Course Title: Diet and Gene Expression: You Are What You Eat
Course Code: BIO 03 W
Instructor: Lucia Aronica, PhD

Course Summary:
There is a give and take between our genes and the food we eat: genes affect nutrient response through genetics, while nutrients affect gene activity through epigenetics. This is a course for those interested in understanding the basic science of diet-gene interactions, and bringing it into their kitchen to optimize their health and defense against disease.

*Please see course page for full description and additional details.

Grade Options and Requirements:
- No Grade Requested (NGR)
  - This is the default option. No work will be required; no credit shall be received; no proof of attendance can be provided.
- Credit/No Credit (CR/NC)
  - Students must participate in at least 70% of weekly discussions.
- Letter Grade (A, B, C, D, No Pass)
  - Students must participate in at least 70% of weekly discussions, and complete a final project (to be discussed further in class).

*Please Note: If you require proof that you completed a Continuing Studies course for any reason (for example, employer reimbursement), you must choose either the Letter Grade or Credit/No Credit option. Courses taken for NGR will not appear on official transcripts or grade reports.

Tentative Zoom Schedule:
Wednesdays 10:30 am PT
<table>
<thead>
<tr>
<th>Week</th>
<th>Zoom sessions and readings/media</th>
<th>Videos</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td><strong>My research at Stanford</strong></td>
<td>V1: Welcome</td>
</tr>
</tbody>
</table>
| 1    | **Zoom session**  
Week recap + Q&A  
**Required readings/media**  
My blackboard videos on epigenetics:  
*Epigenetics Intro*  
*Epigenome and Environment*  
Short video: *Insights from identical twins*, University of Utah  
Research news: *Hidden Treasures in Junk DNA*  
**Additional resources**  
Epigenetic analysis in the DIETFITS study (Dr. Lucia Aronica and Prof. Christopher Gardner):  
[https://www.youtube.com/playlist?list=PLU7a7O4lr4QAtwQQKsxi00YTdQ3Z-QSP6](https://www.youtube.com/playlist?list=PLU7a7O4lr4QAtwQQKsxi00YTdQ3Z-QSP6)  
Research news: *Researchers take a gamble on the human genome*  
Video: *Human Genome Announcement at the White House (2000)*  
Media coverage: *Epigenetics 101*  
Epigenetics (Scitable by Nature Education)  
[https://www.nature.com/scitable/spotlight/epigenetics-26097411](https://www.nature.com/scitable/spotlight/epigenetics-26097411)  
Website: Learn.Genetics (Univeristy of Utah)  
[http://learn.genetics.utah.edu/content/epigenetics/](http://learn.genetics.utah.edu/content/epigenetics/)| V2: Course Overview  
V3: Genetics Refresher  
V4: Intro to Epigenetics |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reversible epigenetic marks in obese people</td>
<td></td>
</tr>
<tr>
<td>Reversible epigenetic marks in smokers</td>
<td></td>
</tr>
</tbody>
</table>

### Zoom session

- Interview with Prof Randy Jirtle

### Required readings/media

- **Research news:**
  - Mother’s diet changes pups’ colour (2003)
  - Famine leaves scars on Dutch genes, New York Times Jan 31 2018

### Additional resources:

- Video lecture: Epigenetics and Diet
- BBC Radio show: Can Your Lifestyle Be Passed on to Future Generations?
- Website: EpiGenie: Epigenetics Background
- Website: Genomic Imprinting Learn.Genetics (University of Utah)

### Deep dives

- Allis CD, Jenuwein, T (2016, Nat Rev Genet)
  - The molecular hallmarks of epigenetic control
- Review article: Krishnakumar R, Blelloch RH. (2013)
  - Epigenetics of cellular reprogramming. Curr Opin Genet
- Review article: Abramowitz LK, Bartolomei MS. (2012)
Genomic imprinting: recognition and marking of imprinted loci

Epigenetic writers and readers

Epigenetics of Royalty

Persistent epigenetic modifications in Dutch famine babies

Obesity changes sperm epigenome

Epigenetic changes due to physical activity. (2018)

Research reviews:
The Dutch Hunger Winter and the developmental origins of health and disease

Book chapter: Environmental Epigenomics in Health and Disease, Chapter 1. Courtesy of Prof Randy Jirtle (see Canvas supplemental materials)


