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Cancer Prevention



# NUTRITION FRONTIERS

A newsletter of the Nutritional Science Research Group

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Dear Colleague,

Welcome to the winter/spring issue of the *Nutrition Frontiers*, a newsletter from the Nutritional Science Research Group (NSRG), Division of Cancer Prevention, NCI. This issue showcases cruciferous vegetables – the bioavailability of sulforaphane in fresh broccoli sprouts compared with that in myrosinase-treated broccoli sprout extracts, sulforaphane and microRNA activation, and how Nrf2 modulates the anti-inflammatory properties of isothiocyanates. Learn about our spotlight investigator, Dr. Janet Novotny, and her research on cruciferous vegetables, upcoming announcements and more.

## RESEARCH UPDATE: ON THE CLINICAL FRONT

### Absorption & Chemopreventive Targets of Sulforaphane from Broccoli Sprouts or Supplements



Sulforaphane (SFN) from cruciferous vegetables, induces Phase 2 and inhibits Phase 1 enzymes and by inhibiting histone deacetylases (HDAC) may be important for helping re-express tumor

suppressor genes. The majority of SFN is formed when its precursor, glucoraphanin (GFN), is hydrolyzed by myrosinase upon plant tissue damage, such as chopping and chewing. Since SFN bioavailability varies from whole foods and supplements, [Atwell and colleagues](#) evaluated SFN absorption and excretion in individuals consuming fresh broccoli sprouts or a myrosinase-treated broccoli sprout extract (BSE) containing SFN, and assessed both molecular targets of SFN before and after SFN consumption. Although the myrosinase-treated BSE provided more SFN than previously tested GFN supplements, SFN absorption was ~3 times lower than from fresh broccoli sprouts. In both SFN groups, twelve-hour dosing retained higher plasma SFN



### Announcements

The *Stars in Nutrition and Cancer* lecture, *Lifestyle and Breast Cancer* by Dr. Pamela Goodwin is available for viewing [here](#).

### Upcoming Events

May 4-6, 2015

[12th Annual Nutrition & Health Conference](#)

Phoenix, AZ

May 17-18, 2015

[International Society of Nutrigenetics and Nutrigenomics](#)

Chapel Hill, NC

May 17-19, 2015

[Digestive Disease Week](#)

Washington, DC

June 3-6, 2015

[International Society of Behavioral Nutrition and Physical Activity](#)

Edinburgh, Scotland

June 23-25, 2015

[International Scientific Conference on Probiotics and Prebiotics](#)

Budapest, Hungary

### Quick Links

metabolite levels than the single dose and dose responses were not observed for molecular targets of SFN. Despite lower SFN bioavailability, myrosinase-treated BSE may be an acceptable SFN source for use in clinical trials to study certain chemopreventive mechanisms of SFN.

- [Funding Opportunities](#)
- [Nutritional Science Research Group](#)
- [Division of Cancer Prevention](#)
- [National Cancer Institute](#)

## RESEARCH UPDATE: WHAT'S NEW IN BASIC SCIENCE

### Sulforaphane Activates MicroRNA Expression and May Reduce Breast Tumorigenesis

MicroRNAs (miRNAs) are dysregulated in nearly every type of human cancer and miR-140 is decreased in ductal carcinoma in situ (DCIS) lesions. Epigenetic mechanisms are frequently



implicated in miRNA dysregulation in breast tumors. Using genome-wide microarray analysis, [Li and colleagues](#) found that miR-140 was downregulated in cancer stem-like cells compared with normal stem cells. Additionally, SOX9, a transcription factor previously associated with miR-140 expression and a regulator of mammary stem cell state, and ALDH1, an enzyme that oxidizes aldehydes and is a marker of breast cancer stem cells and poor prognosis, were found to be direct targets of miR-140. Administration of sulforaphane, restored normal DNA methylation levels and activated miR-140 expression in ER $\alpha$ -negative/basal-like DCIS cells. Restoration of miR-140 with sulforaphane decreased SOX9 and ALDH1, and reduced tumor growth *in vivo*. miR-140 may be a target for prevention of DCIS.

