

## Broccoli Sprouts, cancer prevention and detoxification

By Geoff D'Arcy, Lic. Ac., D.O.M

**When your mother told you, “Eat all your vegetables and don’t miss the broccoli, it’s good for you!” she was right!**

Now the experts agree - there is compelling scientific evidence that consumption of vegetables and fruits helps to reduce the risk of some cancers. The USDA's Dietary Guidelines for Americans, as well as the National Research Council and American Institute of Cancer Research recommendations, all reflect this growing knowledge. It is estimated that 10.3 million new cancer cases are diagnosed each year worldwide, making cancer prevention a major public health priority. Those simple words from your mother held much truth. Vegetables do keep us healthy, and can be a powerful weapon against cancer. According to a recent international expert report, dietary changes can *prevent* 30 to 40 percent of cancer cases (three to four million cases annually).

**What is it about vegetables that produce those healthy effects?** It's the naturally protective phytochemicals in vegetables. The "stars" of these anti cancer chemicals in the body are: **allicin**, found in garlic; **carotenoids**, found in carrots; **lycopene**, in tomatoes; and another amazing compound found in broccoli, **sulforaphane glucosinolate** (SGS ). These compounds increase the body's own defense system against carcinogens. Cells in the body contain a family of detoxification enzymes (Phase 2 enzymes) that neutralize cancer-causing chemicals as well as free radicals before they damage DNA and initiate cancer. **Chemo-protection** can be accomplished by activating the body's Phase 2 "defense." The Phase Two enzymes are an integral part of the body's amazing detoxification system, neutralizing carcinogens and making them inactive. This detoxification system turns carcinogens and other toxic substances into harmless molecules that are excreted from the body.

In his article "Sulforaphane Stimulates the Body's Cancer Fighting Enzymes," Richard Conant describes how sulforaphane works. “The detoxification of carcinogens and other toxic substances takes place in the liver, and involves two distinct enzyme driven processes or 'phases.' Phase One enzymes neutralize toxins by various routes. Some of these convert toxins into substances that are immediately eliminated. However, other Phase One steps convert toxins into intermediate products which are carcinogenic themselves, and require further treatment before they can be excreted. Phase Two enzymes do this vital job. Phase Two enzymes deactivate these carcinogenic metabolites of Phase One, and the final breakdown product is then eliminated once and for all. [For an excellent review of this subject, see Encyclopedia of Natural Medicine, by Drs. Michael Murray and Joseph Pizzo]. Phase Two is critical. If Phase One is in good working order, but Phase Two is not, the potential threat from carcinogens increases. It is vitally important to keep Phase Two operating well. This is where sulforaphane plays its cancer preventive role. Sulforaphane is a powerful inducer of Phase Two enzymes.”

According to studies by Dr. Paul Talalay and his colleagues at Johns Hopkins University School of Medicine, sulforaphane enhances the cancer-protective capacity of animal cells. **Sulforaphane induces Phase 2 (detoxification) enzymes, which are the enzymes that help to deactivate carcinogens and free radicals, thereby enhancing the body's own defense system against cancer-causing chemicals.**

**Some of the best growing techniques now guarantee large quantities, up to 5,500 parts per million, of sulforaphane within organically grown broccoli sprout powder.** "Three-day-old broccoli sprouts consistently contain 20 to 50 times the amount of chemo-protective compounds found in mature broccoli heads, and may offer a simple, dietary means of chemically reducing cancer risk," says Paul Talalay, M.D. (See Fahey, Zhang and Talalay, " Broccoli sprouts: An exceptionally rich source of inducers of enzymes that protect against chemical carcinogens.") In general, Brassica family plants such as broccoli are rich in sulforaphane in its glucosinolate precursor form. Unfortunately, broccoli must be eaten in large quantities to substantially reduce the risk of cancer. Preliminary studies suggest **that to cut the risk of cancer in half**, the average person would need to eat about two pounds of broccoli or similar vegetables per week. Because of the Johns Hopkins research, they were able to identify that broccoli varies in sulforaphane content, and that certain varieties of young broccoli sprouts, grown under standardized conditions, contain large, uniform quantities of the compound. And since the concentration of sulforaphane is much higher in broccoli sprouts than in mature broccoli, **the same reduction in risk theoretically might be had with a weekly intake of just over an ounce of sprouts, and maybe a few capsules of sprout powder**