<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Tobi EW et al (2018, Science Advances) DNA methylation as a mediator of the association between prenatal adversity and risk factors for metabolic disease in adulthood</td>
</tr>
<tr>
<td>3</td>
<td>Schultz LC (2010, PNAS). The Dutch Hunger Winter and the developmental origins of health and disease</td>
</tr>
<tr>
<td>3 <strong>Zoom session</strong></td>
<td><strong>Week recap + broccoli sprouts DIY demo</strong></td>
</tr>
<tr>
<td>4</td>
<td><strong>Required readings/media</strong> EPI-nutrient summary: SOUL-food insights_Lucia Aronica Broccoli sprouts vs. supplements</td>
</tr>
<tr>
<td>5</td>
<td>Research news: Could eating broccoli starve out cancer? The Epigenetic Benefits of Your Thanksgiving Feast</td>
</tr>
<tr>
<td>8</td>
<td>V7: Intro to Nutrigenomics V8: Methyl-donating nutrients: Folate V9: Nutrigenomic modulators: Sulforaphane</td>
</tr>
</tbody>
</table>

Food fortification with folic acid

Vegetarians and B12

Bioavailability and inter-conversion of sulforaphane and erucin in human subjects consuming broccoli sprouts or broccoli supplement in a cross-over study design.

Sulforaphane, epigenetic writers and erasers

DNA damage and repair activity after broccoli intake in young healthy smokers

Broccoli help detox your body from air pollutants

Food source B-vitamins may modify the effect of DNAm-related variant on long-term adiposity change. (2018)

Fighting Breast cancer with EPI-nutrients

Mustard seeds to pump up your sulforaphane

4

Zoom session
Interview with Prof Michael Skinner

Required readings/media
TEDx Talk: Ancestral ghosts in your genome | Michael Skinner | TEDx

Research news:

Could chemotherapy affect future generations?

NYT 2019: Chemicals in Food May Harm Children

V10: Environmental epigenetics and EPI-toxins
**Dogs Exposed to BPA Give Us Epigenetic Clues About Our Own Wellbeing**

Sperm exposure to plastic compounds affects embryo in humans

Phthalates increase the risk of allergies among children

**Additional resources**

Scorecards: Toxins by ZIP-CODENYT Page on BPA

**Deep dives** (for those who want to read about the science behind the topic):

Research articles

Sperm epimutation biomarkers for specific diseases (Skinner, 2018)

Maternal nutrient supplementation counteracts bisphenol A-induced DNA hypomethylation in early development

Epigenetic effects of BPA and phthalates, Skinner lab 2012

Epigenetic effects of chemotherapy on sperm cells, Skinner lab 2016

In utero phthalate exposure is associated with DNA methylation of growth-related genes in human placenta and fetal growth restriction

Epigenetic effects of phthalate and childhood asthma

Research reviews:

Epigenetic translational inheritance of EDC exposure

Epigenetic Effects of Environmental Chemicals Bisphenol A and Phthalates

The burden of endocrine-disrupting chemicals in the USA

Understanding Epigenetic Effects of Endocrine Disrupting
### Chemicals: from Mechanisms to Novel Test Methods.

| 5 | **Zoom session**  
Interview with Dr. Daniel Stickler |
|---|---|

**Required readings/media**

- [The AI diet](NYT 2019)
- [A personalized diet, better suited for you](NYT 2016)
- [Test your genes to find your best diet – WSJ](2016)
- [Ancient DNA can both diminish and defend modern minds](NYT 2016)

**Additional resources**

- [Promethease](Promethease)
- [SNPedia](SNPedia)

**Deep dives** (for those who want to read about the science behind the topic):

Research articles and reviews:

- [Protective alleles and modifier variants in human health and disease](MTHFR alleles in human)
- [MTHFR and decreased prostate cancer risk](MTHFR alleles in human)
- [ApoE, DHA and Alzheimer's disease](ApoE, DHA and Alzheimer's disease)
- [APOE ε4 Is Not Associated with Alzheimer’s Disease in Elderly Nigerians](APOE ε4 Is Not Associated with Alzheimer’s Disease in Elderly Nigerians)
- [Effect of APOE ε4 allele on survival and fertility in an adverse environment](Effect of APOE ε4 allele on survival and fertility in an adverse environment)
- [Apolipoprotein E4 is associated with improved cognitive function in Amazonian forager-horticulturalists with a high parasite burden](Apolipoprotein E4 is associated with improved cognitive function in Amazonian forager-horticulturalists with a high parasite burden)
- [Genetic variation at the FADS1-FADS2 gene locus influences delta-5 desaturase activity and LC-PUFA proportions after fish](Genetic variation at the FADS1-FADS2 gene locus influences delta-5 desaturase activity and LC-PUFA proportions after fish)

| V11: Intro to Nutrigenetics  
V12: Nutrigenetics in direct-to-consumer DNA testing |
<table>
<thead>
<tr>
<th>oil supplement</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AGTR1, salt and hypertension</td>
<td></td>
</tr>
<tr>
<td>ADDUCIN, salt and hypertension</td>
<td></td>
</tr>
<tr>
<td>Coffee, CYP1A2, and risk of heart disease</td>
<td></td>
</tr>
</tbody>
</table>