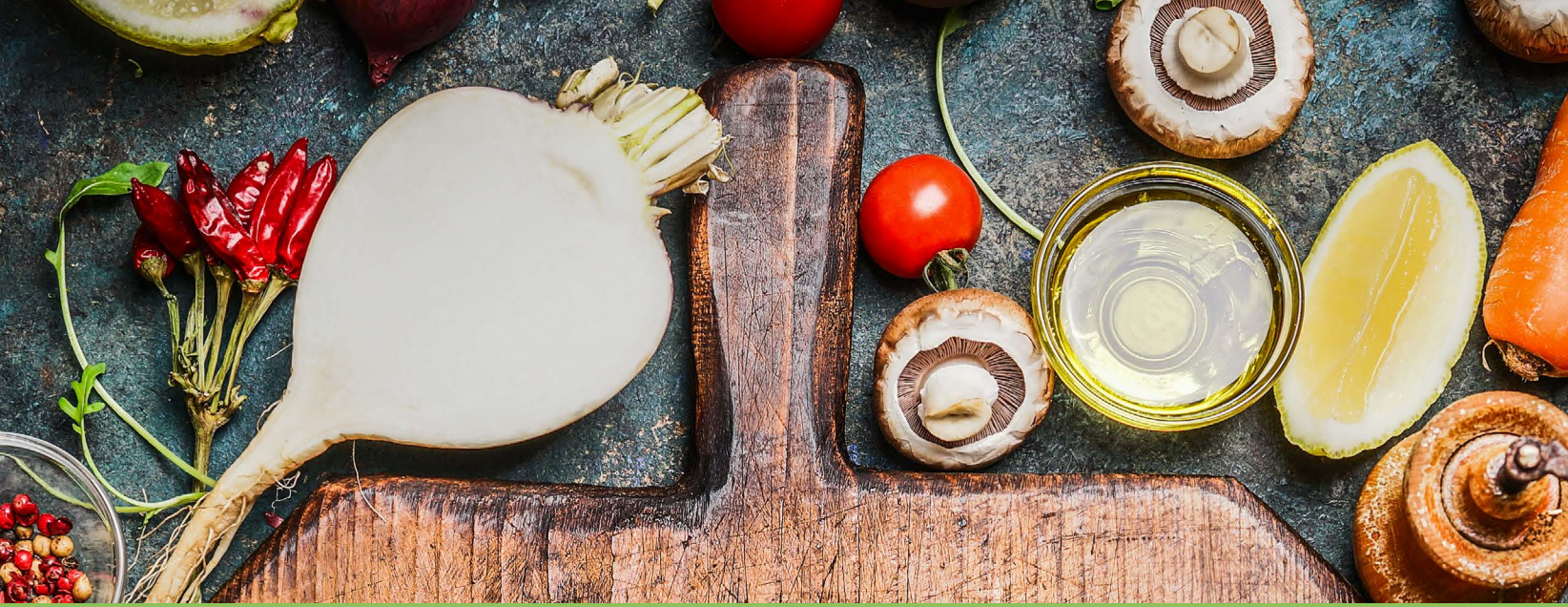


EPIGENETICS IN LIFE:
What We Eat

How Diet May Influence Epigenetics and Our Health

PREVIEW EDITION

WHAT IS
EPIGENETICS

FOREWORD

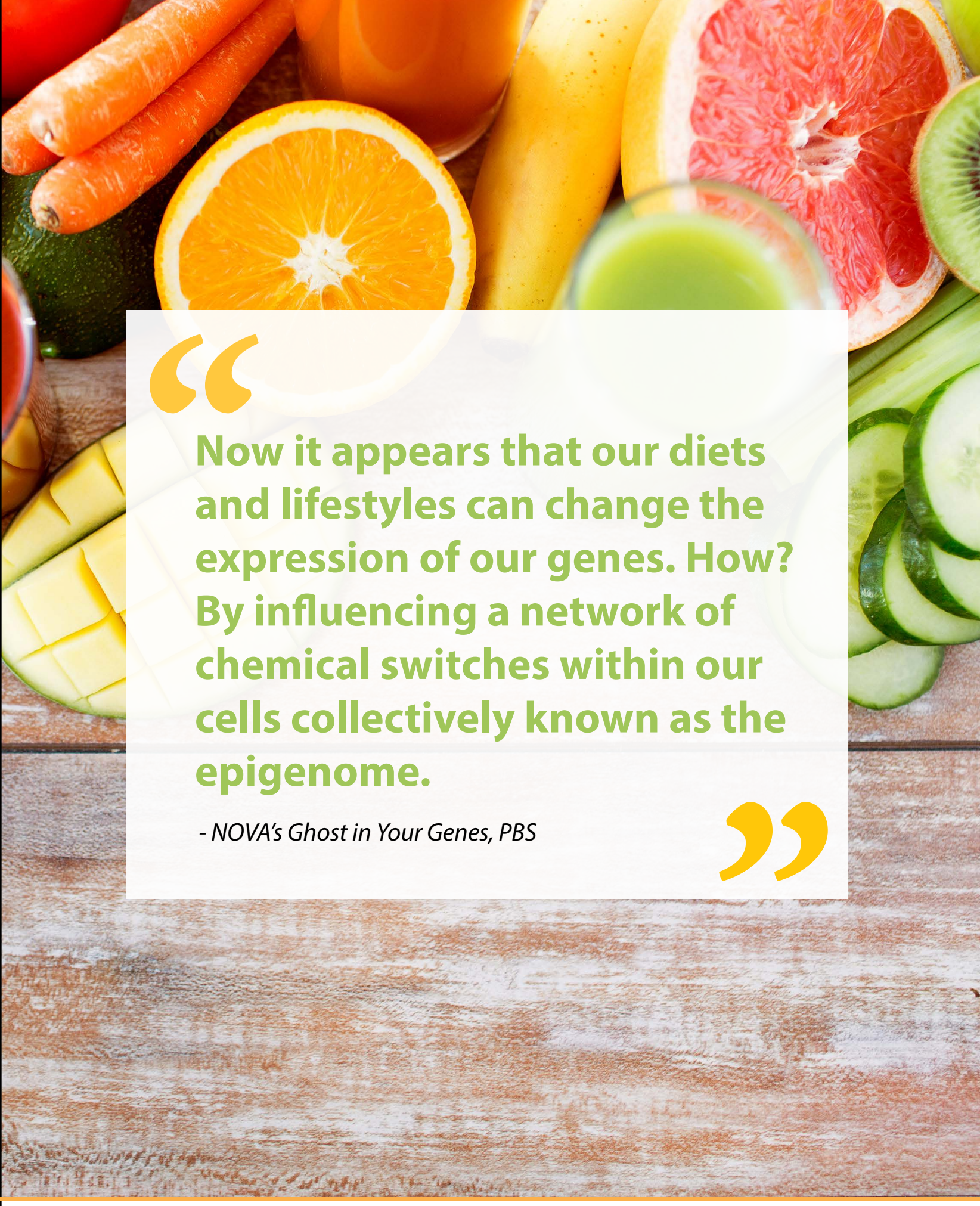
Epigenetics is a relatively new field that has transformed signficantly over the years. Now more than ever, scientists from all over the world are investigating ways in which environmental factors and lifestyle choices can impact our health via epigenetic mechanisms. This includes the foods we eat, the quality of the air we breathe, and even when we go to sleep.

Epigenetics in Life: What We Eat is a collection of epigenetic studies that specifically detail the associations and implications various foods and nutrients may have on biological systems through epigenetic mechanisms. The studies range in complexity and some are conducted using animal models, while others focus on humans.

It is important to approach this novel field with a healthy skepticism and respect for the scientific method, but certainly not abandon our optimism. Hundreds of epigenetic papers are being published as we eagerly form a more accurate understanding of the molecular underpinnings of the impact our lifestyle choices have on our epigenome and, ultimately, our health.

Epigenetics in Life: What We Eat touches on the vast and profound influence our dietary choices could have on the expression of our genes and opens the doors to new possibilities for the future.

We do not recommend using this book for the purpose of medical or dietary advice. A medical profressional should always be consulted before making any drastic lifestyle or dietary changes.



Now it appears that our diets and lifestyles can change the expression of our genes. How? By influencing a network of chemical switches within our cells collectively known as the epigenome.

- NOVA's Ghost in Your Genes, PBS

TABLE OF CONTENTS

Explore topics that focus on the possible epigenetic connections between improving health and consuming foods. Various compounds found in different food types have been shown to impact epigenetic marks on DNA.

