of direct administrative expenses necessary to support research program functions (printing, phone, supplies, shipping/postage, memberships, subscriptions to professional journals, and legal services for contract review).

2. FY 2015 Nutrition Research Projects (New and 2nd Year of Ongoing Projects): Total recommended: \$513,276.

- a. **Alan Crozier: Identification and Quantification of Potentially Protective Polyphenol Derivatives: \$21,000.** Crozier's work on bioavailability and colonic metabolites is cited in many of the proposals received for FY 2015. Access to ileostomy patients provides a unique real world look at how and where raspberry compounds are utilized in the body. Crozier also has been interviewed in numerous consumer and health care professionals' publications, both print and electronic.
- b. **Daniele Del Rio: The Protective Effects of Raspberry Polyphenol Metabolites: \$40,000.** This proposal completes a two-year study that will establish baseline bio-availability data. In addition to looking at raspberries and cardiovascular health, it will address neurodegeneration mechanisms. Del Rio is a collaborator with Crozier.
- c. **Chris Gill: Raspberry Consumption and Colonic Health: \$15,000.** Recommended funds are for the second year of a two-year study. This is a unique opportunity to investigate the impact of a raspberry diet on colonic micro-biota in samples that have been subject to human digestion rather than laboratory-simulated digestive processes, and determine potential protective effects
- d. **Meijin Zhu: Dietary Gut Raspberry: \$54,422.** Matching grant funds of \$120,598 over the two-years proposed more than double funds available to support this project. The project will study the impact of whole fruit rather than an extract. Gut



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- Microbiota and biological metabolites, rather than consumed compounds, are rapidly becoming recognized as the key to bioactivity. Creating a large body of science on biomechanisms will be critical to establishing any future health claim for raspberries.
- e. **Neil Shay: Defining the Metabolic Benefits of Raspberries and Raspberry Compounds: \$75,000.** Shay's two-year project is designed to examine the ability of raspberries and specific raspberry compounds to influence a series of metabolic conditions of interest to the raspberry industry including diabetes, chronic inflammation, obesity, and cardiovascular health. Using a proven mouse model, the study will examine the role of whole fruit, juice, seed extract and two key nutritional components. Raspberries fed to mice would be in real world quantities equivalent to 1-2 servings of fruit per day. Year one is proposed to confirm metabolic benefits from raspberry consumption, while year two would determine the biomechanisms of those benefits. Recommended funding is for year one only. While expensive for an animal trial, it is an extremely well designed project that will examine a number of combinations of compounds and health impacts, concluding with a communications strategy targeting two key audiences of the Council, Experimental Biology and the Academy of Nutrition and Dietetics (AND). The proposal includes matching funds of approximately 2/3 of the funding request.
 - f. **Giulianna Noratto: Protective Effects of Raspberries Against Diabetes Through Modulation of Gut Microbiota: \$25,077.** Dr. Noratto's proposal calls for approximately \$25,000/year of matching funds, doubling resources available for this multi-year project. Recommended funds are for year one only. In this project, the objective is to assess the health benefits of raspberry consumption as it pertains to diabetes, diabetes-induced metabolic disorders, inflammation, and cardiovascular risk factors. Nutrition science is recognizing the inter-relationship of a series of health maladies associated with Metabolic Syndrome, and the moderation of this Syndrome through dietary change by improving gut microbiotic health could have a significant impact on overall health by lowering multiple risk factors.
 - g. **Arpita Basu: Postprandial Metabolism and Type 2 Diabetes: \$48,120.** Raspberries are believed to have a "competitive advantage" among all berries as a whole food moderator of diabetes. This clinical study with human patients will address the role of raspberries in the dietary management of Type 2 diabetes and the effects of raspberries to modulate metabolic stresses contributing to vascular dysfunction and cardiovascular disease in diabetic patients.
 - h. **Jack Losso: Molecular Mechanisms Underlying the Protective Effects of Red Raspberries Against Insulin Resistance: \$98,967.** A clinical study, this project will establish the effects of whole red raspberry consumption on insulin sensitivity and inflammation, and provide data on how Type 2 diabetes patients respond to red raspberry intervention. The in vitro portion of the project will determine the molecular mechanisms of cellular protection.



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- i. **Britt Burton-Freeman: Red Raspberries and Insulin Action: \$78,255.** Burton-Freeman's clinical study will examine the relationship between red raspberries and oxidative inflammatory stress, and the relationship of these responses to insulin action and red raspberry consumption to reduce diabetes risk factors.
 - j. **Ara Kirakoysan: Cardioprotective Benefits of Red Raspberries: \$57,435.** Kirakoysan's proposal draws its hypothesis from Crozier's work on biomechanisms. Taking a holistic view of health, it addresses the moderation of metabolic syndrome to lessen the public health burden of heart disease by reducing cardiovascular risk factors of elevated cholesterol and insulin resistance.
3. **FY 2014 Nutrition Research (Project Completion): Total balance remaining: \$96,659.**
- a. **Alan Crozier: Identification and Quantification of Potentially Protective Polyphenol Derivatives in the Circulatory System Following Red Raspberry Consumption: balance remaining: \$42,190.** Funding will complete Crozier's FY 2014 project seeking an understanding of bio-availability and the metabolites responsible for chemo-protection and their impact on cancer cells.
 - b. **Daniele Del Rio: The Protective Effect of Red Raspberry Polyphenol Metabolites on the Development of Chronic Disease Mechanisms: balance remaining: \$13,893.** Selected phenolic catabolites and urolithin metabolites representing actual circulating forms in humans after consumption of raspberries are being tested for specific bioactivity to address their putative effects and mechanisms of action in the prevention of diabetes and cardiovascular diseases.
 - c. **Chris Gill: Raspberry Consumption and Colonic Health: balance remaining: \$7,500.** This is a unique opportunity to investigate the impact of a raspberry diet on colonic micro-biota in samples that have been subject to human digestion rather than laboratory-simulated digestive processes, and determine potential protective effects.
 - d. **Shanil Juma: Bone Protective Effect of Whole Red Raspberries in Postmenopausal Women: balance remaining: \$33,076.** The impact of diet, beyond foods high in calcium, is an emerging area of bone density research. Study results could compliment findings from previous studies on raspberries arthritic inflammation, bone and joint health.
4. **FY 2015 New Technology Research Projects (2nd Year of Ongoing Projects): Total recommended: \$17,760.**
- a. **Shyam Sablani: Ultraviolet Light (UV-C) Treatment for Improving Safety of Red Raspberries: \$17,760.** Second year of a two-year project to investigate the efficiency of ultraviolet light to inactivate foodborne pathogens and its effect on berry quality.



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5. **FY 2014 New Technology Research Projects (Project Completion): Total balance remaining: \$10,272.**
 - a. **Shyam Sablani: Ultraviolet Light (UV-C) Treatment for Improving Safety of Red Raspberries: balance remaining: \$10,272.**