Epigenetics
The Epicenter of Medicine

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VEGETARIANS IN MOTION PROGRAM
OUR SAVIOR’S LUTHERAN CHURCH
MARCH 13, 2012 7:00 PM
Objectives

- Differentiate between Genetics, Epigenetics, Metagenetics
- Compare and contrast ‘new to nature’ molecules versus ‘known to nature’ molecules
- Give examples of gene expression modification through TLC therapeutic lifestyle change
- Explain the concept of Selfcare as the new primary care
The new science of epigenetics reveals how the choices you make can change your genes—and those of your kids.

January 2010
Organ System Diagnosis

Cardiology
Pulmonary
Urology/Nephrology
Hepatology
Allergy

Signs and Symptoms
Endocrinology
Gastroenterology
Neurology

Fundamental Clinical Imbalances
- Hormonal and Neurotransmitter Imbalances
- Redox Imbalance + Oxidative Stress + Mitochondriopathy
- Detox/Biotransformation/Excretory Imbalance
- Immune Imbalance
- Inflammatory Imbalance
- Digestive/Absorptive and Microbiological Imbalance
- Structural Integrity Imbalance

Fundamental Physiological Processes
1. Communication
   - outside the cell
   - inside the cell
2. Bioenergetics/Energy Transformation
3. Replication/Repair/Maintenance /Structural Integrity
4. Elimination of Waste
5. Protection/Defense
6. Transport/Circulation

Mind and Spirit
Genetic Predisposition
Experiences, Attitudes, Beliefs

Psycho-social
Physical Exercise
Trauma

Xenobiotics
Micro-organisms
Radiation

Diet, Nutrients
Air/Water

Environmental Inputs

Adapted from Textbook of Functional Medicine
2005 DS Jones MD
Division of Care

**Conventional Medical Care**
- Doctor/specialist
- Treat the disease
- Signs & symptoms
- Suppress/remove disease
- Use drugs & surgery

**Lifestyle (Natural) Medicine**
- Self care
- Improve the host
- Address the root causes
- Change the lifestyle
- Food, supplements, CAM

**New to nature molecules (drugs)**
- Disturb the web
- Local specific effects
- Global side effects

**Known to nature molecules (phytonutrients)**
- Rebalance the web
- Global mild effects
- Local specific side effects
Systems Biology Approach

Environmental Inputs
Diet, Nutrition, Exercise, Trauma

Immune and Inflammatory Balance

Gastrointestinal Status

Structural

Mind, Spirit
Emotions and Community

Oxidative Stress and Energy Production

Detoxification

Hormones and Neurotransmitters
Health (phenotype)

- Lifestyle (epigenome): 70%
- DNA sequence: 10%
- Medical care: 10%
- Environment: 10%
She had triplets!
If every cell has copy of the same DNA

- How does it produce such different tissues?
- Some cells make a nose, some toes, & some quills
Chromosomes: the rest of the story

• “We inherit our parent’s chromosomes, which are 50 percent DNA.

• The other 50 percent is non-DNA protein molecules, that carry ‘new’ epigenetic marks and information.”

Emma Whitelaw, PhD
Brief refresher on genomics

• Sequencing of human DNA celebrated a decade ago, Francis Collins

• Genomics: study of gene expression

• Epigenome modulates (alters) the rate of gene expression
Drs. Watson and Crick
Francis Collins MD
Director NIH

Author
The Language of God

Director
The Human Genome Project
1990-2003
Cell nucleus (x73,200)
EPIGENETIC MECHANISMS
are affected by these factors and processes:
- Development (in utero, childhood)
- Environmental chemicals
- Drugs/Pharmaceuticals
- Aging
- Diet

DNA methylation
Methyl group (an epigenetic factor found in some dietary sources) can tag DNA and activate or repress genes.

Histones are proteins around which DNA can wind for compaction and gene regulation.

Histone modification
The binding of epigenetic factors to histone “tails” alters the extent to which DNA is wrapped around histones and the availability of genes in the DNA to be activated.