INTRODUCTION: *EPIGENETICS*

Epigenetics

Perhaps the most intriguing principle of epigenetics is that meaningful changes to gene expression can occur without changing our underlying genetic "code of life." Along with our genotype, our environment and experiences can influence our health via gene expression.

Epigenetics is the study of potentially heritable changes in gene expression (active versus inactive genes) that does not involve changes to the underlying DNA sequence. It represents a change in phenotype without a change in genotype. This, in turn, affects how cells read the genes and can benefit or harm health and many biological processes. Epigenetic change is a regular and natural occurrence but can also be influenced by several factors including age, disease state, lifestyle, and environment.

DNA Methylation

This epigenetic mark has the power to turn genes on or off and can be inherited through cell division. DNA methylation was the first epigenetic mark to be discovered. It plays an important role in normal human development, aging, tumorigenesis, and other genetic and epigenetic diseases.

When a methyl group consisting of one carbon and three hydrogen molecules (CH_3) attaches to the 5 position of cytosine (C) on DNA, it forms 5-methylcytosine (5-mC). When a gene is methylated, its expression is reduced.

Ginger Root

Ginger root, or the rhizome of the flowering ginger plant (*Zingiber officinale*), has been cultivated for millennia for use as a spice added to food and a tonic used to cure ailments.

Ginger's primary bioactive ingredient is gingerol, which research has shown serves as both an anti-inflammatory as well as a cancer-fighting antioxidant. Epigenetic research has shown its efficacy in aiding everything from indigestion to inflammation and muscle pain. By affecting the way thousands of genes express themselves at a time, the molecular components of the ginger root can improve human health.

Ginger is considered a powerful herb with the ability to impact chromatin in a cell's nucleus and regulate epigenetic mechanisms, particularly histone acetylation. One study in *Food & Chemical Toxicology* reported that ginger was able to increase histone H3 acetylation and suppress the expression of histone deacetylase 1 (HDAC1).[13] When an individual consumes health foods like ginger, epigenetic tags attached to histone proteins around which the DNA is wrapped may be adjusted, influencing the expression of genes linked to inflammatory and neuroprotective pathways.

The components of ginger are still being researched for their health benefits, but evidence supports the root's epigenetic possibilities for reducing inflammation and fighting disease.

Arugula Pesto

Ingredients

4 cups packed fresh arugula
1 tablespoon minced garlic
Salt and freshly ground pepper
1 cup olive oil
2 tablespoon pine nuts, toasted, plus 1 tablespoon
⅛ teaspoon vitamin C (optional)
½ cup freshly grated Parmesan

Directions

1. Prepare an ice water bath in a large bowl, and bring a large

heart disease, and plays a major role in synthesizing fats.[17] Betaine is considered a methyl donor and can affect the levels of DNA methylation and thereby influence gene expression. Shellfish is also rich in zinc, which is essential to the body's fight against inflammation.[18]

Consuming shellfish could have a beneficial epigenetic effect on our health as many sources of crucial vitamins and minerals have biological consequences involving epigenetic mechanisms.

SPICES & HERBS

For centuries, various spices and herbs have maintained their place in history as a source of alternative medicine and alleviators of ailments. Many have been supported as anti-microbial, anti-oxidant, anti-inflammatory and anti-carcinogenic. Now, epigenetic research is bringing to light some of the potential underlying epigenetic mechanisms that may influence health as

Lentil Salad With Apples, Fennel, and Herbs

Ingredients

1 tablespoon cider vinegar
¼ teaspoon granulated sugar
Kosher salt and freshly ground black pepper
2 tablespoons olive oil

NEXT STEPS

The Future of Epigenetics

Personalized medicine is becoming more popular as science identifies the varying effects of different substances on an individual's health. Not only is there a need for further research on how our environment and lifestyle choices - like diet - impacts epigenetic marks on human DNA, but how the outcomes will differ depending on a person's body.