In animal studies, **sulforaphane blocked tumor development**, reducing incidence, multiplicity, and size of carcinogen-induced mammary tumors. Small quantities of broccoli sprout extracts have reduced the incidence and size of mammary tumors in animals. Talalay's research team fed extracts of the sprouts to groups of 20 female rats for five days, and exposed them and a control group that had not received the extracts to a carcinogen, dimethylbenzanthracene. The rats that received the extracts developed fewer tumors, and those that did get tumors had smaller growths that took longer to develop. The number of rats that developed tumors was reduced by as much as 60%, the number of tumors in each animal was reduced by 80%, and the size of the tumors that did develop was reduced by 75%. Furthermore, the tumors' appearance was delayed and they grew more slowly. Clinical studies are underway to further explore the effects of broccoli sprouts on protective biomarkers against human cancer.

Scientists at the American Health Foundation discovered that sulforaphane inhibited the formation of pre-malignant lesions in the colons of rats, and researchers in France found that sulforaphane induced cell death in human colon carcinoma cells. This study suggests that "in addition to the activation of detoxifying enzymes, induction of apoptosis [cell death] is also involved in the sulforaphane-associated chemo-prevention of cancer." These results have not yet been validated in humans, but are making a lot of scientists sit up and take note.

**Sulforaphane kills H. pylori.** In a recent article the Boston Globe reported, "In laboratory tests the chemical, sulforaphane, killed helicobacter pylori, a bacteria that causes stomach ulcers and often fatal stomach cancers, the second most common form of cancer worldwide. The scientists found that sulforaphane even killed helicobacter that was resistant to commonly used antibiotics. They also showed that it can kill the bacterium whether it is inside or outside cells. In humans, the bacteria can hide in cells lining the stomach, making it more difficult to get rid of the infection, said Fahey. (Jed W. Fahey of the Johns Hopkins University School of Medicine.) The studies concentrated on mice and the researchers will now seek to determine if the same effect occurs in humans. In some parts of Central and South America, Africa and Asia, as much as 80 percent to 90 percent of the population is infected with helicobacter, likely linked to poverty and conditions of poor sanitation," said Fahey, a plant physiologist. The bacteria can usually be treated with antibiotics, but these are too costly and scarce in many parts of the world, he noted. These findings were published in 5/28/02 Proceedings of the National Academy of Science.

#### **Who should consider supplementation?**

- Any person dealing with cancer presently or in the past, or anyone wanting to be sure of Chemo-prevention
- Dieting and releasing toxins back into the system from fat cells
- Those wanting to guarantee at least 5 portions of fruit and vegetables in their daily diet
- Those wanting to reinforce detoxification.
- Those suspecting or diagnosed with H. pylori.

#### **Some references of Broccoli Sprout research:**

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**Here are a few of the papers and publications pertinent to broccoli sprouts, SGS, phase 2 enzymes and chemo-protective effects. They are sorted by date of publication and taken from [www.brassica.com](http://www.brassica.com), a source of live sprouts to be included in diet.**

- Powerful and prolonged protection of human retinal pigment epithelial cells, keratinocytes, and mouse leukemia cells against oxidative damage: the indirect antioxidant effects of sulforaphane. <http://www.pnas.org/cgi/doi/10.1073/pnas.261572998> *Proc. Natl. Acad. Sci. USA*, Vol. 98, Issue 26, pp. 15221-15226, December 18, 2001 Xiangqun Gao, Alben T. Dinkova-Kostova, and Paul Talalay
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- Potent induction of Phase 2 enzymes in human prostate cells by sulforaphane. <http://cebp.aacrjournals.org/cgi/content/abstract/10/9/949> *Cancer Epidemiology, Biomarkers & Prevention*, Vol. 10, pp. 949-954. Sept. 2001. James D. Brooks, Vincent G. Paton and Genevieve Vidanes
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