DNA methylation and epigenetics

Nutrition and the epigenome
Nutrition and methyl groups

Diet is an important environmental factor in epigenetic change

Food → Digestion → Absorption → Nutrients

Transported by Gastro-intestinal (GI) tract

Absorbed within the GI tract

Metabolic pathways
Nutrients are manipulated, modified, and molded into molecules the body can use

One metabolic pathway in your body is responsible for making methyl groups: an important epigenetic tag that silence genes
Diets high in methyl-donating nutrients can rapidly alter gene expression.
# Nutrients affecting the epigenome

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Food Origin</th>
<th>Epigenetic Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methionine</td>
<td>Sesame seeds, brazil nuts, fish, peppers, spinach</td>
<td>SAM synthesis</td>
</tr>
<tr>
<td>Folic Acid</td>
<td>Leafy vegetables, sunflower seeds, baker's yeast, liver</td>
<td>Methionine synthesis</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>Meat, liver, shellfish, milk</td>
<td>Methionine synthesis</td>
</tr>
<tr>
<td>Vitamin B6</td>
<td>Meats, whole grain products, vegetables, nuts</td>
<td>Methionine synthesis</td>
</tr>
<tr>
<td>SAM-e (SAM)</td>
<td>Popular dietary supplement pill; unstable in food</td>
<td>Enzymes transfer methyl groups from SAM directly to the DNA</td>
</tr>
<tr>
<td>Choline</td>
<td>Egg yolks, liver, soy, cooked beef, chicken, veal and turkey</td>
<td>Methyl donor to SAM</td>
</tr>
</tbody>
</table>

[http://learn.genetics.utah.edu/content/epigenetics/nutrition/](http://learn.genetics.utah.edu/content/epigenetics/nutrition/)
Nutrition and DNA methylation

- Nutrients from food enter the methylation biochemical pathway that extracts methyl groups and then attaches them to the DNA.

- 1-Carbon metabolism links nutrition to DNA Methylation:
  - Nutrients such as folate (in 5-MTHF form), vitamin B12, choline and betaine are required for conversion of homocysteine to methionine and generation of S-adenosylmethionine (SAMe).
Take home messages

• Expression of genes is affected by various factors:
  − Lifestyle choices, nutrition, environment, stress, genetics, and the internal chemical and hormonal state of the body

• The choices made today may impact health and health of future generations