Epigenetics can be utilized for diagnostic tests, or markers that indicate

REFERENCES

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1. Choi S-W, Friso S. Epigenetics: A New Bridge between Nutrition and Health. Advances in Nutrition. 2010;1(1):8-16. doi:10.3945/an.110.1004.
2. Remely M, Stefanska B, Lovrecic L, Magnet U, Haselberger AG. Nutriepigenomics: the role of nutrition in epigenetic control of human diseases. Curr Opin Clin Nutr Metab Care. 2015;18:328.
3. Tagtow A, Rahavi E, Bard S, Stoody EE, Casavale K, Mosher A. Coming Together to Communicate the 2015–2020 Dietary Guidelines for Americans. J. Acad. Nutr. Diet. 2016;116:209–212. doi: 10.1016/j.jand.2015.12.010.
4. Bishop KS, Ferguson LR. The interaction between epigenetics, nutrition and the development of cancer. Nutrients. 2015;7:922–947. doi: 10.3390/nu7020922.
5. Anderson OS, Sant KE, Dolinoy DC. Nutrition and epigenetics: an interplay of dietary methyl donors, one-carbon metabolism and DNA methylation. J Nutr Biochem. 2012;23:853–859.
6. Kim H, Ramirez CN, Su Z-Y, Kong A-NT. Epigenetic modifications of triterpenoid ursolic acid in activating Nrf2 and blocking cellular transformation of mouse epidermal cells. The Journal of nutritional biochemistry. 2016;33:54-62. doi:10.1016/j.jnutbio.2015.09.014.
7. Frighetto RS, Welendorf RM, Nigro EN, Frighetto N, Siani AC. Isolation of ursolic acid from apple peels by high speed counter-current chromatography. Food Chemistry. 2008;106:767-771. doi: 10.1016/j.foodchem.2007.06.003.
8. Ndiaye M, Philippe C, Mukhtar H, Ahmad N. The Grape Antioxidant Resveratrol for Skin Disorders: Promise, Prospects, and Challenges. Archives of biochemistry and biophysics. 2011;508(2):164-170. doi:10.1016/j.abb.2010.12.030.
9. Bishop KS, Ferguson LR. The Interaction between Epigenetics, Nutrition and the Development of Cancer. Nutrients. 2015;7(2):922-947. doi:10.3390/nu7020922.
10. Nagata N, Xi L, Kohno S, Ushia Y, Aoki Y, Umeda R, Fuke N, Zhuge F, Ni Y, Nagashimada M, Takahashi C, Suganuma H, Kaneko S, Ota T. Glucoraphanin Ameliorates Obesity and Insulin Resistance Through Adipose Tissue Browning and Reduction of Metabolic Endotoxemia in Mice. Diabetes. 2017;66:1222-1236. doi: 10.2337/db16-0662.
11. Venkatachalam KV. Methionine Metabolism in Humans: New Perspectives on Epigenetic Inheritance. J Mol Genet Med. 2014;8:138. doi:10.4172/1747-0862.1000138.
12. Atwell LL, Zhang Z, Mori M, Farris PE, Vetto JT, Naik AM, Oh KY, Thuillier P, Ho E, Shannon J. Sulforaphane Bioavailability and Chemopreventive Activity in Women Scheduled for Breast Biopsy. Cancer Prev Res (Phila) 2015;8:1184–1191.
13. Shim S, Kim S, Choi DS, Kwon YB, Kwon J. Anti-inflammatory effects of 6-shogaol: potential roles of HDAC inhibition and HSP70 induction. Food Chem. Toxicol. 2011;49:2734–2740.
14. Fuentes F, Paredes-Gonzalez X, Kong A-NT. Dietary Glucosinolates Sulforaphane, Phenethyl Isothiocyanate, Indole-3-Carbinol/3,3'-Diindolylmethane: Anti-Oxidative Stress/Inflammation, Nrf2, Epigenetics/Epigenomics and In Vivo Cancer Chemopreventive Efficacy. Current pharmacology reports. 2015;1(3):179-196. doi:10.1007/s40495-015-0017-y.
15. Zhang Y and Chen H. Genistein, an epigenome modifier during cancer prevention. Epigenetics. 2011;6:888-891. doi:10.4161/epi.6.7.16315.
16. Karapiperi K, Gousis C and Papaioannidou P. The role of vitamin B12 in DNA modulation mechanisms. Front. Pharmacol. Conference Abstract: 8th Southeast European Congress on Xenobiotic Metabolism and Toxicity - XEMET 2010. doi: 10.3389/conf.fphar.2010.60.00140.
17. Choi S-W, Friso S. Epigenetics: A New Bridge between Nutrition and Health. Advances in Nutrition. 2010;1(1):8-16. doi:10.3945/an.110.1004.
18. Wong CP, Rinaldi NA, Ho E. Zinc deficiency enhanced inflammatory response by increasing immune cell activation and inducing IL6 promoter demethylation. Molecular nutrition & food research. 2015;59(5):991-999. doi:10.1002/mnfr.201400761.
19. Kok DEG, Dhonukshe-Rutten RAM, Lute C, et al. The effects of long-term daily folic acid and vitamin B12 supplementation on genome-wide DNA methylation in elderly subjects. Clinical Epigenetics. 2015;7:121. doi:10.1186/s13148-015-0154-5.
20. Gupta J. Epigenetic Modifying Potential of Dietary Spices: Link to Cure Complex Diseases. International Journal of Bioengineering and Life Sciences. Conference Abstract: ICHG 2017 : 19th International Conference on Human Genetics. urn:dai:10.1999/1307-6892/74609.
21. Reuter S, Gupta SC, Park B, Goel A, Aggarwal BB. Epigenetic changes induced by curcumin and other natural compounds. Genes & Nutrition. 2011;6(2):93-108. doi:10.1007/s12263-011-0222-1.
22. Liu HL, Chen Y, Cui GH, Zhou JF. Curcumin, a potent anti-tumor reagent, is a novel histone deacetylase inhibitor regulating B-NHL cell line Raji proliferation. Acta Pharmacol. Sin. 2005;26(5):603–609.
23. Morimoto T, Sunagawa Y, Kawamura T, et al. The dietary compound curcumin inhibits p300 histone acetyltransferase activity and prevents heart failure in rats. The Journal of Clinical Investigation. 2008;118(3):868-878. doi:10.1172/JCI33160.
24. Flabouraris G, Karikas GA. Nutri-epigenetics and synthetic analogs in cancer chemoprevention. J Buon. 2016;21:4–16.
25. Galicka A, Krętowski R, Nazaruk J, Cechowska-Pasko M. Anethole prevents hydrogen peroxide-induced apoptosis and collagen metabolism alterations in human skin fibroblasts. Molecular and Cellular Biochemistry. 2014;394(1-2):217-224. doi:10.1007/s11010-014-2097-0.