HEALTH ENDPOINTS
- Cancer
- Autoimmune disease
- Mental disorders
- Diabetes
“Mechanisms” of epigenomics

Epigenetics: center of modern medicine

• Epigenetics: is at the epicenter of modern medicine

• Helps explain the relationship between an individual’s genetic background, the environment, aging, and disease

• Epigenome varies during a lifetime, whereas the DNA remains the same

Epigenetics

• Genes turned “on or off” by environmental influences (e.g. nutrigenomics)
• Genes AND their “switch settings” are inherited (trans-generational)
• Progeny start life with the “gene switch” positioned by environmental influences exerted upon ancestors

Epigenetics

• Landmark experiment with agouti mice

• A “DNA-methylating” diet

• The implications are staggering – how we eat can transmit effects up to 4 generations of our descendants
TGF-β signaling far more complex than a reductionist model suggests
TGF-β signaling far more complex than a reductionist model suggests.
Ornish Program Milestones 1980-2010

- Heart disease can be reversed, 
  Also cholesterol, BP, diabetes II, obesity & other
- People can make/sustain lifestyle changes
- Prostate cancer progression can be affected by changing diet and lifestyle
- Your genes are modifiable through Epigenetics
- Telomeres can be lengthened

Read: *The Spectrum* 2008 by Dean Ornish MD
32 months of Therapeutic Lifestyle Change Alone

Esselstyn CB, *Prevent and Reverse Heart Disease*, 2007
ORNISH Program
Early Prostate Cancer Status at 3 mo.

• Decrease rate of PSA rise in early prostate cancer
• Decreased ‘cancer’ metabolic activity (pet scan)
• Decrease IGF1 (insulin like growth factor)
• Decrease serum stimulated prostate ca cell-line growth (in-vitro)
• Changes prostate (pro-health anti-ca) gene expression
• Gene micro array analysis: 48 up regulated, 453 down regulated genes

Book: Ornish D. The Spectrum 2008
The Adventist Health Study

- Large prospective study; 35,000
- Funding: ACS, NCI, NIH
- HQ: Loma Linda University, CHR
- 1958 Mortality Study
- 1974: Cancer Study
- 1981: Coronary Heart Disease Study
- Publications in peer review journals: 200
Life Expectancy (yrs.)
USA (California)

- Male SDA: 77.3
- Male Non-SDA: 71.1
- Female SDA: 80.1
- Female Non-SDA: 76.5
<table>
<thead>
<tr>
<th>Group</th>
<th>Life Expectancy (yrs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male SDA</td>
<td>79.1</td>
</tr>
<tr>
<td>Male Non-SDA</td>
<td>70.2</td>
</tr>
<tr>
<td>Female SDA</td>
<td>78.4</td>
</tr>
<tr>
<td>Female Non-SDA</td>
<td>74.7</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>------------</td>
<td>----------</td>
</tr>
<tr>
<td>Male SDA</td>
<td>71.9</td>
</tr>
<tr>
<td>Male Non-SDA</td>
<td>62.4</td>
</tr>
<tr>
<td>Female SDA</td>
<td>75.1</td>
</tr>
<tr>
<td>Female Non-SDA</td>
<td>70.6</td>
</tr>
</tbody>
</table>
What lifestyle factors enable Adventists to live longer? Would dietary lifestyle differences among Adventists affect disease and death rates?
## Dietary Status in AHS-2 *(N = 97,000)*

<table>
<thead>
<tr>
<th>Diet Type</th>
<th>%</th>
<th>Beef</th>
<th>Poultry/Fish</th>
<th>Dairy/Eggs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegan</td>
<td>8</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Lacto-Ovo</td>
<td>28</td>
<td>None</td>
<td>None</td>
<td>Yes</td>
</tr>
<tr>
<td>Pesco-Veg</td>
<td>10</td>
<td>None</td>
<td>Normal</td>
<td>Yes</td>
</tr>
<tr>
<td>Semi-Veg</td>
<td>6</td>
<td>Some</td>
<td>Some</td>
<td>Yes</td>
</tr>
<tr>
<td>Meat</td>
<td>48</td>
<td>Regular</td>
<td>Normal</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Diet Status & Treated Hypertension* in AHS-2

*adjusted for age, gender, and race
Diet Status & Treated Cholesterol* in AHS-2

*adjusted for age, gender, and race
Diet Status & Treated Diabetes*† in AHS-2

*adjusted for age, gender, and race
† type 2
Diet Status and Weight in AHS-2 \( (N = 97,000) \)

