Stanford | Continuing Studies

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.*

Please contact the Stanford Continuing Studies office with any questions
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Week	Zoom sessions and readings/media	Videos
0	My research at Stanford	V1: Welcome
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=PLU7a7O4lr4QAtwQQKsxi0OYTdQ3Z-QSP6 https://highintensityhealth.com/169-lucia-aronica-phd-low-carb-ketogenic-diets-change-genetic-expression-epigenetics/ 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 Website: Learn.Genetics (Univeristy of Utah) http://learn.genetics.utah.edu/content/epigenetics/ **Deep dives:** Review article: Feil R, Fraga MF (2012). Epigenetics and the	V2: Course Overview V3: Genetics Refresher V4: Intro to Epigenetics

	environment: emerging patterns and implications. Nat Rev Genet. 2012 Jan 4;13(2):97-109. Reversible epigenetic marks in obese people Reversible epigenetic marks in smokers	
2	**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 (Univeristy of Utah) **Deep dives** Allis CD, Jenuwein, T (2016, Nat Rev Genet) The molecular hallmarks of epigenetic control Wang KC, Chang HY. (2011). Molecular mechanisms of long noncoding RNAs. Mol Cell Review article: Krishnakumar R, Blelloch RH. (2013) Epigenetics of cellular reprogramming. Curr Opin Genet Review article: Abramowitz LK, Bartolomei MS. (2012)	V5: Epigenetics at work V6: Diet and epigenetics

	Genomic imprinting: recognition and marking of imprinted loci Curr Opin Genet Dev22(2):72-8. 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) Waterland, R. A. & Jirtle, J. L. Transposable elements: targets for early nutritional effects on epigenetic gene regulation. Molecular and Cell Biology, 23, 5293 - 5300, (2003) McGowan P.O., Meaney M.J., Szyf M. (2008). Diet and the epigenetic (re)programming of phenotypic differences in behavior. Brain Research, 1237: 12-24 (subscription required). Kaati G., Bygren L.O., Pembrey M., Sjostrom M. (2007).Transgenerational response to nutrition, early life circumstances and longevity. European Journal of Human Genetics, 15: 784-790. Dolinoy D.C., Weidman J.R., Waterland R.A., Jirtle R.L. (2006).Maternal Genistein Alters Coat Color and Protects Avy Mouse Offspring from Obesity by Modifying the Fetal Epigenome. Environmental Health Perspectives, 114:567-572. Dolinoy D.C., Huang D., Jirtle R.L. (2007).Maternal nutrient supplementation counteracts bisphenol A-induced DNA hypomethylation in early development. PNAS, 104: 13056-	

	13061. Kucharski R., Maleszka J., Foret S., Maleszka R.Nutritional Control of Reproductive Status in Honeybees via DNA Methylation (2008). Science, 319: 1827-1830 (registration required). 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 Schultz LC (2010, PNAS). The Dutch Hunger Winter and the developmental origins of health and disease van Otterdijk SD, Michels KB. (2016) Transgenerational epigenetic inheritance in mammals: how good is the evidence? FASEB J. 2016 Jul;30(7):2457-65.	
3	**Zoom session** Week recap + broccoli sprouts DIY demo **Required readings/media** EPI-nutrient summary: SOUL-food insights_Lucia Aronica Broccoli sprouts vs. supplements Research news: Could eating broccoli starve out cancer? The Epigenetic Benefits of Your Thanksgiving Feast **Deep dives**: Epigenetics and Nutritional Environmental Signals Elizabeth A. Mazzio, Karam F. A. Soliman Integr Comp Biol. 2014 Jul; 54(1): 21–30. Published online 2014 May 26. doi: 10.1093/icb/icu049 Mentch SJ and Locasale JW (PNAS 2015) One Carbon Metabolism and Epigenetics: Understanding the Specificity Review articles: Shorter K et al (2015). Methyl-donor	V7: Intro to Nutrigenomics V8: Methyl-donating nutrients: Folate V9: Nutrigenomic modulators: Sulforaphane

	supplements: Is more always better? Progr Biophys Mol Biol. Mayne ST, Playdon MC, Rock CL. (2016). Diet, nutrition, and cancer: past, present and future. Nat Rev Clin Oncol. 2016 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 grow 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 **Additional resources** Promethease 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 ApoE, DHA and Alzheimer's disease 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 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	V11: Intro to Nutrigenetics V12: Nutrigenetics in direct-to-consumer DNA testing

	oil supplement AGTR1, salt and hypertension ADDUCIN, salt and hypertension Coffee, CYP1A2, and risk of heart disease	