NUTR/GNET 865: Nutrigenomics: Understanding gene x diet interactions
Syllabus 2015

Instructor: Brian J. Bennett, PhD
2 credit, Spring semester, Rosenau (PH) - Rm 0241
Mondays 12:20-2:15 pm

I. Course Description

This course focuses on nutrigenomics, the effect of diet on gene expression, and nutrigenetics, how genetic differences affect nutrient uptake and metabolism. It combines instructor and student led presentations focused on how diet and underlying genetics interact to affect molecular phenotypes and ultimately susceptibility to disease. Weekly readings are assigned to all students and students will present 1-2 times on specific topics.

II. Contact information

Brian J. Bennett, PhD
Primary Work Location: Nutrition Research Institute, Kannapolis, NC
In Chapel Hill: 5076 Genetics Medicine Building
Phone 704-250-5044
Office Hours: By appointment. Please email to arrange (bennettb@email.unc.edu)

III. Textbooks

None. Various required reading assigned (Sakai)

IV. Student Learning Outcomes covered in this course:

Upon completion of this course, students will be able to demonstrate the following:

- Knowledge of how diet and underlying genetics interact to increase susceptibility to disease
- Appreciation for the methods and strategies used to study complex trait genetics and nutrition.
- Understanding of the application of -omics scale approaches to measure the effect of diet

V. Learning Experiences:

When assigned to take leadership on a specific topic, students are expected to do the following:

1. Prepare a presentation on the assigned topic, of ~30-45 minutes in length.
    - Following the presentation, guide a class discussion on the topic ~30-45 minutes in length.
    - Students may either use the preselected papers or students may select alternative papers representative of the assigned topic, and notify instructor at least 2 weeks in advance. Instructor will consult with student to ensure alternative papers are appropriate.
      Note: Dr. Bennett has selected 1 review paper and 1 research paper as suggested papers
2. Final project consists of a 5-page paper that is a mock grant submission

VI. Grading

Students are expected to attend all classes. Special allowances will be made for students with legitimate conflicts that are communicated in advance (whenever possible).
Students are expected to come to class prepared: this requires that you carefully read the assigned articles, and do any additional background reading that might be required to understand the topic.

Participation in class discussions:	35%
Presentation(s)	40%
Final Project	25%

Policy

>93%	H
75-92%	P
70-74%	L
Below 70%	F

Tentative Course Schedule

Week	Date	Lecture Topic	Presentation	Presentation leader	Suggested readings
1	1/12/15	Overview of course	Course overview	Brian Bennett	(1, 2)
2	1/19/15	MLK Day	**XXXXXXXXXX**	**XXXXXXX**	
3	1/26/15	Nutrition, genetics and disease	Introduction to Genetics	Brian Bennett	(3, 4)
4	2/2/15	Nutrition, genetics and disease	Human Genetics	Brian Bennett	(3, 4)
5	2/9/15	Diet and the Microbiome	Example presentation	Brian Bennett	(5, 6)
6	2/16/15	Evolutionary perspective or Taste Genetics	Amylase and copy number Or Bitter taste and obesity	Dean	(7, 8) or (9, 10)
7	2/23/15	Obesity	FTO and weight loss	Rachael	(11, 12)
8	3/2/15	Food intake	GWAS of macronutrient intake	Laura	(13, 14)
9	3/9/15	**Spring Break**	**XXXXXXXXXX**	**XXXXXXX**	
10	3/16/14	Cardiovascular Disease	Diet and 9p21	Brian Bennett	(15, 16)
10 11	3/16/14 3/23/14	Outside assignment: 1 page concept paper Email paper to: **bennettb@email.unc.edu** with subject: Nutri-genomics concept paper			
		Metabolic Disease	Mediterranean diet	Dean	(17, 18)
12	**3/30/14**	Epigenetics	Agouti locus and obesity	Laura	(19, 20)
13	4/6/14	Trans-generational effects	Parental effects of high fat diet	Rachael	**TBD and (21)**
14	4/13/14	miRNA-		Brian Bennett	(22, 23)
15	4/20/14	**Final Project due**	**Email paper to: bennettb@email.unc.edu with subject of: Nutrigenomics final paper**	**XXXXXXX**	**XXXXXX**