<table>
<thead>
<tr>
<th>Diet Status</th>
<th>Female (5'6'')</th>
<th>Male (5'10'')</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegan</td>
<td>141</td>
<td>188</td>
</tr>
<tr>
<td>Lacto-Ovo</td>
<td>161</td>
<td>181</td>
</tr>
<tr>
<td>Pesco-Veg</td>
<td>171</td>
<td>180</td>
</tr>
<tr>
<td>Semi-Veg</td>
<td>164</td>
<td>177</td>
</tr>
<tr>
<td>Meat</td>
<td>180</td>
<td>193</td>
</tr>
</tbody>
</table>
Adventist Health Study
Diet & Fatal Heart Disease

- Californians: 100%
- Adventists w/Meat: 64%
- Ovo-Lacto Vegetarians: 40%
- Pure Vegetarians: 23%
The Dietary Difference

The Adventist Health Study, NIH

100% Risk of Hypertension

SDA Meat

45% SDA LOV
The Dietary Difference
The Adventist Health Study, NIH

Risk of Diabetes

100% SDA Meat

51% SDA LOV
The Dietary Difference

The Adventist Health Study, NIH

100% Risk of Arthritis / Rheumatism

SDA Meat

65% SDA LOV
The Dietary Difference

The Adventist Health Study, NCI

100% Risk of Prostate Cancer

SDA Meat

65% SDA LOV
The Dietary Difference
The Adventist Health Study, NIH

100% Risk of Colon Cancer

SDA Meat

55% SDA LOV
# Lifestyle and Survival (AHS-1)

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>% Living to age</th>
<th>% Living to age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Japan</td>
<td>81</td>
<td>90</td>
</tr>
<tr>
<td>Sweden</td>
<td>79</td>
<td>88</td>
</tr>
<tr>
<td>Canada</td>
<td>75</td>
<td>86</td>
</tr>
<tr>
<td>Great Britain</td>
<td>75</td>
<td>85</td>
</tr>
<tr>
<td>USA</td>
<td>72</td>
<td>84</td>
</tr>
<tr>
<td>CA SDA</td>
<td>87</td>
<td>89</td>
</tr>
<tr>
<td>CA SDA Vegs</td>
<td>89</td>
<td>94</td>
</tr>
</tbody>
</table>

The table above illustrates the percentage of people living to specific ages in different countries, comparing both genders.
Self-care Check List

1. Stop white flour, white rice, sugar, high fructose corn syrup
2. Avoid junk foods (read labels for chemicals)
3. Change sugary drinks to tea, water
4. Drink 6-8+ glasses water/day
5. Eat foods as grown, seasonal, organic
6. Eat 7+ colors a day
7. 30+ grams fiber per day
8. Omega 3 Fatty Acids (EPA/DHA) daily (wild salmon, flax seeds/oil, walnuts/almonds, sea algae DHA) Avocado
9. Limit caffeine, alcohol, meats
10. Walk 10,000 steps / day
11. Develop stress management skills
12. Spend time with people who make you feel good
1. Changing your diet & lifestyle
1. Changing your diet & lifestyle

2. Changes your epigenome
1. Changing your diet & lifestyle

2. Changes your epigenome

3. Changes gene expression
1. Changing your diet & lifestyle

2. Changes your epigenome

3. Changes gene expression

4. Changes you! (literally)
The Body’s Constant Renewal Process

- New stomach lining every 7 days.
- New skin every 30 days.
- New liver every 45 days.
- New red blood cells every 120 days.

Atomic tracer studies* show body renewal 98% every year from what we eat, to support what we do, according to our genetic plan.

The Body Needs to Be:

- Anti-Inflammatory
- Anti-coagulant
- Anti-oxidant
- Anti-Acid=Alkaline
## Cholesterol Content of Food

### Animal Foods

<table>
<thead>
<tr>
<th>Food</th>
<th>Cholesterol Content (mg per 100 gm portion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg, whole</td>
<td>550</td>
</tr>
<tr>
<td>Kidney, beef</td>
<td>375</td>
</tr>
<tr>
<td>Liver, beef</td>
<td>300</td>
</tr>
<tr>
<td>Butter</td>
<td>250</td>
</tr>
<tr>
<td>Oysters</td>
<td>200</td>
</tr>
<tr>
<td>Cream cheese</td>
<td>120</td>
</tr>
<tr>
<td>Lard</td>
<td>95</td>
</tr>
<tr>
<td>Beefsteak</td>
<td>70</td>
</tr>
<tr>
<td>Lamb</td>
<td>70</td>
</tr>
<tr>
<td>Pork</td>
<td>70</td>
</tr>
<tr>
<td>Chicken</td>
<td>60</td>
</tr>
<tr>
<td>Ice Cream</td>
<td>45</td>
</tr>
</tbody>
</table>

