

The NRF2 Pathway & Sulforaphane

A prominent cancer-protective pathway & its powerful activator

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One of the most important biological pathways in the human body is called the NRF2 pathway. Due to its extreme importance in cancer, aging, inflammation and detoxification it has been called such things as “*the fountain of youth pathway*,” “*the anti-aging pathway*,” and “*the cancer protection pathway*.” Its activation effects the expression of over 200 genes including antioxidant and anti-inflammatory genes as well as genes that inactivate dangerous compounds (detoxification genes). Fortunately, there is a compound found in nature that innately induces this powerful pathway. This compound is called isothiocyanate.¹ Sulforaphane is a potent isothiocyanate and is found in cruciferous vegetables such as broccoli sprouts, cauliflower, cabbage and kale. Robust amounts of scientific research point towards sulforaphane’s potent cancer preventative effects as well as its benefit in those who already diagnosis of cancer.^{5,6,7}

Decreased cancer risk in those who consume healthy amount of cruciferous vegetables on a regular basis has been shown in the scientific research.^{4,7,8} For example, in a 2010 study, smokers who consumed 4.5 serving of raw cruciferous vegetables per month were shown to have a 55% reduction in lung cancer risk.⁴ Multiple studies have shown that women who have consumed cruciferous vegetables at least once a week had between a 17% and 50% reduction in breast cancer risk for those consuming it everyday.⁸ Some of the differences in the positive effects of sulforaphane in cruciferous vegetables in these studies are thought to be due to the way these vegetables were prepared. Naturally occurring sulforaphane in cruciferous vegetables is formed from glucosinolates, which are produced from the help of an enzyme called myrosinase. This enzyme is activated when the cruciferous vegetable is chewed, crushed or chopped. However, and importantly, it is **inactivated when boiled or steamed**. Researchers take advantage of the importance of this: In studies where the effect of sulforaphane is tested, typically the participants are fed raw cruciferous vegetables, mainly broccoli sprouts or nutraceuticals containing sulforaphane. In a study where men with prostate cancer were given 60mg of sulforaphane daily, (approximately 140g of fresh broccoli sprouts) the results showed a slowing of the doubling rate of PSA by 80% compared to placebo.⁶ A study in those with bladder cancer demonstrated that consuming 4 servings of raw cruciferous vegetables per month

decreased bladder cancer mortality by 57% compared with those who only consumed 1 serving.⁵

The proposed mechanism by which sulforaphane has its “anti-cancer” properties is due to its effects on both tumor cells and on healthy cells as well. One action is that sulforaphane prevents is deactivation of phase I biotransformation enzymes - these enzymes convert procarcinogens into carcinogens. Another is that sulforaphane can activate phase II detoxification enzymes.¹ It can also cause increased expression in the NQO1 gene. NQO1 is involved in important processes associated with detoxification. Most importantly, it prevents the degradation of the tumor suppressor protein p53². Over 50% of all adult cancers have a broken or mutated p53 gene.³ Sulforaphane can also prevent DNA adducts, a type of DNA damage known to lead to cancer.

The NRF2 pathway and its effects on inflammation, detoxification and cancer are well known and scientifically-backed. Upregulating this pathway is relevant in many disease processes, especially in cancer prevention and treatment. At The Connors Clinics we utilize the anti-cancer effects of sulforaphane with our patients. We have personally seen so much clinical success using this extraordinary compound that we have developed our own formulation. We have also created a new delivery system of our own sulforaphane product that combines other synergistic ingredients and mode of ingestion to ensure proper dosing and absorption. Furthermore, we use genetic testing to determine if any single nucleotide polymorphisms exist in the NRF2 pathway, which aids in personalizing one’s supplement and treatment regimen.

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3) Soussi T1, Shaping genetic alterations in human cancer: the p53 mutation paradigm. *Wiman KG. Cancer Cell.* 2007 Oct;12(4):303-12.

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5) Munday R1, (2008). Inhibition of urinary bladder carcinogenesis by broccoli sprouts. *Cancer Res.* 68(5):1593-600.

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Each quart-sized jar of broccoli sprouts contains approximately 90-120mg of sulforaphane