Course readings

1. QI L. Gene-Diet Interactions in Complex Disease: Current Findings and Relevance for Public Health, Curr Nutr Rep 2012: 1: 222-227.
2. TUCKER K. L., SMITH C. E., LAI C. Q., ORDOVAS J. M. Quantifying diet for nutrigenomic studies, Annual review of nutrition 2013: 33: 349-371.
3. PETERS L. L., ROBLEDO R. F., BULT C. J., CHURCHILL G. A., PAIGEN B. J., SVENSON K. L. The mouse as a model for human biology: a resource guide for complex trait analysis, Nature reviews Genetics 2007: 8: 58-69.
4. FRAZER K. A., MURRAY S. S., SCHORK N. J., TOPOL E. J. Human genetic variation and its contribution to complex traits, Nature reviews Genetics 2009: 10: 241-251.
5. DAVID L. A., MAURICE C. F., CARMODY R. N., GOOTENBERG D. B., BUTTON J. E., WOLFE B. E. et al. Diet rapidly and reproducibly alters the human gut microbiome, Nature 2013.
6. KUCZYNSKI J., LAUBER C. L., WALTERS W. A., PARFREY L. W., CLEMENTE J. C., GEVERS D. et al. Experimental and analytical tools for studying the human microbiome, Nature reviews Genetics 2012: 13: 47-58.
7. PERRY G. H., DOMINY N. J., CLAW K. G., LEE A. S., FIEGLER H., REDON R. et al. Diet and the evolution of human amylase gene copy number variation, Nat Genet 2007: 39: 1256-1260.
8. LUCA F., PERRY G. H., DI RIENZO A. Evolutionary adaptations to dietary changes, Annual review of nutrition 2010: 30: 291-314.
9. LEDDA M., KUTALIK Z., SOUZA DESTITO M. C., SOUZA M. M., CIRILLO C. A., ZAMBONI A. et al. GWAS of human bitter taste perception identifies new loci and reveals additional complexity of bitter taste genetics, Hum Mol Genet 2014: 23: 259-267.
10. TEPPER B. J. Nutritional implications of genetic taste variation: the role of PROP sensitivity and other taste phenotypes, Annual review of nutrition 2008: 28: 367-388.
11. FRAYLING T. M., TIMPSON N. J., WEEDON M. N., ZEGGINI E., FREATHY R. M., LINDGREN C. M. et al. A common variant in the FTO gene is associated with body mass index and predisposes to childhood and adult obesity, Science 2007: 316: 889-894.
12. ZHANG X., QI Q., ZHANG C., SMITH S. R., HU F. B., SACKS F. M. et al. FTO genotype and 2-year change in body composition and fat distribution in response to weight-loss diets: the POUNDS LOST Trial, Diabetes 2012: 61: 3005-3011.
13. TANAKA T., NGWA J. S., VAN ROOIJ F. J., ZILLIKENS M. C., WOJCZYNSKI M. K., FRAZIER-WOOD A. C. et al. Genome-wide meta-analysis of observational studies shows common genetic variants associated with macronutrient intake, Am J Clin Nutr 2013: 97: 1395-1402.
14. CHU A. Y., WORKALEMAHU T., PAYNTER N. P., ROSE L. M., GIULIANINI F., TANAKA T. et al. Novel locus including FGF21 is associated with dietary macronutrient intake, Hum Mol Genet 2013: 22: 1895-1902.
15. DO R., XIE C., ZHANG X., MANNISTO S., HARALD K., ISLAM S. et al. The effect of chromosome 9p21 variants on cardiovascular disease may be modified by dietary intake: evidence from a case/control and a prospective study, PLoS medicine 2011: 8: e1001106.
16. CORNELIS M. C., EL-SOHEMY A., KABAGAMBE E. K., CAMPOS H. Coffee, CYP1A2 genotype, and risk of myocardial infarction, Jama 2006: 295: 1135-1141.
17. MADDEN J., WILLIAMS C. M., CALDER P. C., LIETZ G., MILES E. A., CORDELL H. et al. The impact of common gene variants on the response of biomarkers of cardiovascular disease (CVD) risk to increased fish oil fatty acids intakes, Annual review of nutrition 2011: 31: 203-234.
18. GARCIA-CALZON S., MARTINEZ-GONZALEZ M. A., RAZQUIN C., CORELLA D., SALAS-SALVADO J., MARTINEZ J. A. et al. The Pro12Ala Polymorphism of the PPARgamma2 Gene Interacts with a

Mediterranean Diet to Prevent Telomere Shortening in the PREDIMED-NAVARRA Randomized Trial, Circ Cardiovasc Genet 2014.

19. DOLINOY D. C., WEIDMAN J. R., WATERLAND R. A., JIRTLE R. L. Maternal genistein alters coat color and protects Avy mouse offspring from obesity by modifying the fetal epigenome, Environmental health perspectives 2006: 114: 567-572.
20. JIRTLE R. L., SKINNER M. K. Environmental epigenomics and disease susceptibility, Nature reviews Genetics 2007: 8: 253-262.
21. NG S. F., LIN R. C., LAYBUTT D. R., BARRES R., OWENS J. A., MORRIS M. J. Chronic high-fat diet in fathers programs beta-cell dysfunction in female rat offspring, Nature 2010: 467: 963-966.
22. DONOHOE D. R., BULTMAN S. J. Metaboloepigenetics: interrelationships between energy metabolism and epigenetic control of gene expression, Journal of cellular physiology 2012: 227: 3169-3177.
23. COONEY C. A., DAVE A. A., WOLFF G. L. Maternal methyl supplements in mice affect epigenetic variation and DNA methylation of offspring, J Nutr 2002: 132: 2393S-2400S.