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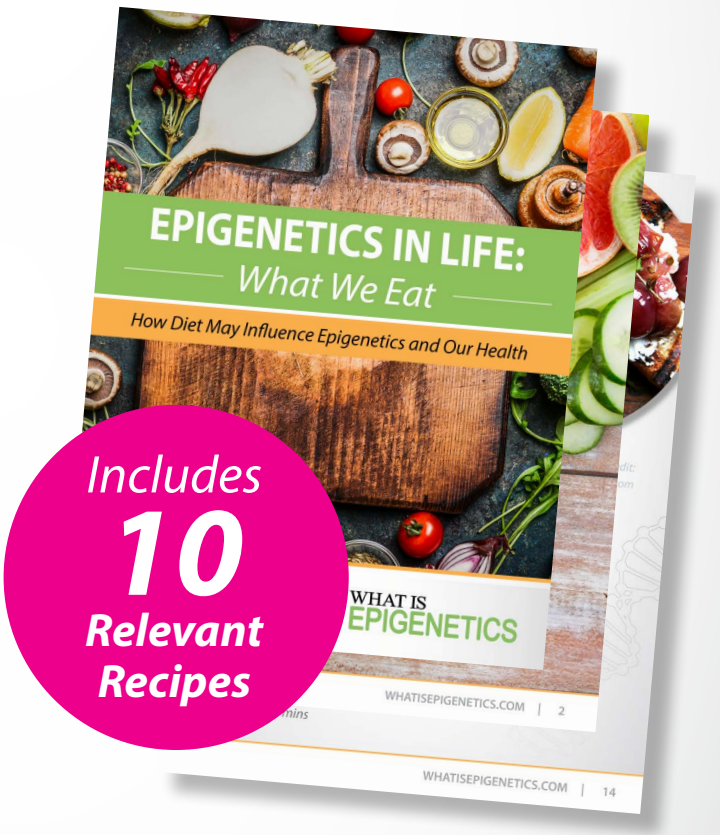

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