### Plant Foods

<table>
<thead>
<tr>
<th>Food</th>
<th>Cholesterol Content (mg per 100 gm portion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All grains</td>
<td>0.</td>
</tr>
<tr>
<td>All vegetables</td>
<td>0.</td>
</tr>
<tr>
<td>All nuts</td>
<td>0.</td>
</tr>
<tr>
<td>All seeds</td>
<td>0.</td>
</tr>
<tr>
<td>All fruits</td>
<td>0.</td>
</tr>
<tr>
<td>All legumes</td>
<td>0.</td>
</tr>
<tr>
<td>All vegetable oils</td>
<td>0.</td>
</tr>
</tbody>
</table>

Pennington J. Food Values of Portions Commonly Used, '85.
<table>
<thead>
<tr>
<th>Food Item</th>
<th>Fiber (g/kg)</th>
<th>Food Item</th>
<th>Fiber (g/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blueberries</td>
<td>15.2</td>
<td>Ground Beef</td>
<td>0</td>
</tr>
<tr>
<td>Brussels Sprouts</td>
<td>13.5</td>
<td>Sirloin Steak</td>
<td>0</td>
</tr>
<tr>
<td>Oat Flakes</td>
<td>13.5</td>
<td>Lamb Chops</td>
<td>0</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>12.0</td>
<td>Pork Chops</td>
<td>0</td>
</tr>
<tr>
<td>Cooked Carrot</td>
<td>9.6</td>
<td>Chicken</td>
<td>0</td>
</tr>
<tr>
<td>Brown Rice</td>
<td>8.1</td>
<td>Ocean Perch</td>
<td>0</td>
</tr>
<tr>
<td>Swiss Chard</td>
<td>6.8</td>
<td>Salmon</td>
<td>0</td>
</tr>
<tr>
<td>Lettuce</td>
<td>6.3</td>
<td>Cheddar Cheese</td>
<td>0</td>
</tr>
<tr>
<td>Cucumber</td>
<td>5.7</td>
<td>Whole Milk</td>
<td>0</td>
</tr>
<tr>
<td>Applesauce</td>
<td>5.3</td>
<td>Eggs</td>
<td>0</td>
</tr>
</tbody>
</table>
ACID AND BASE FORMING CAPACITIES OF SELECTED FOODS

ACID-FORMING FOODS

<table>
<thead>
<tr>
<th>Food</th>
<th>Acidity (m-equiv. per 100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calves Liver, Fried</td>
<td>46.9</td>
</tr>
<tr>
<td>Chicken, Roasted</td>
<td>25.4</td>
</tr>
<tr>
<td>Beefsteak, Grilled</td>
<td>23.5</td>
</tr>
<tr>
<td>Ham, Boiled, Lean</td>
<td>22.3</td>
</tr>
<tr>
<td>Eggs, Poached</td>
<td>19.7</td>
</tr>
<tr>
<td>Haddock, Fried</td>
<td>14.0</td>
</tr>
<tr>
<td>Cheddar Cheese</td>
<td>5.4</td>
</tr>
</tbody>
</table>

BASE-FORMING FOODS

<table>
<thead>
<tr>
<th>Food</th>
<th>Base capacity (m-equiv. per 100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peas, Fresh, Raw</td>
<td>1.2</td>
</tr>
<tr>
<td>Apples, Raw</td>
<td>3.0</td>
</tr>
<tr>
<td>Tomatoes, Raw</td>
<td>5.6</td>
</tr>
<tr>
<td>Carrots, Raw</td>
<td>9.0</td>
</tr>
<tr>
<td>Potatoes, Baked in Skin</td>
<td>10.0</td>
</tr>
<tr>
<td>Almonds</td>
<td>18.3</td>
</tr>
<tr>
<td>Raisins, Dried</td>
<td>27.0</td>
</tr>
<tr>
<td>Spinach, Boiled</td>
<td>39.6</td>
</tr>
</tbody>
</table>
Animal Vs Plant Protein Consumption

- China: 64 gm
- India: 66 gm
- Mexico: 78 gm
- USA: 101 gm

Green represents Animal protein, Orange represents Plant protein.
GNP and Diet Composition

- Protein
- Starch
- Sugar
- An. Fats
- Vg. Fats

% of Calories

$\rightarrow$ GNP $\rightarrow$ $