EPIGENETICS IN LIFE: What We Eat

How Diet May Influence Epigenetics and Our Health

PREVIEW EDITION
Epigenetics is a relatively new field that has transformed significantly 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 professional 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
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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.

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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 (CH₃) 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.
Histone modifications describe a group of epigenetic marks that occur to histone proteins. DNA wraps around these specific proteins to form what is called chromatin. Gene expression is impacted based on how tight or loose the chromatin structure is. Genes are less expressed the tighter the structure, which means the DNA is less accessible. There is greater gene expression the looser the structure, opening up the chromatin and revealing more of the DNA for transcription. Various histone modifications include histone acetylation/deacetylation, methylation/demethylation, and phosphorylation.

Histone Modification

A reduction in DNA methylation, or hypomethylation, as well as an excess of DNA methylation, or hypermethylation, has been linked to the formation of cancer and tumor progression. Different types of sequences are generally targeted for cancer-related decreases and increases in DNA methylation.

When what we eat affects the methylation status of certain genes that are central to our health, it can have a very powerful effect on our lives.

Learn more about each epigenetic modification at www.whatisepigenetics.com/fundamentals

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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). 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.
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**Arugula Pesto**

**Ingredients**

- 4 cups packed fresh arugula
- 1 tablespoon minced garlic
- Salt and freshly ground pepper
- 1 cup olive oil
- 2 tablespoons 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 pot of water to a boil. Put the arugula in a large sieve and plunge it into the boiling water.

2. Blanch for 15 seconds.

3. Remove, shake off the excess water, then plunge the arugula into the ice water bath and stir again so it cools as fast as possible. Drain.

4. Squeeze the water out of the arugula with your hands until very dry. Roughly chop the arugula and put in a blender.

5. Add the garlic, salt and pepper to taste, olive oil, 2 tablespoons of the pine nuts, and the vitamin C, if using.

6. Blend for at least 30 seconds.

7. Add the cheese and pulse to combine.

8. Toss on pasta or use as desired. Before serving, add the remaining 1 tablespoon of toasted pine nuts.
Shellfish is another epigenetic power food group that contains many essential vitamins and minerals. Like the many fruits and vegetables mentioned, shellfish such as oysters, lobster, and shrimp contain high amounts of vitamin B12, betaine, and zinc. B12 is a crucial vitamin to the human body, as deficiencies in B12 have been linked to Alzheimer’s, heart disease, and breast cancer. B12 plays a role in methionine synthesis, which is responsible for protein synthesis in humans, and can also help regulate DNA methylation.16

Betaine, an amino acid, has shown promise in liver detoxification and health, preventing 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.
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 a result of consuming spices and herbs or, humans can reap the benefits.

Turmeric is a spice often used in Indian cuisine and as a medicinal herb. It has been shown to have significant benefits for the body and the brain and carries many antioxidants, such as the compound known as curcumin. It is important to note that most studies use curcumin extract since it is not very concentrated in natural sources of turmeric. However, supplements may be able to provide a higher concentration of the anti-inflammatory antioxidant. Notably, curcumin is fat soluble, so it may be beneficial to consume along with a meal higher in fat.

Other spices and herbs such as licorice root, fennel, cardomom, and fenugreek have been shown to influence epigenetic machinery like DNA methylation, histone modifications or microRNA expression patterns. Research is still working to uncover the precise molecular underpinnings of the benefits of curcumin and other spices, but it seems there is a positive health benefit to consuming some spices in particular.

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Lentil Salad With Apples, Fennel, and Herbs

Ingredients

1 tablespoon cider vinegar
1/4 teaspoon granulated sugar
Kosher salt and freshly ground black pepper
2 tablespoons olive oil

Directions

1. In a large bowl, whisk together the vinegar, sugar, salt, and pepper until the sugar dissolves.
2. Add in the olive oil, and whisk until emulsified. Add the water and whisk to loosen.
3. Add the fennel, apple, and tomatoes, toss to combine, and allow to sit in the vinaigrette for 15 minutes.
4. Finally, add the lentils and fresh herbs, and allow to sit another 15 minutes. Serve and enjoy.
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 whether someone may be prone to developing a disease. Personalized regimes could then be assigned in order to counteract or balance these effects, although much more detailed and comprehensive research is necessary before practical steps and actual lifestyle changes or diets can be prescribed.

Inter-individual variability in the major epigenetic process in humans, such as DNA methylation and histone modifications, could inform diagnostic and therapeutic strategies curated specifically for a particular individual.

Furthermore, the role of nutriepigenomics, or the way in which nutrition impacts epigenetics, will continue to lead us towards a path of personalized medicine and individualized diets and regimens with hopes for optimal health.
REFERENCES


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Download the full book which includes 10 healthy recipes and epigenetic insights so you can get started on the path to positive health and wellness.

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