### Nrf2's Role in the Anti-Inflammatory and Antioxidant Effects of Isothiocyanates and Curcumin



The transcription factor, nuclear factor-erythroid 2-related factor 2 (Nrf2), regulates downstream antioxidative stress genes, such as hemoxygenase-1 (HO-1), and lowers inflammation.

Curcumin and isothiocyanates, such as phenethyl isothiocyanate (PEITC) in broccoli sprouts and water cress, are potent Nrf2 inducers. [Boyanapalli and colleagues](#) compared the anti-inflammatory and antioxidative effects of curcumin and PEITC in the presence and absence of the Nrf2 gene in peritoneal macrophage cells of mice. Peritoneal macrophages that were challenged with lipopolysaccharides alone and in combination with PEITC or curcumin resulted in an increase in the expression of the inflammatory markers cyclooxygenase-2, inducible nitric oxide synthase, Interleukin-6, and tumor necrosis

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factor- $\alpha$  in the absence of Nrf2. In the presence of the Nrf2 gene, however, the macrophages exhibited increased HO-1 and decreased inflammatory genes expression following PEITC or curcumin exposure. Nrf2 plays a critical role in mediating the anti-inflammatory properties of PEITC and curcumin, which may explain the anticancer properties of these bioactives.

#### SPOTLIGHT: JANET NOVOTNY



Janet A. Novotny, PhD, is a Research Physiologist with the U.S. Department of Agriculture's Human Nutrition Research Center in Beltsville, Maryland. Dr. Novotny received a BS in Mathematics, a MS in Nutritional Sciences, and a PhD in Biophysics from the University of Illinois. Dr. Novotny assesses nutrient

absorption and pathways of metabolism, including the pharmacokinetics of anthocyanins, carotenoids, vitamin A, vitamin K, vitamin E, and molybdenum. She also conducts human intervention studies to assess mechanisms by which dietary bioactive components improve health and reduce risk of chronic disease, including cancer, diabetes, and cardiovascular disease. Dr. Novotny was recently awarded an Agriculture and Food Research Initiative entitled *[Adaptation in Polyphenol Bioavailability and Bioactivity During Long Term Exposure to Polyphenol-Rich Foods in Lean and Obese Individuals](#)*. And with the NSRG, she is engaged in a USDA-NCI interagency project to explore *[Brassica Intake and Isothiocyanate Absorption: Intake Patterns May Have Implications for Cancer Prevention by Dietary Brassica Vegetables](#)*.

[Read More »](#)

#### DID YOU KNOW?

##### Radishes Come Fast and in Many Colors



Radishes derive their name from the Latin *radix*, meaning *root* and the Greek, *raphanus*, meaning *quickly appearing*. And for good reason, radishes are one of the fastest growers in the garden. White tuber radishes, also known as daikon, grow in winter; red radishes begin to proliferate in early spring. They come in a variety of colors – pink, dark grey, purple, two-tone green and white, and yellow. No matter the color, shape, or size, these cruciferous vegetables contain glucosinolates, the sulfur-containing chemicals responsible for their pungent aroma, indoles, sulforaphane and the carotenoids zeaxanthin, lutein, and beta carotene. The roots of the radish are an

excellent source of vitamin C and fiber along with other vitamins and minerals.

Don't throw away the leaves! The leaves of the radish plant actually contain more vitamin C, protein and calcium than their roots. Try mixing the leaves with other greens such as spinach. As for the radish root, add thin slices to a salad to offer a peppery zing or serve with honey and vinegar as the Greeks and Romans traditionally did.

#### References

- [http://www.naturalnews.com/031944\\_radishes\\_health\\_benefits.html#ixzz3WOWjPdWE](http://www.naturalnews.com/031944_radishes_health_benefits.html#ixzz3WOWjPdWE) 
- <http://foodfacts.mercola.com/radish.html> 
- <http://www.cancer.gov/cancertopics/causes-prevention/risk/diet/cruciferous-vegetables-fact-sheet>
- <http://aggie-horticulture.tamu.edu/archives/parsons/publications/vegetabletravelers/radishes.html> 

Sincerely,

*Your friends at the Nutritional Science Research Group*

Division of Cancer Prevention  
National Cancer Institute  
National Institutes of Health  
U.S. Department of Health & Human Services

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